



# 3<sup>rd</sup> INTERNATIONAL WORKSHOP ADVANCES IN CLEANER PRODUCTION

“CLEANER PRODUCTION INITIATIVES  
AND CHALLENGES FOR A SUSTAINABLE WORLD”

## Advances In Cleaner Production CONFERENCE PROCEEDINGS

São Paulo – Brazil – May 18–20 – 2011  
Universidade Paulista – Campus Indianópolis



*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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## Conference Proceedings

May, 18<sup>th</sup> to 20<sup>th</sup> 2011

São Paulo, SP, Brazil

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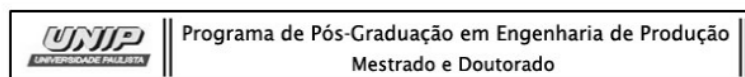
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Instituto Jatobás  
Intertox  
São Paulo Turismo  
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Ministério do Meio Ambiente



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The Organizing Committee is extremely grateful to the invited speakers and their kind participation.

**Sergio Ulgiati**

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**Ken Zarker**

Washington State Department of Ecology - USA

**Leo Bäas**

Linköping University - Sweden

**Nora Elba Munguía Vega**

Universidad de Sonora - Mexico

**Donald Huisingh**

University of Tennessee – USA

**Peter Wells**

Cardiff University - UK

**Mohamed Osmani**

Loughborough University - UK

**Sergio Ponce-López**

Universidad De La Salle Bajío

Thank you the authors and to all the participants who have made this event possible. Special thanks are addressed to the UNIP's support committee. We are sincerely grateful to students, teachers and coordinators of the UNIP's courses. We could not refrain from expressing our gratitude to the FAPESP, and CAPES for the financial support.

Special thanks are addressed to Dr. Marília Ancona-Lopez, the Vice-Rector of Post Graduation and Research of Universidade Paulista and to Dr. Marina Soligo for their unconditional support.

## Message of Welcome

On behalf of the Organizing Committee, I have the honor to welcome for this opportunity to all participants, and to express my greatest wishes that the event will serve to establish fruitful collaborations among participants.

The extensive program, the representative number of participants, the quality of the conferences and contributions allows this event to be considered the most important event held in Brazil addressing Cleaner Production. It is the consequence of contributions from several colleagues scattered in different parts of Brazil and of the World. Colleagues who are working for several years in different types of institutions: academic, business and government.

You are responsible for the size and quality of the **International Workshop on Advances in Cleaner Production**. The impact will largely depend on the interaction and discussion that will occur among you, encouraged by the organization of this event.

**Welcome!**

**Bienvenidos!**

**Bem-Vindos!**

I wish a fruitful participation, a pleasant stay, and that you have a good return to your home institutions. I hope also that you continue contributing to the Advance of Cleaner Production and Sustainable Development.

Biagio F. Giannetti  
Conference Chair

## Presentation

The Post-Graduate Program in Production Engineering of the Paulista University (**PPGEP - UNIP**) is the organizer of **3<sup>rd</sup> International Workshop the on Advances in Cleaner Production** (in São Paulo, Brazil, 2011 May 18<sup>th</sup> to 20<sup>th</sup>) in participation with **NPPR, UCF e UNISON**.

The International Workshop is a multi/interdisciplinary forum for the exchange of information and research results on technologies, concepts and policies based on Cleaner Production and conceived to assist the desired transition to a sustainable society.

Cleaner Production is a concept that goes far beyond the simple pollution control. It includes research and development of new processes, materials and products directed to promote the efficient use of resources and energy. Prevention must be the first approach of governments and corporations concerning sustainable development, and for this, environmental friendly strategies allied to economical robustness of products and services must be assured.

The adoption of Cleaner Production by governments, companies, and universities is getting speed with technical assistance and training programs, but it is worthy of attention that all these initiatives, even if implemented by all governments and corporations, do not guarantee the achievement of sustainable development. There is still a lack of a science, and consequently of a consolidated engineering devoted to the sustainable development. The Workshop's theme intends to stimulate the discussion of crucial importance "**Cleaner Production Initiatives and Challenges for a Sustainable World**".

## Objectives

The event has as central theme **Cleaner Production Initiatives and Challenges for a Sustainable World** with the aim to promote:

The 3<sup>rd</sup> International Workshop on Advances in Cleaner Production is an international forum to be held at May 18-20, 2011 in São Paulo, Brazil. The 3<sup>rd</sup> International Workshop on Advances in Cleaner Production has the aim to promote:

- The exchange of academic information
- The presentation of recent results
- The discussion of common problems and their possible solutions
- The increase of the contact among academic knowledge and corporative experiences
- The discussion of the event's theme "Cleaner Production Initiatives and Challenges for a Sustainable World"

## Program

Time	May 18th, 2011 (Wednesday)	May 19th, 2011 (Thursday)	May 20th, 2011 (Friday)
08:00 to 09:40	<b>Reception</b>	<b>Oral Presentations (5A)</b>	<b>Oral Presentations (6A)</b>
09:40 to 10:00	<b>Opening Ceremony</b>	<b>Break</b>	<b>Break</b>
10:00 to 10:30		<b>Workshops</b>	<b>Workshops</b>  Industrial Ecology in Practice  <b>Leo Baas</b>  Sustainable Farming  <b>Gloria C. Rótolo; Clara Rosalia Alvarez-Chavez; Irenilza Nääs</b>  Tools for Sustainability  <b>André Coinbra Félix; Carlos Alberto Di Agustini; João S. Furtado</b>  Emission Registration and Transfer of Polluants (RETP)  <b>Marcus E. M. da Matta; Mirtes Vieitas Boralli</b>
<b>10:30 to 12:00</b>	<b>Opening Conference</b>  Organic Waste, Residues and By-Products from Agricultural, Industrial and Urban Systems as Biorefinery Substrates: Viable Option or Fairie Tale? An Application of SUMMA (Sustainability Multi-method Multi-scale Assessment)  <b>Sergio Ulgiati</b> Pathenope University - Italy	How to Develop a Green Chemistry Roadmap and Alternatives Assessments <b>Ken A. Zarker</b>	
		Multidimensional Assessment of Sustainability and Performance in the Agro-Industry <b>Sergio Ulgiati</b>  Ecological Footprint <b>Enrique Ortega; Flavio Horneaux Junior; Pedro A. Frugoli; João S. Furtado</b>  Submarine Development Programme / Shipyard and Naval Base <b>Gilberto Huet de Bacellar Sobrinho</b>  Management of Organizational Performance with Focus on Sustainable Development <b>Miguel Afonso Sellitto; Miriam Borchardt; Carla Gonçalves Machado; Othon Fabrício Martins da Silva</b>	
12:00 to 13:30	<b>Lunch</b>	<b>Lunch</b>	<b>Lunch</b>

## Program

<b>13:30 to 15:00</b>	<p><b>Conference</b></p> <p>Advancing Chemicals Policy in the United States to Promote Safer Chemicals and Products</p> <p><b>Ken Zarker</b> Washington State Department of Ecology - USA</p>	<p><b>Conference</b></p> <p>Cleaner Production and Industrial Ecology: Two Important Concepts for a Sustainable Industry</p> <p><b>Leo Baas</b> Linköping University - Sweden</p>	<p><b>Conference</b></p> <p>Sustainability Practices Performed at the Mexican Maquiladora Industry: A Case Study in the State of Sonora and Baja California, Mexico</p> <p><b>Nora Munguía</b> Universidad de Sonora - Mexico</p>
<b>15:00 to 16:30</b>	<b>Oral Presentations (4B)</b>	<b>Oral Presentations (5B)</b>	<b>Oral Presentations (6B)</b>
<b>16:30 to 16:50</b>	<b>Coffee break</b>	<b>Coffee break</b>	<b>Coffee break</b>
<b>16:50 to 18:50</b>	<p><b>Plenary Presentations - Three Initiatives and Challenges in Cleaner Production</b></p> <p><b>Peter Wells</b> Cardiff University - UK</p> <p><b>Sergio Ponce</b> Universidad De La Salle Bajío</p> <p><b>Mohamed Osmani</b> Loughborough University - UK</p>	<p><b>Workshop</b></p> <p>Envisioning and Making Plans to implement truly sustainable societies</p> <p><b>Donald Huisingsh</b> University of Tennessee - USA</p>	<p><b>Closing Conference</b></p> <p>Five Challenges We Must Address IF We Are to Make Progress Toward Truly Sustainable Societies!</p> <p><b>Donald Huisingsh</b> University of Tennessee - USA</p>
<b>18:50 to 19:50</b>			<b>Closing Ceremony and Cocktail</b>

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“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

**Conferences**

**and**

**Oral Presentations**

**18<sup>th</sup> May 2011**

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"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011



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"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

**18<sup>th</sup> May 2011**

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**10h30 -12h00      Opening Conference**

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**Sergio Ulgiati**

**Parthenope University, Italy**

Organic waste, residues and by-products from agricultural, industrial and urban systems as biorefinery substrates: Viable Option or Fairie Tale? An application of SUMMA (Sustainability Multi-method Multi-scale Assessment)

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**Organic waste, residues and by-products from agricultural, industrial and urban systems as biorefinery substrates: Viable Option or Fairie Tale? An application of SUMMA (SUstainability Multi-method Multi-scale Assessment)**

Sergio Ulgiati  
*Parthenope University, Italy*

Our societies are day by day overwhelmed by increasing amounts of organic waste materials, from agricultural, industrial and urban systems. Solutions to safely dispose of these waste materials are most often not easy, not cheap, not environmentally friendly. New strategies for prevention, recycling, and conversion of waste to useful products are urgently needed and call for the ability to evaluate the feasibility and profitability of proposed solutions, from several points of view, in order to take into proper account the economic, energetic, environmental and social sustainability.

SUMMA (SUstainability Multi-method Multi-scale Assessment), a performance evaluation tool, capable to provide an integrated assessment of technological, energy and environmental processes across time and spatial scale, is applied to a biorefinery system design aimed at usefully converting organic residues into bioenergy and biochemicals, in order to test the feasibility of the model as well as identify bottlenecks and improvement opportunities. The approach is based on the joint and consistent application of material, energy, exergy, economic and emergy methods, at local, regional and global scales, and provides a set of efficiency, feasibility and

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environmental sustainability indicators in support to sound policy making.

Results indicate first of all the importance of preventing waste generation. Integrated clusters of production and consumption processes must be properly designed in order to make the biorefinery feasible and viable. Short distances, transfer infrastructures, and proper exchange of still usable resources according to their information content and chemical characteristics are all crucial to a successful strategy.

The emergy synthesis method, integrated in SUMMA, projects the assessment to the global scale of the biosphere, providing a sustainability check that complements economic and LCA evaluations.

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**18<sup>th</sup> May 2011**

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**13h30 -15h00      Conference**

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**Ken Zarker**

**Washington State  
Department of Ecology USA**

Advancing chemicals policy in  
the United States to promote  
safer chemicals and products.

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“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

## **Advancing chemicals policy in the United States to promote safer chemicals and products.**

Ken Zarker

*Washington State Department of Ecology USA*

In the United States, state governments have been recognized for developing and implementing chemicals policy initiatives designed to promote the transition to safer chemicals, materials, products and processes. These policy efforts were initiated in several leading states to address increasing concerns about toxic chemicals that are found in products, including children's products. This presentation will describe the rise of state comprehensive chemicals policies, efforts to prioritize chemicals of concern, and future actions and tools necessary to spur reform to the federal chemicals management system in the United States under the Toxic Substances Control Act of 1976.

The story about chemicals policy is about how individual states have been taking legislative and policy actions while gaining experience and building the case for comprehensive reforms to address the systemic need for a national solution to address all chemicals in commerce.

As recently as five years ago, "chemicals policy" was just beginning to be recognized as a new area of environmental policy designed to address failures at both the state and federal levels to prevent toxic chemicals exposures to people and the environment. In late 2005,

only a few states were addressing individual chemicals of concern such as mercury or toxic flame retardants. Several states were beginning to discuss the need for comprehensive chemicals policy reform as a strategy to move beyond the “chemical by chemical” approach to ban or restrict the use of targeted chemicals.

Those of us working in state pollution prevention and toxics use reduction programs began to expand our vision beyond our traditional work with manufacturers that focused on improved process efficiencies, toxic waste reduction and saving businesses money.

The evolution of state chemicals policy initiatives was fostered by state pollution prevention programs. These programs were initially established by the states in response to rising concerns associated with improper hazardous waste management and toxic releases from industrial facilities. As a result, over 23 states passed pollution prevention and waste reduction legislation that either required or encouraged facilities to develop pollution prevention plans to reduce the generation of hazardous wastes and toxics.

In 1990, the U.S. Congress passed the Pollution Prevention Act that established source reduction as a national policy. U.S. EPA further defined pollution prevention and assisted the states with grant funding to provide technical assistance support to industry.



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**18<sup>th</sup> May 2011**

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**15h00-16h30**

**Session 4B**

**Room 1**

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A Study on the use of Environmental Performance Indicators (EPI) in Environmental Management Systems (EMS)

Integration of Sustainability Aspects to Supplier Selection Processes – The Role of Locational Criteria

Environmental Indicators of the Industrial Companies in São Paulo

Scientific Requirements Analysis Focusing the Environmental Dimension of BM&FBOVESPA ISE and Sustainability Indicators Published in Annual Business Sustainability Reports

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## **A Study on the use of Environmental Performance Indicators (EPI) in Environmental Management Systems (EMS)**

D. M. Heinzen<sup>a</sup>, L. M. S. Campos<sup>b</sup> e P. A. C. Miguel<sup>c</sup>

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### **Abstract**

Environment issues have gained greater evidence on the corporate agenda nowadays. The view that pollution is only one undesirable consequence is no longer endorsed by organizations, bringing up the importance of managing their environmental issues. Facing this challenge, one of the actions taken by the companies has been the implementation and certification of an environmental management system (EMS). In this sense, the aim of this paper is to present a set of environmental performance measures used to manage the EMS and that can contribute to the effectiveness of ISO 14001 system. This research is exploratory and descriptive, conducted through a survey. Data was collected by an instrument sent to ISO 14001 certified companies in the Santa Catarina State in Brazil. The target companies were from various economic sectors. The target population consisted of 73 organizations and accessible population resulted in 62 companies. From those, 39 companies participated in the survey. The results show the characteristics of respondents and the most used environmental performance measures according to the requirements of the standard. Findings have shown that companies mostly adopt environmental performance measures more directly associated with the legal requirements (legal and other requirements, preparation and emergency response, evaluation of legal and other requirements and environmental aspects). In addition, the following economic sectors that "always" and/or "often" used most measures are: Pulp and Paper/Furniture/Wood, Textiles, Metals and Electrical/Electrical and Electronic.

**Keywords:** *environmental performance indicators, EPI, environmental management systems, EMS, ISO 14001.*

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## **Integration of Sustainability Aspects to Supplier Selection Processes The Role of Locational Criteria**

M. A. S. de Castro <sup>a</sup>, M. A. G. Figueiredo <sup>b</sup>, V. Schalch <sup>c</sup>, F. A. S. Vecchia <sup>d</sup>

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### **Abstract**

The consideration of sustainability-related aspects provides nowadays a competitive edge, but, due to factors such as public and market pressures, may soon become the only way for an organization to subsist. In this shift, supply chains play an important, strategic role, because of the amount, importance and implications of the decisions taken during its planning, such as the supplier selection process. However, despite the attention publicly given by the organizations to environmental and social issues, supplier selection processes have been based mainly on economical aspects. The purpose of this paper is to highlight the importance of the decisions regarding supply chain planning in the search for a higher degree of sustainability, through an analysis of the locational criteria used for supplier selection. Initially, a literature review was conducted in order to point out such criteria, as well as the corresponding models of application in the decision making process. They were, after that, evaluated and classified according to the Triple Bottom Line (TBL) concept of sustainability. As a result, the paper identified three historical moments, which currently represent three possible approaches for locational criteria adoption in the supplier selection process: the consideration of purely economical aspects, and the subsequent addition of environmental and social aspects in decision making. Further, the paper presents some closing remarks and suggestions for future research.

**Keywords:** *supply chain, supplier selection, sustainability*

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## Environmental Indicators of the Industrial Companies in São Paulo

F. Hourneaux Junior <sup>a</sup>, H. Hrdlicka <sup>b</sup>, I. Kruglianskas <sup>c</sup>

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**Abstract** A major challenge for organizations is to establish an appropriate measure for their performance, considering the growing need for inclusion of more stakeholders other than the traditional ones and issues related to sustainability, such as the insertion of a Triple Bottom Line approach - which comprises the economic, social and environmental dimensions. The aim of this paper is to highlight the use of indicators within the environmental dimension, using as its basis the proposal of the GRI (Global Reporting Initiative). The field research is of the survey type and had the participation of 149 companies both in the industry sector and associated to CIESP (Center of Industries of the State of São Paulo). Its main results suggest different uses of environmental indicators, with an emphasis on those more directly linked to the industrial productive processes.

**Keywords:** *environmental indicators, performance measurement, Global Reporting Initiative (GRI).*

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## **Scientific Requirements Analysis Focusing the Environmental Dimension of BM&FBOVESPA ISE and Sustainability Indicators Published in Annual Business Sustainability Reports**

C. A. Di Agustini, L. P. Vendrametto

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### **Abstract**

Sustainability is a *conditio sine qua non* for the survival of man on Earth, and economic growth has been antagonistic to the maintenance of life on the planet. Even the stock market reflects this dichotomous condition by the performance of the market value of companies classified as sustainable in BM&FBOVESPA (Bolsa de Valores, Mercadorias e futuros). The performance of the ISE (Corporate Sustainability Index) from 2005 to 2010 was 6.30% lower than the Ibovespa. The analysis of adherence of the requirements of Pulselli et al. with the ISE with annual environmental sustainability reports of participating companies shows that only 12.5% of the requirements are met in annual sustainability reports/2009 from participating companies. Scientific requirements are essential for assessing current conditions, compare trends, provide warning information and anticipate future conditions. Although the ISE is founded on a scientific basis recognized by the international community (requirement F), only 15.63% of participating companies have published such requirement in their annual sustainability reports/2009. A survey of non-probability convenience scanning showed that almost all the investors sustainability indicators are relevant in investment decisions and that the ISE is a leading indicator of sustainability of companies listed on BM&FBOVESPA. Of the 32 companies participating in the ISE that published sustainability reports / Annual 2009, only 12% of indicators have shown a correlation with the requirements of Pulselli et al. This may be a contributing factor to the underperformance relative to the ISE Bovespa index. Sustainability indicators that employ scientific criteria, practical tools and friendly communication can be crucial to aggregate and quantify information about sustainability (complex phenomenon) in a relevant way so that the significance becomes more apparent, thus improving the communication process with stakeholders in the process.

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**Keywords:** *Sustainability, indicators, ISE and BMF&BOVESPA.*

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*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

**18<sup>th</sup> May 2011**

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**15h00-16h30**

**Session 4B**

**Room 2**

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Development of Environmentally Friendly Products: Case Study in a Germany Company Producer of Household Appliances

Cleaner Production and Product Life Cycle Design of the Upholstered Furniture in the State of Alagoas, Brazil

Product End-of-Life, Remanufacturing and Reuse Market: Trends, Barriers and Challenges in a Case Study

Elimination of Mercury (Hg) in the Health Sector: the Case of a Hospital in the City of Hermosillo, Sonora, Mexico

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## **Development of Environmentally Friendly Products: Case Study in a Germany Company Producer of Household Appliances**

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### **Abstract**

This paper presents results of an investigation into the development of environmentally friendly products: case study in a Germany company producer of dishwashers. Concepts of eco-design and life cycle analysis are shown in the literature review. The case study uses these concepts to investigate the dishwashers produced by the German multinational company called *Bosch und Siemens Hausgeräte*. Historical quantitative analysis of water and electrical energy consumption from the first versions of dishwashers until the most modern ones, as well as the systems which were implemented and improved in order to achieve the targets linked to the reduction of water and electrical energy consumption, are presented.

**Keywords:** *product development process, life cycle analysis, case study.*

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## **Cleaner Production and Product Life Cycle Design of the Upholstered Furniture in the State of Alagoas, Brazil**

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### **Abstract**

This paper presents some results concerning environmental and organizational aspects obtained from analysis of the manufacture processes of upholstered furniture in the Furniture Cluster in the State of Alagoas, Brazil. The methodology is based on concepts of Pollution Prevention and Cleaner Production. The data were collected through interviews with employees and direct observation in the local. The results indicate the need for advanced studies to identify possible changes in the product and / or in the development process of upholstered furniture of that cluster. The partial conclusions suggest a future application of Life Cycle Assessment on one of upholstered furniture to improving the manufacturing efficiency through the cleaner environmental practices.

**Keywords:** *cleaner production, product life cycle design, furniture production, upholstered furniture.*

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## **Product End-of-Life, Remanufacturing and Reuse Market: Trends, Barriers and Challenges in a Case Study**

M. Bouzon, C. L. Cardozo, C. M. T. Rodriguez, L. A. Gontijo, A. A. Queiroz

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### **Abstract**

Within the current environmental context, the focus of society and businesses is oriented to finding solutions to reduce environmental impacts which are also economically sustainable. Accordingly, remanufacturing deals with issues related to environmental impact reduction such as the economy of material, energy, capital, labor, and emissions used in the manufacture of products. However, remanufacturing deals also with variabilities and inefficiencies that are barriers to the business' economic sustainability. This paper presents perspectives of product end-of-life and describes the state of the remanufacturing industry and reuse market. To complement the existing literature, a case study was conducted in a remanufacturing telecommunication products industry in southern Brazil. It was found that the studied company does not collect end-of-life products - it receives only aftermarket products and products for repair. The company fears selling remanufactured products at lower prices for the reuse market may cannibalize the sale of new products. Furthermore, the remanufacturing processes were observed to involve several wastes, which confirms its status of "immature" industry.

**Keywords:** *remanufacturing, reuse market, product end-of-life, sales cannibalization.*

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## **Elimination of Mercury (Hg) in the Health Sector: the Case of a Hospital in the City of Hermosillo, Sonora, Mexico**

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### **Abstract**

The objectives of this study were to provide an analysis of policies that are related to the Hg, management practices (acquisition, storage, use and final disposal), as well as the inventory of the sources of Hg in different areas of the hospital and propose actions for the implementation of a cleaner production (CP) program in a hospital in the city of Hermosillo, Sonora, Mexico. The data collection instruments were a questionnaire and interview assessment and inventory sheet. With the information gathered and an assessment glass clinical thermometer was selected as the source of the most important Hg. Finally was developed a pilot program of CP for a hospital, to assist in the implementation of alternatives to reduce and / or eliminate Hg.

This case study showed some deficiencies in the hospital, such as lack of employee training, inadequate practices for cleaning up spills, lack of policies for the removal of Hg, the lack of identification of equipment and laboratory chemicals containing Hg. The actions recommended include: promoting the creation of a policy to reduce and/or elimination of Hg, to form a team in the hospital, develop support material for an awareness campaign, training of nursing staff and medical material supply for cleaning spills of Hg, formulate policies for the purchase of mercury-free devices, starting with the replacement of mercury thermometers for digital thermometers. This case is part of Elimination of Mercury project in Ecuador and Mexico Hospitals led by University of Massachusetts Lowell, USA, aims at gradual elimination of mercury from healthcare facilities. Participation in the project is voluntary.

**Keywords:** *mercury, hospital, pollution prevention, cleaner production.*

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"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

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**18<sup>th</sup> May 2011**

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**15h00-16h30**

**Session 4B**

**Room 3**

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Evaluation of the Use of Recyclable Materials for Heating Water in Swimming Pools

Cleaner Production, Process Innovation and Environmental Benefits: A case from the Metal-Mechanic Industry in Serra Gaúcha, Brazil

Cleaner Production Practices in Military Organization Service Provider Industry (MOSP-I): a study in the Naval Base of Val-de-Cães, Brazil

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## **Evaluation of the Use of Recyclable Materials for Heating Water in Swimming Pools**

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### **Abstract**

With the population growth and mechanization increased the demand for electricity in Brazil that causes significant environmental impacts with the construction of hydroelectric plants. Solar power helps reduce energy consumption in power plants, due to high levels of solar radiation and by being a source of renewable energy. The construction of solar collectors of recyclable materials such as PET and Tetra Pak is a way to minimize the cost of a solar collector system, solar water heating in swimming pools and consumption of electricity. This project aims to evaluate the use of recyclable materials for heating water in swimming pools, through library research and its deployment on a farm with surface area of 50 m<sup>2</sup>. In assessing the thermal system (solar collector and tank), has an efficiency of 28% and a reduction of deployment costs by 50 % with other systems

**Keywords:** *solar energy, warming, economy.*

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## **Cleaner Production, Process Innovation and Environmental Benefits: A Case from the Metal-Mechanic Industry in Serra Gaúcha, Brazil**

E. A. Severo, J. C. F. Guimarães, M. R. da Cruz, E. Dorion  
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### **Abstract**

The Cleaner Production methodology (CP) provides organizations with viable alternatives to minimize and prevent solid waste production, liquid effluents and atmospheric emissions, efficient use of raw materials, especially water and energy, reducing environmental risks to human beings and bringing economic benefits to companies. Process innovation occurs through the adoption of new forms and methods of production. These methods allow improvements in productivity, reduce costs and waste; increasing the productive life of equipment and processes, among others. The aim of this study is to analyze the environmental and economic benefits for a company, through the use of the CP methodology and the process of innovation that were implemented in a company of the metal-mechanic Pole of the region of Serra Gaúcha, Brazil. The research method is exploratory and applied to a case study. The company is active on the Brazilian market since 1954, producing a number of products for the construction, furniture, automotive and housewares industries. The CP methodology of CP was implemented in 2007 and the teams are currently undertaking improvement, articulating the innovations in the search of waste reduction from the source, the incorporation of new technologies; bringing benefits to the work environment. The implementation of these process innovations has generated a 65% reduction of the production of oil and water wastes. These innovations resulted in a 67.9% savings on treatment and final disposal of these wastes. Through the CP methodology, the innovations developed caused economic and environmental benefits, which contribute to the sustainability of the company.

**Keywords:** *Cleaner production, process innovation, metal-mechanic industry, Serra Gaúcha.*

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## **Cleaner Production Practices in Military Organization Service Provider Industry (MOSP-I): a study in the Naval Base of Val-de-Cães, Brazil**

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### **Abstract**

The increase and diversification of activities within the Military Organizations Service Providers Industrial (MOSP-I) have provided increased waste generation and consumption rates of energy and water, making it necessary to support the planning for the integrated management of environment in order to maintain the environmental quality, from stock control and waste treatment, energy efficiency and waste-water. The methodology known as Cleaner Production (CP), based on practical principles that include integrated actions between aspects of environmental quality, occupational health and safety, promoting development and transfer of clean technologies. The results show decline and improvement in various sectors through programs of the organization itself to reuse waste projects and solutions to improve the functioning of elements of different subsystems and prevent waste. Other products expected to include a program that will include workshops on environmental education, improvements in handling, packaging and disposal of waste generated, as a condition for improving the quality of the environment at the Naval Base of Val-de-Cães.

**Keywords:** *Cleaner Production, Environmental Management, Military Organization.*

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**18<sup>th</sup> May 2011**

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**15h00-16h30**

**Session 4B**

**Room 4**

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Evolution of the Environmental Management System for Enterprise in Brazil: an Exploratory Study of Certifications

GRI – Global Reporting Initiative: Viable Tool for Small Companies Competitive Profit

The Relations between Maintenance and Enterprise Sustainability Strategies: A Reflective Approach in the Input-Transformation-Output

A Comparative Survey among Emergy Indices and More Usual Sustainability Indexes

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*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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## **Evolution of the Environmental Management System for Enterprise in Brazil: an Exploratory Study of Certifications**

B. C. S. Peixe, A. C. Trierweiler, A. C. Bornia, F. S. P. Sant`anna

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### **Abstract**

This research tries to reveal the information to demonstrate the performance improvement of the environmental management of businesses, from the evolution of environmental certifications as a way to give more visibility to stakeholders. The objective this research is to elicit information related to the certifications to show the evolution of the Environmental Management System (EMS) companies. This research is qualitative and its nature as it is applied, his approach is descriptive and exploratory investigations with regard to the goal, besides being made of a literature search. Was identified in the results to performance evaluation of the environmental management of companies, based on the authors of the research scope and in relation to issue certifications by the certifying body, the National Institute of Metrology, Standardization and Industrial Quality (INMETRO). It was found that firms use certification as one of the indicators to influence the improvement of performance and competitiveness, indicating the evolution of the system certification of environmental management in businesses and demonstrate the importance of performance evaluation in this process.

**Keywords:** *Evolution of Certification, Evaluation of Environmental Management, ISO 14001, ISO 14031.*

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## **GRI – Global Reporting Initiative: Viable Tool for Small Companies Competitive Profit**

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### **Abstract**

This paper aims to show a possibility of GRI – Global Reporting Initiative implantation. At first, it's presented a literature review about environment to discuss some important questions and reports GRI models as a valuable way to add SME competitive value. A case study was done with a SME hotel to identify differences with sustainable practices, according GRI. The results indicate a waste reduction, function and market image improvements through cleaner production practices. Furthermore, production patterns changes didn't add costs. On the other hand, environment and socioeconomic gains were perceived, which contributes to a sustainable achievement. It was observed that the adoption of reports of support of the GRI viable must its simplicity of implementation, such reports yearn for to describe the economic, ambient and social impacts, triple bottom line, beyond allowing to measure the actions of the company.

**Keywords:** *Sustainable Reporting, GRI, Competitiveness, Sustainability.*

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## **The Relations between Maintenance and Enterprise Sustainability Strategies: A Reflective Approach in the Input-Transformation-Output**

J. B. de Souza <sup>a</sup>, J. B. Sacomano <sup>b</sup>, S. L. Kyrillos<sup>c</sup>, F. J. S. Milreu <sup>d</sup>, J. D. B. de Souza<sup>e</sup>

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### **Abstract**

To reach the sustainable development focused on the production's enterprise sustainability, it is necessary a holistic view that reaches the product and/or the service and the processes and operations in the same way as it reaches all the chain of events, including the systems of the manufacturing of the product in its different life-cycles and the maintenance management system. This requires improved models, indicators for sustainability evaluation and process optimization techniques, product and knowledge of the system levels (entrance-transformation-exit model). This article presents a general view of the new trends and concepts regarding the development of products and sustainable systems considering the relations between the maintenance and enterprise sustainability strategies. In order to reach the article's goals, the research was conducted by a procedure combining two techniques for collection of data: the bibliographical research and the accomplishment of the field work through e-mail exchange with the researchers and specialists to collect their final thoughts regarding the relations between the maintenance and enterprise sustainability strategies. Now, the result is the presentation of an ample view of the relations between the maintenance and enterprise sustainability strategies and the consequences of these relations in the entrance-transformation-exit model in order to contribute with the advance of the use of the enterprise sustainability as a source of competitive advantage.

**Keywords:** *Maintenance, Productive system, Enterprise sustainability.*

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## **A Comparative Survey among Emergy Indices and More Usual Sustainability Indexes**

P. A. Frugoli, A. P. Z. dos Santos, A. D. Frugoli

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### **Abstract**

The search for sustainability and the growing concern about the environmental degradation attract more and more researchers from all over the world, therefore, there is the need of development of indexes that include the economy, society and environment. This study applies the emergy synthesis with the aim of determine its indexes and compare them with well known indexes obtained from the literature. The natural resources flows (renewable and non renewable) and the resources from the economy of the countries are evaluated for the calculation of emergy indexes. Correlations were made between the calculated indexes with the well known indexes taken from the literature. The best correlation results were obtained between the Human Development Index and the Ecological Footprint (HDIxEF) and between the Surplus Biocapacity Index and the Environmental Sustainability Index (SB x ESI).

**Keywords:** *emergy synthesis, indexes, sustainability, countries.*

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"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

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**18<sup>th</sup> May 2011**

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**15h00-16h30**

**Session 4B**

**Room 5**

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Innovation in Cleaner Production through Concrete and Cement Composite Recycling

Re-engineering Process to Reach Sustainability in Laboratories of the University of Sonora

Processing Centers in Artisanal and Small-scale Gold Mining: Evolution or More Pollution?

Exploration and Practice on the Compulsory Cleaner Production Auditing of Key Enterprise in China

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“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011



## **Innovation in Cleaner Production through Concrete and Cement Composite Recycling**

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### **Abstract**

In the United Kingdom, most glass reinforced plastic (GRP) waste is currently sent to landfill due to its intrinsic thermoset composite nature, lack of information relating to its characteristics and insufficient knowledge of potential recycling options. Experimental attempts were made to recycle GRP waste in concrete and cement composites. As such, more than 190 concrete specimens were prepared in accordance with BS EN12390-2:2000 and BRE 1988 mix design for normal concrete and used GRP waste powder content varying from 5% to 50% as replacement for fine aggregates. Results showed that GRP waste can be used as a partial replacement for fine aggregate as well as an admixture in cement concrete. Additionally, the presence of polymer and short glass fibre content in GRP waste powder can significantly contribute to improve the quality of various concrete products and has ample scope for use in several applications in the construction sector.

**Keywords:** *Glass reinforced plastic (GRP); Recycling; Concrete composites; Cement composites; UK*

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## **Re-engineering Process to Reach Sustainability in Laboratories of the University of Sonora**

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### **Abstract**

There are several ways to contribute to sustainability in higher education institutions. One of them is the implementation of programs for handling hazardous wastes and materials that reduce or eliminate the impacts on health and the environment in laboratories and workshops. This paper presents a research on Mexican universities environmental programs that are integrated into the Mexican Consortium Universities Environmental Programs for Sustainable Development (COMPLEXUS) and in the Institutional Program of Environmental Health and Safety of University of Sonora (PISSA-UNISON), to know the tendencies in the management of hazardous materials and wastes and to propose recommendations to improve this line of action of PISSA-UNISON. In addition, a survey to laboratories users to diagnose their knowledge about general aspects of sustainability and safe management of hazardous materials and wastes on campus was conducted to this end. The students, who had taken environmental, health and safety and sustainability courses, and professors, were interviewed. Results showed deficiencies on safety and pollution prevention practices in laboratories. A plan to improve safety in laboratory practices under PISSA-UNISON framework was proposed to strengthen this program as a contribution towards sustainability. Greater institutional support and agglutination of isolated efforts are considered essential to achieve sustainability on campus.

**Keywords:** *Sustainability, PISSA-UNISON, Hazardous wastes and materials, Environmental Programs, Sustainable Development*

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## **Processing Centers in Artisanal and Small-scale Gold Mining: Evolution or More Pollution?**

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### **Abstract**

This article discusses the technical evolution observed worldwide in the artisanal and small-scale gold mining (ASGM) sector. At first glance, the centralization of mineral processing activities in local centers seems to rationalize the production and reduce the dispersion of polluting tailings in rural areas. However, the rise of processing centers around the world is taking advantage of the ignorance and lack of capital of the artisanal miners. These centers receive gold ores from miners and process using poor grinding and amalgamation processes to extract less than 30% of the gold. As payment, miners leave the tailings (residues) at the centers which are processed by cyanidation to extract residual gold. The cyanidation of Hg-contaminated tailings produces mercury-cyanide complexes that are not always recovered in the process of activated carbon or zinc precipitation. As a result, tailings discharged into the local water streams carry mercury either as soluble cyanide complexes or Hg droplets. Some technologies to extract gold in small-scale to replace amalgamation are discussed and the cyanidation of concentrates in small-ball mills is highlighted as the most promising one. Any technique to replace mercury should invest in gravity or flotation concentration in order to reduce the mass of material to be leached or melted. This reduces dramatically capital and operating costs. There are a few processing centers, in particular at the South of Ecuador, doing responsible and cleaner gold extraction. They are integrating miners in the evolution process and creating a new breed of professionals in the small gold industry. The proliferation of these centers is possible but private capital is the main key factor since most Governments of developing countries do not have the understanding and the capacity to change the behavior of artisanal miners.

**Keywords:** *gold, mining, mercury, cyanide, technology*

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## **Exploration and Practice on the Compulsory Cleaner Production Auditing of Key Enterprise in China**

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### **Abstract**

The very big result in the enterprise voluntary cleaner production auditing has been obtained since cleaner production was carried out in our country, and our country has been generally acknowledged as in the best development country for cleaner production. More and more key enterprises have implemented the cleaner production auditing in recent years. The work for cleaner production has been done in recent ten years. With the announcing key enterprises from each province environment protection hall for recent years, cleaner production auditing has been done by thousands of enterprises involving in more than twenty industries. Through the key enterprises of compulsory auditing of exploration and practice, this article on the key enterprises of compulsory cleaner production auditing need, innovation, implementation of status and elaborating the problems.

**Keywords:** *key enterprise; compulsory cleaner production auditing; auditing practice*

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"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

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**18<sup>th</sup> May 2011**

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**15h00-16h30**

**Session 4B**

**Room 5**

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The Remanufacturing as Option in the Recovery of Products in the Post-Consumer: In the Vision on Brazilian Enterprises

From Modern Thermodynamics to How Nature Works – a View of Emergent Paradigms Associated with Sustainability

Cleaner Production as a Corporate Sustainability Tool: An Exploratory Discussion

Sustainability in Agricultural Activities Developed in the Western Region of Santa Catarina, Brazil, from the Viewpoint of Rural Extension Technicians

Oeco-Nomics in the Light of the Maximum Ordinality Principle. The N-Good and Three Factor Problem

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## **The Remanufacturing as Option in the Recovery of Products in the Post-Consumer: In the Vision on Brazilian Enterprises**

Y. M. B. Saavedra, A. P. B. Barquet, A. R. Ometto, H. Rozenfeld, F. A. Forcelini

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### **Abstract**

The concern with the increased generation of solid waste for the more frequently discard of the products has increased the interest of the international community to developed alternatives that help to diminish these wastes, especially in the phase of discard (post-consumer) where the major opportunities of recovery appears. However, one of the major difficulties is the lack of projection by the enterprises in the moment when developing their products, making complicated and unfeasible the recovery. Strategies for end of life are presented as an opportunity to recover these products. In this case, the remanufacturing is shown to be a strategy that has the greatest gains on the pillars of sustainability. In this sense, was realized an exploratory study in the literature about the remanufacturing to identify their main features, as well as two case studies with an original equipment manufacturing (OEM) and one independent manufacturer with the purpose to make a comparative analysis of the critical aspects identified in the two enterprises. The results demonstrate that the OEM companies have major advantages with regard to aspects relationship with suppliers of used product, reverse logistics operation for Remanufacturing and marketing of remanufactured product. However, we can mention the possibilities that may arise from possible partnerships between the two companies to achieve major gains in the recovery of these products.

**Keywords:** *Recovery of products, Post-consumer, Remanufacturing, Actors*

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## **From Modern Thermodynamics to How Nature Works – a View of Emergent Paradigms Associated with Sustainability**

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### **Abstract**

The importance of the second law of thermodynamics, already called the most metaphysical of all laws of nature, as key to understand the questions of ecology and sustainability is discussed, as well as the a fast paced conceptual evolution that gained momentum in the last 50 years, changing our view of Nature. Classical thermodynamics, is associated with the tendency to disorganization, while nonlinear irreversible thermodynamics, introduces the concept of emerging ordered dissipative structures, a necessary tool to deal with the nature of living beings and its social, economic and ecological aggregates. Most introductory texts in thermodynamics are limited in scope, restricting the expositions to the study of equilibrium systems- meaning the study of idealized, infinitely slow process, hardly a situation encountered by the professional life, and far away from how nature works, as an coherent and complex aggregate of dissipative processes. Dissipative structures are living ( i.e. amoeba and humans), and non-living (i.e. tornadoes, hurricanes, the gulfstream), or composed by non-living and living, like economies, factories, social structures. The author's teaching experience gives evidence that undergraduate students are ill prepared for the discovery and fascination of how nature works, and consequently striving for sustainability. Systems of major interest to the issue of sustainability are open, coherent, purposive, and irreversible. Irreversible thermodynamics is presented as an element for the understanding and unification of a wide range of disciplines needed by the student, but still subjected to a fragmentation of a somewhat bureaucratic nature. This integration benefited from the enormous development of computers, and its use in the study, as an example, of nonlinear dynamics system with wide applications in various fields including engineering, biology, ecology, economics, and sociology.

**Keywords:** *Thermodynamics, open systems, non-linear dynamics, sustainability*

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## **Cleaner Production as a Corporate Sustainability Tool: An Exploratory Discussion**

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### **Abstract**

This study brings form an exploratory discussion on the CP as a corporate sustainability tool, describing some subjects like sustainable development and cleaner production. These subjects were investigated in studies conducted by several researchers and institutions from Brazil and abroad. Thus, it was considering the three aspects of corporate sustainability, corporate social responsibility (improving quality of life), eco-efficiency (optimizing natural resources usage and reduction of pollutant burden considering the life cycle of products) and competitive position. Thus, it is possible to associate CP as a tool to assist the promotion of corporate sustainability, hence this tool allows continuously search for the environmental efficiency of operations through optimizing of natural resources usage and eliminating waste, improving the environment working by the elimination or minimization of risk to employees and community, and change the consciousness of employees facing the environmental problem, while allowing economic gains with the elimination of waste and risks, as well as increased productivity. Thus, Cleaner Production can be considered a 'win-win' strategy, can protect the environment, the consumer and the worker while also improving industrial efficiency, profitability and competitiveness.

**Keywords:** *Sustainable Development, corporate sustainability, Cleaner Production.*

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## **Sustainability in Agricultural Activities Developed in the Western Region of Santa Catarina, Brazil, from the Viewpoint of Rural Extension Technicians**

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The perception of rural extensionists from Santa Catarina State Agricultural Research and Rural Extension Agency (EPAGRI) and from Watershed Project 2 – as regards the sustainability of agricultural activities in the Western Region of Santa Catarina, Brazil – was assessed by means of a semi-structured questionnaire used to interview 116 professionals in the areas of Chapecó, Maravilha, Palmitos, São Lourenço do Oeste and Xanxerê. Respondents believe that the degree of sustainability of regional primary production is low/medium and that nine out of ten farmers do not require that the practices adopted in their farms are sustainable or they are indifferent to this aspect. Environmental degradation, lack of knowledge and economic factors appear as the main problems concerning this issue. Results lead to the conclusion that the Western Region faces an “unsustainability syndrome of the agricultural model”. Most respondents agree with the implementation of differentiated payment for farmers who produce in a sustainable way, but a quarter of the respondents do not have a general opinion on this subject.

**Keywords:** *Rural extension; sustainability; sustainable agriculture; Western Region of Santa Catarina.*

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## **Oeco-Nomics in the Light of the Maximum Ordinality Principle The N-Good and Three Factor Problem**

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### **Abstract**

Fundamental Principles in Economics and, in particular, in Neo-Classical Economics (NCE), such as Walras General Equilibrium, Pareto Optimality, etc., are the result of a direct transposition to economic activities of the Principles of Classical Mechanics (CM) and, even more, of Classical Thermodynamics (CT).

Consequently NCE Principles suffer from the same defects as CT Principles, when the latter are analyzed in the light of the Maximum Ordinality Principle (MOP). In fact Utility-Expenditure Conservation Principle (corresponding to Energy Conservation) does not hold when reconsidered in terms of Incipient Differential Calculus (IDC), a mathematical language which is much more appropriate to describe Generative Systems.

This also means that neither does Walras General Equilibrium represent a "stable" equilibrium condition nor does Pareto Optimality represent a "maximum" condition, precisely because the latter presupposes the former.

In reality traditional Economics, in all its different Schools of Thought, does not recognize that Emerging Property, usually termed as Quality (with a capital Q), which vice versa is clearly pointed out by the Maximum Em-Power Principle or, in more adherent formal terms, by its generalized version represented by the Maximum Ordinality Principle. Quality in fact represents that fundamental aspect which is ever-present in any physical-biological-social Process, never ever reducible to mere phenomenological processes or to our traditional mental categories.

As a consequence of the same subjacent presuppositions, NCE is not even able to solve the "Three good, two factor Problem" which, on the other hand, is very similar to the more famous "Three body Problem" in Classical Mechanics.

So, by starting from the solution to the latter problem, this paper will focus on a different concept of "Economics" (thus here renamed as "Oeco-Nomics") which, being based on the Maximum Ordinality Principle, is

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"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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consequently able to lead us to a general solution to the “N good, three factor Problem”. A solution which evidently includes the solution to the “Three good, three factor Problem” and, as a particular case, the solution to the “Three good, two factor Problem” too.

These results then suggest that traditional economic maximization criteria (usually corresponding to Pareto Optimality) should preferably be replaced by the Maximum Ordinality Principle. The latter in fact enables the Decision Maker to recognize those optimal working conditions which realize the Maximum Ordinality level of the System and, at the same time, to evaluate the corresponding optimum economic conditions (Investments, Benefits, Incentives, etc.) as a consequential adherent reflex.

As a term of comparison, two well-known approaches will also be reconsidered: i) Kummel’s KLE and KLEC Models; ii) and Odum’s Emergy Synthesis.

The proposed approach allows us to conclude that: *Production becomes cleaner when Processes become Generative* and, at the same time, they are also characterized by a progressive Ascendant Ordinality. In other words, when Decision Making progressively tends to realize, in actual fact, the Maximum Ordinality conditions.

**Keywords:** *Economic Complex Systems, Walras General Equilibrium, Energetics and Classical Thermodynamics, Maximum Ordinality Principle, Incipient Differential Calculus (IDC).*

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"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

**18<sup>th</sup> May 2011**

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**15h00-16h30**

**Session 4B**

**Room 7**

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Evaluation of the Removal of Heavy Metals in Sewage with the use of Wetland

Use of Red Mud Treated with Hydrogen Peroxide and Activated by Heat Treatment as a Means Adsorption of the Dye Reactive Blue 19

Use of Vermiculite Coated with Chitosan as an Agent Adsorbent Synthetic Ions of Lead (Pb++)

Equilibrium and Kinetic Modelling Studies of Adsorption of Crystal Violet dye onto Zeolites of Coal Fly and Botton Ashes

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## Evaluation of the Removal of Heavy Metals in Sewage with the use of Wetland

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### Abstract

Currently only 10% of sewage produced in Brazil is undergoing some kind of treatment. Getting a volume of approximately 10 billion gallons to be played every day in the country's rivers and streams, causing major environmental impacts on water resources. The deployment of wetlands also known internationally for wetlands represent an efficient technology for wastewater treatment in places of low purchasing power. The purpose of this study was to evaluate the efficiency of a pilot constructed wetland system, installed at UNICAMP, the removal of metals and other chemicals present in sewage, Faculty of Agricultural Engineering, UNICAMP using the technique for Synchrotron Radiation Total of X-Ray Reflection Fluorescence (SR-TXRF). This study is important because many researchers have studied the rate of removal of total phosphorus, DBO, DQO, fecal coliform, turbidity, etc., but there are not many studies related to analysis of metals. For the project macrophyte species were used: *Typha sp.* and *Eleocharis sp.* for the purification of sewage. There was, for example, that the system input concentration of Cr ranged from 0,050 to 2.9 mg.L<sup>-1</sup>, while the output with *Typha sp* concentration ranged from 0,001 to 0,050 mg.L<sup>-1</sup> and output with *Eleocharis sp* rate ranged from 0,003 to 0,500 mg.L<sup>-1</sup>. Comparing the removal of P for the two macrophyte species *Eleocharis sp* showed better efficiency, as the removal averaged for the entire sampling period was 71,04%, while to *Typha sp.* the value obtained was in 23,20%.

**Keywords:** Wetland, environment, heavy metal, total reflection.

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## **Use of Red Mud Treated with Hydrogen Peroxide and Activated by Heat Treatment as a Means Adsorption of the Dye Reactive Blue 19**

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### **Abstract**

The effluents generated by textile industries have an undesirable level of staining due to the dyeing step, leading to changes in water quality resulting in harmful effects to the environment. Adsorption is a technique that has been used successfully in the treatment of textile effluents, but due to the high cost of some conventional adsorbents such as activated carbon, research has been directed to the use of alternative low cost adsorbents. Among the materials with great potential adsorbent that may be used instead of activated charcoal is the red mud, a waste generated on a large scale in the manufacturing process of aluminum. As a result, the objective of this study was to use the red mud activated by chemical treatment by hydrogen peroxide and heat treatment at a temperature of 500 ° C as a means adsorption of the dye Reactive Blue 19. Through the model of Langmuir was possible to obtain the adsorption capacity of red mud of approximately 192.3 mg / g, and can thus be concluded that the conditions used in the adsorption process were appropriate and conducive to the removal of the dye in aqueous solution, and that the red mud when activated by heat and chemical treatment is presented as an alternative adsorbent and low cost.

**Keywords:** *red mud, dye, adsorption, isotherm.*

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## **Use of Vermiculite Coated with Chitosan as an Agent Adsorbent Synthetic Ions of Lead (Pb<sup>++</sup>)**

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### **Abstract**

Vermiculite and chitosan have been used as adsorbent materials of low cost, because they present good characteristics for removal of heavy metals. This work presents a study of removal of lead ions (II) by clay vermiculite coated with chitosan, previously characterized by scanning electron microscopy (MEV). The results showed that the removal capacity of Pb<sup>++</sup> by vermiculite was, on average, 88.4% for synthetic wastewater with concentrations ranging from 1000 mg / L.

**Keywords:** *Vermiculite, chitosan, heavy metals, adsorption*

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## **Equilibrium and Kinetic Modelling Studies of Adsorption of Crystal Violet dye onto Zeolites of Coal Fly and Bottom Ashes**

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### **Abstract**

The adsorption of the crystal violet dye (CV) over zeolites from coal fly ash (ZCL) and coal bottom ash (ZCP) was evaluated. The coal ashes were used in the synthesis of zeolites by alkaline hydrothermal treatment. The dye adsorption equilibrium was rapidly attained after 8 min and 10 min contact time for ZCL and ZCP, respectively. Pseudo-first- and second-order kinetic models have been applied to the experimental data and pseudo-second-order kinetic was found to describe the adsorption of the dye on the adsorbents. Intra-particle diffusion studies revealed that the adsorption rates were not solely controlled by the diffusion step. The equilibrium data of ZCL was found to best fit to the Langmuir model, while ZCP was best explained by the Freundlich model. The maximum adsorption capacities were 19,6 mg g<sup>-1</sup> for the CV/ZCL system and 17,6 mg g<sup>-1</sup> for the CV/ZCP system.

**Keywords:** *coal fly ash; coal bottom ash; zeolite; basic dye; adsorption.*

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“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

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**18<sup>th</sup> May 2011**

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**15h00-16h30**

**Session 4B**

**Room 8**

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Performance Analysis of High Efficiency Thickeners to Suspensions of Leachate

Leaching of Mo, Cd, Zn, As and Pb of Fly Ash from Figueira, Paraná Power Plant

The Cleaner Production Tool and the Management of Phosphorus in the Environment

Decisions and Procedures to Cleaner Production Concerning on Liquid Effluents Assessment

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“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

## Performance Analysis of High Efficiency Thickeners to Suspensions of Leachate

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### Abstract

Leachate is a dark liquid generated by the degradation of waste, potentially polluting. Usually contains high concentrations of suspended solids, heavy metals and organic compounds. Characterize the flakes from a process of coagulation-flocculation of slurry is essential for calculations in thickeners, as well as identifying the optimum operation conditions, such as type of coagulant, concentration and pH. In this study, after determining the optimal conditions of flocculation were determined the diameter of the flake, the density of the floc, density of the supernatant and porosity of the flake using the method of Bailey and Ollis (1986), as well as some parameters obtained from batch sedimentation tests as average speed of sedimentation, and speed of Stokes using the equation of Richardson and Zaki modified . Using this results the flocs can be modeled using techniques proposed by França et al. (1999) and the results are validated by experiments.

**Keywords:** *Leachate, Flocculation, Sedimentation.*

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## **Leaching of Mo, Cd, Zn, As and Pb of Fly Ash from Figueira, Paraná Power Plant**

C. N. Lange, J. C. Silva, C. S. Bocci, I. M. C. de Camargo

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### **Abstract**

Fly ashes are frequently disposed inadequately on soil at thermoelectric power plants proximities, where toxic elements may be leached by the rain, transported to natural water sources and absorbed by plants and animals in soil. Fly ash columns were leached using a solution that simulated an acid rain for one year to evaluate the liberation of As, Cd, Zn, Pb and Mo. The results had showed that some of these elements, such as Mo, As and Cd were leached in amounts that may cause underground water contamination.

**Keywords:** *ash, coal, metal, leaching and thermoelectric.*

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## **The Cleaner Production Tool and the Management of Phosphorus in the Environment**

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### **Abstract**

The development of strategies for management of phosphorus in the environment has been considered, increasingly, of great importance for the maintainance of the quality of life. This is because besides the correlation of phosphorus with the deterioration of water resources due to eutrophication, it is projected a decrease in availability of natural reserves of this nutrient, which are finite and non-renewable. Thus, besides the discussions on ways to strengthen the protection of waters, tools for source control and recycling of phosphorus in the environment are assessed, in order to ensure the sustainability of known and exploitable stocks of this nutrient in an integrated way. Given the above, our objective is to discuss the dynamics of phosphorus in the environment, presenting the experiences already adopted, to rationalize the use and the management of the nutrient, discussing the importance of introducing the concepts of Cleaner Production. As an illustration, we present a scaling potential load of phosphorus released daily into the waters of the Tiete river, located in São Paulo state, Brazil, from urban and agricultural activities developed in the watershed. It is verified that the Cleaner Production emerges as an important tool for pollution prevention and management support, as it can contribute to reduce emissions and for implementing changes in production processes, helping them to improve the perception of this subject by producers and consumers, and the fulfillment of public policies for environmental preservation.

**Keywords:** *Phosphorus, Environment, Cleaner Production.*

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## **Decisions and Procedures to Cleaner Production Concerning on Liquid Effluents Assessment**

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### **Abstract**

This paper describes a study for cleaner production liquid effluent assessment. The radioisotope Tritium (<sup>3</sup>H), generated in the routine operation plant was stored in a 300m<sup>3</sup> capacity tank. The tank flow rate exit was estimated as 10.9 ± 0.9 m<sup>3</sup>.h<sup>-1</sup> for liquid controlled dispenser. The Tritium, potential pollutant was used as radiotracer for estimate the dilution factor liquid effluent. A planned release for stored effluent tank was carried-out. Simultaneously it was made sampling upstream of the storage tank discharge point, monitoring the tritium concentration in the mix sewerage system point. The initial concentration of the <sup>3</sup>H was determined as 56881±3255 Bq L<sup>-1</sup>. The estimated dilution factor for the aqueous effluent, in the discharge point E1 was of 4.3 and 7.4 respectively relative to two consecutive days of planned release and diluted effluents sampling. The developed methodology was rapid and without additional environmental or monetary costs, being able to use in industry, mining, milling, agriculture and others human production field. As the used radiotracer Tritium is already existent routinely in the effluent, doesn't increment radioisotope concentrations into sewage and environment, the goal of cleaner production practices and procedures.

**Keywords:** *liquid effluent, environmental assessment, radiotracer, tracer, cleaner production.*

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“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

**Conferences**

**and**

**Oral Presentations**

**19<sup>th</sup> May 2011**

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São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

**19<sup>th</sup> May 2011**

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**8h00-9h40**

**Session 5A**

**Room 1**

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Opportunity for Continuous Implementation of Cleaner Production with New Paradigm for Sustainable Engineering

Knowledge in Sustainability: (Self-)Perceptions of Rural Extension Technicians in Santa Catarina

Preliminary Studies on the Production of Nanofibrils of Cellulose from Never Dried Cotton, Using Eco-Friendly Enzymatic Hydrolysis and High-Energy Sonication

Industrial Cleaning with Ultra-Clean Water According to the Qlean-Method – A Case Study of Printed Circuit Boards

Environmental Management Program at Tyco Electronics

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## **Opportunity for Continuous Implementation of Cleaner Production with New Paradigm for Sustainable Engineering**

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### **Abstract**

Since the advent and wide-ranging discussion about sustainability, several concrete examples of initiatives in order to conduct environmental issues in engineering as, for example, Cleaner Production – CP, can be found in the literature. This article provides a theoretical/conceptual framework from the literature review on two themes, aiming to identify and establish an interrelation of the concepts, principles and practices of CP and the new paradigm of Sustainable Engineering, aiming to build sustainability.

**Keywords:** *CP; Sustainable Engineering; Sustainability.*

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## **Knowledge in Sustainability: (Self-)Perceptions of Rural Extension Technicians in Santa Catarina**

A. W. L. da Silva <sup>a</sup>, P. M. Selig <sup>b</sup>, A. A. Lerípio <sup>c</sup>, C. V. Viegas <sup>d</sup>

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### **Abstract**

Knowledge is the basis for a sustainable attitude and, as such, of sustainability itself. This assertion – valid for any social sector – seems particularly relevant to agricultural activities, which are acknowledged as a source of environmental disturbances. A survey based on a semi-structured questionnaire was used to assess the perceptions of rural extensionists of the Western Region, Santa Catarina, Brazil. The focus was on their knowledge about agricultural sustainability as well as on their interests as regards the qualification in this matter. The technicians assessed that their present understanding of the topic is from reasonable to good, and that technical events were the principal means of obtaining the knowledge they possess. All extensionists showed interest in participating in professional training processes, showing a preference for practical activities and short courses. Most technicians consider the possibility of using their own financial resources for their own qualification.

**Keywords:** *Sustainable agriculture; sustainability knowledge; rural extension; agricultural production.*

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## **Preliminary Studies on the Production of Nanofibrils of Cellulose from Never Dried Cotton, Using Eco-Friendly Enzymatic Hydrolysis and High-Energy Sonication**

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### **Abstract**

An ecologically friendly method, to obtain cellulose nanofibrils, starting from Never Dried Cotton (NDC) is described, where cotton bolls are opened and maintained in water. NDC cotton exhibits a highly accessible structure and porosity, thus allowing a more efficient enzyme action and chemical treatments and derivatization. In this work, the conditions utilized to synthesize nano-fibrils from NDC were also tested on once dried cotton; the latter failed to produce nano-fibrils when submitted to the experimental conditions applied. A first-drying of cotton fibers results in a structure characterized by a collapse of the NDC fiber structure, which change from a circular cross section to its typical "bean-like" cross section, with reduced accessibility and porosity, and lower water sorption capacity. Those changes are of the same nature as the well known *hornification* described in pulp and paper science studies, associated with irreversible reduced accessibility, which affects paper properties, and in general, the utilization of cellulose for utilization as materials or fuel (i.e. alcohol). In this work, enzymatic hydrolysis of the fibers was followed the by high energy sonication for 20 to 50 minutes, resulting in the production of nanofibrils when using NDC. Similar treatment applied to once-dried cotton failed to produce nanofibrils. Although analysis of films made from hydrolyzed and sonicated NDC material, with scanning electronic microscopy, disclosed micro-fibers lengths of approximately 30 µm, and some nano-scale structures, only with Transmission Electron Microscopy was possible to confirm the presence of nanofibrils, Structures with 50 nm in diameter, were present after submitting the NDC to enzymatic hydrolysis, and high-energy sonication. Both processes are considered eco-friendly: enzymatic hydrolysis and, especially, high energy sonication which is gaining impressive industrial utilization in the last decade.

**Keywords:** *Never -Dried Cotton, Cellulose, nanofibrils, ultrasound, hydrolysis*

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## **Industrial Cleaning with Ultra-Clean Water According to the Qlean-Method – A Case Study of Printed Circuit Boards**

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### **Abstract**

The manufacturing industry today uses many kinds of chemicals in its cleaning processes. The industrial cleaners often contain some sort of degreasing chemical to clean parts and components before the main processes, for instance assembly or surface treatment. These types of cleaning methods are often expensive and involve hazardous handling of chemicals in manufacturing, as well as in the transportation of hazardous waste. In addition, the cleaning processes often use a substantial amount of energy for cleaning.

The aim of this paper is to explore how ultra-clean water cleaning, using a method called Qlean, can be applied in the manufacturing industry. In order to meet this aim, a case study was conducted at Flextronics, in Karlskrona, Sweden. The data for this research was collected through interviews and functional tests at different industries, which then was analysed further.

The results from this research show that using solvent-free industrial cleaning with ultra-clean water is beneficial from the perspectives of quality, environment and business. The quality improvement derived from using solvent-free industrial cleaning in the case of cleaning printed circuit boards was the most important benefit.

**Keywords:** *Ultrapure, De-gassed, Cleaner Production, Qlean, SOFIQ project.*

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## **Environmental Management Program at Tyco Electronics**

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### **Abstract**

The project "Environmental Management Program in Tyco Electronics" aims to help on preventing, eliminating and / or reducing environmental and occupational hazards that are generated in the production process of one of the company's work teams. To achieve this, we will work on the development of an environmental management program that reduces the generation of pollutants and waste in this production line.

In a society increasingly aware of the need to protect natural resources and environment, the company Tyco Electronics has the need to start with this type of project due not only to state and national standards that regulate corporations But also as a strategy to reduce costs and increase competitiveness, and especially for its social commitment to preserve and conserve the environment.

The team that is going to be in charge of the EMP has experience in developing and implementing such programs within the company. In addition, the company has an approach on caring for the environment, facilitating the teamwork among the rest of the staff of the company.

**Keywords:** *pollution prevention, cleaner production.*

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**19<sup>th</sup> May 2011**

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**8h00-9h40**

**Session 5A**

**Room 2**

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Design Methodology of Life Cycle Assessment (LCA) of Ethanol Fuel by CML 2000 with SimaPRO

Optimization of Integrated Clean Production of Pyrogas, Biogas, Methanol, Bioelectricity, Fertilizer and Feed from Agro Wastes with Reduced Emission

Technological Innovation and Sustainability in the Sugar Cane Chain

Untying the Need for Fossil Fuels: The Role of Brazil in Building a Greener Energy Matrix

Los Residuos Agrícolas y Cañeros como Alternativa Energética del Presente y del Futuro

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## **Design Methodology of Life Cycle Assessment (LCA) of Ethanol Fuel by CML 2000 with SimaPRO**

I. D. Zapparoli <sup>a</sup>, S. S. da Silva <sup>b</sup>

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### **Abstract**

The aim of research is to study through life cycle assessment (LCA) economic and environmental aspects related to the production of fuel ethanol from sugarcane, fuel be auditable environmental improvements during its lifecycle and be forward alternative to fossil fuels is of great strategic importance for Brazil. The methodological framework is based on the recommendations of series ISO 14040 and CML method is used in 2000, life cycle assessment, identifying impacts the following categories: climate change; destruction of the ozone layer; acidification; eutrophication; ecotoxicity of freshwaters and human toxicity. This research identify the environmental impacts at each stage of the lifecycle of ethanol fuel, can contribute to the debate on the new forms of action of the State and of the challenges and market prospects for the sugar-alcohol sector, after the deregulation of agroindustry, seeking a better economic and environmental efficiency.

**Keywords:** *methodology. Life cycle assessment (LCA). Fuel ethanol. CML 2000. Agroindustry*

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*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

## **Optimization of Integrated Clean Production of Pyrogas, Biogas, Methanol, Bioelectricity, Fertilizer and Feed from Agro Wastes with Reduced Emission**

P. V. Pannirselvam <sup>a,b</sup>, M. M. Cansian <sup>a</sup>, M. Cardoso <sup>a</sup>, A. H. F. Costa <sup>a</sup>, R. F. Guimarães <sup>a</sup>, R. S. Kempegowda <sup>c</sup>

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### **Abstract**

Brazil is the leader known for its ethanol biofuel development, but also for biomass charcoal, yet lacks in clean rural biofuel and bioenergy production. This paper deals with the system design based on zero emission for sustainable projects developments based on the alternative bioenergy production from biomass wastes using innovative process equipments design and the process optimization. Agro industrial wastes pose a major concern today due to the increase of production with time and thus needs ecological solution. For this problem, an integrated industrial ecological system using the clean Small Bioenergy-Systems (SBS) based on the Zero waste concept was studied by the three basic principles. The first principle is to use all components of the biological organic materials of the wastes. The second principle is to obtain more co-products from the wastes. The third principle is to close the loop via reuse, recycle and renewal of the material and nutrient flows. The SBS approach has many benefits and potentials. The system design is meant for small-scale energy production using hybrid bio-fuel and internal combustion (IC) engine from wastes: It was developed using process analysis (synthesis, modeling, and design) of two stage anaerobic bio process and its integration. SuperPro Designer Process simulation software was used to make synthesis and evaluate these options and performs mass material balance.

Case study was made with the anaerobic process in several stages and recycle of reactor output are found to be very use full and increases the biomass load and also the productivity when used with staged baffled and up flow reactor to produce biofertilizer, bio-hydrogen, bio-methane ,charcoal, ethanol and bio electrical energy with recycle of water ,CO<sub>2</sub> and microbial biomass, which are integrated to internal Combustion engine for combined heat and power (CHP). Existing biogas technologies has potential for practical application combined with hydro pyrolysis to make methanol via low temperature methanol production, but if biohydrogen systems are to become competitive, they need more detailed integrated two stage biohydrogen and methane bio reactor to enhance the efficacy of biofuel utilization for energy needs. The results obtained from several preliminary project developments of clean SBS are reported for integrated system developments for fuel and food using process and cost simulation models. These models render the process development and optimization problem with ecological economic potential objectives to be resolved very rapidly and make it possible make successful project design with the reduction of CO<sub>2</sub> emission , water consumption and solid residues, sustainable bioelectric CHP with value added co-products.

**Keywords:** *Clean technology, Carbon Reduction, Biomass, Syngas, Biogas, Biohydrogen, Biomethanol.*

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“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

## **Technological Innovation and Sustainability in the Sugar Cane Chain**

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### **Abstract**

This paper assesses the present pattern of interactions between universities, public research institutes and industrial firms in Brazil and the sugar cane business chain. The proposal is to identify and analyze possible links between universities, research institutes and enterprises for the scientific, technological and economic activity of the so called "sugar cane territory", as well as the existence of some kind of link between these activities and sustainable management of this territory. This is done in light of a context of a late development of institutions and industrialization. Recent research points to a depletion of incremental improvement in the production of ethanol by the current route of fermentation of sugar cane, restricting the increase of production to increase in area planted. The expansion of sugarcane may result in increased deforestation, fire, contamination of aquifers, and the historical problematic work relations in the field. The databases analyzed in this research are: CNPq Directory of Research Groups and FAPESP-BIOEN Program. The relevance of this study is based on the strong expansion of cane cultivation, and the need to produce knowledge directed to social and environmental sustainability of this activity to support the definition of public policies for technological innovation and environmental management.

**Keywords:** *Technological innovation, environmental management, sugar cane business chain.*

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## **Untying the Need for Fossil Fuels: The Role of Brazil in Building a Greener Energy Matrix**

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### **Abstract**

The purpose of this essay is to discuss how Brazil has invested in diversification of its energy matrix to support the diplomatic discourse, in recent years, that defended new and less polluting resources over the current global energy paradigm that is based on the use of oil. In this way, we will analyze the latest available data provided by the government agencies and we will confront this information to the use of few clean resources explored in the country. We concluded that Brazil still has a framework of energy dependence. However, we believe that Brazilian diplomacy played the main role of encouraging other countries to think about alternative possibilities to the current energy paradigm taking into account their possible contribution to reduce greenhouse effect and to reduce damage to the environmental impact on the globe.

**Keywords:** *Energy matrix. Brazil. Renewable resources. Diplomacy.*

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## **Sugarcane and Agricultural Residues as an Alternative Energy for Present and Future**

P. F. Beltrán, J. B. C. Martínez, J. R. F. Veja, I. F. Acea, A. S. Medina, V. Mencia

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### **Abstract**

This work presents biomasses uniaxial deformation experiments in a cylindrical matrix, and mathematical models of the biomasses physical behaviour are obtained. These models were very useful in the design of hydraulic briquettes- molders. The results in the production of tubular are relevant. Thus, the technical and economical standards of these briquettes are equal or superior to those appearing in the specialized literature for the technology in question. The higher effectiveness of the tubular briquettes over the solid ones has been demonstrated theoretically and practically in the cases of thermochemical processes and transformation of biomasses. This is feasible for biomasses coming from not wooden waste, and which geometrical dimensions have been conveniently modified. It is important to highlight the sources and conditions of the waste used. It is obtained mainly as a result of the agricultural processes and the sugar cane industry. This waste is often found in the harvest fields or recollection centres at a humidity between 12-20%. The levels of humidity cannot be easily reduced, since there are serious difficulties to create the technical and technological infrastructure that the improvement of these conditions requires. Because of the briquettes- molder adaptability and mobility, the hydraulic densification technology is the most viable alternative to address the above stated problem. They can be taken to the diverse places where the biomasses are located.

**Keywords:** *Energy. Waste, biomass.*

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**19<sup>th</sup> May 2011**

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**8h00-9h40**

**Session 5A**

**Room 3**

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Utilization of Energy in Municipal Solid Waste Landfill

Energy Accounting in the Two Systems of Generating Electricity Using Waste

Microorganisms Growth Rate Evaluation and Proposal of Model for Biomass Production of *Haematococcus pluvialis*

Evaluación de un Proceso Microbiológico de Compostaje Acelerado de la Fracción Orgánica de los Residuos Sólidos

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## **Utilization of Energy in Municipal Solid Waste Landfill**

G. F. da Silva, C. M. V. B. de Almeida

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### **Abstract**

In developing countries the landfills stand out as a way for final disposition of the urban solid waste by showing the lower cost and the engineering techniques that aim the minimization of the impacts to the public and environmental health. In this sense, this study makes the emergy synthesis of a landfill in the city of São Paulo. That has a project of environmental compensation and electric energy generation by burning biogas. The total emergy of the system equals  $1,22 \times 10^{20}$  sej. And the specific emergy of the USW are equivalent to  $8,36 \times 10^{11}$  sej/m<sup>3</sup> and transformity of the electric energy that was produced is  $4,67 \times 10^3$  sej/J.

**Keywords:** *emergy, landfill, biogas, environmental*

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## **Emergy Accounting in the Two Systems of Generating Electricity Using Waste**

I. Corsini; B. S. Carvalho; E. M. Pereira, M. C. A. Cunha, C. C. Silva

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### **Abstract**

This article aims to assess by emergy accounting, two systems of electric power production. Comparing two different realities, one that uses a power generation system installed on a standalone mill in São Paulo and another in a Sewage Treatment Station (STS) located in Uppsala, Sweden. The systems were measured by indicators that indicate the environmental burden.

This methodology presents the results, synthetic and easy to understand that aid in the pursuit of sustainable development and environmentally friendly. Based on our analysis of the digestion system installed at the station ETE indicates disadvantages over the plant unattended.

This is due to higher utilization that makes the plant independent of renewable resources (R, N), thus Transformity better, lower environmental burden and reduced pressure on the environment.

**Keywords:** *emergy, STS, independent power plant, waste, energy*

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## **Microorganisms Growth Rate Evaluation and Proposal of Model for Biomass Production of *Haematococcus pluvialis***

R. M. Galvão, T. S. Santana, C. H. O. Fontes, E. A. Sales

*Universidade Federal da Bahia, UFBA, Escola Politécnica, Laboratório de Bioenergia e Catálise (LABEC), Bahia, BRASIL*

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### **Abstract**

The use of microalgae for production of biofuels has been pointed by many researchers as essential to reduce the emissions of gases that cause global warming. Microalgae cultivation can act in the process of CO<sub>2</sub> sequestration and the biomass formed can be used to replace fossil fuels. Thus, the interest in optimization of the microalgae cultivation is not only in high added value products but also in the formation of biofuels. This paper presents a study the growth of microalga *Haematococcus pluvialis* considering light conditions equal to 10000 lux, temperature  $298 \pm 1$  K and pH in the range 7-9. The formation of biomass was evaluated by an exponential model where the parameters were adjusted in order to describe the growth of the microalgae over time.

**Keywords:** *biomass of microalga, growth rate, Haematococcus pluvialis, modeling.*

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## **Microbiological Evaluation of Accelerated Composting Process of the domestic solid waste organic fraction**

D. Di Giusto, A. Ledesma, J. Dutto

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### **Abstract**

In this organizational presentation was developed a biotechnology, for the planet's health care and quality of life for its inhabitants. The main solution consists of a pool of natural microorganisms, which combine synergistically to accelerate and improve the biotransformation of organic solid waste source at home. This method generated as a result a number of economic, social and environmental as well as an excellent cost-effectiveness.

This system of waste treatment is intended to minimize the amount of waste to be disposed of, and is considered to be transformed into the perfect complement to any landfill technology by accelerating time to degrade the material and reduce the space used for this process.

This initiative aims to transform the philosophy which sees waste, harnessing the potential they have, when considered not as mere waste, but as important renewable resources.

The proposed method is a microbiological process accelerated composting the organic fraction of domestic solid waste. Under controlled conditions of aeration, temperature and moisture, organic waste is converted into a biological fertilizer in a period not exceeding 20 days. The speed of the process prevents the occurrence of disease vectors, flies, rodents, and the emergence of odors associated with anaerobic decomposition of waste. Is performed on concrete cradles to prevent runoff of liquids, and every time you finish the biotransformation of waste can be used the same crib.

The resulting compost is high in nitrogen, phosphorus and potassium, which makes it a high quality fertilizer.

**Keywords:** *Accelerated Compost - microbiological inoculums - organic waste.*

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*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

**19<sup>th</sup> May 2011**

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**8h00-9h40**

**Session 5A**

**Room 4**

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The Relation Between Business and Law Under the View of a Cleaner Production

Environmental Regulation to Sustainability: Contributions to Build a Theoretical Reference on the Limits of Traditional Models

The CONAMA Resolution N<sup>o</sup>. 302 of 20 March 2002 and the Preconditions for Sustainable Management of the Area Surrounding the Artificial Reservoirs Filled by Invasive Plants

A Research on the Awareness Toward Sustainable Production Aspects

Political Economy of Sustainability: Payments for Ecosystem Services (PSA) on the Upper Stretches of Rio Tibagi, Paraná

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## **The Relation between Business and Law under the View of a Cleaner Production**

L. C. Ribas, L. M. S. Ota, R. M. de Oliveira, L. A. G. Rocha, E. C. Navarro

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### **Abstract**

In order to adapt to new standards of development, companies have sought to incorporate in their practices the principles of sustainability. Environmental legislation runs parallel, renewing towards the same trend. This paper aims to study the case experienced by GEPSIG Group (Integrated Management System, Faculty of Agricultural Sciences, Botucatu - SP) and analyze the relation between business, environment and legislation. It is also discussed proposals for better integration of the sectors in the pursuit of cleaner production.

**Keywords:** *Environmental licensing, environmental legislation.*

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## **Environmental Regulation to Sustainability: Contributions to Build a Theoretical Reference on the Limits of Traditional Models**

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### **Abstract**

Under the argument that environmental regulation should accompany changes in how society perceives its relationship with the environment, this paper presents some limits of the current regulation model, based on a selected literature review. Through a proposed taxonomy of these limits, some hurdles to sustainable development attaining are presented, concluding that the transition depends not only, and perhaps not even mainly, on technology, but on profound social changes.

**Keywords:** *environmental regulation; sustainability; environmental public policy*

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**The CONAMA Resolution N<sup>o</sup>. 302 of 20  
March 2002 and the Preconditions for  
Sustainable Management of the Area  
Surrounding the Artificial Reservoirs Filled  
by Invasive Plants**

G. P. Freitas, L. C. Ribas

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**Abstract**

The Forest Code is an instrument command and control guiding, primarily, of the national policy and of the system of forestry production's organization, and stimulates the planting of forests. Aside from the aspect of forest production of Forest Code, is found the worry with the environmental protection. Allied to this instrument of standardization, The National Council of The Environment (CONAMA in Portuguese) may be mentioned, in order of, issuing resolutions, consolidate tools susceptible of the regulation and complementary of various devices recommended by the Forest Code. In this article will be especially discussed the Resolution of CONAMA n. 302, of May 20, 2002. The purpose is the discussion the applicability of the resolution for sustainability for Permanent Protection Areas (PPA) the surroundings of artificial reservoirs. This discussion is based on a proposal for a human intervention in PPA of artificial reservoirs, aiming to control invasive species (*Melinis minutiflora*). We conclude that, focusing on the social, environmental and economic, it is possible to support a proposed technical plan for the establishment of grasses, planting native species and fruit trees, building of materials originating from timber and eco-friendly, thus enhancing even the objectives established in the National Policy on the Environment.

**Keywords:** *CONAMA, Resolution 302, Sustainability, Permanent Protection Areas, Artificial Reservoirs*

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## **A Research on the Awareness toward Sustainable Production Aspects**

A. R. Sacomano, P. L. O. Costa Neto

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### **Abstract**

In this paper it is present part of a broader research named “Social Responsibility as an Element do Sustainability, Quality of Products and Services and Quality of Life”, part which deals with the awareness on sustainable production of entities related to the subject and professionals classified in lawyers and others. By selecting the mentioned part of the broader research, this one carried on during a master degree work, the authors aim to show points of Brazilian reality related to this awareness, in order to indicate its progresses and omissions with respect to the thought on social responsibility and sustainability, so wishing to contribute for the adoption of propositions able to improve this degree of awareness in Brazil, including a better commitment of the legal professionals.

**Keywords:** *Sustainability, social responsibility, lawyers, awareness, quality of life.*

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**Political Economy of Sustainability:  
Payments for Ecosystem Services (PSA) on  
the Upper Stretches of Rio Tibagi, Paraná,  
Brazil**

I. D. Zapparoli <sup>a</sup>, F. V. D. Zapparoli <sup>b</sup>, S. S. da Silva <sup>c</sup>, L. S. Reichel <sup>d</sup>

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**Abstract**

Water is the public domain and a resource indispensable to life. Therefore, the implementation of public policies aimed at the proper use of this natural resource, is a challenge coupled with economic growth. This work aims to verify of payment for environmental services (PSA) as a means of protection of surface wellheads in stretches of River Tibagi. The hypothesis initially was that this mechanism could contribute in building alternatives covering the conservation of water resources. This paper used descriptive research as a methodology. The delimitation of the study marched in the municipalities of River Tibagi in especially in area of Londrina e Ortigueira, located in the State of Paraná. Through the study was not possible to conclude that the adoption of this economic incentive in the country is recent and emerges as a complementary alternative to the current mechanisms of Command-Control (CC). Experiments show that this may be the correct path, but is a fundamental debate in the communities involved within the River Tibagi. This study has not exhausted the subject and suggests how to search other instruments continuity of financial compensation for the preservation of hydrology.

**Keywords:** *Payment for ecosystem services (PSA). River Tibagi Basin. Londrina. Ortigueira*

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**19<sup>th</sup> May 2011**

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**8h00-9h40**

**Session 5A**

**Room 5**

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Environmental Accounting of ABC Paulista Using the Emergy Synthesis

Rehabilitation Program of the Central Area of São Paulo (Procentro) and its Influence on the Formation of Heat Island

Environmental Assessment of Natural Resources Located in Urban Areas: A Case Study in the Bacia do Pina and Parque dos Manguezais

Municipal Urban Parks of São Paulo: Environmental Accountability of eMergy

Concepts, Principles and Tools for an Urban-Industrial Environment More Sustainable

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## **Environmental Accounting of ABC Paulista Using the Emergy Synthesis**

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### **Abstract**

The great growth of the urban population generates a great change in the life style, land use, energy demand and consequent environmental pressure. In this way, studies related to environmental sustainability of urban systems and the availability of natural resources are of major importance. Emergy is considered to be a powerful tool to environmental accounting and measures both natural and human resources to generate products and services. The evaluation through emergy synthesis of cities, states, nations and its base resources provides large scale perspective to evaluation of environmental areas and can help selection of policies for public benefit. This preliminary study applies the emergy synthesis to evaluate the sustainability of the cities that compose the ABC Paulista, accounting the local free renewable resources that give support to the cities. It's also done an evaluation of the results based on the GDP's and the HDI's of each municipality.

**Keywords:** *Emergy synthesis, environmental accounting, environmental sustainability, urban systems.*

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*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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## **Rehabilitation Program of the Central Area of São Paulo (Procentro) and its Influence on the Formation of Heat Island**

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### **Abstract**

The city of São Paulo passed through five major urbanizations since 1825 until today that intensified land use over urban climate. Since 1960 the central region goes into a process of decay, and in 2002 is being launched Rehabilitation Program of the Central Area of São Paulo (Procentro) to reverse this situation through assistance distributed by the Districts of the República and Sé and that taking into consideration environmental issues, reduce the intensity of the heat island of São Paulo.

**Keywords:** *urbanizations, land use, heat island*

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## **Environmental Assessment of Natural Resources Located in Urban Areas: A Case Study in the Bacia do Pina and Parque dos Manguezais**

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### **Abstract**

Population growth in urban centers causes the reorganization of space, causing serious consequences, and long-term shortages of natural resources. In this sense, there is a preoccupation with the measures for conservation of natural resources in metropolitan areas as the city of Recife, state of Pernambuco. The importance of this work is the proposition preservation and conservation measures in areas affected by the inappropriate use of natural resources. This article analyzes the environmental impacts, using the method of Rodrigues *et al.* (2000), suffered by the Bacia do Pina (this consists of rivers, and represents a key element in the dynamics of estuarine ecosystem) and the Parque dos Manguezais (one of the last remnants of mangrove preserved at Recife). It was observed that these areas suffer from the ground due to speculation - building, highway and proximity to a shopping mall near by the mangrove, deteriorating by the deposit of waste affected by the disorder of the urban area, among other factors. This shows the indifference of the public on these sites and the need to integrate the community on environmental issues.

**Keywords:** *Urban space; Natural resources; Preservation; Conservation and Tourism.*

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## **Municipal Urban Parks of São Paulo: Environmental Accountability of eMergy**

M. V. Mariano, C. M. V. B. Almeida, A. P. Z. Santos

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### **Abstract**

São Paulo city has been investing on the deployment of green areas to improve people life quality. In this regard, the Secretary of the Green and the Environment of São Paulo has increased vegetation coverage through a program of afforestation and creation of new urban parks. The establishment of linear parks along the courses of rivers and streams also takes part of this guideline. This article uses the environmental accountability on emergy for the evaluation of two parks on the east zone of São Paulo: the Linear Park Tiquatira and the Park Vila Silvia. The energy flow and materials in maintenance and use on each one of these parks are accounted. The total energy of Linear Park Tiquatira é  $1,52 \times 10^{17} \text{seJ/m}^2$ , being 57% related to renewable natural resources and 43% from the economy. The total emergy of urban park Vila Silvia is  $1,68 \times 10^{16} \text{seJ/m}^2$ , being 9% of renewable natural resources and 91% from the economy.

**Keywords:** *Emergy, environmental accountability, environmental sustentability, parks.*

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*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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## **Concepts, Principles and Tools for an Urban-Industrial Environment More Sustainable**

T. S. Dalbelo, R. A. Freire, E. W. Rutkowski, E. Z. Monteiro

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emilia@fec.unicamp.br, evandrozig@fec.unicamp.br*

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### **Abstract**

The main objective of this paper is to understand how the concepts of Industrial Ecology, the principles of the certification of buildings and the tools of sustainability indicators can relate to achieve a more sustainable industrial architecture that integrates and benefits the urban environment. Such a search is made from a survey of the applications of environmental certification systems in industrial buildings and also the main concepts related to indicators of environmental performance in buildings and Industrial Ecology. We propose a comparative analysis of key concepts and there is a correlation between certification and Industrial Ecology.

**Keywords:** *Industrial Ecology, Building Certification, Sustainability Indicators and Industry*

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**19<sup>th</sup> May 2011**

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**8h00-9h40**

**Session 5A**

**Room 6**

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Biodiversity Loss due to Climatic Impact of Land Use in LCA: a Case Study in Regionalization of Carbon Transfer Data in the Brazilian Atlantic

Life Cycle Assessment (LCA): Discussion on Full-Scale and Simplified Assessments to Support the Product Development

Life Cycle Analysis for Cow Beef in Sonora: Slaughtering Stage

Comparative Environmental Assessment for Public Luminaires

Social indicators of LPB - Liquid Packaging Board production from a life cycle perspective

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## **Biodiversity Loss due to Climatic Impact of Land Use in LCA: A Case Study in Regionalization of Carbon Transfer Data in the Brazilian Atlantic Forest**

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### **Abstract**

Land use leads to different impacts on nature, so that the Life Cycle Assessment (LCA) of land use should include at least the impacts on biodiversity, biotic production and regulatory functions in the natural environment. This study focuses on the climatic effect of land use, determined by the carbon transfers between vegetation/soil and atmosphere, considering re-absorption by the earth's surface, aiming to generate usable data for assessing the loss of biodiversity. There are current methods for LCA use, which provide data for the main world biogeographic regions. But considering that carbon transfers are very specific for each microregion of the globe and even the existence of a more detailed division of biomes in each country – each of them with significant differences in species, ecological dynamics, ecological interactions and environmental conditions – a regionalization of the data for the Brazilian biomes is proposed, considering the main land uses. As an example and for validation of the data regionalization process, the study is focused on obtaining data of carbon transfers in the Atlantic Forest Biome. Therefore, initially, data on carbon stocks in soil and vegetation, for each of the strata of the Atlantic Forest Biome, were collected and tabulated. Then, calculation procedures were performed, considering not only the amount transferred, but also the permanence of carbon in the atmosphere, to finally determine values for the carbon transfer to the air due to implantation of pastures in the different strata, expressed as fossil-combustion-equivalent tons of carbon. The case study allowed the conclusion that the regional data are quite different from the generic data previously found for rainforests. Furthermore, differences were found between the values of carbon transfer to the various strata that make up the same biome - the Atlantic Forest. Thus is reinforced the need to regionalize the data on carbon transfer in order to make them more realistic and reliable.

**Keywords:** *Life Cycle Assessment (LCA). Carbon Transfers due to Land Use. Biodiversity Loss.*

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## **Life Cycle Assessment (LCA): Discussion on Full-Scale and Simplified Assessments to Support the Product Development Process**

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### **Abstract**

The environmental impacts observed throughout a product life cycle are, to a large extent, determined during its development phase, especially on the initial stages of product development process. These stages are characterized by a high level of uncertainty, environmental performance improvement potential and by the unavailability of quantitative and detailed data of the product for performing full-scale LCAs, since it is still under development. Companies are more than ever recognizing the need for adopting a systemic view of the environmental impacts in the first stages of product development but, the complexity and slowness of full-scale LCA studies coupled with the lack of technical expertise of the designers to apply LCA, prevents the use of the results in the decision making process of product development. In order to overcome this problem, a large amount of ecodesign practitioners and academics has developed simplified methods and tools to assess the environmental impacts in the product life cycle. In this context, the main goal of this study is to discuss the use of full-scale and simplified LCA in product development process context and present an overview of the so called simplified LCA, obtained during a systematic literature review on ecodesign methods and tools.

**Keywords:** *Life Cycle Assessment (LCA), Simplified Life Cycle Assessment (S-LCA), Ecodesign, Product Development Process (PDP).*

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## **Life Cycle Analysis for Cow Beef in Sonora: Slaughtering Stage**

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### **Abstract**

By using a life cycle analysis, impacts to the environment were identified and assessed during the slaughtering stage of the production system of beef from Mexico Supreme Quality official brand in a Federally Inspected Type (TIF by Spanish acronym) Slaughterhouse within the state of Sonora, Mexico. The weight of two channels was the functional unit considered. To this end, the slaughter process characterization was carried out on the slaughterhouse, where qualitative and quantitative data was obtained as inputs into production processes and cleaning, and emissions to water, air, solid waste, etc.

The following environmental impacts were identified and analyzed using software GaBi Education: global warming potential, eutrophication of water, air acidification, photochemical ozone creation and human toxicity. The results showed that the main environmental impacts include the potential for water eutrophication and global warming due to pollution of wastewater, which contained organic matter and chemicals during the production process, and due to emissions of CH<sub>4</sub> and CO<sub>2</sub> from livestock enteric fermentation, manure management, and use of fossil fuels.

Opportunities were proposed to improve the environmental aspects on the slaughterhouse such as improving sewage treatment, optimizing water use, introducing the use of renewable energy, among others. The results of this study are useful in efforts to improve environmental issues and to prevent pollution at this stage of the production chain of beef.

**Keywords:** *Life cycle analysis (LCA), Global Warming Potential, Eutrophication Potential, beef, Greenhouse Gases (GHG) emissions.*

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## **Comparative Environmental Assessment for Public Luminaires**

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### **Abstract**

A comparative analysis was performed to compare the design of two distinct products, ie, luminaires manufactured by different processes (manufacturers) to obtain sensitivity and validate the technique of LCA for product redesign. Following recommendations of ISO 14040, was defined the scope of study to ensure that its breadth, depth and degree of detail to attend the established objective. The inputs and outputs relevant to all stages of life were recorded. With the support of software GaBi 4.0, the environmental impacts were obtained from environmental surveys. The functional unit was customized in order to promote a gain in sensitivity when comparing the environmental performance of both products. The products were then compared according to the environmental impacts considered. From the strategies prescribed by the ecodesign approach, we identified the main points to be improved in the redesign of products to mitigate the potential environmental impacts associated with its life cycle and improve on their environmental performance. Thus there was the potential of technology as a development tool for this type of product.

**Keywords:** *acv of lighting products, acv of luminaires, environmental assessment of lighting products, products redesigning by acv; ecodesign of lighting products.*

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## **Social indicators of LPB - Liquid Packaging Board production from a life cycle perspective**

A. L. Mourad <sup>a</sup>, H. L. G. da Silva <sup>b</sup>, J. C. B. Nogueira <sup>c</sup>

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### **Abstract**

Despite sustainability needing to be analyzed through the integration of environmental, economic and social aspects, almost always only the first aspect is considered. The objective of the present article is to show partial results of a life cycle assessment study of the production of Liquid Packaging Board - LPB, concerning social aspects. The LCA study was carried out for Klabin, the biggest producer, exporter and recycler of paper in Brazil, with 17 industrial plants in Brazil and one in Argentina. The scope of this study includes data from the forest up to the rolls of finished carton leaving the production line ready for shipment, considering a cradle-to-gate approach. Social indicators based on qualification levels proposed by UNESCO (United Nations Education Science and Culture Organization) and income levels according to IBGE (Brazilian Institute of Geography and Statistics) were proposed. It was observed that 9 seconds of human labor was required to produce 1 kg of Liquid packaging Board in 2008. The level of professional and educational qualification of the employees was rather high, with 4% of the employees holding a post-graduate degree (M.Sc. or PhD.) and only 7% having just primary level education. The income-distribution profile shows that 94% of the employees receive more than double the monthly minimum salary, which is a factor of great significance in a country where 55% of the population receives less than this. It is very important that sustainability of products and processes should also be analyzed by their social contribution besides environmental aspects.

**Keywords:** *life cycle assessment, social indicators, packaging, beverage container*

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**19<sup>th</sup> May 2011**

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**8h00-9h40**

**Session 5A**

**Room 7**

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More Demand for Resources with the Same Resources:  
Increased Vehicle Fleet in São Paulo

Environmental Pollution: Quantitative Analysis of Particulate  
Matter (PM10) by SR-TXRF

Evaluation of Factors Influencing the Purchase of a Vehicle,  
Based on the Vehicle Brazilian Labeling Program

Sustainability and Environmental Preservation: A Bibliometric  
Study on Biofuels

Management of the Use of Cooking Oil for Biodiesel  
Production: A Case Study McDonald's

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## **More Demand for Resources with the Same Resources: Increased Vehicle Fleet in São Paulo**

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### **Abstract**

The economic growth of Brazil, observed in recent years has brought benefits in terms of people's lives. However, all growth requires planning for it to occur adding as many possible advantages to this process. Vehicle sales in Brazil have grown every year raising concerns about the infrastructure available to support it. This article, exploratory, says such growth with main focus on the metropolitan region of Sao Paulo warning of the increased emission of pollutants into the atmosphere.

**Keywords:** *Air pollution, motor vehicles, emission of pollutants*

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In Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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## **Environmental Pollution: Quantitative Analysis of Particulate Matter (PM<sub>10</sub>) by SR-TXRF**

A. S. Melo Júnior<sup>a</sup>; S. Moreira<sup>b</sup>; D. M. Roston<sup>c</sup>; J. E. Paternianni<sup>d</sup>; P. J. G. Ferreira<sup>e</sup>; F. Camargo<sup>f</sup>

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### **Abstract**

To study is the air quality in the region of Campinas was set up three collection sites in different locations: Barão Geraldo, Campinas, downtown and Paulinia. Environmental monitoring in addition to researching the amount of total suspended particles (PM<sub>10</sub>) by comparing the values with the reference value for air quality considered regular CETESB (Technology Company Environmental Sanitation) for 150 µg.m<sup>-3</sup>. After the samples were prepared by a chemical process for measuring technique the total reflection (SR-TXRF) synchrotron radiation at the National Synchrotron Light Laboratory (LNLS). The technique detected 19 chemical elements: Al; Si; P; S; Cl; K; Ca; Ti; V; Cr; Mn; Fe; Co; Ni; Cu; Zn; Se; Br and Pb, addition to measuring the percentage of chemicals related to particulate matter collected. Even with the help of the statistical method – PCA (Principal Components Analysis) grouping the elements according to one of four emission sources that they are: soil re-suspension, vehicular, industrial and sulfates. Getting the percentage of pollution emitted by each source.

**Keywords:** *Environment, particulate, total reflection.*

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## **Evaluation of Factors Influencing the Purchase of a Vehicle, Based on the Vehicle Brazilian Labeling Program**

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### **Abstract**

At the end of the twentieth century many countries designed laws and benefits in order to reduce the waste of energy. Thus, is created in Brazil in 1993, the Brazilian Program Labeling that aimed to inform consumers the energy performance standard of domestic appliances. However, cars, which are responsible for a large share of fossil fuels, were not included in the program. So in 2008 was created the Brazilian Labeling Program (PBE vehicle), which aimed to classify vehicles in terms of energy consumption. Thus the present study analyzed the EBP vehicular regarding their knowledge to consumers, and its use when buying a vehicle. As a result it was evident that the program requires greater dissemination to be more recognized by the market consumer, and a new policy for the participation of assemblers, since some cars that have greater popularity are not included in the program.

**Keywords:** *Vehicle Brazilian Labeling Program; Brazilian Automotive Industry; Car Passangers*

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## **Sustainability and Environmental Preservation: A Bibliometric Study on Biofuels**

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### **Abstract**

The need to reduce greenhouse gases emission improves the interest in research and production of biofuels.

The main objective of this work is to understand the literature of biofuels, more specifically related to the strategies adopted by countries seeking sustainability and environmental preservation. For this, the authors performed a bibliometric study with content analysis. The database chosen was ISI Web of Knowledge (Web of Science), with the topics "biofuels" and "strategy". One hundred thirty works were obtained, but the authors chose to only analyze articles, decreasing the number to eighty-nine jobs, which involved three hundred seventy-nine authors, sixty-four journals and thirty-six countries. After reading the abstracts, thirteen articles were excluded because they did not fit the theme, resulting a final sample of seventy-six articles, between 1999 and 2010.

The authors analyzed the publications (journals and most important areas) and citations (frequency, most cited articles, citations of articles to references). The journals that published more articles on the topic were: Biomass & Bioenergy, Energy Policy, Environmental Science & Technology, Proceedings of the National Academy of Sciences of the United States of America. The main areas were: agriculture, bacteria / protein, biomass, fuel consumption, emissions and energy.

**Keywords:** *biofuels, strategy, bibliometric study.*

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## **Management of the Use of Cooking Oil for Biodiesel Production: A Case Study McDonald's**

T. N. Lopes <sup>a</sup>, V. A. Belo <sup>b</sup>, A. Formigoni <sup>c</sup>, E. F. Rodrigues <sup>d</sup>, I. P. A. Campos <sup>e</sup>

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### **Abstract**

In view of the currently rising awareness on the sustainability and environmental questions on the part of the general public, the present work reflects on the importance of implementing an Environmental Management System, both as an image improving initiative, and as a source of financial return, for the companies that decide to take this step, and as a source of environmental benefits for both the company itself and the society it exists within. A case-study was performed to investigate the actuality of those concepts, focusing on the fast-food services sector, McDonald's having been selected as a very representative large company in this sector, which, therefore, presents the ideal conditions for the application of environmental management techniques, in view of the high volume of residues it generates. Hence, the present state of the solution McDonald's has implemented for its management of used cooking oil, which nowadays is integrally converted to biodiesel, in particular, and its policy for residue management, in general, are described and discussed herein.

**Keywords:** *environmental management, sustainability, biodiesel from organic residues*

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*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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**19<sup>th</sup> May 2011**

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**13h30 -15h00      Conference**

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**Leo Bäas**

**Linköping University -  
Sweden**

Cleaner Production and  
Industrial Ecology: Two  
Important Concepts for a  
Sustainable Industry

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“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

## **Cleaner Production and Industrial Ecology: Two Important Concepts for a Sustainable Industry**

Leo Bäas  
*Linköping University - Sweden*

Industrial routines are embedded in unsustainable practices that are difficult to change. The complexity and uncertainties of new concepts such as Cleaner Production and Industrial Ecology are often approached with ignorance and misperception. Nevertheless, the integration of economic, environmental and social dimensions in industrial activities is increasingly perceived as a necessary condition for a sustainable society. Cleaner Production and Industrial Ecology are important inter-linked pillars in such change processes of improved economic, environmental and social performance as basis of sustainability. Cleaner Production is optimizing industrial activities from cradle to grave in single companies and Industrial Ecology, which is sometimes described as: ‘an integrated system, in which the consumption of energy and materials is optimized and the effluents of one process serve as the raw material(s) or energy for another process’, is optimizing industrial activities between companies.

Although Cleaner Production is applied world-wide, the dissemination to go from single cases towards general application is still a time-consuming process. This is also the case for Industrial Ecology. The Industrial Ecology concept was introduced to industrial leaders as a prevention-oriented paradigm for achieving cleaner

*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): *Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.*

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industry and more sustainable communities. Industrial Ecology is based upon both the technological and mechanical dimensions of change as well as upon understanding and working with the non-technical dimensions. Economic relations between individuals or firms are embedded in actual social networks and do not exist in an abstract idealised market. Industrial Ecology activities are shaped within such context. Illustrations of Cleaner Production and Industrial Ecology practices in the Netherlands, Sweden, and China will be presented as basis for further information-sharing and dialogue in the workshop.



*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

**19<sup>th</sup> May 2011**

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**15h00-16h30**

**Session 5B**

**Room 1**

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Treatment of Textile Wastewater by Physical-Chemical and Advanced Oxidation Processes

Cleaner Production Implementation within Textile Industry: Economic and Environmental Benefits

Waste Effluent as Natural Dyestuff

Applying of Ecological Cost Accounting in a Dye Discoloring Process

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## **Treatment of Textile Wastewater by Physical-Chemical and Advanced Oxidation Processes**

J. C. Tosato Jr, M. R. T. Halasz

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### **Abstract**

This study aims to evaluate the performance of three techniques for the treatment of textile effluents, specifically the coagulation / sedimentation, ozonation and Fenton applied alone, and the application of oxidative processes after the physical and chemical treatment. We checked the effects of the treatments used in the removal of concentrations of the parameters color, BOD, settleable solids, total suspended solids, total dissolved solids and turbidity. The results show that all forms of treatment achieved the standards for release in the receptor, whereas, maximum reductions were achieved after treatment with coagulation / sedimentation followed by ozonation, they are: 94.39% for settleable solids, 93.5% for total dissolved solids, settleable solids to 97.5%, 78.1% for COD, 67.5% for BOD, 98.3% to 96.6% for turbidity and apparent color. Based on these results, the use of advanced oxidation processes for treatment of textile effluents is justified by the potential removal of the parameters studied as a function of time, providing economic and environmental gains for the industry.

**Keywords:** *textile wastewater, ozonation, fenton, coagulation.*

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## **Cleaner Production Implementation within Textile Industry: Economic and Environmental Benefits**

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### **Abstract**

This study aimed to analyze the environmental and economic benefits from the Cleaner Production implementation within a furniture industry from Natal-RN. For this, an analysis was made including operational and environmental aspects (process flow diagrams, inputs and outputs information, mass balance, environmental aspect and impact analysis, waste studies) and Feasibility analysis (technical, economic and environmental evaluation, select options for implementation). According the results, it was possible to implement the three levels of CP, through housekeeping practices (cutting and handling of chemicals); technological modification (installation of a pressure washer with the printing of fabrics); internal recycling and external recycling. Regarding economics, there was an annual savings of R\$ 55,946.96, making the company more productive and tend to become more competitive.

**Keywords:** *Cleaner production, operational and environmental adequacy, Textile industry*

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## Waste Effluent as Natural Dyestuff

T. Rossi, R. S. R. Almeida, J. O. Brito, E. Bittencourt, P. N. Faria, C. T. S. Dias

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### Abstract

Currently, natural dyes are gaining wider interest in society, creating a new market niche that values products obtained from natural raw material, due to less damage to human health and the environment. A potential source for obtaining these dyes lies in the industrial production of essential oil from eucalyptus leaves. This uses the liquid waste generated in the distillation stage of the eucalyptus leaves, using water steam; a large volume of which is generated and disposed of as effluent. Brazil is one of the main global producers of oil from eucalyptus leaves, especially *Corymbia citriodora* (*Eucalyptus citriodora*), and so there is enormous potential for exploitation of this effluent as raw material. The potential of this residue as a natural dye was evaluated, specifically for cotton fabrics. The effluent residue was concentrated and the physical-chemical characteristics of the obtained natural dyestuff was evaluated; presenting an acid pH and total solid content of 3.3% and 48.1% and condensed tannin content of 10.9% respectively. As for color of the extracts, it showed a brown color with CIE LAB values of L=0,19; a=0,50 and b=0,17. The naturally dyed fabric was evaluated for color solidity after washing: staining of the multi-fiber fabric was greater than 4 and the notes of color change were 3-4. The solidity of the washing results showed that the natural dyestuff reached the acceptable notes for the textile industry and the natural dye obtained from the waste effluent leaves of *C. citriodora* has a potential of use as natural dyestuff in the dyeing of cotton. In future studies, the evaluation of color solidity using natural dye in dyed fabrics is intended.

**Keywords:** *distillation, residue, Corymbia citriodora, dyed fabric.*

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## Applying of Ecological Cost Accounting in a Dye Discoloring Process

J. M. Rosa<sup>a, b, c</sup>, M. A. Pereira<sup>a</sup>, F. H. Pereira<sup>a</sup>, E. A. Baptista<sup>a</sup>, F. A. Calarge<sup>a</sup>, J. C. C. Santana<sup>a</sup>, E. B. Tambourgi<sup>c</sup>

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### Abstract

This work sought to apply the Accounting of Complete Ecological Costs (ACEC) methodology in a textile segment company through the reutilization of colored wastewater, after treatment by advanced oxidation processes (POA) in reactors using hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) in a catalysis activated by ultraviolet light (UV). Facing the worries with the sustainable development and the difficulty in measuring environmental costs through the traditional accounting method, the proposed methodology tries to integrate costs, either internal or external ones, into a single dimension. At reducing the environmental impacts, the company shows a proactive position regarding the sustainability, becoming sustainable itself. The study presented the financial and ecological economy obtained, thus showing this process is efficient and may be used by companies in the textile sector for reutilizing water, reducing the financial and ecological costs, as well as the negative externalities.

**Keywords:** *advanced oxidation process, UV/H<sub>2</sub>O<sub>2</sub>, ecologic cost accounting, dye discoloring, sustainability.*

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*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

## **19<sup>th</sup> May 2011**

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**15h00-16h30**

**Session 5B**

**Room 2**

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Eco-Efficiency: A Case Study in a Chemical Industry

Performance in Operations Systems: The Contribution of the Sustainable Manufacturing in a Printing Company

Sustainable Manufacture: Study and Analysis of the Combination Adoption of Cleaner Production and Lean Production

Preliminary Study for Environmental Management in Surfboards Production

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## **Eco-Efficiency: A Case Study in a Chemical Industry**

H. M. de Pinho; M. N. Catanzano; P. J. C. Candeira

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### **Abstract**

Eco-efficiency is of vital importance for the maintenance of organizations nowadays, not only to maintain an ecologically speech accepted by society, but also because it brings all kinds of benefits. As more companies seek respectability, the better the prospects for growth and environmental integration. Moreover, it is a management tool which main function is the environment preservation. This work addresses questions related to environmental management through a system of eco-efficiency. During the development of this work, a research was conducted at a chemical industry located in a petrochemical pole in Maua city, Sao Paulo State. The methodology was based on a case study, therefore a questionnaire was designed to answer what this organization has done in order to save resources. The results show that this organization has carried out activities related to the topic, although there are great opportunities for improvement in the management system currently applied.

**Keywords:** *eco-efficiency, management system, environment and sustainable development.*

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## **Performance in Operations Systems: The Contribution of the Sustainable Manufacturing in a Printing Company**

O. F. M. da Silva, V. Cavenaghi, G. C. S. Barros

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### **Abstract**

In the last decades of the 20th century, changes in patterns of competition, ways of organizing work and production in line with the pressures of a growing population, economic development and resource shortages were observed. The search for sustainable models which are applicable to several productive activities became a reality in the 21st century leading external and internal changes in organizations, specifically in manufacturing ones, which can be change factors for the sustainability performance measurement. The Sustainable Manufacturing and the measures of sustainability performance, supported by tools such as the GRI Sustainability Report, have emerged as alternatives to serve these new demands and they are gradually modifying the current models of performance measurement systems. Therefore, this article aims to present a proposal to introduce a program of sustainable manufacturing in the production system and demonstrates its contributions to the performance measurement system of a printing company. We performed a literature review, data collection and documentary research describing the main elements of sustainability management and performance management. The researchers conducted a case study, identifying the steps in the implementation of the sustainable manufacturing, performance indicators and considerable results in the use of resources such as consumption reduction of electrical energy and water.

**Keywords:** *Sustainable Manufacturing; Indicators; Performance Measurement.*

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## **Sustainable Manufacture: Study and Analysis of the Combination Adoption of Cleaner Production and Lean Production Techniques**

G. V. Rizzo, A. Batocchio

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### **Abstract**

Currently the industries are deploying new technologies and strategies to enable the improvement of process and increase the productivity in the value chain, for this, recovery and reuse techniques was applied. Current techniques show many similarities, this converge to the elimination of waste and reuse this in the process, which generates operational advantages that allow increased the productivity. In this work, was presented and studied the different techniques applied to manufacture, including the concept of sustainability, through the analysis and combined adoption for cleaner production and lean production concepts, so that will be discussed for the application in production processes. These adoption present associated benefits in reducing impacts to the environment than approach the resources used in the process.

**Keywords:** *Cleaner production, lean production, tools articulation*

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## **Preliminary Study for Environmental Management in Surfboards Production**

P. E. A. Grijó, P. Brügger<sup>b</sup>

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### **Abstract**

The surfboard industry, both in Brazil and the rest of the world, has for the past 50 years been dumping toxic and flammable waste in normal landfill sites without any environmental treatment or control. These residues, classified by the NBR 10.004 as class I, are considered dangerous, have a high aggregate value and a very high decomposition time period. During the manufacturing process of this product, the need for environmental management of these units was identified, the aim of which is to reduce water consumption, electric energy usage and the production of residues, as well as to increase the recovery of waste that cannot be eliminated. It has been noted that this manufacturing activity can be re-dimensioned so as to minimize the impact on the environment and on public health as well as to maximize financial resources. Since 1999, it has been found through alternative research into the waste recovery generated in the production of surfboards that this could be an end-activity within a process of sustainability, and hence it confirmed the necessity of working primarily with changing the culture of waste and consumerism prevalent in this industry. To bring about this initiative, there needs to be a system to promote environmental education and awareness at the socio-entrepreneurial level, and to produce a diagnosis in a surfboard factory, with the aim of formulating a reference model of ecological responsibility. This will be achieved through the promotion of debating forums and the formulation of an Environmental Management for the surfboards industry.

**Keywords:** *Environmental Education. Environmental Management. Sustainability.*

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*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

**19<sup>th</sup> May 2011**

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**15h00-16h30**

**Session 5B**

**Room 3**

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Study of Anodic Electrooxidation of Dimethyl Phthalate Using DSA

Molten Salt Oxidation – A Safe Process for Hazardous Organic Wastes Decomposition

Study of Degradation of the complex EDTA-Cu (II) by Electrochemical Methods

Electrochemical Discoloration of Alizarin Red S Solutions in Dimensionally Stable Anode

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## Study of Anodic Electrooxidation of Dimethyl Phtalate Using DSA

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### Abstract

Anodic oxidation of dimethyl phthalate (DMP) was studied in a flow cell using a single compartment dimensionally stable anode nominal composition Ti/Ru<sub>0,3</sub>Ti<sub>0,7</sub>O<sub>2</sub> (De Nora Brasil) cathode and titanium, both of 14 cm<sup>2</sup>. 350 mL of solution containing approximately 161.81 mg L<sup>-1</sup> of compost (equivalent to 100 ppm C) were electrolyzed at 25 ° C in a flow of 140 ml min<sup>-1</sup> at an ionic strength of 0.15 mol L<sup>-1</sup>. Parameters as the composition of electrolyte (NaCl and Na<sub>2</sub>SO<sub>4</sub>), the Cl<sup>-</sup> concentration (250 mg L<sup>-1</sup> - 2500 mg L<sup>-1</sup>), the pH range (2.0 to 8.0) and current density (20-120 mA cm<sup>-2</sup>) were investigated, as well as their effects on current efficiency and energy consumption. The higher removal of DMP, TOC and COD is achieved when NaCl is used as supporting electrolyte, in which case both the oxidation by hydroxyl radicals adsorbed on the electrode surface by species and active chlorine are happening. Oxidation occurs more readily in acidic reaching an optimum at pH 2.0. Variations in the concentration of chloride showed that lower concentrations are sufficient for further removal of DMP / TOC, although the COD removal is directly dependent on the amount of chloride. The increase in current density for high values, does not favor the oxidation of the compound, once the oxygen evolution reaction is favored over chlorine evolution reaction that occurs in parallel with the oxidation of DMP, reaching a maximum at 40 mA cm<sup>-2</sup>. The decay kinetics follows a pseudo-first reaction order with coefficients greater than 0.99. The reaction rate is higher when using chloride as supporting electrolyte, but is inversely proportional to the increase of chlorine concentration, current density and pH.

**Keywords:** *phthalates, anodic oxidation, dimensionally stable anode*

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## **Molten Salt Oxidation – A Safe Process for Hazardous Organic Wastes Decomposition**

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### **Abstract**

In the last decades, there were significant changes in the perception of the necessity of environmental preservation. The main actions that have been used to impede the migration of pollutants to the environment are: the inventory of the hazardous chemical compounds, their safety collection and their suitable treatment. One of the predominant concepts currently is that the wastes should be destroyed in some point of their cycle of use, specially the dangerous ones, in reason of the risk that they represent for human beings, animals and plants. The worldwide interest in the development of advanced decomposition technologies of wastes elapses, mainly, of the problems created by the denominated POPs - persistent organic pollutants. The thermal decomposition has been commercially used in the disposal of hazardous wastes, mainly the incineration, whose most important characteristic is the combustion with flame. However, the incineration technologies have failed to meet some performance criteria. An alternative to the incineration, for the treatment of a vast range of dangerous wastes or not, it is the thermal decomposition by means of the submerged oxidation in molten salt baths. The interest in the decomposition of hazardous wastes by advanced methods, as alternative to the incineration, and especially through the molten salt oxidation has elapsed mainly by the adoption of more restrictive air emissions legislations in several countries. Among several advantages, such as oxidative reactions that transform completely the components of the organic solvent in just CO<sub>2</sub> and water, the process equipment can be built in small scale. Molten salt oxidation equipment has already been built at IPEN and different organic wastes have been tested. During the program the selection and the performance tests of the employed materials, the construction of components and auxiliary systems, their assembly and the operational tests have been carried out. Several decomposition tests of different organic wastes have been performed in laboratory equipment developed at IPEN, with excellent results (dichlorethane, dichlorodifluoromethane and toluene). The completeness of the oxidation reactions in the range of temperatures studied (900 to 1020°C) was evaluated by mass spectrometry of the gases released. This paper describes the main characteristics of the molten salt process, besides the conception, the construction, the development of equipment with this purpose in IPEN and its effectiveness. During the activities the main accomplished tasks were the selection and the performance tests of the employed materials, the construction of components and auxiliary systems, their assembly and the operational tests carried out.

**Keywords:** *oxidation, molten, salts, hazardous, wastes.*

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## Study of Degradation of the complex EDTA-Cu (II) by Electrochemical Methods

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### Abstract

In mixed wastewater, the presence of metal ions can reduce the rate of organic contaminant removal and decrease the efficiency of metal recovery. The study of ethylenediamine tetraacetic acid (EDTA) degradation in natural environments has demonstrated its poor biodegradability and indicates that EDTA behaves as a persistent pollutant in the environment. Additionally, the contribution of EDTA to toxic metal bioavailability and remobilization processes in the environment is a major concern. In the present study, the electrochemical degradation of the complex EDTA-Cu(II) was performed at different currents (10 - 120 mA cm<sup>-2</sup>), and different concentrations of the EDTA-Cu(II) complex (0,10, 0,15 and 0,20 mmol dm<sup>-3</sup>), using a Ti/Ru<sub>0.3</sub>Ti<sub>0.7</sub>O<sub>2</sub> type electrode. The results show that the electrochemical degradation was efficient in oxidation of solutions, achieving a significant performance, about 85% removal of the complex.

**Keywords:** *Ethylenediaminetetra-acetic acid (EDTA); electrochemical degradation; copper.*

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## **Electrochemical Discoloration of Alizarin Red S Solutions in Dimensionally Stable Anode**

E. M. Moreira <sup>a</sup>, F. L. Souza <sup>b</sup>, D. W. Miwa <sup>c</sup>, C. R. Costa <sup>d</sup>, A. J. Motheo <sup>e</sup>

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### **Abstract**

Alizarin red S is a dye utilized by textile and leather industries. As it is a dye, alizarin red S is a potential environmental aggressor because it inhibited the photosynthesis in water bodies. In this work we evaluated the discoloration kinetic of alizarin red S in dimensionally stable anode in presence of phosphate buffer and, in some cases, in presence of sodium chloride also. Removal values of color higher than 90% were obtained after 5 hours of treatment of alizarin red S solutions containing 700 mg L<sup>-1</sup> of this dye.

**Keywords:** *Electrochemical discoloration, alizarin red S, rate constant*

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"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

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**19<sup>th</sup> May 2011**

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**15h00-16h30**

**Session 5B**

**Room 4**

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Water Pumping Station Santana: a Case Study on Loss Reduction and Energy Consumption in the Sanitation Sector

Use of Cleaner Production Techniques to Recovery of the Soils and Reuse of the Sewage

New Technologies in the Tertiary Treatment of Industrial Water

Initial Evaluation of the Efficiency of Constructed Wetlands in the Post-Treatment of UASB Reactor

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“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

## **Water Pumping Station Santana: a Case Study on Loss Reduction and Energy Consumption in the Sanitation Sector**

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### **Abstract**

The sector of water supply Santana located in the northern zone of São Paulo was the pioneer in Sabesp undergoing a restructuring focused on process optimization. The excellent results obtained with the changes in the layout and replacement of old equipment is given in the environmental sphere, economic, technical and social. The main highlights were saving on energy consumption, the amount of water loss reduction and adducted.

**Keywords:** *sanitation, water, energy, reduction, loss.*

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## Use of Cleaner Production Techniques to Recovery of the Soils and Reuse of the Sewage

K. C. Passarini<sup>a</sup>, T. M. F. Brito <sup>a</sup>, S. M. Levy<sup>a</sup>, R. M. Vanalle<sup>a</sup>, E. B. Tambourgi<sup>b</sup>, J. C. C. Santana<sup>a\*</sup>

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### Abstract

In this study is reported a methodology for reusing of the construction building waste (CBW) in agriculture, to better of the degraded soil, thus contributing with the waste decreasing, material extraction and inadequate disposal of these waste. It used a layer of construction building waste for treatment of sewage collected of the Station of Sewage Treatment of SANASA from Campinas (Brazil) was treated by decantation process, using as the precipitating agent a compound obtained from construction building waste. For humus production the sludge from decantation process was mixed to the degraded soil and after 15 days maize seeds were germinated. The liquid from sewage was also treated by microfiltration to obtain the reuse water and applying in the irrigation. The best condition of humus production was evaluated by factorial planning and response surface methodology. Results had proven to improve in soil fertility by using humus produced from sludge composed of a mixture of crushed construction waste and raw sewage, as well as irrigation using treated sewage water is possible.

**Keywords:** *reuse, sewage, construction building waste, humus, sustainability.*

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## **New Technologies in the Tertiary Treatment of Industrial Water**

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### **Abstract**

The dissolved salts removal for process water because a very usual requisite in actual times. Ultrapure water for the most diverse applications, such as high pressure boilers, medication, beverage and microelectronics, the salt removal become a fundamental item with water quality and treatment efficiencies each time more strict.

With the objective to comply with the fast-growing demand for more strict characteristics of process Waters, new Technologies are being developed, allying higher efficiencies to lower operation costs.

In this context, through the application of the Cleaner Production Tools, it was elaborated a change analysis considering a technology increase in the tertiary treatment of industrial water for dissolved salts removal comparing Ion Exchange resins versus reverse osmosis followed by one of the latest treatment Technologies, the electrodeionization .

For such analysis, it was evaluated the capital and operational costs of each treatment process (considering the same work conditions) targeting the optimization of the treatment process. Through these costs calculated by volume of water treated, it is possible to conclude clear advantages of the reverse osmosis and electrodeionization units.

**Keywords:** *Cleaner Production, Eletrodeionization, Ion Exchange, Demineralization*

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## **Initial Evaluation of the Efficiency of Constructed Wetlands in the Post-Treatment of UASB Reactor**

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### **Abstract**

This study aimed to implement and monitor 03 units of sewage treatment by constructed wetlands systems in the post-treatment of a UASB reactor. The deployment of the units occurred in the Sewage Treatment Station of School of Arts, Sciences and Humanities of University of São Paulo - EACH / USP, São Paulo, between September-October 2010. For system monitoring and tracking performance, were analyzed dissolved oxygen (DO), turbidity (qualitative per-view), NH<sub>4</sub> e PO<sub>4</sub>. Two units of vertical flow wetlands and a horizontal flow have been deployed, both with emerging macrophytes (*Typha sp.*), rated for hydraulic loadings between 135 and 733 mm.day<sup>-1</sup>. The vegetation of the three units showed good adaptation, with the presence of new seedlings and increased plant density. Furthermore, they showed high oxygen uptake capacity, increasing the concentration of DO in the effluent (2.76 to 3.46 mg.L<sup>-1</sup>), with a good removal of suspended solids and turbidity. The vertical units showed removal of NH<sub>4</sub> ranged from 10 to 76%, indicating good nitrification. For PO<sub>4</sub>, the vertical units presented, at the beginning, an increased concentration, and subsequently a removal between 34 and 44%, while the horizontal unit showed removal rates of 7 and 40% during the whole period. Thus, we conclude that the units presented satisfactory performance, resulting in promising systems for the post-treatment of effluents from UASB reactors.

**Keywords:** *constructed wetlands; post-treatment; UASB Reactor.*

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**May 19<sup>th</sup> 2011**

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**15h00-16h30**

**Session 5B**

**Room 5**

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Health Impact Assessment in Southern Brazilian EIAs: Too Far Away from Recommended Practices

MAS: A Proposed Tool for Assessing the Sustainability

Storage of Carbon Dioxide in Geological Reservoirs: Is It a Cleaner Technology?

Proposed Methodology of Cleaner Production with Quality Tools

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“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

## **Health Impact Assessment in Southern Brazilian EIAs: Too Far Away from Recommended Practices**

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### **Abstract**

Health impact assessment practice, although listed as mandatory under Brazilian legislation on Environmental Impact Assessment (EIA), is still in its infancy mainly because it lacks the support of detailed tools that can enable it as a systematic process. In this paper, we investigate how far away health assessment stands from best practice, taking two departure points. The first one is a theoretical basis for advised practices in HIA that we propose from a literature review and compilation. This comprises 25 requirements for analysis, divided in three categories: theoretical lines of argumentation (biomedical/risk, promotion, and social/political features), broad measurability (which includes impacts magnitude and mitigation), and detailed measurability (going deep into biological, behavioral, circumstantial, environmental and institutional aspects). The second one is a set of six EIAs documents delivered by practitioners in Southern Brazil, that we take as a case study in order to assess their performance in relation to the international best practices outlined. EIAs selected are two from landfills, performed in 1992 and in 2006 by the same consulting firm; two from Small Hydropower Facilities (SHF), finalized in 1997 and in 2005, both by the same consulting firms; and two from a road (2004) and from an industrial plant (2007) projects, each one carried out by different consulting firms. Descriptive results are divided into three: a requirements' conformity analysis; a gap analysis, in which we assess the level of full, partial and non-completion of requirements; and a peer analysis, in which we compare, respectively two landfills and two SHF EIAs between each other, in order to highlight differences in health assessment in EIAs performed by the same consulting firms. With respect to theoretical lines of argumentation, we find that: biomedical risks are common but not considered in detail in all EIAs; epidemiological and toxicological models are rarely used; cause-effect relationships for environmental-health issues are only partially described; quantification is poor, but not so much in more recent documents; health promotion is not targeted by practitioners, and collective health is of more concern in EIA's landfill projects; regarding social aspects, they are partially considered in just two documents. Concerning broad measurability aspects, EIAs performed before 2000 have neither magnitude description nor investigation parameters, and wellbeing indicators are absent in all documents. With respect to detailed measurability, we highlight that health data are not accurate and/or reliable in all cases; biological issues are disregarded, as well as equity issues, which implies that there is no understanding of how the same impacts can affect different profiles of people.

**Keywords:** *Health Impact Assessment; Environmental Impact Assessment; Social Impact Assessment; best practice; evaluation.*

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## MAS: A Proposed Tool for Assessing the Sustainability

C. A. C. Guimarães<sup>a</sup>, L. M. S. Campos<sup>b</sup>, G. Buso<sup>c</sup>

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### Abstract

This article describes a tool called Map of Sustainability Assessment (MSA). This tool was developed in order to find ways to assess the sustainability of the processes of a network of company's customers in the food sector in nature. This tool aims to achieve a final grade of sustainability and its dimensions in order to avoid risks and returns indicating progress or the practices of their clients. Existing data from questionnaires submitted to hundreds of clients over five years was used to draw the main results of this work. The article is descriptive and exploratory, addressing a theoretical discussion of concepts used for the development of the tool. The proposal also shows the methodology used and the results of a pre-test implementation conducted by a customer of the company. Finally, the article shows some strengths and weaknesses of the instrument and some aspects of implementation and development of the tool.

**Keywords:** *sustainability, assessment, indicators, tool, map.*

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## Storage of Carbon Dioxide in Geological Reservoirs: Is It a Cleaner Technology?

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### Abstract

Climate changes due to the increase of anthropogenic emissions and the accumulation of greenhouse gases (GHGs) in the atmosphere are among the major global environmental concerns. The scientific analysis and discussions on the effect of anthropogenic GHG emissions and its consequences on climate change received notoriety in recent decades. Carbon Dioxide (CO<sub>2</sub>) is one of the main GHG and several technologies have been developed to capture and dispose it before it being released. CO<sub>2</sub> storage in geological reservoirs is one of the technological solutions that have gained strength as an option for the disposal of CO<sub>2</sub>. This article primarily focuses on answering the following question: To what extent can the Storage of Carbon Dioxide in Geological Reservoirs (CGS) be considered a cleaner technology? Accordingly literature research on the subject, as well as document analysis and expert consultation were undertaken. Initially it was reviewed the literature on environmental technologies and, more specifically, the literature on the CGS technology. Subsequently, it is discussed the CGS technology as an environmental technology, concluding that it can be considered as a transitional technology. For now, it is understood that this is an exploratory research on the subject due to the CGS technology being under development and consequent maturation which results in the need for further and continuous studies on both this technology and its impacts.

**Keywords:** *Environmental Technology, Geological Storage of Carbon Dioxide, CGS, CO<sub>2</sub>.*

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## **Proposed Methodology of Cleaner Production with Quality Tools**

D. A. L. Silva<sup>a</sup>, B. Barra<sup>b</sup>, A. R. Ometto<sup>c</sup>

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### **Abstract**

The Cleaner Production (CP) aims to minimize waste generation, making the production process more efficient. The CP implantation methodology is widespread in the literature. Nevertheless however, it does not deal deeply and clearly questions such as "what tools to use in collecting and analyzing data from the production process?", or "how to prioritize improvement actions most important?". Therefore, the authors of this study noticed the existence of problems or gaps in the CP methodology when it comes to deploying the program in companies. For example, delays during CP implementation activities and the gathering of false and/or incomplete information, which may hinder the decision-making. The goal of this paper is to propose solutions to these observed deficiencies. In order to do that, we suggested changes in the CP implementation methodology and the use of quality tools. These suggestions were made for each step of the methodology, based on literature review and critical analysis, turning the CP program implementation clearer.

**Keywords:** *Cleaner Production; pollution prevent; quality tools; source reduction; environment.*

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**19<sup>th</sup> May 2011**

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**15h00-16h30**

**Session 5B**

**Room 6**

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Electrical and Electronic Wastes: A Challenge for Sustainable Development and the New National Policy for Solid Wastes

The Social Construction of Garbage: A Social Analysis of Representations Over the Issue in the Messias Targino City (RN)

Selective Waste Collection as a Public Policy Tool: The Sorocaba/SP Experience

Proposal of the New Model for Solid Urban Waste Management

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## **Eletrical and Eletronic Wastes: A Challenge for Sustainable Development and the New National Policy for Solid Wastes**

R. Y. Natume <sup>a</sup>, F. S. P. Sant'Anna <sup>b</sup>

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### **Abstract**

The growing concern with the generation of solid wastes in Brazil and worldwide has challenged managers in several areas due to the scope of the emerging impacts, being either environmental, economical, social or cultural. The 12.035 Act which establishes the National Policy for Solid Wastes demonstrates how the Brazilian leaders are worried about this issue. The growth in the generation of electric and electronic wastes is due mainly to the growing technological revolution in the past years which has produced equipments in large scale, with varied uses. This growth results in an increase of the amount and diversity of equipments, which for becoming obsolete fast, represent a significant percentage of discarded wastes today. These electric and electronic wastes are considered dangerous due to their diverse composition, mainly heavy metals which cause serious problems to human lives, animals, vegetables, water beds, among others. In this perspective, this work tries to cooperate to broaden the knowledge about this kind of residues and find possible solutions which could minimize their environmental impacts. Companies cases are presented and analysed which have already properly managed their electro and electronic residues. Other cases such as some companies which have not yet implemented any kind of management of the residues they produce and their difficulties to discard these wastes are also presented.

**Keywords:** *Eletrical and electronic wastes, sustainability, recycling, reuse, National Policy for Solid Waste*

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## **The Social Construction of Garbage: A Social Analysis of Representations Over the Issue in the Messiah Targino City (RN)**

A. K. P. de Almeida <sup>a</sup>, A. S. B. da Silva <sup>b</sup>, F. L. S. Campos <sup>c</sup>

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### **Abstract**

Assuming from the axiomatic assumption that the garbage is something established historically and also can vary according to the culture that generates itself, likewise, it also receive a symbolic treatment and differentiated according to social group that manipulate them. These assumptions were checked (in fact) during the field research with social segments of the Messiah Targino city (RN). In this context, the main worry of this study was to analyze social representations of the local population (examined) about the physical accumulation of garbage in the city. The systematization of this evaluation was made using collected data during the field observation and semi-structured interviews, in which represent that the population is performed in relation to litter the symbolic point of view when it is related to esthetics issues, and from the material point of view once related to issues of public policy. Based on the results, we conclude that there are garbage in two intertwined and inseparable stories: concerning the meaning and the material object as well.

**Keywords:** *Garbage; Social representation; Messiah Targino City (RN).*

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## **Selective Waste Collection as a Public Policy Tool: The Sorocaba/SP Experience**

G. V. B. Simões <sup>a</sup>, J. L. Ferraz <sup>b</sup>, S. D. Mancini <sup>c</sup>, S. H. Bonilla <sup>d</sup>,  
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---

### **Abstract**

This study has the objective of demonstrating the implantation experience and evolution of a selective waste collection program performed in a Brazilian city of approximately 600.000 inhabitants – Sorocaba/SP. The “Selective Waste Collection Program – Recycling Lives” begun in the year of 2007 and was incorporated as a city public policy means through the execution of Partnership Terms between the Public Administration and the Civil Organizations involved and through the insertion of the program as a Priority Program for the Municipal Government. To carry out the research a document investigation was brought about in order to expose information about the city legislation regarding local public policies related to selective waste collection and to obtain documents and data related to the evolution of the program. Moreover, a field research involving visits to the recycling cooperatives was conducted to obtain real data relevant to the collection and sorting of the materials, the work methods applied and the results obtained by each of the cooperatives involved with the system. The studies performed show that the evolution process of the program can be characterized by three well-defined stages. The first concerns the legal and institutional compilation of the program and the start of the cooperatives’ operational activities. The second involves the mechanization of the system, which resulted in a growth in the selective waste collection’s productivity. The third stage is defined by a productive expansion of the system, which promoted significant growth in profit and in the number of workers in the selective waste collection Program.

**Keywords:** *Recycling, selective waste collection, recycling cooperatives, municipal public policies.*

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## **Proposal of the New Model for Solid Urban Waste Management**

C. F. M. Morejon, J. F. de Lima, W. F. Rocha, R. D. Possa

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### **Abstract**

With the uncontrolled increase of solid waste production, consequence of the increased population and inadequate management of these residues, the environmental problems and public health have increased. In the current scenario waste is a "curious" indicator of socioeconomic development of a nation, ie, the more of the growth economy, reather the volume of waste produced. But, the tragic side of this scenario is a consequence of the management model implemented, depending on the case the waste can pose a problem, and at the same time can mean the source of solution the problems caused. In this context, this paper discusses and proposes a management model urban solid waste on the basis of methodology and technology developed at the university (PI 0801312-8). The analysis made diagnostic, identified the advantages and disadvantages of conventional models, and explained the opportunities of a new management model based on differentiated methods in the steps of collection, transport, recovery and disposal of urban solid waste. The laboratory results demonstrated the technical, economic and financial viability of the of the new model proposed, in which the waste is no more a cost factor, it is an investment opportunity. In this proposal, the economic variable is the greatest attraction for individuals at the same time as the impacts on the environment and society are also positive.

**Keywords:** *Urban waste, collection, transport, processing, recovery.*

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*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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**19<sup>th</sup> May 2011**

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**15h00-16h30**

**Session 5B**

**Room 7**

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Sustainability of Bio-based Plastics: General Comparative Analysis

Cleaner Production and Environmental Sustainability: Case of a Plastic Industry in Serra Gaúcha

Performance Evaluation of Corporate Sustainability in an Industry of Plastic Film

Eco-industrialism: The Potential for Inclusive Growth with Bio-Plastic Production in Brazil Using Sugarcane Ethanol

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“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

## **Sustainability of Bio-based Plastics: General Comparative Analysis**

C. R. Álvarez-Chávez <sup>a</sup>, S. Edwards <sup>b</sup>, R. Moure-Eraso <sup>c</sup>, K. Geiser <sup>d</sup>

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Rafael\_Moure@uml.edu, Ken\_Geiser@uml.edu*

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### **Abstract**

This study evaluated the sustainability of bio-based plastics including all the stages of their life cycle (cradle to grave) to assist in decision-making about selection of these bio-based materials. Plastics are considered essential materials in today's society, but during their life cycle they contribute to pollution and depletion of natural non-renewable resources. Bio-based plastics appear as more environmentally friendly materials than their petroleum based counterparts when they are compared considering their origin and biodegradability. But which of the bio-based plastics currently on the market or soon to be on the market are preferable from an environmental, health, and safety perspective? Results of this study were summarized in two graphic tools based on analysis of the data gathered on bio-based plastics according to sustainability criteria. They showed that none of bio-based plastics currently in commercial use or under development are fully sustainable. Each of the bio-based plastics reviewed utilizes genetically modified organisms for feedstock manufacture; toxic chemicals in the production process or generates as byproducts, or copolymers from non-renewable resources, etc. Substitution of conventional petroleum-based plastics with safer bio-based plastics requires the knowledge of the flow of these materials and their adverse impacts in all their life cycle in order to consider new approaches towards sustainability.

**Keywords:** *Bioplastics, bio-based plastics, life cycle analysis.*

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## **Cleaner Production and Environmental Sustainability: Case of a Plastic Industry in Serra Gaúcha**

J. C. F. Guimarães <sup>a</sup>, E. A. Severo <sup>b</sup>, E. Dorion <sup>c</sup>, P. M. Olea <sup>d</sup>

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edorion@ucs.br, pelayo.olea@gmail.br*

---

### **Abstract**

Given the large consumption of natural resources, environmental impacts, the organizations have been incorporating into their strategies the concept of sustainability. Today, the organizations are becoming the object of new expectations about their responsibilities to society as agents that dispose of financial and technological resources to solve with more agility, decisiveness and direction environmental problems. Cleaner Production (CP) incorporates technological, economic and environmental processes, products and services in order to increase efficiency in the use of inputs and raw materials to reduce waste, non-generation, minimization and recycling of waste generation, providing economic and environmental benefits. The most important aspect of CP is that it requires not only technological improvement, but the application of know-how and a change in management behavior. These three factors together are what makes the difference compared to other techniques related to production processes. The objective of this research is to examine the results obtained by the implementation of CP in production processes in a plastic industry of the Serra Gaúcha. The current case produces accessories for the furniture industry and construction, is active on the national and international markets for about fifty-six years. In implementing a CP strategy, the company has developed a new process for producing a polystyrene handle. From this case study, a qualitative research was executed and the results show a reduction of 90.3% of the waste of raw materials and other contaminants, as well as a reduction in production costs by 36,4% of the polystyrene handle. Another improvement from the CP process occurred in the substitution of materials for the painting of handles through the use of new technologies, causing a 60% reduction in loss of material in use, and a 9.6% reduction in acquisition costs inputs for the painting. Furthermore, it is noteworthy to mention that in addition to CP practices, the company treats all its effluents and wastes from the production process, contributing to the economic and environmental sustainability of the organization.

**Keywords:** *cleaner production, environmental sustainability, plastic industry.*

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## **Performance Evaluation of Corporate Sustainability in an Industry of Plastic Film**

L. R. P. Kurtz, M. Borchardt

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### **Abstract**

The aim of this study is to qualitatively analyze the performance in terms of corporate sustainability in economic, social and environmental prospects. The research method is an exploratory case study, performed in a company producing plastic films, that looks for identifying the level of importance and availability of application the applied practices related to sustainability. Among the analyzed variables showed that the studied organization adopts practices associated with research and development of new products with customers and market, analyzing trends for its products when it comes to economic perspective. It already has a social perspective, such as the company's relationship with employees, internal development these are items to be considered. About the environmental perspectives, the approach follows the basic models of management in the control and the disposal of waste. This despite being another relevant contribution to analysis, the life cycle of products is still in infancy.

**Keywords:** *Corporate sustainability, sustainable development, system management, stakeholders, organization.*

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## **Eco-industrialism: The Potential for Inclusive Growth with Bio-Plastic Production in Brazil Using Sugarcane Ethanol**

P. Wells <sup>a</sup>, C. Zapata <sup>b</sup>

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*b. UNDP, Brasil*

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### **Abstract**

Eco-industrialism embraces the concept of spatially-concentrated and inter-connected industrial activities that collectively are eco-efficient in the use of resources, though not necessarily premised on renewable resources. One area of activity that has potential for renewable eco-industrialism is that of bio-plastics; specifically in this case the production of plastic feedstock from sugarcane ethanol along with downstream products manufactured from bio-plastic feedstock for industrial or consumer markets. Eco-industrialism, in addition, has little to say about the subject of inclusive growth – an important element in the social and economic dimensions of sustainability. Inclusive growth means bringing some of the wealth created by growth to the marginal elements of society. This paper examines the nascent sugarcane ethanol bio-plastic industry in Brazil with a view to understanding the potential of the sector for renewable eco-industrialism in general, and for inclusive growth to mitigate rural poverty in particular. It is concluded that while the sector and the underlying technology is only in the formative stages, there are reasons to suppose that there is potential for inclusive growth and alleviating rural poverty by broadening income flows and reducing income volatility risk to rural areas. The paper explains that the concept of eco-industrialism has thus far been limited in that it is not based on renewable resources per se. Hence in theoretical terms the paper seeks to explain the significance of two possible developments of the concept: a basis of on renewable resources; and an extension with 'inclusive growth'. The analysis is grounded in an understanding of contemporary definitions of bio-plastic and why it might be important e.g. in the automotive industry. Information on the technology and scale of production, etc. is used to compare the bio-plastic sector with the mainstream petrochemical plastic sector. We then present a case study of Brazil in which it is shown that an embryonic bio-plastic industry exists, though it is far from being an eco-industrial cluster. The subsequent analysis argues that there is a strong sustainability basis for developing a Brazilian bio-plastic eco-industrial complex based on sugarcane ethanol, and outlines some potential policy frameworks to further encourage the development of such a sector. It is concluded that there are broad social and economic benefits, such as greater inclusive growth and higher retention of added value within Brazil, alongside the environmental advantages of using sugarcane such as lower carbon emissions. The wider theoretical conclusions are that eco-industrialism based on renewable resources could be the foundation of a new form of materialism in modern society.

**Keywords:** *Inclusive growth; sugarcane ethanol; eco-industrialism; ethanol; Brazil.*

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"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

**Conferences**

**and**

**Oral Presentations**

**20<sup>th</sup> May 2011**

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"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

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"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

**20<sup>th</sup> May 2011**

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**8h00-9h40**

**Session 6A**

**Room 1**

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Reverse Logistics in Practice: Economic Study of Returnable Packing on the Transport of Machined Engine Heads

Reverse Logistic: Destination of Expanded Polystyrene Expanded (Isopor®) Post Consumption from a Catarinense Industry

Reverse Flow of Scrap Tires in the City of Santos

Industrial Ecology: contributions to the Reverse Logistics Post-Consumer Rutkowski (UNICAMP) [abstract] [paper]

Recycling Management Considering the Dispersion of Supply Sources - Collection, Storing, Selection, Classification and Distribution of Waste Discarded Scrap for Reprocessing - A Study of Reverse Logistic

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## **Reverse Logistics in Practice: Economic Study of Returnable Packing on the Transport of Machined Engine Heads**

G. W. S. Renó <sup>a</sup>, O. M. S. Truzzi <sup>b</sup>, G. Sevegnani <sup>c</sup>, D. A. L. Silva <sup>d</sup>

*a.b. UFSCar - Universidade Federal de São Carlos, São Carlos - SP*  
*c. SOCIESC – Sociedade Educacional de Santa Catarina, Joinville - SC*  
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### **Abstract**

The environmental subject is increasing on customers discussions for the last years, due to a huge increase on ecologic mindset on societies. New legal rules covering environmental are being developed as new technologies and new materials that are making reverse logistics an important subject on actual days. The proposal of this paper is to explain the reverse logistics applied on machined engine heads being transported from a company in Joinville, Santa Catarina state in Brazil to Peterborough in United Kingdom, using disposable packing materials. This situation has generated many problems when disposing the wastes generated by the packing on the final customer and it's involved environment. The target of this paper is to present results from an economic study based on a new reverse logistic system developed with the usage of returnable and reusable packing system. The technical procedure adopted was the case study and data collection to complete the necessities previewed on the economical study. As results of the study made in Brazil the researchers could identify that the practice of reverse logistics and reusable materials brought a significant result on the concept of more resistant packing systems. It also allowed a reduction on the generation of disposables materials on the final customer, allowing a lower environmental impact and costs reduction.

**Keywords:** *returnable packing; enviromental impact; reverse logistics.*

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*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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## **Reverse Logistic: Destination of Expanded Polystyrene Expanded (Isopor®) Post Consumption from a Catarinense Industry**

F. H. C. Chagas, A. L. Berretta-Hurtado, C. A. K. Gouvêa

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### **Abstract**

The aim of this paper was to analyze the disposal ways of expanded polystyrene residues (EPS) at an industry located in Barra Velha – SC, focusing economical, legal and ecological aspects obtained with the application of reverse logistics concepts. Then a case study was carried out seeking to quantify the EPS used by the company. As a main result, it was verified that all EPS residue had the industrial landfill as a destination after production process utilization, and a better alternative was studied in order to dispose this material. Therefore, economical, legal and environmental values were added for both company and society.

**Keywords:** *Reverse logistic, EPS, discharge*

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## **Reverse Flow of Scrap Tires in the City of Santos**

J. A. Yemal, N. O. V. Teixeira, C. G. Rodrigues

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caroline\_gr@yahoo.com.br*

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### **Abstract**

This paper describes a fairly unexplored area of Business Logistics, Reverse Logistics. Dealing with the reverse distribution channel, "reverse flow", is the direct opposite of the chain, from materials unusable or post-consumer or post-sale in order to add value in many different ways, by return cycle productive. The scrap tires are one of the products that most cause disorder communities and the environment if not a suitable target. As the retail industry the last link in the supply chain to final consumers, shall be those retailers a tool that is helping significantly to the reuse of scrap tires. Given the principles required by increasingly stringent laws regarding disposal of scrap tires to the environment. By forming an instrumental research based on concepts described in this paper attempt to identify the process of proper disposal of scrap tires by the authorized dealer of tires in the city of Santos.

**Keywords:** *Reverse Logistics, Environment, Scrap Tires.*

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*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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## **Industrial Ecology: contributions to the Reverse Logistics Post-Consumer**

J. C. F. Lima, A. Avoleta, O. F. Lima, E. W. Rutkowski

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oflimaj@fec.unicamp.br, emilia@fec.unicamp.br*

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### **Abstract**

In Brazil with the approval of the National Solid Residues Politics of the industrial sector starts to be obliged to incorporate reverse logistic of after-consumes to it's products. This study it analyze the concept of reverse logistic points and the Contributions of the Industrial Ecology in this process.

**Keywords:** *industrial ecology, reverse logistics, waste management.*

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## **Recycling Management Considering the Dispersion of Supply Sources - Collection, Storing, Selection, Classification and Distribution of Waste Discarded Scrap for Reprocessing - A Study of Reverse Logistic**

E. Lopes

*Designer – desenvolvimento de novos produtos*

*pesquisador autônomo*

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### **Abstract**

Recycle management is seen here as a sector of reverse logistic. The author developed a conceptual work methodologically directed to organizational intelligence in the logistic field and so, in recycling management. The dispersion of supply source is the most important problem in this field, making management a complex activity dedicated to the optimization of distributed factors, that still escape control in spatial and temporal vectors. Such factors are attributed to human, equipment and materials. Recycling management problems become associated to knowledge management (KM) equated in a context of SCM – Supply Chain Management. Some device may facilitate objective reply and actions concerning who should get what, where, in what volume, with what operational means, where it should be stored, what actions should be executed in what location, how long this activity will take. It will also answer whether that should be an isolated activity or whether it should be articulated with others. The author points to the efficacy of organized models with special attention to his SGR that has as one of its most interesting applications the capacity to be a model of reference for the elaboration of corporative portal. The group of solutions for recycling management consists of three recommendations: 1 – to implant virtual community of agents or a corporative portal as a virtual social web; 2 – to adopt a new transport system combining, 3 - priority production cooperatives.

**Keywords:** *Recycling, Reverse Logistic, Organizational Intelligence, Management, Dispersion*

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**20<sup>th</sup> May 2011**

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**8h00-9h40**

**Session 6A**

**Room 2**

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Structuring of Environmental Area in a Transport Company Sector of Pernambuco through Enterprise-University Partnership

Development of Actions of Socio Environmental University Responsibility in Semiarid Northeastern

Undergraduate Student Understanding of Green Chemistry Concept

The Cleaner Production in a Research and Education Institute: Bibliometric Study

Challenges of Teaching Corporate Environmental Management in Brazil: The "5 Ls"

CP: Sustainable Development and Environmental Higher Education

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## **Structuring of Environmental Area in a Transport Company Sector of Pernambuco through Enterprise-University Partnership**

Y. M. Paz<sup>a</sup>, R. Prota<sup>b</sup>, N. S. Cavalcanti<sup>c</sup>, S. G. El-Deir<sup>d</sup>, V. L. L. Bezerra<sup>e</sup>

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### **Abstract**

The interaction with regard to the joint company x University brings the prospect of building new forms of action regarding the management of the environment and an the rethink of the executive area to the academy. The "Grande Recife Consórcio de Transporte" (CTM), urban transport company of the Pernambuco State Government, along with the Environmental Management Group in Pernambuco (Gampe) of the Federal Rural University of Pernambuco, structured the Environmental Management area of Consortium aimed at rational use resources, improvement of environmental quality and energy efficiency. This partnership was based on participatory methodologies that articulated corporate and academic knowledge. The process was based on the principles of Participatory Strategic Environment Planning, being developed in a dialogue way, with the shareholders commitment and empowerment of stakeholders inside and outside the company, followed a modular structure and thematic (strategic planning, water, air, energy, waste solids, air quality and health of confined spaces). This study, focused on Corporate Environmental Management, is liable to be replicated in the corporate environment, being easy to apply. In this sense this paper contributes to the elevation of environmental quality in corporate environments and disseminate such methodology for medium-sized businesses, especially in office places, aiming at the direct or indirect conservation of natural resources.

**Keywords:** *Environment, Strategic Planning, Participatory Methodology*

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## **Development of Actions of Socio Environmental University Responsibility in Semiarid Northeastern**

G. D. Silva, Y. M. Paz, C. M. C. Rocha, A, L. Jacob , S. G. El-  
Deir

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### **Abstract**

Socio Environmental Responsibility University (RSU) is the way universities relate to the environment and stakeholders. This term can be given to actions taken by other social groups, including Corporate Social Responsibility (RSC). The capacity that the university has to put into practice the knowledge, through processes such as management, teaching, research and extension, giving answers to the academic community and the country itself, featuring the RSC. The Environmental Management Group in Pernambuco (Gampe), Department of Rural Technology (DTR), Federal Rural University of Pernambuco (UFRPE) developed actions in the community of Poço da Cruz, Municipality of Ibitimirim – PE. The RSC activities were structured by the group through three distinct actions, such as Easter, Christmas and Reading Solidary. The projects were based on the methodology of action research, given this community to be under focus in several research projects and extension UFRPE. This initiative represents a mutual gain for the university and society, as humanize the process of teaching and learning, raises the social commitment of the student, creates greater connection with the various segments of society and contextualizes the academic knowledge. The communities of the semiarid region of Pernambuco are characterized as places of lower Human Development Index in Brazil, to the detriment of the lack of basic infrastructure, as a poverty state of the population, privation and total absence of the presence of public power, as concerning the structure of the minimum conditions for a life with human dignity. This way UFRPE and GAMPE Group has been developing projects and actions that can subsidize the empowerment of this community in endogenous processes of local development. In this sense the present paper aims to portray the actions of RSU and discuss the results derived from these activities.

**Keywords:** *university extension, semi-arid, rural communities*

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## **Undergraduate Student Understanding of Green Chemistry Concepts**

V. S. Antonin <sup>a</sup>, A. C. Morashashi <sup>b</sup>, G. R. P. Malpass <sup>c</sup>

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### **Abstract**

The teaching module introduction to Green and sustainable chemistry was given for the first time at the Universidade Federal do ABC during the 3<sup>rd</sup> academic term of 2009. With the aim of mapping the students understanding of the subject before and after the learning process, a questionnaire with 8 questions was applied. The questionnaires were distributed to the students of two classes (daytime and nighttime). It was observed that the module was efficient in the sense that the students were able to increase (or initiate) their knowledge of the area. It was also verified that there was a need to increase awareness of Green and Sustainable chemistry in academic circles and to educate professionals in the private sector in the area.

**Keywords:** *Green Chemistry; Sustainable Chemistry; Life Cycle Analysis; Industrial Ecology.*

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*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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## **The Cleaner Production in a Research and Education Institute: Bibliometric Study**

J. A. Guedes, G. C. De-Simone, M. M. L. Barata

*Fundação Oswaldo Cruz, Instituto Oswaldo Cruz, Comissão Interna de Gestão Ambiental, Rio de Janeiro, RJ, Brasil,*

*juliaguedes@ioc.fiocruz.br, gregorio@ioc.fiocruz.br,  
barata@ioc.fiocruz.br*

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### **Abstract**

Cleaner Production is a United Nation's program developed to offer support in order for companies to be managed according to the concept of eco-efficiency, whose objective is to increase the offer of high-quality products and services that cause less environmental impact. The Cleaner Production program, which has been implemented in laboratories of Oswaldo Cruz Institute since 2007, is also known as "Cleaner Research". The aim of this article is to evaluate the current situation of Cleaner Production in the realm of research institutions all over the world through a bibliometric study. For the accomplishment of this study, a survey of articles on this subject on the main electronic journals' websites was conducted. The articles chosen had been pre-selected by title amongst those that showed the implementation of an environmental management system in a research institution. Only nine of them showed concrete results of Cleaner Production in practice and the prevention of pollution within institutions. These contained case studies on the implementation and adoption of such a system in universities. The other articles were related to the practice of sustainability in the context of the university's syllabus, such as environmental education, but without demonstrating results within the university campus.

**Keywords:** *Cleaner Production, Research Institute, Environmental Management.*

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## **Challenges of Teaching Corporate Environmental Management in Brazil: The “5 Ls”**

C. J. C. Jabbour<sup>a</sup>

*Universidade de São Paulo, Faculdade de Economia, Administração e Contabilidade de Ribeirão Preto (USP-FEARP)*

*charbel@usp.br*

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### **Abstract**

Teaching corporate environmental management (CEM) is fundamental for the education of more responsible students. We analyzed the main challenges for CEM in Brazil from the viewpoint of teachers. Results indicate five types of barriers for teaching CEM, denoted here as the “5 Ls”, namely a lack of integration of other teachers in the teaching of CEM, a lack of acceptance of CEM as a subject by the peers teachers, a lack of focus on business while teaching CEM, a lack of CEM teaching materials appropriate for the realities of Brazil and a lack of interest among some students in CEM.

**Keywords:** *Corporate Environmental Management, Brazil, Education for Business, Environmental Management.*

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## **CP: Sustainable Development and Environmental Higher Education**

P. A. O. George

*Independent researcher, Cienfuegos, Cuba*

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### **Abstract**

This work presents briefly the results obtained in the reduction and reuse of waste generated in various processes by applying CP principles. The aim of this work is not only to demonstrate the effectiveness of such principles in the management of industrial processes, but also to show the science required to perform such work, with the aim of highlighting the need to include CP principles in Environmental Higher Education, as the work of university graduates have a major impact on achieving or not sustainable development.

**Keywords:** *CP, Environmental Higher Education, sustainable development*

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*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

## 20<sup>th</sup> May 2011

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**8h00-9h40**

**Session 6A**

**Room 3**

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Water Management in the Tanning Industry – A Diagnosis under the Cleaner Production Principles in Sao Paulo State,

Water Demand Management through Partnerships with SABESP and Government Sectors

Covenants and Partnerships with Municipalities Ran by SABESP North Business Unit for Water Resource Management

Mitigating actions for the Drug Industry in the Comarca de Londrina-PR, Brazil: Environmental Impact of Waste Dump in Water Bodies

Waste Water Minimization of Starch Industry Using Water Pinch Technology

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## **Water Management in the Tanning Industry A Diagnosis under the Cleaner Production Principles in Sao Paulo State, Brazil**

J. W. F. Pacheco <sup>a</sup>, D. D. Telles <sup>b</sup>, F. M. Ribeiro <sup>c</sup>

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### **Abstract**

Water is an important resource for the tanning industry. Considering the increasing necessity of the rational use of water by the mankind, the aim of this work was to make a diagnosis of water management in the tanneries with beamhouse operations in the State of Sao Paulo, Brazil, under the focus of the Cleaner Production (CP). The methodology included the elaboration and application of a survey, evaluating management parameters, through interviews in 9 (nine) tanneries. The data analysis resulted in a 'water management traffic light', which shows the overall degree of this management. Results showed that although some good practices were found in these tanneries, generally the water management under CP is incipient.

**Keywords:** *water management, cleaner production, tannery, leather industry*

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## **Water Demand Management through Partnerships with SABESP and Government Sectors**

R. R. Chahin

*Companhia de Saneamento Básico do Estado de São Paulo – Sabesp*

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### **Abstract**

The availability of water resources and adequate bulk water and wastewater infrastructure to meet the growing water demand in the São Paulo Metropolitan Area can be a limiting constraint to the social upliftment and economic prosperity of the city. Therefore, partnerships with Municipalities and Government Departments focusing on conservation efforts are very important.

The aim of this paper is to show initiatives of The Water and Sewage Services Company of the State of São Paulo – Sabesp in water demand management hard task.

**Keywords:** *water, conservation, government, demand management*

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## **Covenants and Partnerships with Municipalities Ran by SABESP North Business Unit for Water Resource Management**

E. G. V. Souza

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### **Abstract**

The Rational Use of Water Programme – translated in portuguese: “PURA” – is a programme developed by SABESP and its objective is reduce water consume population through the world water deficit perception and economize water equipments association. The programme is developed in a public institutions and the financial support is originating from water use charges.

This written work objective is illustrate this programme applied in public institutions in the São Paulo north districts, managed by Sabesp - North Business Unit.

**Keywords:** *rational use of water, world water deficit, public institutions.*

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## **Mitigating actions for the Drug Industry in the Comarca de Londrina-PR, Brazil: Environmental Impact of Waste Dump in Water Bodies**

I. D. Zapparoli, M. R. G. da Camara, C. Beck

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cleusabeck@sercomtel.com.br*

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### **Abstract**

The aim of this work is to analyse the consequences of disposing of pharmaceuticals in water bodies in the city of Londrina, in the light of the economic theory of the environment. The study focuses on the analysis on the impact of pharmaceutical industry production, in particular the Group antibiotics and hormones and its different forms of disposition in the environment. The research makes a cut for the processes used in sewage treatment plants (ETE), proposing measures that solve problem for some processes already tested for drugs. The results leads to the conclusion that the pharmaceutical industry has an important role in the process of problem minimize making use of environmental management system (EMS), evaluating control equipment and treatment system, elaborating programs dump of follow-up and monitoring of impacts, making use of waste treatment centre (CTR) and reverse logistics. The use of agricultural waste as bioadsorventes is efficient and economically viable alternative, minimizing environmental impacts.

**Keywords:** *Environmental impact. Water bodies. Pharmaceutical industry.*

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## Waste Water Minimization of Starch Industry Using Water Pinch Technology

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### Abstract

Water is a vital component for many industrial operations, and is utilized for a wide range of purposes in industrial processes. The rapid growth in population, coupled with industrialization and urbanization, resulted in an increased demand for water, leading to serious consequences on the environment. The cost and scarcity of water beside stricter regulations on industrial effluents have become a significant factor in commodity material manufacturing. In this paper sincere efforts had been put to demonstrate, the potential of water pinch technology at real world of industries. To explore the effectiveness of this technology a case studies from a Starch industry of India is under taken with an aim to reduce demineralised (DM) water flow rate and subsequently waste water flow rate. The problem is viewed as a single contaminant problem and all the three modes of water integration i.e. *re-use*, *regeneration-reuse*, *regeneration –recycle* are demonstrated. The DM water consumption is 50 tph before modification and after modification using water pinch it reduces to 31.9 tph (*reuse*), 21.6 tph (*regeneration-reuse*) and 12 tph (*regeneration-recycling*). The results obtained from the present analysis are compared well with the results obtained from well established software ASPEN WATER which uses mathematical programming approach based on MINLP. The cost benefit analysis illustrates that the profit obtained in the case of reuse is 17, 63,914 INR per year and the payback period for the *regeneration-reuse* and *regeneration –recycling* are 1.8 and 1.1 months. A computer program is developed in MATLAB for analysis of the above case study using water pinch technology.

**Keywords:** *Waste water minimization, Water Pinch, Starch*

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## **20<sup>th</sup> May 2011**

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**8h00-9h40**

**Session 6A**

**Room 4**

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Cleaner Production Opportunities in a Dairy Farm and Cheese Factory

Evaluating the Global Productivity of a Medium Size Agribusiness

The Integrated Production of Fruits in Brazil and the Interface with a Cleaner Production

Clean Technologies (Bio-Fertilizers) Alternative to Urea for Production of Basil in and Out of Season

Study on Clean Technology Energy Production and Feed the Use of Agricultural Residues on Sugarcane and Integrated Biosystems

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## **Cleaner Production Opportunities in a Dairy Farm and Cheese Factory**

J. Esquer, C. D. Cordero, L. E. Velazquez, N. E. Munguía

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### **Abstract**

According to the National Institute for Federalism and Municipal Development (INAFED by Spanish acronym), Sonora's livestock activity possess the national prestige of being one of the main livestock producers in Mexico because of its magnificent quality and its ability to cover the demand of products as well as its important contribution to the national exports. Internationally, this state has been recognized by the United States of America for being a disease free zone referred to livestock production. One of the derivatives obtained from the cattle is cheese; all around the state is possible to find different places where this food is produced, from small producers who make the cheese in a home-made manner with gas or even wood stoves in some small communities, to big industries who count with sophisticated equipment and a big investment capacity to commercialize and also export this product.

As the cattle raising and cheese production are common activities within the region, analyzing this industries from the cleaner production perspective takes a higher relevance. The aim of this paper is to show relevant results from a study conducted on a cheese production facility in a small city at the northwestern side of the state. The most important opportunities found were those for reducing the energy demand for thermal processes and improving the manure management system, among others; such things will not only achieve an improvement on the company's environmental performance, but also it will provide a considerable economical benefit which is expected to work as a motivation for further and deeper research and analysis.

**Keywords:** *Dairy farming, Cheese, Cleaner Production.*

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## **Evaluating the Global Productivity of a Medium Size Agribusiness**

A. D. Frugoli, C. M. V. B. Almeida, P. A. Frugoli, A. P. Z. Santos, M. V. Mariano

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### **Abstract**

A medium size agribusiness located at São Sebastião do Paraíso, Minas Gerais, Brazil, is evaluated in order to determine the effects of the integrated production process in its productivity. Results are compared with those obtained for agribusiness without integration. The farm is composed by an integrated production of corn, eggs, pigs and milk. Emergy accounting is applied to evaluate the energy and materials flows driving the production process. The farm total emergy is  $1,23 \times 10^{18}$  seJ/ano. The values obtained for eggs, pigs and milk are, respectively, 24, 5 e 6 times higher than the results observed in literature for traditional production systems. Global productivity values for the three by-products are indicate that integrated production processes are more environmentally efficient.

**Keywords:** *emergy; agribusiness; transformity; environmental efficiency; global productivity*

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## **The Integrated Production of Fruits in Brazil and the Interface with a Cleaner Production**

L. P. Vendrametto, C. A. Di Agustini, S. H. Bonilla

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### **Abstract**

Currently, there is a high level of concern regarding principles that guide production systems. The same applies in agriculture. Production based on guidelines such as integrated disease and pest management; the rational use of input; restricted use of non-renewable natural resources; conservative soil and water practices; contamination and disease prevention among rural workers are the most important steps towards achieving sustainability. This article presents a discussion based on "Sustainable Agricultural Production or Cleaner Agricultural Production". The Integrated Production of Fruits can be considered an excellent example of success regarding productivity, quality and reduction of environmental impacts in agriculture. Briefly, it is a system that uses the resources only after they are rationalized and their real need monitored. This article aims at discussing and presenting the principles and norms of Integrated Fruit Production in Brazil.

**Keywords:** *Integrated Production; Integrated management; Sustainable Agriculture.*

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## Clean Technologies (Bio-Fertilizers) Alternative to Urea for Production of Basil in and Out of Season

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### Abstract

The growth in the use of pesticides and fertilizers which cause pollution of surface and belowground water, soil, air, flora, fauna and produce negative effects on the health of the population, has increased interest in clean technologies like bio-fertilizers. In the context of sustainable agriculture, the objective of this research is assess the effects of different bio-fertilizers (vermicompost) and urea in the production of basil (*Ocimum basilicum* L.) variety Catamarca INTA (wide leaf) in and out of season. The seeds were sown in the greenhouse in March (out of season) and in October (in season). The treatments used were: vermicompost from bovine ruminal content 50%:50% soil (LCR), vermicompost from rabbit manure 50%:50% soil (LEC), urea 100 kg/ha and the soil (control). Completely randomized design was applied with three repetitions and thirty plants per treatment. The variables were analyzed by ANOVA and the mean comparison was performed by Fisher LSD ( $p < 0.05$ ). The results indicate that the variables are significantly increased in season: the number of leaves and branches are greater and is double the height and aerial fresh weight, of the root and the total fresh weight, and aerial dry weight are fourfold greater while the total dry weight, of the root and leaf area produced three times the amount produced out of season. The time-substrate interaction was highly significant for height. In both seasons it can be observed the highly beneficial effects of vermicompost than the ones achieved with urea and control, but urea station has a more favorable effect than the control. In season the LEC performs better in terms of the number and area of leaves and chlorophyll content compared to LCR. In both periods, the use of vermicompost produces better results due to its effects on all production variables. These clean technologies are a sustainable alternative to the application of urea in the production of basil both in and out of season.

**Keywords:** *clean technology, biofertilizers, vermicompost, basil, production.*

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## **Study on Clean Technology Energy Production and Feed the Use of Agricultural Residues on Sugarcane and Integrated Biosystems**

M. C. A. Neto, M. M. Cansian, A. H. F. Costa, J. M. Santos, P. V. Pannirselvam

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### **Abstract**

Economic activity divorced from production of energy and agro animal feed production in Brazil has low sustainability technologic, economic and ecological. The main objective of this proposal is the development of innovative technologies, seeking solutions for these problems with the use of residual biomass for use in the production of bioenergy and clean pet food on a small scale. The proposal involves the multidisciplinary study of the production chain with clean technology, both in feed production cost down, as in the process of obtaining raw materials with the participation of sugarcane mills of newborns in all phases of the project. This study will be selected communities and designed micro plants to feed production, bio-hydrogen and biogas. Through a case study of utilization of solid waste, this study uses innovative methods of analysis and synthesis processes both for power generation in small rural communities as the processing of waste into feed low cost solar power and biogas integrated way for drying food. Results were obtained on various parameters related to the economic viability and the use of clean energy from biogas and solar energy to replace the wood. Technology designed for each route, we will analyze various scenarios of feed production, based on raw material bagasse of sugarcane. This innovative system design will be released via internet and the diffusion of technology will be in partnership with collaborating companies through the implementation of a pilot plant for the community, including micro-entrepreneurs and farmers. Producers will be able to build and operate micro feed production plants in order to reach the local market to improve the nutritional characteristics of bagasse and production of nutritious meal of animal protein and vegetable waste sludge digester, with innovative formulas using low-cost computational tool as a way to replace the conventional diets.

**Keywords:** *digester, sugarcane, bio-energy.*

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## 20<sup>th</sup> May 2011

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**8h00-9h40**

**Session 6A**

**Room 5**

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Bibliometric Analysis of Literature on Product Life Cycle Management, Product Development Process and Sustainability and their Interfaces

Cleaner Production at an Environmental Agency: 15 Years of Experience at CETESB, Sao Paulo - Brazil

Proyecto Piloto Implementación de la Metodología de Producción Más Limpia en la Universidad de la Salle Bajío Escuela de Turismo y ECEA

Caso Cuba. Un Camino al Desarrollo Sostenible

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## **Bibliometric Analysis of Literature on Product Life Cycle Management, Product Development Process and Sustainability and their Interfaces**

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### **Abstract**

The aim of this paper is to present a review, classification, codification, and analysis of the literature of the concepts Product Life Cycle Management (PLM), New Product Development (NPD), Sustainability and their interfaces. It seeks to map the literature on those concepts by bibliometric analysis. The analysis is supported by software (UCINET and SITKIS) to present the relations among the concepts, networks of citations and references, and related topics. Subsequently, the paper identifies a gap in the literature on perspectives for future research. ISI Web of Knowledge database is accessed as well as a Brazilian portal which is linked to various databases (CAPES). The analysis considers publications between 2006 and 2010, classifying according to various criteria. When classifying the papers, difficulties were encountered in identifying the research methods, since there was limited information on many articles. The results show that the papers are published in a dispersed way in different journals. The majority of them adopt case study as a methodological research approach as well as theoretical-based conceptual papers. Concerning the nature of the data, qualitative approach is more used than the quantitative one. Most papers are descriptive studies. One of the reasons might be due to the fact that these concepts are not well consolidated in the literature. The examined publications incorporated the concept of sustainability and PLM in the NPD process and are more extensively applied in industries, supply chain and software development. Papers usually emphasises the improvement NPD, performance assessment, and the integration of information from different areas. Finally, the article concludes that the literature converges to an integration of the concepts of sustainability and PLM, within the current practices of the NPD. There is a trend increased towards environmental issues demanded by society and the need of organizations to employ strategies that consider product end of life (remufacturing, recycling and reuse).

**Keywords:** *Product development process (PDP). Product life cycle management (PLM). Sustainability.*

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*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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## **Cleaner Production at an Environmental Agency: 15 Years of Experience at CETESB, Sao Paulo - Brazil**

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### **Abstract**

The State of São Paulo concentrates about 40% of Brazilian industry, which although conferred a large economic force to the state has also brought several environmental challenges in its history. In order to ensure and improve the environmental quality, in 1968 the State government created CETESB, the São Paulo State Environmental Company, which has served on permitting pollution sources, monitoring the environment and transferring technology in its 40 years of existence. In 1996, CETESB made its first contacts with cleaner production (CP) and since then has developed several initiatives to foster CP in the State. This paper presents the main initiatives and the most relevant achievements, with emphasis on the institutional development and the relationship improvement with industrial sectors representatives, concluding with a brief view of the main prospects for the near future.

**Keywords:** *cleaner production, environmental agency, public policy, environmental regulation*

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## **Pilot Project Implementation of Cleaner Production Methodology at the University de la Salle Bajío School of Tourism and ECEA**

S. P. López, M. A. M. Centeno, L. M. V. Castillo, F. G. Olvera

*Universidad De La Salle Bajío*

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### **Abstract**

This paper presents the results of the Bajío Cleaner Production Center (CPLB) in its project conducted jointly with the University of La Salle Bajío (Universidad de La Salle Bajío). The project called "Pilot Implementation Cleaner Production methodology at the University of La Salle Bajío Tourism and ECEA Schools". The objective of this project was to detect the potential savings in the use of raw materials, water and energy, and also contribute to a productive efficiency and reduction of operating costs of companies in this sector. In addition to the economic and environmental benefits by the Cleaner Production (CP) and Energy Efficiency (EE) Implementation, under this scheme all schools that make a Cleaner Production project can get the "Clean Company" Certificate issued by PROPAEG, so in a single project, the university could obtain environmental regulatory compliance, financial savings, public image, increased competitiveness, and minimizes negative environmental impacts and the efficient use of raw materials, water and energy.

The "University of De la Salle Bajío" is located in León, Guanajuato, México. Some of the results obtained are: train at least a thousand students on the importance of pollution prevention and productive efficiency in educational institutions. The detection of areas of opportunity in CP and EE in the University can lead to an estimated economics savings. The implementation of CP and EE at the University is being translated in a decrease in water consumption of 2,038.65 m<sup>3</sup>/year. The Tourism/ECEA Building produces an average of 21.5 tons of garbage per year of which 37.8% are recycled. The raw materials produced at The Tourism/ECEA building are paper, carton, plastic, glass y aluminum and 53.4% goes directly to the dump. 80% of these materials are organic, so there is a big percentage that can be used to produce compost for the green areas of the university. There will be a reduction of electricity consumption of 275,709 kWh/year; all this can be translated in a decrease of CO<sub>2</sub> emissions into the atmosphere of about 180 tons per year.

**Keywords:** *Cleaner Production, Universidad de la Salle Bajío, Pilot Project*

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## **Case Cuba: A Path to Sustainable Development**

J. J. C. Eras <sup>a</sup>, D. G. Lorenzo <sup>b</sup>, A. S. Gutiérrez <sup>c</sup>, L. Hens <sup>d</sup>, C. Vandecasteele <sup>e</sup>

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### **Abstract**

This work analyzes the Cuban model for sustainable development and explain the causes in order to convert this country in the world the only that in accordance with World Wide Fund for Nature accomplish the requirements for sustainability. Explains the results in education and health sectors such improve the high value for IDH. Also analyzes the Cuban foot print and policies applied in both fundamental aspects, the carbon foot and agricultural lands. This makes available the economic growth without sensible increasing for the foot print.

**Keywords:** *Cuba, Sustainable Development, IDH, Foot Print*

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*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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**20<sup>th</sup> May 2011**

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**8h00-9h40**

**Session 6A**

**Room 6**

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Incineration: An Inevitable Alternative for Waste Disposal

Proposed Structure of the Solid Waste Management in the Corporate Environment

Post-consumer Packing Residue Management: a Case-study on McDonald's

Environmental Impacts of the Brazilian Shrimp Culture

Shellfish Clams use Possibility

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“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

## **Incineration: An Inevitable Alternative for Waste Disposal**

R. M. C. Coutinho<sup>a</sup>, A. L. O. Coutinho<sup>b</sup>, L. C. Carregari<sup>c</sup>

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### **Abstract**

According to the Brazilian Institute for Geography and Statistics, Brazilian population (about 180 million inhabitants in 2004) produces close to 85 million tons of waste per year, or 225 tons per day, and this amount is household waste only, generated in homes or workplaces. This research aims to expand the general knowledge through literature review in scientific databases regarding the use of techniques, and methods or processes that can minimize the effects of solid wastes may pose a risk to life, the quality of life and the environment. Specific objectives: to describe the use of key technologies in solid waste management and reporting major damage that solid waste pose to public health and the environment. The most common methods in Brazil for the disposal of non-recyclable solid waste are the landfills or the famous dumps. The latter have caused many problems, such as the emission of odors and water and soil contamination. It is noticeable that many of the toxic elements present in the original residues are still present in the landfill, uncontrolled and unknown, and this is contributing to air pollution, soil and water bodies, besides facilitating the proliferation of macro and micro arrays. This research aims to expand the general knowledge through literature review, regarding the use of techniques and methods or processes that can minimize the effects of solid wastes to expose life to risk, quality of life and the environment. Fortunately the dumps are prohibited, and landfills have become unviable due to its cost and the rejection of the population directly affected is no longer possible to forget the trash or hide it. We must not turn it into garbage, and chances are many, but not equally efficient and viable. The only viable solution in the relatively short time, with proven technology and without major environmental impacts, is to convert municipal waste into industrial feedstock for the production of electricity through incineration. We know that the European Union, North America and some other developed parts of the globe, incineration is very widespread and used in hospitals, airports, industries and even cities. But in Brazil, this type of waste for disposal is not explored yet and one of the main reasons is the low cost of disposal in landfills and also the lack of legal requirements that require the total destruction of waste. Undoubtedly, after the enactment of Law 12.305/10, establishing the National Policy on Solid Waste, incineration is has a larger consideration, because the law provides for the waste management hierarchy that includes the recovery.

**Keywords:** *Incineration, Solid Waste, Environmental Law, Industrial Waste.*

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## **Proposed Structure of the Solid Waste Management in the Corporate Environment**

T. S. Pinheiro, R. B. Prota, C. M. C. Rocha, N. S. Cavalcant<sup>d</sup>, G. S. El-Deir

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### **Abstract**

Um Plano de Gestão Integrada Corporativa de Resíduos Sólidos – PGICRS visa à An Corporate Integrated Management Plan for Solid Waste - PGICRS aims at reducing environmental business passive, both in production area and in administrative spaces, as regards the shopping, management and relocation or disposal of materials. In this context, the objective was to generate the beginning of a Solid Waste Management - GRS for "Company A ". It began with the situational diagnosis, realized through on-site observation, interviews with employees and evaluating formal documents of the company. Interviews indicated that staff have superficial knowledge about environmental issues, but recognize the importance of selective collection. Based on data collected from existing reality and the potential for change, in accordance with the guideline of management, was conducted in a coordinated way, systemic and integrated approach, a proposal that PGICRS told how the basic principles of compliance with current legislation, Environmental Education, the 3R's and the PDCA cycle, also were deployed to GRS logistics, ensuring worker safety, the relevance of integration with strategic planning and the creation of the steering committee.

**Keywords:** *Corporate Environmental Management, environmental perception, waste, Environment.*

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## **Post-consumer Packing Residue Management: A Case-study on McDonald's**

T. N. Lopes <sup>a</sup>, V. A. Belo <sup>b</sup>, M. R. Henrique <sup>c</sup>, A. Formigoni <sup>d</sup>, E.  
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### **Abstract**

In view of the currently rising awareness on the sustainability and environmental questions on the part of the general public, the present work reflects on the importance of implementing an Environmental Management System, both as an image improving initiative, and as a source of financial return, for the companies that decide to take this step, and as a source of environmental benefits for both the company itself and the society it exists within. A case-study was performed to investigate the actuality of those concepts, focusing on the fast-food services sector, McDonald's having been selected as a very representative large company in this sector, which, therefore, presents the ideal conditions for the application of environmental management techniques, in view of the high volume of residues it generates. Hence, the present state of the quest for better solutions for the environmental problems, in particular, and for residue management, in general, as actually undertaken by a big player in the fast-food sector, is described and discussed herein.

**Keywords:** *Waste Management, Packaging, Post-consume, McDonald's.*

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## **Environmental Impacts of the Brazilian Shrimp Culture**

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### **Abstract**

The possible environmental impacts caused by shrimp culture affect the biological, social and physical area, due to the launch of its effluents in water used in public. Non adequately managed farms may cause several problems. These problems are the appearance and fast dissemination of diseases. The environmental degradation due to high concentration of nutrients. Low quality food results in greater quantity of phosphorus and organic matter release. The shrimp production is an alternative to social development, but it can also generate social impacts. It can cause the expulsion of aquaculture local farmers from their local of work. This can socially exclude the traditional communities' dependents on the mangrove. The ecosystem and landscape degradation is related to the physic impact. The risks of land cover loss, reduction of protected areas, soil salinization are potential impacts to the area of shrimp production. The shrimp production should be adequately planed. If it does not happen it causes several environmental impacts that harm the nearby environment. In other hand, if it is adequately organized it may become environmentally positive. Besides, there is a problem about the mangroves areas. These areas are destroyed to the implementation of shrimp farms. There is a great biological impact because several species lost their habitat. As these impacts advance it may affect the bio atrophic interface, affecting the humans. This paper has a bibliographical review about the main impacts caused by the shrimp culture. These impacts are related to organic matter discharge from bad management practices. This economic activity is growing because it is an alternative to the extractive fish industry but it also contributes to the marine environment degradation. In order to minimize the environmental impacts is take decisions to promote mitigating actions and improve the technology to produce shrimp. These actions include the super-intensive production, use of macrophytes, bioflocs and quality food. The use of macrophytes to treat the liquid effluent minimize the impacts on the aquatic systems, reducing the nitrogen and phosphorus availability. The biofloc shrimp culture technology consists in the use of heterotrophic bacteria that are naturally present in the aquatic environment. The bacteria are capable of assimilate nitrogen compounds and convert it in to biomass when carbon sources are available.

**Keywords:** *shrimp culture, environmental impacts, sustainable development, mitigating actions*

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## **Use Possibility for Shellfish Clams**

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### **Abstract**

The Santa Catarina State is the main bivalve shellfish producer in Brazil. The total production (mussels, oysters, scallops) of 2009 was 12,462 tons. The Florianópolis is the city with the major shellfish production with 1,301 tons with 76.6% of the state oysters production and 3.12 tons and 57% of the scallops production. The mussels production corresponds to 558 tons and represents 5.25% of the state production. The calcium carbonate (CaCO<sub>3</sub>) is the main material of the shells and it is the base material for several products. The waste of these shells results in a great waste of materials. This waste can promote the development of animals and insects that can transmit illness and environmental degradation. There are studies that demonstrate the potential of reutilization of these materials with a simple shell processing step to add value to the material. The products that can be made from the calcium carbonate source are: quicklime, hydrated calcarium, polymers charge, construction blocks, roads construction materials, paper paste, compact marble, fertilization, pesticides, food, ceramic blocks industry, paint industry, polyurethane foam, talcum powder, glass production, cement, varnishes, rubbers, soil correction and medicines.

**Keywords:** *molluscs, calcium carbonate, shells, reuse, environment.*

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## 20<sup>th</sup> May 2011

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**8h00-9h40**

**Session 6A**

**Room 7**

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Feasibility of Using Scrap Tires How the Composition of Concrete Aggregates Sidewalk to Rubber

Characterization of Waterworks Sludge and Coal Ashes Aiming its Use in Manufacture of Brick

Study of Incorporation of Wind Blades Waste in Portland Cement

Tunnels and Non-Destructive Methods of Multi-Utility: Benefits for the Sustainability of the Networks of Urban Infrastructure

Analysis of the Application of AQUA Certification in Civil Construction in Brazil

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## **Feasibility of Using Scrap Tires How the Composition of Concrete Aggregates Sidewalk to Rubber**

A. C. A Romualdo<sup>a</sup>, D. E. dos Santos<sup>a</sup>, L. M. de Castro<sup>a</sup>, W. P. de Menezes<sup>b</sup>, A. Pasqualetto<sup>c</sup>, O. R. dos Santos<sup>c</sup>

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### **Abstract**

The disposal of scrap tires has become an environmental problem evident. The objective is to develop a technology that is capable of reusing these wastes inserting them into the composition of concrete paving of sidewalks, replacing the fine aggregate. For four traits that were made of concrete, one conventional and three with the addition of 5%, 10% and 15% of zest tires. The tests were conducted at ages 3, 7 and 28 days in body-in- cylindrical specimens of dimensions 10 cm x 20 cm and body-of-proof prismatic of dimensions 5cm x 5cm x 20cm, evaluating properties such as tensile and compressive strength in flexion, respectively. The results showed that the trait that best satisfy the use for paving sidewalks was 5% plus tire fibers, however, despite losing in strength, the concrete rubber won in other mechanical properties inherent in conventional concrete, mainly related to flexibility. The use of concrete could promote the reduction of scrap tires improperly disposed into the environment.

**Keywords:** *scrap tires, fiber, rubber, concrete, resistance.*

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## **Characterization of Waterworks Sludge and Coal Ashes Aiming its Use in Manufacture of Brick**

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### **Abstract**

Sludge from treatment water Brazilian plant station are, frequently, disposed and launched directly in the water bodies, causing a negative impact in the environment. Also, fly ash is produced by burning of coal in coal-fired power stations and is the industrial solid waste most generated in southern Brazil: approximately 4 million tons/y. Efficient disposal of coal fly ash is an issue due to its massive volume and harmful risks to the environment.

The present work is being developed with the objective of evaluating the viability of the use of the sludge of the treatment water plant stations along with the coal ashes to manufacture bricks. Samples of fly ashes from a cyclone filter from a coal-fired power plant located at Figueira County in Paraná State, Brazil and waterworks sludge of Terra Preta County in São Paulo State, Brazil, were used in the study. The materials were characterized by chemical analysis, X-ray diffraction, thermal analysis, morphological analysis and granulometric analysis. Fly ash-sludge and fly ash-sludge-soil-cement bricks were molded and tested, according to the Brazilians Standards. None of the bricks produced in the studied conditions has attended the requirements of the Brazilian norms of quality of compressive strength.

**Keywords:** *Coal Ashes, Waterworks Sludge, Brick*

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## **Study of Incorporation of Wind Blades Waste in Portland Cement**

M. P. M. Bini, M. L. P. Antunes, L. Sottovia

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### **Abstract**

Industrial Residues represent a huge waste of raw material. And also they represent a potential risk to the environment. The incorporation of waste in other processes may minimize environmental damages, contributing to clean production. A residue produced in large quantities in Sorocaba (S.P.) is the residue of wind blades. This waste needs a great area to disposal which means much cost to the company. An alternative to residue disposal is incorporation in cement matrix. The aim of this work is study the incorporation of wind blades waste in Portland cement matrix, and produce a new material. The residue was characterized by wettability techniques, infrared spectroscopy and granulometric analyses. The waste is hydrophilic and less heavy than pebbles. A reduction in the mechanical strength occurred as the waste additions were increased. The incorporation of this waste in cement matrix can be used to produce non-structural bricks.

**Keywords:** *Portland cement, Waste, Characterization.*

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## **Tunnels and Non-Destructive Methods of Multi-Utility: Benefits for the Sustainability of the Networks of Urban Infrastructure**

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### **Abstract**

This paper aims at addressing the constructive processes of underground networks and urban infrastructure from the perspective of sustainability. The methodology is based on analyzing the most common methods that are digging the tunnels and non-destructive multi-utility. From the study of the methods separately is a comparative analysis that results in the profile within each aspect of sustainability. The conclusion can be reached after this study is of how much still needs to be done in the construction sector so that it incorporates the concepts of sustainability.

**Keywords:** *urban infrastructure, underground, sustainability.*

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## **Analysis of the Application of AQUA Certification in Civil Construction in Brazil**

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### **Abstract**

The accelerated development of constructions of buildings in large cities brings degrading impacts on the environment and people's lives. One can consider another point of observation concerns not only the volume of inputs used, but the strong consumption of resources like water, electricity, discomfort in the vicinity of the project, ventilation. Society as agent of change has required the use of these resources better entrepreneurs associated with the economy, reduction and even total replacement forcing streamlined and sustainable innovation. In order to improve the quality of the built environment and minimize its negative impact on the natural environment, various methods for measuring sustainability is being developed by different countries and regions. The study aims to analyze the methodology High Environmental Quality (HEQ) of international review and adapted to Brazil by Vanzolini, its criteria, definition of parameters for the management and monitoring, structure and applicability. It is discussing its convergence with the dimensions of sustainability: social, cultural, environmental and economic criteria and the certification and maintenance of the title. As a result it was possible to verify which requirements are suitable for the methodology of sustainability certification, policies and proposed criteria, management and future studies.

**Keywords:** *Civil Engineering, Sustainable Construction, Green Buildings, Certification HEQ.*

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## 20<sup>th</sup> May 2011

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**8h00-9h40**

**Session 6A**

**Room 8**

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Level of Disclosure of Environmental Information in the Electricity Sector: an Empirical Study of Brazil and Iberian Peninsula

The Nuclear Option to Contribute to a Cleaner and Sustainable Production of Electricity

Participatory Governance and Decision-Making: Oil and Gas in the Santos (Brazil) Coastal Region

Sustainability and the Allocation of Oil Royalties: A Theoretical Contribution

Environmental Management System and the Pillar of the Environment - Eletronorte Rondônia Experience for the sustainable production of electricity

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## **Level of Disclosure of Environmental Information in the Electricity Sector: An Empirical Study of Brazil and Iberian Peninsula**

C. Braga <sup>a</sup>, P. P. Silva <sup>b</sup>, G. P. Santos <sup>c</sup>

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### **Abstract**

The world is faced with a challenge in the world market for electricity: energy security, protected environment and competitiveness in the search for the sustainable energy. The balance of these three elements enables the production of cleaner and compatible energy with sustainable development. One way to assess the environmental performance and level of disclosure of a company is the use of indicators. The Global Reporting Initiative (GRI) indicators are highlighted. In the first decade of this century there was an increase in social and environmental disclosure in the electricity sector in Brazil. The demand of stakeholders for environmental reporting and accountability by promoting the dissemination of the environmental report, especially in an industry sensitive to the environment. With the privatization of the sector in Brazil, some of the Iberian Peninsula enterprises made investments in companies that integrate various links of the industry value chain. This paper aims to identify the Environmental Information Disclosure Level (EIDL) of Brazilian and the Iberian Peninsula companies, which have made environmental disclosure using the GRI indicators, G3, posted on the GRI, in the period 2006 to 2008. The conclusions show that Brazilian companies are in the process of improving the level of disclosure and the Iberian ones are divided between those that grew in the dissemination and those that experienced a reduction. The analysis between the level of disclosure and the location of the firms suggests that the Iberian companies are better positioned than the Brazilian. The definition of stakeholders for companies is similar in all three countries. Regarding the company's communication process with stakeholders there are also similarities.

**Keywords:** *disclosure, GRI, environment, Brazil, the Iberian Peninsula.*

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## The Nuclear Option to Contribute to a Cleaner and Sustainable Production of Electricity

L. S. Guimarães <sup>a</sup>, J. R. L. de Mattos <sup>b</sup>

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### Abstract

The integration and economic balance, environmental and social concerns are fundamental to the preservation of human life on Earth. For achieving these goals we must take a fresh look at how to produce, consume, live, work and relate with people. The concept is revolutionary, and like all original ideas, leverage heated debates between governments and citizens on how to achieve this sustainability.

Access and absolute amount of energy used per capita, especially electricity, are essential for human development and for the delicate equation of sustainability. Globally, electricity generation should increase by around 80% over the next 20 years, with heavy dependence on fossil fuels (coal and natural gas). This dependence contrasts with the need to reduce emission of greenhouse gases. Electricity generation is responsible for 41% of emissions of greenhouse gases and this share has increased steadily, growing from 36% in 1990 to 39% in 2000, and continues to grow in the projections of the International Energy Agency - IEA to 44% in 2020 and 45% in 2030. A course correction is urgent to prevent further environmental issue. Assessments prepared by IEA as subsidy to the discussions at COP-15, indicate that correcting this trend is necessary to reduce the intensity of CO<sub>2</sub> emissions by 21% compared to 2007.

Producing electricity from clean and sustainable manner while promoting social inclusion, rising its offer, it is an equation of increasing complexity in which is not always the socio-economic costs and environmental impacts are possible to be equalized. In this scenario, the nuclear option back on the agenda of various countries, due its favourable environmental aspect regarding the generation of greenhouse gases, and is the only source of electricity production on a large scale that is fully liable for the costs of decommissioning of its facilities and the management and disposal of waste generated.

From an economic standpoint, even with all costs included in the price charged to consumers, nuclear-generation is economically competitive with other forms of electricity generation, except where there is direct access to fossil fuels of low cost . This competitiveness can be changed significantly if financial penalties from greenhouse gases emissions be added to fossil fuel plants.

In this paper we discuss the contribution of the nuclear option as a support for continuous and sustainable development, as well as aspects related to operational safety, radioactive waste management, the mechanisms that prevent the diversion of nuclear materials for use in reactors for military purposes, the horizon of use permitted by uranium reserves and the status of this option in the Brazilian scenario.

**Keywords:** *electricity, nuclear, development, sustainability.*

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## **Participatory Governance and Decision-Making: Oil and Gas in the Santos (Brazil) Coastal Region**

E. S. Monteiro, I. P. A. Campos, E. P. Guerreiro

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### **Abstract**

The worldwide growth experienced by the industrial and services' business endeavors, in recent decades, is correlated to major events that drive whole nations to pursue strategies of local, integrated and sustainable development, built upon structural and conjunctural change, stemming from human factors or from natural causes beyond mankind's influence, and falls within the scope of innovative models of productive arrangements and supply-chain, as is the case of networked corporative governance strategies for oil and gas. The present study aims to identify and analyse the local and regional impacts on Santos City, Brazil, resulting from the introduction of oil and gas production (originating in the surrounding pre-salt stratum). The current state of a system for gauging the current-stage, and following the evolution, of the participatory governance decision process controlling the production of oil and gas in Santos is presented herein.

**Keywords:** *Governance, Participation, Decision-Making, Indicators, Oil, Gas*

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## **Sustainability and the Allocation of Oil Royalties: A Theoretical Contribution**

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### **Abstract**

This paper aims to build the principle of justice within and between generations by proposing the unitary approach of several human generations for the standardization of the allocation of government take from the production of hydrocarbons. Thus, it argues that the allocation of oil revenues on public policies should reflect each recipient location, within the perspective of considering the vocation of the territory's development and thinking about the real needs of the whole local population, considering the basic premise for the continuity of quality of life on the globe and according to the sustainability vision.

**Keywords:** *principle of justice within and between generations, production of hydrocarbons, allocation of government takes, sustainability.*

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## **Environmental Management System and the Pillar of the Environment - Eletronorte Rondônia Experience for the sustainable production of electricity**

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### **Abstract**

This work shows the development and implementation of the results of the Environmental Management System, and the experience of Eletronorte in Rondônia to reduce losses and hazards in the electric power plants, from TPM Program (Total Productive Manager), whose goal is zero loss. This system is crucial for the compatibility of corporate goals, environmental sustainability, allied to the principles of clean production of energy, values of great significance in the Amazon. Its implementation demonstrates the company's commitment to environmental issues, reducing risk and incidence of environmental fines, and describes the advantages and difficulties of implementation.

**Keywords:** *Environment, Power, Sustainability, Cleaner Production.*

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**20<sup>th</sup> May 2011**

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**13h30 -15h00      Conference**

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**Nora Munguía**

**University of Sonora, Mexico**

Sustainability practices  
performed at the Mexican  
Maquiladora Industry: A case  
study in the state of Sonora and  
Baja California, Mexico

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### **Sustainability practices performed at the Mexican Maquiladora Industry: A case study in the state of Sonora and Baja California, Mexico**

Nora Elba Munguía Vega  
*Universidad de Sonora - Hermosillo - México*

By definition, maquiladora used to be any manufacturing plant that imports and assembles duty-free components for export. This definition has suffered some alterations, but not for maquiladoras owned by Americans. Due to under the Article 303 of the North American Free Trade Agreement, it was removed the privilege of duty-free importation of inputs and equipment to all countries apart from the Unites States, Canada and Mexico.

Maquiladoras arrived in Mexico, around four decades ago, as a way to propel economic development and alleviate the unemployment problems. In the course of its development, maquiladoras have created jobs opportunities, but they also brought all kinds of risks. For that reason, maquiladoras have been under fire over allegations of environmental pollution and poor labor conditions. However, often Mexican authorities do not find scientific evidence that link the maquiladora´s industrial activity to the occurrence of these outcomes.

The research covers the particular cases of two cities located in the state of Sonora, Mexico and one city of the state of Baja California, Mexico. These cases study are aimed to identify the diverging pollution prevention and occupational and safety practices undertaken by the management of the maquiladoras participating in

*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): *Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.*

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the study in order to be able in generating meaningful insights for facilitating the adoption of sustainable production strategies for a responsible management of products, processes, and operations in the maquiladora industry.

Although the concept of "sustainability" could be understood in different ways, in this research sustainability is conceived as a broad structural approach that takes into account economic, social, and environment aspects. This with the purpose for incorporating human health concerns into the definition of sustainability.

If sustainability in maquiladoras is to be achieved, products and production processes have to be oriented towards new patterns of production. It is called "sustainable production. This term is used to define systems of production that integrate concerns for long-term viability of the environment, worker health and safety, the community, and the economic life of a particular firm. It holds the exciting potential of protecting the environment and labor and strengthening economic growth through more efficient production.

*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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## **20<sup>th</sup> May 2011**

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**15h00-16h30**

**Session 6B**

**Room 1**

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Reduction in Generation of Scrap Metal by Internal Reuse and External Recycling at Serralheria Montanheza

Cleaner Production Philosophy Applied to Metal Covers Packaging Industry of Seafood

Environmental and Economic Benefits in the Implementation of Cleaner Production in a Galvanic Company

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“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

## **Reduction in Generation of Scrap Metal by Internal Reuse and External Recycling at Serralheria Montanheza**

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### **Abstract**

The Serralheria Montanheza (Montanheza Metalworks) is a microenterprise with 02 owners and 4 employees. The company produces thermo-acoustic roofing, both glass and polycarbonate, ladders, handrails of stainless steel and steel, fences, gates and doors.

During the year 2010, data was collected from Serralheria Montanheza which resulted in this pioneering and innovative proposal in this sector. The data demonstrated the need for the implantation of the UNEP Cleaner Production Methodology (CP).

The objective of this Case Study is to set up a segregated scrap metal collection program, in which the company would separate the different kinds of scrap metals generated during its production process for external recycling. The scrap metals would be delivered to "Bolsa de Resíduos da FIEMG" (The Residue Exchange of FIEMG).

The program would generate new business opportunities, that is, strengthen the local metal recycling market, with the help of the private sector.

There are different kinds of scrap metals in Serralheria Montanheza waste (stainless steel and steel) around 900 kg/year. The segregation process should be as efficient as possible to obtain maximum economic benefit.

The average purchase prices of the scrap metal in the Belo Horizonte market, in November 2010, were: stainless steel series 400 at R\$500,00/ton., stainless steel series 300 at R\$2500,00/ton., and steel at R\$150,00/ton.

By segregating metallic residues it will be possible to quantify the volume and cost to Serralheria Montanheza. As a result, it will be possible to identify the best opportunities for business in the exchange market.

Currently, Serralheria Montanheza gets no revenue from scrap metals sales, as there is no segregation program and these metals have been donated.

By using the scrap metal segregation tool, the company might have earned, for example, R\$148,92/year at November 2010 price quotes.

This revenue would represent around 35% of one monthly energy bill of Serralheria Montanheza.

An indicator would be used to track and evaluate scrap metal generation. This indicator will be called The Scrap Metal Generation Indicator and will measure by kilogram of scrap metal/kilogram of stainless steel and steel.

**Keywords:** *Cleaner Production, scrap metal, indicator, recycling and business.*

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## **Cleaner Production Philosophy Applied to Metal Covers Packaging Industry of Seafood**

S. M. Kakuda, A. L. Berreta-Hurtado, C. A. K. Gouvêa

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### **Abstract**

A packaging manufacturer company produces metal covers as part of the package to stow fish. In this process the metal sheets are submitted to a stage where they are cut and it is necessary after-varnishing to avoid any oxidation and a consequent reduction of the package life cycle and food contamination. The pre-existing varnishing process consisted of mixing varnish and hardener by gravity, but it did not allow a total control over the two components. Besides, it was necessary to maintain mechanical agitators working constantly even during weekends and holydays in order to prevent curing inside pipes. As a consequence, the process resulted in residue incrustation in the equipment and pipes, as well as solvent waste and uncontrolled residues destination. Cleaner production philosophy was implemented through installing an air compressed equipment to mix the two-component varnish and control their quantities, what led to a considerable varnish economy even with metal covers production growth. This allowed cleaning pipes and shutting off the equipment after use with no risks of obstruction. Waste control and solvent recycling were implemented and resulted in material economy and product quality.

**Keywords:** *Cleaner production; Waste reduction; Environmental impact.*

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## **Environmental and Economic Benefits in the Implementation of Cleaner Production in a Galvanic Company**

G. C. de Oliveira Neto<sup>a,b</sup>, O. Vendrametto<sup>b</sup>, L. E. C. Chaves<sup>a</sup>

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### **Abstract**

The chemical components, base of surface treatment processes generate chemical waste and effluents that will drastically affect the environment and causes serious health problems in the population. The main objective of this study is to show the economic and environmental advantages in the implementation of Cleaner Production (CP) in wastewater treatment in a galvanic plant. In this study occurred on proper disposal of solid waste and water reuse in the production process while eliminating the plastic blister packaging equipment and investment in rationing electricity. In particular it will show the calculation of return on investment and the comparison between the economic and environmental gains resulting from the implementation of Cleaner Production. The results were obtained at first by means of qualitative research, reviewing the literature, then exploratory case study participant observation. In possession of the data, we assessed the economic and environmental advantages. For the evaluation of environmental benefits will be used the methodology of Material Intensity (Wuppertal Institute). The tool was applied to assess the benefits on the scale of the biosphere as a result of emissions reduction intervention on behalf of P + L.

**Keywords:** *Cleaner Production. Economic advantage. Environmental advantage. Galvanic Plant*

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**20<sup>th</sup> May 2011**

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**15h00-16h30**

**Session 6B**

**Room 2**

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Development of Catalytic Materials for Degradation  
Photoelectrochemical of Pesticides

Mechanistic Study of the Fenton and Cupro-Fenton  
Reactions by Voltammetric Analysis in situ

Study of Stability of C<sub>19</sub>H<sub>23</sub>N<sub>3</sub> (Amitraz) through Analysis  
FT-IR Spectroscopy

Electrochemical Remediation of 17 $\alpha$ -Ethinylestradiol under  
Different Agitation and Electromotive Force

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## Development of Catalytic Materials for Degradation Photoelectrochemical of Pesticides

G. R. P. Malpass <sup>a</sup>, S. Aquino Neto <sup>b</sup>, A. R. de Andrade <sup>c</sup>, A. L. T. Fornazari <sup>d</sup>, D. W. Miwa <sup>e</sup>, A. J. Motheo <sup>f</sup>

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### Abstract

The application of electrochemical methods is an interesting and clean alternative for the abatement of toxic organic pollutants. The present communication details the study of the synthesis of electrode materials of nominal composition  $Ti/Pb_xTi_{1-x}O_2$  (onde  $X = 0; 0.05; 0.10; 0.20$  e  $0.30$ ) and their subsequent use as electrodes for degradation of organic pollutants using both electrochemical and photo-assisted electrochemical techniques.

The results obtained demonstrate that the materials produced are interesting from the point of view of organic removal. The application of simultaneous UV radiation with electrical current was capable of removing greater amounts of the organic load (32% in under 1 h) than the purely electrochemical technique alone.

**Keywords:** *photo-assisted electrochemical degradation, formaldehyde, pollution control.*

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## **Mechanistic Study of the Fenton and Cupro-Fenton Reactions by Voltammetric Analysis *in situ***

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### **Abstract**

Although Fe(II) exhibits a high initial rate of degradation, the degradation is not complete due to the formation of compounds refractory to the hydroxyl radical. In the presence of Cu(II), the degradation is slower, but results in a greater reduction of TOC at the end of the reaction (t = 120min). The addition of Cu(II) ions classical Fenton reaction (Fe(II) plus H<sub>2</sub>O<sub>2</sub> at pH 3) is found to accelerate the degradation of organic compounds. This synergic effect causes an approximately 15% additional reduction of the TOC. Voltammetric studies confirm the catalytic role of catechol in the presence of Fe(III)/Fe(II) and Cu(II)/Cu(I). Addition of aliphatic acids to the reaction medium, did not interfere with the cupro-Fenton reaction, but had an inhibitory effect on the classical Fenton reaction, consistent with the following order of interaction with the ion Fe(III): Oxalic Acid (OA) >> Formic Acid (FA) ~ Acetic acid (AA).

**Keywords:** Phenol, ions Copper and Fenton reaction.

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## **Study of Stability of C<sub>19</sub>H<sub>23</sub>N<sub>3</sub> (AMITRAZ) through Analysis FT-IR Spectroscopy**

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### **Abstract**

The work aims to study the stability of C<sub>19</sub>H<sub>23</sub>N<sub>3</sub> in veterinary products through the technique of analysis by infrared spectroscopy and Fourier Transform with Transmission and Reflection (FT-IR). The potential and limitations of this method were investigated by analyzing the spectroscopic changes occurring inside and on the surface of the material. This work will present the sensitivity levels of the active principle as well as the small structural changes that may occur in the material.

**Keywords:** *ftir, amitraz, spectroscopy*

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## Electrochemical Remediation of 17 $\alpha$ -Ethinylestradiol under Different Agitation and Electromotive Force

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### Abstract

Among many species that exist in urban or industrial wastewater, endocrine disrupters are substances that can alter the functioning of the reproductive system, causing feminization of species, causing diseases like breast cancer, uterine cancer and prostate cancer, abnormal sexual development, reduced male fertility, increased incidence of polycystic ovaries, disturbances in the functions of the ovary (follicular growth and ovulation), fertilization and pregnancy. In animals may deregulate the reproduction and development of organisms. Among these substances is the 17 $\alpha$ -ethinylestradiol as synthetic estrogen developed for medical use in hormone replacement therapies and contraceptive methods, having high potential estrogen and has been ranked as one of the most responsible in triggering endocrine changes in organisms exposed to surface water. This paper presents a study of the use of sheets of carbon as electrode material for electrochemical remediation of 17 $\alpha$ -ethinylestradiol. In this context we evaluated the efficiency of electrochemical oxidation for ethinyl estradiol at different flow conditions, potential and electrolytic means.

**Keywords:** *endocrine disrupters, cardboard, carbon electrochemical oxidation.*

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*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

**20<sup>th</sup> May 2011**

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**15h00-16h30**

**Session 6B**

**Room 3**

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Analysis of National Policy on Climate Change in Confrontation with the State Policy on Climate Change in the State of São Paulo

Determination of the Amount of Emitted Carbon Dioxide Due to the Construction and Operation of Refrigerating Cycle with Ammonia Vapor Compression and Evaporation Temperature between -30°C and 5°C

Cleaner Technologies and Sustainable Development: contributions of Brazilian Clean Development Mechanism (CDM) Projects

Environmental Performance Comparison of Carbon Black Production Process with the Implementation of Environmental Control Actions

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## **Analysis of National Policy on Climate Change in Confrontation with the State Policy on Climate Change in the State of São Paulo**

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### **Abstract**

In this article were analyzed the new National Policy on Climate Change, Law No. 12.187/09, compared with the State Policy on Climate Change of the State of São Paulo State Law No. 13.798/09. To develop the study, the authors correlated the new National Policy on Climate Change, its challenges, new regulatory frameworks, difficulties in defining targets for economic sectors, the estimation of greenhouse gases reduction, such as commitment signed by the government in relation to the current State Policy on Climate Change of the State of São Paulo. They conclude that the São Paulo State is one step ahead of the National Policy on Climate Change, with respect to state law be earlier than federal law, and the provision by the end of the second half of 2010 Pioneer Inventory greenhouse effect. The new milestone in the National Policy on Climate Change constitutes a serious commitment of Brazil, which marked a change of attitude in the country face the discussions on climate, and highlighted the historical role of industrialized countries front the concentration of greenhouse effect, and their responsibilities in securing financial assistance to developing countries in carrying out mitigating actions in order to ensure a balanced environment of diffuse right for the good of all and future generations, and only with concessions for all countries to reach a new climate agreement.

**Keywords:** *National Policy, Climate Change.*

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**Determination of the Amount of Emitted Carbon Dioxide Due to the Construction and Operation of Refrigerating Cycle with Ammonia Vapor Compression and Evaporation Temperature between -30°C and 5°C**

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**Abstract**

The refrigerating cycle for ammonia vapor compression has its use very spread out, because it can generate very low temperatures and operate in some temperatures of evaporation. The present work aims at to quantify the emitted carbon dioxide due to the construction and operation of a refrigerating cycle for ammonia vapor compression that operates using the hydroelectricity. As Costa (1982) the temperature of evaporation must be enters 5 °C the 15 °C inferior to the cooled environment. It adopts the case more criticize considering environment cooled in the -20 band °C the 5 °C implying temperature of evaporation between -35 °C and -10 °C. In the development of this article it will be used the computational program Engineering Equation Solver (E.E.S) and methodology developed for the authors.

**Keywords:** *refrigerating systems; conservation of fish; refrigerating cycle for absorption.*

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## **Cleaner Technologies and Sustainable Development: contributions of Brazilian Clean Development Mechanism (CDM) Projects**

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### **Abstract**

This paper evaluates the contribution of ten Clean Development Mechanism (CDM) projects for the generation of cleaner technologies and the promotion of sustainable development in Brazil. The results of this multiple-case study demonstrate the prevalence of projects that: a) use end-of-pipe technologies; b) have a single or double bottom line profile with regard to sustainable development; c) show endogenous technology transfer, with the acquisition/development of most of the know-how and equipment in Brazil. In short, this paper defends Brazilian CDM projects make only a modest contribution to cleaner technology generation and to the promotion of triple bottom line sustainable development.

**Keywords:** *Cleaner technologies, sustainable development, the Clean Development Mechanism - CDM*

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## **Environmental Performance Comparison of Carbon Black Production Process with the Implementation of Environmental Control Actions**

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### **Abstract**

This study presents initiatives to improve the environmental performance applied in a specific sector of chemistry industry – carbon black production. The first step of this project was to study all the manufacturing technologies off carbon black in Brazil and abroad and understand all the energy and mass flows in the manufacturing step in order to identify all environmental aspects. The second step was to identify the major environmental aspects and impacts in order to propose Cleaner Production initiatives – enhance efficiency in the use of natural resources; energy and raw materials; reduction, reuse and recycling all effluents generated (solid, liquid and gaseous), which provide environmental, occupational health and economics benefits. This project also considered the adoption of Environmental Post-Combustion Control techniques applied for the wastewater treatment and air pollution control system associated in the industrial process to attend environmental regulations and decrees. Is important to point that the benefits generated are classified according to the approach used (cleaner production initiatives or environmental post-combustion control). As final result of this study was obtained the improvement of environmental performance of carbon black both qualitative and quantitative aspects, and proposed various management actions to reduce the environmental impacts of this activity, for example: reduction of 100% wastewater sent out to the environment (total wastewater generated is reused), reduction of the energy used (100% to electricity energy and savings in thermal energy sources) and approximately 80% of reduction in nitrogen oxide emitted into the atmosphere (NO<sub>x</sub>), and others improvement.

**Keywords:** *carbon black production, environmental performance, cleaner production, best practices.*

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"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

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**20<sup>th</sup> May 2011**

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**15h00-16h30**

**Session 6B**

**Room 4**

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Extraction of Caffeine from the Husk of *Coffea arabica*

Coagulation/Flocculation Process with Seeds of *Moringa oleifera* Lam for the Removal of *Giardia* Cysts and *Cryptosporidium* Oocysts from Water

Characterization of Brazilian Red Mud (Bauxite Refinery Residues) and Assessment its Properties for Futures Applications

Metal Removal in a Sewage Treatment System by Slow Filter

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## Extraction of Caffeine from the Husk of *Coffea arabica*

C. R. Cardoso<sup>a</sup>, F. F. G. Telles<sup>b</sup>, J. V. Nicolini<sup>c</sup>, R. Santório<sup>d</sup>,  
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### Abstract

The high amount of waste generated in coffee stimulates studies of valorization ways of these. In order to make use of the coffee husk and decrease the generated environmental impacts in this activity, this study aims to define a caffeine extraction and purification methodology from *Coffea arabica* husk using dichloromethane as extractor solvent. The extraction of caffeine was performed using coffee husk roasted at 160 °C for a period of 5 minutes, by direct contact with agitation, indirect contact using Soxhlet and direct contact without agitation for 8 hours, resulting in 50% , 47% and 40% efficiencies respectively. Aiming to evaluate the direct contact with agitation method, the extraction efficiency behavior was determined according 1, 4 and 8 hours extraction times, obtaining 32%, 33% and 55% respectively, suggesting efficiency increase in over time. For the same method in order to analyze the extraction efficiency behavior according the husk/solvent ratio of 1:5, 1:10 and 1:20, getting 51%, 55% and 21,1% respectively, indicating an efficiency decrease according to husk/solvent ratio decrease. The caffeine extraction efficiency from this study was compared with some references data and these reviews can be seen that dichloromethane is another alternative of organic solvent to extract caffeine. In the caffeine purification was used a methodology in which the caffeine was treated with calcium oxide, activated coal and submitted to crystallization and adsorption process. The results showed that is possible to obtain an 99,95% efficiency and a 90,58% purity.

**Keywords:** coffee husk, caffeine, extraction, purification.

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## Coagulation/Flocculation Process with Seeds of *Moringa oleifera* Lam for the Removal of *Giardia* Cysts and *Cryptosporidium* Oocysts from Water

L. Nishi <sup>a\*</sup>, G. S. Madrona <sup>a</sup>, A. M. S. Vieira <sup>a</sup>, F. J. Bassetti <sup>b</sup>, G. F. Silva <sup>c</sup>, R. Bergamasco <sup>a</sup>

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### Abstract

Waterborne diseases occur worldwide, and outbreaks caused by the contamination of community water systems have the potential to cause disease in large numbers of consumers. Among waterborne diseases, gastroenteric ones are the most frequent. Approximately, 19% of outbreaks in the USA are attributed to parasitic protozoans, especially species of *Giardia* and *Cryptosporidium* because of their wide distribution in the environment, high incidence and resistance to conventional chlorination treatment. In conventional water treatment, several chemical coagulants are used, most commonly aluminum sulfate, although the production of non-biodegradable sludge and indications of damage to health have led to a search for other coagulants that are less harmful to the environment and to human health. Therefore, several natural coagulants are being studied, such as the seeds of *Moringa oleifera*. The objective of this study was to assess the efficiency of moringa seeds as a coagulant for the removal of *Giardia* and *Cryptosporidium* (oo)cysts, color and turbidity from raw water. To carry out the coagulation assays, raw water was artificially contaminated with these protozoans. This water was submitted to coagulation/flocculation with different dilutions of a stock solution of 1 % moringa seeds, and the mixtures were tested in a jar test apparatus. The water samples were analyzed before and after the coagulation assays. In order to assess (oo)cysts removal, samples were analyzed by the membrane-filtration technique, with mechanical extraction and elution followed by direct immunofluorescence technique. Water color and turbidity were measured according to the procedure recommended by the Standard Methods. Concentrations above 150 mg/L from the 1% solution of moringa seeds gave the best (oo)cysts removal, about 94% to *Giardia* cysts and 90% to *Cryptosporidium* oocysts. Turbidity removal ranged from 0 to 97.4%, color removal varied from 6.7% to 73.5%. Color and turbidity removal were found to be dependent on the initial turbidity of the water sample and the concentration of coagulant. Coagulation with moringa seeds gave satisfactory results in reducing the number of protozoan parasites (oo)cysts. The use of *M. oleifera* Lam seeds can be considered advantageous and a promising step towards improving the processes of water coagulation/flocculation to remove these protozoans.

**Keywords:** *Giardia*, *Cryptosporidium*, *Moringa oleifera*, coagulation/flocculation.

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## **Characterization of Brazilian Red Mud (Bauxite Refinery Residues) and Assessment its Properties for Futures Applications**

M. L. P. Antunes<sup>a</sup>, F. T. da Conceição<sup>b</sup>, G. R. B. Navarro<sup>c</sup>

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### **Abstract**

Aluminum is an abundant element in the Earth. In contemporaneous World it has huge application and it is very important to economy. However, Production of aluminum is associated with the generation of red mud as the major waste material. Its disposal remains an issue of great importance with environmental concerns. The alternative is find and develop red mud applications. Its applications depend on its properties. This way, the present work aimed to characterize the Brazilian red mud and after heat treatment by different techniques (granulometric analysis, powder X-Ray diffraction, thermal analyses, gas adsorption – BET, transmission electron microscopy analyses and ICP analyses). The Heat treatment of red mud increases the surface area which can promote adsorption applications. With heating of red mud, the quantity of iron oxide increases. This allows other application to red mud as coagulant, catalyst or Fenton reagent. The heat treatment enables new applications for red mud.

**Keywords:** *red mud, aluminium, thermal analysis, characterization.*

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## **Metal Removal in a Sewage Treatment System by Slow filter**

A. S. Melo Júnior<sup>a</sup>, S. Moreira<sup>b</sup>, D. M. Roston<sup>c</sup>, J. E. Paternianni<sup>d</sup>, P. J. G. Ferreira<sup>e</sup>, M. Wagner<sup>f</sup>

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### **Abstract**

The survey aimed to measure the degree of heavy metal removal in a pilot wastewater treatment by slow sand filtration using the technique Synchrotron Radiation Total of X-Ray Reflection Fluorescence (SR-TXRF). The slow sand filtration is a relatively simple process where the removal of chemical residues in organic and biological materials occurs through the passage of sewage by means of textural differences. The filter consists of a filter with sand and gravel of different sizes in order of decreasing porosity. The use of slow sand filtration has great relevance to conservation of water resources. The pilot treatment system was installed in the experimental field of Agricultural Engineering College, UNICAMP, consisting of barrels (60 L) containing sand and gravel with different particle sizes. Samples were collected weekly for 16 weeks. The samples were collected in the influent and effluent system, detected the following chemicals: P, S, Cl, K, Cr, Mn, Fe, Zn in almost all samples. The maximum concentration of Fe was 5,66 mg.L<sup>-1</sup> input and 1,54 mg.L<sup>-1</sup> in output, while for the Zn concentration was 1,68 mg.L<sup>-1</sup> and 0,73 mg.L<sup>-1</sup> input and output, respectively. For the element Cr values were 0,250 mg.L<sup>-1</sup> in input while the output was 0,11 mg.L<sup>-1</sup>. For the K variations in input and output were 41,80 and 28,40 mg.L<sup>-1</sup>, respectively, showing an efficiency of 78,10% na the removal of this element. Thus it was concluded that the removal efficiency was high for most elements detected, which proved the feasibility of this technology for the removal of metals present in domestic sewage.

**Keywords:** *Slow sand filtration, metals, total reflection, environment.*

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“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

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**20<sup>th</sup> May 2011**

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**15h00-16h30**

**Session 6B**

**Room 5**

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Cell Layout Application in Product Recovery: a Lean Proposal to Increase Efficiency in Remanufacturing

Environmental Assessment of the Production of Sunflower Oil Epoxidized Esters Seeking Employment in the Machining

Cleaner Machining Through a Toolholder with Internal Cooling

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“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

## **Cell Layout Application in Product Recovery: A Lean Proposal to Increase Efficiency in Remanufacturing**

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### **Abstract**

The growing demand of organizations for technological alternatives to reduce environmental damage and meet the new legislative requirements has brought greater focus to the activities of product recovery. Remanufacturing is a means of recovering a product. It is defined as the process of restoring a product to its original specifications with the reuse of materials, improving quality and functionality. However, the remanufacturing industry faces difficulties and is considered an unstable and inefficient environment if compared to manufacturing. Therefore, this paper proposes a cell layout based on lean manufacturing concepts and adapted to the remanufacturing context, aiming to minimize waste, reduce variability and ultimately increase efficiency.

**Keywords:** *remanufacturing, cell layout, lean remanufacturing, product recovery.*

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## **Environmental Assessment of the Production of Sunflower Oil Epoxidized Esters Seeking Employment in the Machining**

A. L. Klafke, F. Bock, M. Schneider, R. C S. Schneider, J. A. R. Moraes

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### **Abstract**

This study aims to evaluate the production of sunflower oil epoxidized methyl order to their implementation in cutting fluids for machining process. The steps of epoxide ester producing were inventoried and the impacts were analyzed in an interaction Leopold matrix. The impact relationship were 170 and 48.8% were identified. 18% of the identified impacts were positive, corresponding to economic gains for the region and 82% were negative, corresponding to the use of solvent, solid waste generation, energy consumption for heating and accidental release of organic vapors into the atmosphere. The interaction of these impacts with the biotic and anthropic environment is temporary and reversible, and most are direct and scope local. The production of these epoxides, because they are by catalysis and allow the reuse of raw materials, may be a promising alternative and cleaner for the replacement of components in the formulation of cutting fluids in machining activities.

**Keywords:** *epoxides, cleaner production, metal cutting, sunflower, biocatalysis.*

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## **Cleaner Machining Through a Toolholder with Internal Cooling**

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### **Abstract**

This work treats of a cooling system for cutting tool in turning based in a toolholder with cooling fluid flowing inside its body being that this fluid must necessarily be able to phase change due to heat generated from machining processes. In this way the fluid evaporates just under the cutting tool allowing a heat transfer more efficient than if were used a fluid without phase change once the latent heat of evaporation is beneficial for removal heat. Following, the cooling fluid evaporated passes through a condenser located out of the toolholder where it is condensated and returns to the toolholder again and a new cycle is started. In this study the R-123, a hydrochlorofluorocarbon (HCFC) fluid, was selected for the turning of a Cr-Ni-Nb-Mn-N austenitic steel of hard machinability. As result, the developed system allows a tool life equal to or better than the conventional cutting fluid method, moreover there are environmental and economics advantages once the cooling fluid is maintained in a loop circuit. .

**Keywords:** *Turning; Internal cooling; Dry machining; Tool life; Coolant fluid*

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## **20<sup>th</sup> May 2011**

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**15h00-16h30**

**Session 6B**

**Room 6**

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Performance Factors for the design of Sustainable Logistic Platforms

Planning and Production Control in Enterprises Incorporated in the Network Environment: Implications for the Occurrence of a Development with a Sustainable Basis

Selection Process Theoretical Framework: Environmental Performance Evaluation

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“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

## **Performance Factors for the Design of Sustainable Logistic Platforms**

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### **Abstract**

The growth and development of large cities indicate a significant increase in economic activities, the flow of goods distributed and the consequent loss logistical, environmental and social issues. It is in this context that arise logistics platforms, transport infrastructures able to improve this scenario. This paper proposes guidelines for the design of logistics platforms based on identification of performance factors of technicians, environmental and social. The methodology used was a multiple case study, having as a theoretical model that combines the three visions of sustainability, triple bottom line. Factors were identified logistical, environmental and social issues for the design of this type, but it is worth noting that both the social and environmental factors are still lacking in this type of enterprise.

**Keywords:** *logistics platforms, Sustainability, performance, triple bottom line*

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**Planning and Production Control in Enterprises  
Incorporated in the Network Environment:  
Implications for the Occurrence of a Development  
with a Sustainable Basis**

S. L. Kyrillos, J. B. Sacomano, J. B. de Souza, F. J. S. Milreu

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**Abstract**

According the requirements of the global market it is clear that the economic growth models, based on the exploitation of nature, show clear signs of exhaustion. So is necessary a new vision of manufacturing strategy, linked to the Planning and Production Control with the objective of achieving both competitiveness and productivity to achieve goals and accomplish goals. The Brazilian business units, in accordance of the new demands imposed by the global market, are under pressure from domestic regulatory authorities, international organizations, social agencies and others organisms. Is necessary that the business units will use appropriate technologies to manufacturing. So increase awareness and employee training and print a professional management to business based on sustainable manufacturing is fundamental. If this occurs, Brazil may be one of most important countries in the business competitive global scenario. Thus, consider the business strategies in conjunction with the production strategies and management tools, under the aegis of development with sustainable basis it becomes important, since the production costs are very sensitive in function the current environment, highly competitive.

**Keywords:** *Business networks, Planning and Production Control, Sustainable Development.*

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## **Selection Process Theoretical Framework: Environmental Performance Evaluation**

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### **Abstract**

On the approach of the research problem, we seek through an exploratory study to assemble a set of papers on the theoretical framework to analyze their adherence to the research objectives; to allow the identification of the state of the art on a specific theme. Therefore, the main objectives of this paper are: (a) create, from a structured process, an initial base of articles examining the topic environmental performance and (b) identify opportunities for research on this topic. This survey and selection of articles was based on bibliometric criteria defined in the methodology. As a result of the proposed methodology it was possible to define a set of articles to identify trends and existing research on the environmental performance evaluation. The main opportunities found are related to the process for identifying criteria for measuring environmental performance and search for custom models, taking into account the specificities of each context. As for future work in the study of environmental performance assessment, it is suggested to expand this systemic analysis, including detailed examination of 13 articles of the portfolio as well as their references and the making of the citation map, and by consulting specialists in the environment area for a qualitative analysis of selected articles and their references.

**Keywords:** *Bibliometric Criteria, Evaluation of Environmental Performance, Environmental Performance Indicators.*

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## **20<sup>th</sup> May 2011**

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**15h00-16h30**

**Session 6B**

**Room 7**

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The Utilization of Wood Industry Waste for Use in Small Solidarity Economic Enterprises

Assessment and Implementation of a Cleaner Production Opportunity Furniture Industry in a Metropolitan Region of Belo Horizonte, Minas Gerais

Effect of Extractive Removal on the Calorific Power of Wood Residues

Sustainability of Operations for the Timber Industry of Mato Grosso

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## **The Utilization of Wood Industry Waste for Use in Small Solidarity Economic Enterprises**

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### **Abstract**

The increase of wastes availability generated by wood industries creates a problem for the supply chain, because often, these wastes are deposited in inappropriate places or are reused in the wrong way. This study aimed to design small wooden objects with the approach of reusing lignocellulosic residue, from industrial processes. The objects produced were a basket, a crumber and a support for portable personal computer. The proposal of use wood wastes sought to add value for them, sustainability in the production process of the product, beyond the environmental aspect, seeking to minimize the indiscriminate disposal of wastes on the environment. The manufacturing of these products is simple and requires low-skilled labor, a factor that promotes the generation of jobs and income for artisans in small solidarity economic enterprises, as is the case of the partnership with the women joinery, located in the rural settlement of Pirituba.

**Key words:** small objects, wood, reuse, industrial residues, solidarity economic enterprises.

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## **Assessment and Implementation of a Cleaner Production Opportunity Furniture Industry in a Metropolitan Region of Belo Horizonte, Minas Gerais**

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### **Abstract**

Based on the application of concepts and methodology of Cleaner Production - CP in an industry of the furniture sector - Mod Line Soluções Corporativas Ltda -, installed in the municipality of Contagem, Metropolitan Region of Belo Horizonte, as a management tool available for achieving eco-efficiency and obtain environmental benefits associated with economic gains, promoted himself in two productive sectors of the company an audit of generation of waste and effluent, using tools for evaluating material flows and water, to support the identification, assessment and deployment of nine preventive opportunities for CP, which resulted in minimizing waste and industrial effluents generation, and consequently, decreasing the inflow of raw materials, inputs and water. The deployment of nine opportunities for CP provided for undertaking an annual savings of about U.S. \$ 103,000.00, obtained by minimizing of the generation of solid waste and wastewater emissions, in amounts equivalent to 374,000.00 kg and 200,000.00 L, respectively, added to reduce the annual consumption of 381,000.00 kg of raw materials and 200,000.00 L of water, ie, the minimization of process losses. This article will be a description and assessment of only one of the opportunities for CP, of which nine were implanted, through the adoption of technological innovations in the production process involved, resulted in considerable environmental and economic benefits.

**Keywords:** *Cleaner Production (CP). Optimization production processes. Environmental management. Industry furniture. Brazil (Minas Gerais).*

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## Effect of Extractive Removal on the Calorific Power of Wood Residues

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### Abstract

In mechanical processing of wood, the generation of residues is an unavoidable factor. The use of wood residues has gained increasing importance due to the large amount generated and improper disposal, which causes serious environmental damage. Burning of such residues to energy generation is an increasingly usual practice. However, the wood residues hold substances that could be recovered before burning. These substances are the wood extractives, which may have many uses as natural dyes for fabrics, foods and cosmetics, as well as substances of interest to medicine. Thus, it is of great interest to study the effect of extractive removal on the calorific power of wood. In this work, the calorific power of four species of woods commonly used in sawmills (ipe, cedroarana, and jatoba) and residues of urban arborization (Brazil wood ) were evaluated before and after extraction in hot water. In woods studied, the calorific power showed three patterns of behavior after removal of extractives soluble in hot water. For Brazil wood, the removal of extractives caused no significant change in calorific power, which suggests that there is no potential energy in these wood extractives. For cedroarana and jatoba, extractive removal led to a decrease in wood calorific power of 161.3 kcal/kg and 40.1 kcal/kg, respectively, which indicates that the extractives from these species have a positive energy potential. Finally, for ipe, the removal of extractives resulted in an increase in calorific power of wood (67.6 kcal/kg), which might encourage the recovery of extractives from wood residues before burning for energy generation.

**Keywords:** *calorific power, extractives, wood residues, recovery.*

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## **Sustainability of Operations for the Timber Industry of Mato Grosso**

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### **Abstract**

The operations of extraction and industrialization of timber from the Amazon suffer restrictions on domestic and international market. This article reports the results of a project developed with 15 companies in the timber sector in the State of Mato Grosso. Aiming to encourage increasing efficiency of operations of the logging industry, we used the methodology of Cleaner Production. 1275 hours were dedicated to working together with Ecotimes to analyze operations, identify opportunities for improvement and implement projects. The results were highly significant both in the point of view environmental, such as economic, technical / technological and social.

**Keywords:** *Sustainability, Timber Industry, Cleaner Production, Amazon, Mato Grosso State.*

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*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

**20<sup>th</sup> May 2011**

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**15h00-16h30**

**Session 6B**

**Room 8**

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Environmental Accounting in Energy for the Reserves of Clay, Gypsum and Limestone from the Point of View of the Brazilian Population Deficit

Sustainability in Civil Construction

Installation of the Head Office of the Superintendence of Environmental Management of SABESP from the Reuse of an Operational Building

The Use of Computer Resources for Improving Performance Improvement in Energy Efficiency in Construction in Brazil

The Importance of Certifications and Construction Management Systems

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## **Environmental Accounting in Emergy for the Reserves of Clay, Gypsum and Limestone from the Point of View of the Brazilian Population Deficit**

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### **Abstract**

The present study uses the environmental accounting in emergy to evaluate the behavior of the reserves of clay, gypsum and limestone when planned the construction of 4,468 million houses (deficit Brazilian urban population).

Through constructive alternatives 3 (blocks of clay brick, concrete block and gypsum blocks) are evaluated the effect on reserves and a discussion is made. The alternative to concrete blocks is that has a smaller impact (investment) in emergy in the three stocks studied.

**Keywords:** *emergy; environmental accounting; building manufacturing, mineral reserves, population deficit.*

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## Sustainability in Civil Construction

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### Abstract

Given the competitive landscape in the civil construction industry, many companies discard their waste as cheaply and quickly, without proper responsibility to the environment. With this there is a growing environmental concern in which builders seek more viable restructuring techniques for better reuse of these materials, seeking a sustainable development for your business. The concern for Cleaner Production has become part of their strategic plans. In this sense, the firm minimizes environmental damage in the production process and meets the new industry regulations, with the focus on getting the most value with its customers and to seek competitive advantage over competitors. The research aims to identify practices responsible for Cleaner Production in a construction company that seeks sustainability through environmental methods is correct and the techniques can boost sustainability in civil construction.

**Keywords:** *Sustainability, Cleaner Production, Civil Construction, Waste.*

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## **Installation of the Head Office of the Superintendence of Environmental Management of SABESP from the Reuse of an Operational Building**

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### **Abstract**

The project concept for the head office of the Superintendence of Environmental Management of SABESP was based in the cleaner production and sustainable construction principles. The head office was installed in a existing building , a disabled sewage pump station, at SABESP Costa Carvalho unit, São Paulo, SP – Brazil.

The *retrofit* project to utilization of these facilities shows singularities like impact minimization, energy efficiency, management and water saving and eco-efficient materials utilization.

Nowadays, the *retrofit* works is almost finished and the building allows the perception of its role in the past, as a living record of one of the stages in the history of SABESP, and provides experience for new sustainable buildings in the company.

**Keywords:** *eco-efficiency ,sustainable building, retrofit*

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## **The Use of Computer Resources for Improving Performance Improvement in Energy Efficiency in Construction in Brazil**

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### **Abstract**

This research presents a review of the concepts of energy efficiency against the principles of sustainable development. Also emphasized is the importance of optimization of energy consumption, particularly within the buildings. It highlights the government initiatives and the impacts to the environment by various sources of power generation. The research identifies as important the existence of computational resources to support designers and users in order to optimize the use of electric energy in buildings. The case study evaluates the computational resource "PLUS MARK IV. Presents proposals for updating of computer resource using a critical analysis by specialists. The result of consultation with experts confirmed the importance of computational resources in project development and use of electricity in a rational way in construction. One conclusion is that the computational resources for management of electric energy use in buildings, allows obtaining the energy diagnosis and induces rationality in design criteria and use of energy. In the end, were outlined to the possibilities of improving the computational resource "PLUS MARK IV.

**Keywords:** *Quality in Construction, Energy Efficiency, Engineering Sustainability*

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## **The Importance of Certifications and Construction Management Systems**

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### **Abstract**

Managing a construction site organized way, results in a cleaner production, and helps the world to be more sustainable. The sustainable development represents an effort in balancing and integrating the social welfare. The economic prosperity, and the environment protection bring benefits to current and future generation. The recovery or even the reduction of the consequences of errors committed in the past, will demand an extraordinary international effort, with plan carefully developed to substitute the raw material in materials or energy sources that are harmful to the environment. Thinking about the management of waste in the construction site, should be part of the project planning, from the conception of the project to its construction; starting the teaching and information, training, hearing the right employees (skilled workman), follow up the evolution of the process, check-listing to judging with is the best posture to feed the system. The professionals' actuation and companies involved in the process of the organization at the construction site, the operational procedures, and organization are very important for a satisfactory result in this process. To the system work in benefit to nature and also looking forward to the best for the future generations, the routine of a reduced consuming and raising awareness is significant for the future of the planet. The important actuation of Companies as the Constructor Sobloco proves that environmental management system works, beyond being certified by ISO 14001. By the clamor of tripod: civil society, public authorities and private sector that are facing the issue of environment and competitiveness that requires the companies new postures of citizenship, especially those geared to the protection of the environment.

**Keywords:** *Waste of Construction and deconstruction; Recycling; Environmental management system; ISO 14001.*

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**20<sup>th</sup> May 2011**

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**16h50 -18h50      Closing Conference**

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**Donald Huisingh**

**University of Tennessee, EUA**

Five Challenges we Must Address  
IF We are to Make Progress  
Toward Truly Sustainable  
Societies

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“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

## **Five Challenges We Must Address IF We are to Make Progress Toward Truly Sustainable Societies**

Donald Huisingsh

*University of Tennessee - Tennessee - EUA*

As the world's human population continues to increase at more than 70,000,000 per year and as climate change related challenges continue to increase the frequency of severe weather events, it is increasingly urgent that we develop and use new values, visions, strategies, processes and governance methods to transform our societies.

What are the primary challenges we must address and how can we chart our course locally, nationally and globally, toward truly sustainable societal processes and lifestyles?

From an integrated system's perspective, there are numerous aspects that must be addressed to make the urgently needed transitions. I will scope the urgently needed transitions under the following five challenges:

Climate Change & Energy

Species Diversity and Habitat Losses

Water Security

Food Security

Human Population Control & Governance

I will engage the audience in beginning to wrestle with the challenges and in becoming empowered to develop the vision and will to make the individual and collective changes that must be made, IF we are to make REAL progress toward sustainable societal development.

## Index of Contents

<b>Conferences</b>	<b>page</b>
Organic Waste, Residues and By-Products from Agricultural, Industrial and Urban Systems as Biorefinery Substrates: Viable Option or Fairie Tale? An Application of SUMMA (Sustainability Multi-method Multi-scale Assessment)	18
Advancing Chemicals Policy in the United States to Promote Safer Chemicals and Products	22
Cleaner Production and Industrial Ecology: Two Important Concepts for a Sustainable Industry	118
Sustainability Practices Performed at the Mexican Maquiladora Industry: A Case Study in the State of Sonora and Baja California, Mexico	216
Five Challenges We Must Address IF We Are to Make Progress Toward Truly Sustainable Societies!	262
<b>Oral Presentations</b>	<b>page</b>
A Comparative Survey among Emergy Indices and More Usual Sustainability Indexes	45
A Research on the Awareness Toward Sustainable Production Aspects	97
A Study on the use of Environmental Performance Indicators (EPI) in Environmental Management Systems (EMS)	26
Analysis of National Policy on Climate Change in Confrontation with the State Policy on Climate Change in the State of São Paulo	230
Analysis of the Application of AQUA Certification in Civil Construction in Brazil	208
Applying of Ecological Cost Accounting in a Dye Discoloring Process	125



*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

<b>Oral Presentations</b>	<b>page</b>
Assessment and Implementation of a Cleaner Production Opportunity Furniture Industry in a Metropolitan Region of Belo Horizonte, Minas Gerais	251
Bibliometric Analysis of Literature on Product Life Cycle Management, Product Development Process and Sustainability and their Interfaces	192
Biodiversity Loss due to Climatic Impact of Land Use in LCA: a Case Study in Regionalization of Carbon Transfer Data in the Brazilian Atlantic Forest	106
Case Cuba: A Path to Sustainable Development	195
Cell Layout Application in Product Recovery: a Lean Proposal to Increase Efficiency in Remanufacturing	242
Challenges of Teaching Corporate Environmental Management in Brazil: The "5 Ls"	176
Characterization of Brazilian Red Mud (Bauxite Refinery Residues) and Assessment its Properties for Futures Applications	238
Characterization of Waterworks Sludge and Coal Ashes Aiming its Use in Manufacture of Brick	205
Clean Technologies (Bio-Fertilizers) Alternative to Urea for Production of Basil in and Out of Season	189
Cleaner Machining Through a Toolholder with Internal Cooling	244
Cleaner Production and Environmental Sustainability: Case of a Plastic Industry in Serra Gaúcha	159
Cleaner Production and Product Life Cycle Design of the Upholstered Furniture in the State of Alagoas, Brazil	33
Cleaner Production as a Corporate Sustainability Tool: An Exploratory Discussion	56

"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

<b>Oral Presentations</b>	<b>page</b>
Cleaner Production at an Environmental Agency: 15 Years of Experience at CETESB, Sao Paulo - Brazil	193
Cleaner Production Implementation within Textile Industry: Economic and Environmental Benefits	123
Cleaner Production Opportunities in a Dairy Farm and Cheese Factory	186
Cleaner Production Philosophy Applied to Metal Covers Packaging Industry of Seafood	221
Cleaner Production Practices in Military Organization Service Provider Industry (MOSP-I): a study in the Naval Base of Val-de-Cães, Brazil	40
Cleaner Production, Process Innovation and Environmental Benefits: A case from the Metal-Mechanic Industry in Serra Gaúcha, Brazil	39
Cleaner Technologies and Sustainable Development: contributions of Brazilian Clean Development Mechanism (CDM) Projects	232
Coagulation/Flocculation Process with Seeds of Moringa oleifera Lam for the Removal of Giardia Cysts and Cryptosporidium Oocysts from Water	237
Comparative Environmental Assessment for Public Luminaires	109
Concepts, Principles and Tools for an Urban-Industrial Environment More Sustainable	104
Covenants and Partnerships with Municipalities Ran by SABESP North Business Unit for Water Resource Management	182
CP: Sustainable Development and Environmental Higher Education	177
Decisions and Procedures to Cleaner Production Concerning on Liquid Effluents Assessment	71
Design Methodology of Life Cycle Assessment (LCA) of Ethanol Fuel by CML 2000 with SimaPRO	82

“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

<b>Oral Presentations</b>	<b>page</b>
Determination of the Amount of Emitted Carbon Dioxide Due to the Construction and Operation of Refrigerating Cycle with Ammonia Vapor Compression and Evaporation Temperature between -30°C and 5°C	231
Development of Actions of Socio Environmental University Responsibility in Semiarid Northeastern	173
Development of Catalytic Materials for Degradation Photoelectrochemical of Pesticides	224
Development of Environmentally Friendly Products: Case Study in a Germany Company Producer of Household Appliances	32
Eco-Efficiency: A Case Study in a Chemical Industry	128
Eco-industrialism: The Potential for Inclusive Growth with Bio-Plastic Production in Brazil Using Sugarcane Ethanol	161
Effect of Extractive Removal on the Calorific Power of Wood Residues	252
Electrochemical Discoloration of Alizarin Red S Solutions in Dimensionally Stable Anode	137
Electrochemical Remediation of 17 $\alpha$ -Ethinylestradiol under Different Agitation and Electromotive Force	227
Eletrical and Eletronic Wastes: A Challenge for Sustainable Development and the New National Policy for Solid Wastes	152
Elimination of Mercury (Hg) in the Health Sector: the Case of a Hospital in the City of Hermosillo, Sonora, Mexico	35
Emergy Accounting in the Two Systems of Generating Electricity Using Waste	89
Environmental Accounting in Emergy for the Reserves of Clay, Gypsum and Limestone from the Point of View of the Brazilian Population Deficit	256

*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

<b>Oral Presentations</b>	<b>page</b>
Environmental Accounting of ABC Paulista Using the Emery Synthesis	100
Environmental and Economic Benefits in the Implementation of Cleaner Production in a Galvanic Company	222
Environmental Assessment of Natural Resources Located in Urban Areas: A Case Study in the Bacia do Pina and Parque dos Manguezais	102
Environmental Assessment of the Production of Sunflower Oil Epoxidized Esters Seeking Employment in the Machining	243
Environmental Impacts of the Brazilian Shrimp Culture	201
Environmental Indicators of the Industrial Companies in São Paulo	28
Environmental Management Program at Tyco Electronics	80
Environmental Management System and the Pillar of the Environment - Eletronorte Rondônia Experience for the Sustainable Production of Electricity	214
Environmental Performance Comparison of Carbon Black Production Process with the Implementation of Environmental Control Actions	233
Environmental Pollution: Quantitative Analysis of Particulate Matter (PM10) by SR-TXRF	113
Environmental Regulation to Sustainability: Contributions to Build a Theoretical Reference on the Limits of Traditional Models	95
Equilibrium and Kinetic Modelling Studies of Adsorption of Crystal Violet dye onto Zeolites of Coal Fly and Botton Ashes	65
Evaluating the Global Productivity of a Medium Size Agribusiness	187

“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

In Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

<b>Oral Presentations</b>	<b>page</b>
Evaluation of Factors Influencing the Purchase of a Vehicle, Based on the Vehicle Brazilian Labeling Program	114
Evaluation of the Use of Recyclable Materials for Heating Water in Swimming Pools	38
Evaluation of the Removal of Heavy Metals in Sewage with the use of Wetland	62
Evolution of the Environmental Management System for Enterprise in Brazil: an Exploratory Study of Certifications	42
Exploration and Practice on the Compulsory Cleaner Production Auditing of Key Enterprise in China	51
Extraction of Caffeine from the Husk of <i>Coffea arabica</i>	236
Feasibility of Using Scrap Tires How the Composition of Concrete Aggregates Sidewalk to Rubber	204
From Modern Thermodynamics to How Nature Works – a View of Emergent Paradigms Associated with Sustainability	55
GRI – <i>Global Reporting Initiative</i> : Viable Tool for Small Companies Competitive Profit	43
Health Impact Assessment in Southern Brazilian EIAs: Too Far Away from Recommended Practices	146
Incineration: An Inevitable Alternative for Waste Disposal	198
Industrial Cleaning with Ultra-Clean Water According to the Qlean-Method	79
Industrial Ecology: contributions to the Reverse Logistics Post-Consumer	169
Initial Evaluation of the Efficiency of Constructed Wetlands in the Post-Treatment of UASB Reactor	143

“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> – 2011

In Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

<b>Oral Presentations</b>	<b>page</b>
Innovation in Cleaner Production through Concrete and Cement Composite Recycling	48
Installation of the Head Office of the Superintendence of Environmental Management of SABESP from the Reuse of an Operational Building	258
Integration of Sustainability Aspects to Supplier Selection Processes – The Role of Locational Criteria	27
Knowledge in Sustainability: (Self-)Perceptions of Rural Extension Technicians in Santa Catarina	77
Leaching of Mo, Cd, Zn, As and Pb of Fly Ash from Figueira, Paraná Power Plant	69
Level of Disclosure of Environmental Information in the Electricity Sector: an Empirical Study of Brazil and Iberian Peninsula	210
Life Cycle Analysis for Cow Beef in Sonora: Slaughtering Stage	108
Life Cycle Assessment (LCA): Discussion on Full-Scale and Simplified Assessments to Support the Product Development Process	107
Management of the Use of Cooking Oil for Biodiesel Production: A Case Study McDonald's	116
MAS: A Proposed Tool for Assessing the Sustainability	147
Mechanistic Study of the Fenton and Cupro-Fenton Reactions by Voltammetric Analysis <i>in situ</i>	225
Metal Removal in a Sewage Treatment System by Slow Filter	239
Microbiological Evaluation of Accelerated Composting Process of the domestic solid waste organic fraction	91
Microorganisms Growth Rate Evaluation and Proposal of Model for Biomass Production of <i>Haematococcus pluvialis</i>	90

“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

<b>Oral Presentations</b>	<b>page</b>
Mitigating actions for the Drug Industry in the Comarca de Londrina-PR, Brazil: Environmental Impact of Waste Dump in Water Bodies	183
Molten Salt Oxidation – A Safe Process for Hazardous Organic Wastes Decomposition	135
More Demand for Resources with the Same Resources: Increased Vehicle Fleet in São Paulo	112
Municipal Urban Parks of São Paulo: Environmental Accountability of eMergy	103
New Technologies in the Tertiary Treatment of Industrial Water	142
Oeco-Nomics in the Light of the Maximum Ordinality Principle. The N-Good and Three Factor Problem	58
Opportunity for Continuous Implementation of Cleaner Production with New Paradigm for Sustainable Engineering	76
Optimization of Integrated Clean Production of Pyrogas, Biogas, Methanol, Bioelectricity, Fertilizer and Feed from Agro Wastes with Reduced Emission	83
Participatory Governance and Decision-Making: Oil and Gas in the Santos (Brazil) Coastal Region	212
Performance Analysis of High Efficiency Thickeners to Suspensions of Leachate	68
Performance Evaluation of Corporate Sustainability in an Industry of Plastic Film	160
Performance Factors for the design of Sustainable Logistic Platforms	246
Performance in Operations Systems: The Contribution of the Sustainable Manufacturing in a Printing Company	129

“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> – 2011

*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): *Advances in Cleaner Production*, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

<b>Conferences</b>	<b>page</b>
Planning and Production Control in Enterprises Incorporated in the Network Environment: Implications for the Occurrence of a Development with a Sustainable Basis	247
Political Economy of Sustainability: Payments for Ecosystem Services (PSA) on the Upper Stretches of Rio Tibagi, Paraná, Brazil	98
Post-consumer Packing Residue Management: a Case-study on McDonald's	200
Preliminary Studies on the Production of Nanofibrils of Cellulose from Never Dried Cotton, Using Eco-Friendly Enzymatic Hydrolysis and High-Energy Sonication	78
Preliminary Study for Environmental Management in Surfboards Production	131
Processing Centers in Artisanal and Small-scale Gold Mining: Evolution or More Pollution?	50
Product End-of-Life, Remanufacturing and Reuse Market: Trends, Barriers and Challenges in a Case Study	34
Proposal of the New Model for Solid Urban Waste Management	155
Proposed Methodology of Cleaner Production with Quality Tools	149
Proposed Structure of the Solid Waste Management in the Corporate Environment	199
Proyecto Piloto Implementación de la Metodología de Producción Más Limpia en la Universidad de la Salle Bajío Escuela de Turismo y ECEA	194
Recycling Management Considering the Dispersion of Supply Sources - Collection, Storing, Selection, Classification and Distribution of Waste Discarded Scrap for Reprocessing - A Study of Reverse Logistic	170

"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011



*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): *Advances in Cleaner Production*, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

<b>Oral Presentations</b>	<b>page</b>
Reduction in Generation of Scrap Metal by Internal Reuse and External Recycling at Serralheria Montanheza	220
Re-engineering Process to Reach Sustainability in Laboratories of the University of Sonora	49
Rehabilitation Program of the Central Area of São Paulo (Procentro) and its Influence on the Formation of Heat Island	101
Reverse Flow of Scrap Tires in the City of Santos	168
Reverse Logistic: Destination of Expanded Polystyrene Expanded (Isopor®) Post Consumption from a Catarinense Industry	167
Reverse Logistics in Practice: Economic Study of Returnable Packing on the Transport of Machined Engine Heads	166
Scientific Requirements Analysis Focusing the Environmental Dimension of BM&FBOVESPA ISE and Sustainability Indicators Published in Annual Business Sustainability Reports	29
Selection Process Theoretical Framework: Environmental Performance Evaluation	248
Selective Waste Collection as a Public Policy Tool: The Sorocaba/SP Experience	154
Social indicators of LPB - Liquid Packaging Board production from a life cycle perspective	110
Storage of Carbon Dioxide in Geological Reservoirs: Is It a Cleaner Technology?	148
Structuring of Environmental Area in a Transport Company Sector of Pernambuco through Enterprise-University Partnership	172
Study of Anodic Eletrooxidation of Dimethyl Phtalate Using DSA	134
Study of Degradation of the complex EDTA-Cu (II) by Electrochemical Methods	136

*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

<b>Oral Presentations</b>	<b>page</b>
Study of Incorporation of Wind Blades Waste in Portland Cement	206
Study of Stability of C19H23N3 (Amitraz) through Analysis FT-IR Spectroscopy	226
Study on Clean Technology Energy Production and Feed the Use of Agricultural Residues on Sugarcane and Integrated Biosystems	190
Sugarcane and Agricultural Residues as an Alternative Energy for Present and Future	86
Sustainability and Environmental Preservation: A Bibliometric Study on Biofuels	115
Sustainability and the Allocation of Oil Royalties: A Theoretical Contribution	213
Sustainability in Agricultural Activities Developed in the Western Region of Santa Catarina, Brazil, from the Viewpoint of Rural Extension Technicians	57
Sustainability in Civil Construction	257
Sustainability of Bio-based Plastics: General Comparative Analysis	158
Sustainability of Operations for the Timber Industry of Mato Grosso	253
Sustainable Manufacture: Study and Analysis of the Combination Adoption of Cleaner Production and Lean Production Techniques	130
Technological Innovation and Sustainability in the Sugar Cane Chain	84
The Cleaner Production in a Research and Education Institute: Bibliometric Study	175
The Cleaner Production Tool and the Management of Phosphorus in the Environment	70
The CONAMA Resolution N <sup>o</sup> . 302 of 20 March 2002 and the Preconditions for Sustainable Management of the Area Surrounding the Artificial Reservoirs Filled by Invasive Plants	96

“CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD”

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> - 2011

*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): *Advances in Cleaner Production*, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

<b>Oral Presentations</b>	<b>page</b>
The Importance of Certifications and Construction Management Systems	260
The Integrated Production of Fruits in Brazil and the Interface with a Cleaner Production	188
The Nuclear Option to Contribute to a Cleaner and Sustainable Production of Electricity	211
The Relation Between Business and Law Under the View of a Cleaner Production	94
The Relations between Maintenance and Enterprise Sustainability Strategies: A Reflective Approach in the Input-Transformation-Output	44
The Remanufacturing as Option in the Recovery of Products in the Post-Consumer: In the Vision on Brazilian Enterprises	54
The Social Construction of Garbage: A Social Analysis of Representations Over the Issue in the Messias Targino City (RN)	153
The Use of Computer Resources for Improving Performance Improvement in Energy Efficiency in Construction in Brazil	259
The Utilization of Wood Industry Waste for Use in Small Solidarity Economic Enterprises	250
Treatment of Textile Wastewater by Physical-Chemical and Advanced Oxidation Processes	122
Tunnels and Non-Destructive Methods of Multi-Utility: Benefits for the Sustainability of the Networks of Urban Infrastructure	207
Undergraduate Student Understanding of Green Chemistry Concept	174
Untying the Need for Fossil Fuels: The Role of Brazil in Building a Greener Energy Matrix	85
Use of Cleaner Production Techniques to Recovery of the Soils and Reuse of the Sewage	141

"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

São Paulo – Brazil – May 18<sup>th</sup>-20<sup>th</sup> – 2011

*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

<b>Oral Presentations</b>	<b>page</b>
Use of Red Mud Treated with Hydrogen Peroxide and Activated by Heat Treatment as a Means Adsorption of the Dye Reactive Blue 19	63
Use of Vermiculite Coated with Chitosan as an Agent Adsorbent Synthetic Ions of Lead (Pb++)	64
Use Possibility for Shellfish Clams	202
Utilization of Energy in Municipal Solid Waste Landfill	88
Waste Effluent as Natural Dyestuff	124
Waste Water Minimization of Starch Industry Using Water Pinch Technology	184
Water Demand Management through Partnerships with SABESP and Government Sectors	181
Water Management in the Tanning Industry – A Diagnosis under the Cleaner Production Principles in Sao Paulo State, Brazil	180
Water Pumping Station Santana: a Case Study on Loss Reduction and Energy Consumption in the Sanitation Sector	140

*In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): Advances in Cleaner Production, Proceedings of the 3<sup>rd</sup> International Workshop, UNIP, São Paulo, SP, Brazil. May 18-20, 2011.

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