

2nd
INTERNATIONAL WORKSHOP
ADVANCES IN CLEANER PRODUCTION

“KEY ELEMENTS FOR A SUSTAINABLE WORLD:
ENERGY, WATER AND CLIMATE CHANGE”

Advances In Cleaner Production

CONFERENCE PROCEEDINGS

São Paulo - Brazil - May 20-22 - 2009
Universidade Paulista - Campus Indianópolis



www.advancesincleanerproduction.net

Conference Proceedings

May, 20th to 22nd 2009
São Paulo, SP, Brazil

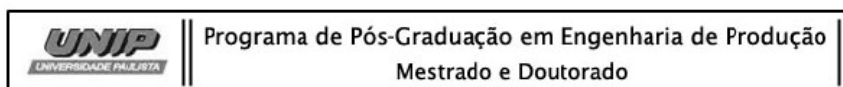
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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

São Paulo – Brazil – May – 20-22 – 2009

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Organization

PPGEP-UNIP – Post-Graduate Program in Production Engineering of the
Paulista University
ASEC – Associação dos Engenheiros da CETESB
NPPR – National Prevention Pollution Roundtable
UCf - Universidad Cienfuegos
UNISON – Universidad de Sonora

Partnership

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BANCO DO BRASIL

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CAPES

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Editora Manole

Institutional Support

PNUMA – Programa das Nações Unidas para o Meio Ambiente
UNIDO – United Nations Industrial Development Organization
Red Latinoamericana de Producción mas Limpia
ABEPRO – Associação Brasileira de Engenharia de Produção
ANAB – Associação Nacional de Arquitetura Bioecológica
FGV – Fundação Getúlio Vargas
Programa de Responsabilidade Social e Sustentabilidade no Varejo
FIERGS – SENAI
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Words from Donald Huisingh

Consulting Committee of the
2nd International Workshop Advances in Cleaner Production

I congratulate all planners and participants in this 2nd International Workshop Advances in Cleaner Production.

By your participation in this very important conference, you are having the opportunity to share your experiences with others who are also convinced that the holistic, prevention-oriented approaches of Cleaner Production of Cleaner Products ecologically, socially, politically and economically better than placing sole reliance upon 'end-of-pipe' pollution control and clean-up approaches.

I am pleased that the special issue from your previous conference is available on-line and in hard copy.

I look forward to co-working with all of you in the development of a second special issue, based, primarily upon inputs to this year's conference.

Donald Huisingh
Editor-in-Chief
Journal of Cleaner Production

Acknowledgments

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

José Goldemberg

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National Cleaner Production Center - China

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New Orleans University - USA

Paulo Antunes de Oliveira Rosa

CNTL SENAI/UNIDO/UNEP, Brazil

Luc Hens

Vrije Universiteit Brussels - Belgium

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, Prof. Alessandra Ancona de Faria and the Post-Graduate and Research team. We are sincerely grateful to students, teachers and coordinators of the UNIP's Tourism course, Prof. Marília Gomes dos Reis Ansarah, Prof. Célia Maria dos Santos and Prof. Luana Cunha Palma. Special thanks are addressed to Dr. Marília Ancona-Lopez, the Vice-Rector of Post Graduation and Research of Universidade Paulista, by her unconditional support.

We could not refrain from expressing our gratitude to the SENAC, Banco do Brasil, FAPESP, and CAPES for the financial support.

Message of Welcome

On behalf of the Organizing Committee, I have the honor to welcome for this second 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 the 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 **2nd International Workshop the on Advances in Cleaner Production** (in São Paulo, Brazil, 2009 May 20th to 22nd) in participation with ADESC, 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 "**Key Elements for a Sustainable World: Energy, Water and Climate Change**".

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Objectives

The event has as central theme **Key Elements for a Sustainable World: Energy, Water and Climate Change** with the aim to promote:

The 2nd International Workshop on Advances in Cleaner Production is an international forum to be held at May 20-22, 2009 in São Paulo, Brazil. The 2nd 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 "**Key Elements for a Sustainable World: Energy, Water and Climate Change**"

**Conferences
and
Oral Presentations**

20th May 2009

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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

São Paulo - Brazil - May - 20-22 - 2009

20th May 2007

10h30 -11h30 Opening Conference

José Goldemberg

São Paulo University, Brazil

**The Role of Energy in
Sustainable
Development**

The role of energy in sustainable development

Prof. José Goldemberg
*University of São Paulo
São Paulo, Brazil*

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs”.(Brundlund Commission 1987)

Looking at sustainable development through the lens of energy can help clarify the definition above, because the nature of energy systems offers a response to the thorny question of how many “future generations” we should consider.

Exhaustible fossil fuels (oil, coal and gas) represent 80.1 percent of the present world energy supply, nuclear energy 6.3 percent and renewables, 13.6 percent. Due to the dominance of fossil fuels in the world’s energy supply and their limited expected lifetime, they cannot be considered the world’s main source of energy for more than one or two generations – thus providing a metric to the aim of “not compromising the ability of future generations to meet their own needs”.

A sustainable energy system must compromise four components, characterized as

- Physical (related to securing supplies adequate to meet future energy needs and extending their life – essentially an energy supply problem);
- Environmental (related to the use of present sources of supply at the local, regional and global levels, including averting global warming and catastrophic climate change);
- Geopolitical (related to security risks and conflicts that could arise from escalating competition for unevenly distributed energy resources) and
- Equity (not strictly an energy problem, but similar to the problem of access to food and other amenities provided by modern civilization.

The technological options that are being consider to meet these characteristics are:

- More efficient use of energy, especially at the point of end use in buildings, transportations and production processes
- Increased reliance on renewable energy sources.
- Accelerated development and deployment of new energy technologies particularly next-generation fossil fuel technologies that produce near-zero harmful emissions, but also nuclear technologies if the issues surrounding their use can be resolved.

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Is the industrialized countries concerted efforts where mounted in the last few decades to improve energy efficiency and reduce carbon intensity. The worldwide introduction of price signals for carbon emissions – with consideration of different economic and energy system in individual countries – has not occurred yet but is being actively negotiated among countries.

Regarding developing countries, rather than mimicking the industrialized nations and going through the economic development road they followed in the past that is dirty and wasteful – creating a enormous legacy of environmental pollution – developing countries should “leapfrog” over some of the steps followed by them and incorporate early in their process of development currently available modern and efficient technologies.

The substitution of gasoline (a fossil fuel) by ethanol from sugarcane (a renewable fuel) in Brazil is an important example of a “leapfrogging” strategy followed by a developing country

20th May 2007

13h30 -14h30 Plenary Session

Bhaskar Kura

University of New Orleans, USA

**Cleaner Production Research
at the University of New
Orleans, USA**

**Paulo Antunes de Oliveira
Rosa**

CNTL SENAI/UNIDO/UNEP, Brazil

**CNTL-SENAI Participation in
Latinoamerican Net of CP**

Luc Hens

Vrije Universiteit Brussels,
Belgium

**A University Centre for CP in
Cienfuegos (Cuba)**

Cleaner Production Research at the University of New Orleans, USA

Dr. Bhaskar Kura
University of New Orleans, New Orleans, USA

The University of New Orleans (UNO), a Carnegie Doctoral/Research Intensive University, provides essential support for the educational, economic, cultural and social well-being of the culturally rich and diverse New Orleans metropolitan area. UNO offers 43 undergraduate degree programs, 37 masters, and 11 doctoral programs from five academic colleges and caters to the needs of highly qualified national and international students. UNO's award winning faculty have research partnerships with NASA, DARPA, DoD, Office of Naval Research, USGS, U.S. Wildlife and Fisheries, NOAA and many public organizations and private industries. UNO's strategic location in the Gulf Coast where maritime industry is dominant and UNO's nationally recognized School of Naval Architecture and Marine Engineering (NAME) were synergetic in promoting UNO's cleaner production research. The author with his strong background in environmental engineering, industrial engineering, and sustainability was able to establish a "Clean Technologies Initiative" within the Department of Civil & Environmental Engineering to promote "Cleaner Production" within the maritime industry. Research concepts, approaches, and infrastructure developed at UNO will be scalable to the demands of other

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municipal, industrial, and service sectors to (1) minimize their multimedia waste generation and (2) protect environmental quality, worker health and public health.

This plenary session presentation specifically covers highlights of the author's experiences in developing UNO Clean Technology Research Initiative and will address the following topics:

- Clean technology and cleaner production research goals
- Case study of maritime industry and development of resources at UNO
- Student training and training of industry personnel
- Scalability of research concepts, resources, and results to other sectors
- Management / software tools to effectively transfer the benefits of research
- Current and future research

CNTL-SENAI Participation in Latinoamerican Net of CP

Paulo Antunes de Oliveira Rosa
CNTL SENAI/UNIDO/UNEP, Brazil

Cleaner Production (CP) is a preventive environmental strategy that aims to reduce waste and emission generation and improve the productive use of natural resources. UNIDO (United Nations Industrial Development Organization) and UNEP (United Nations Environmental Programme) launched in 1994 a joint programme to establish National Cleaner Production Centres/Programmes (NCPCs/NCPPs). This UNIDO-UNEP Programme currently covers activities in 42 countries, including 12 in Latin America.

A new experience was implemented, in Latin America, since 2005: the creation of the Latin American Cleaner Production Network. This network has the participation of 12 countries of the region: Bolivia, Brazil, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua and Peru.

This network has a knowledge management system that is available through its web page (www.produccionmaslimpia-la.net/www.produçãomaislimpa-al.net). Details about this Network activities are available there and also about the activities of each one of the Centres/Programmess of Cleaner Production which composes it. There are also information about

national and international events, guidebooks and technical reference manuals, as well as many technical documents, cases of application of cleaner production, documents about environmental legislation of each country member of the Network, monthly reports and several links.

CNTL SENAI/UNIDO/UNEP - Centro Nacional de Tecnologias Limpas SENAI /UNIDO/UNEP, created in Brazil in 1995, was the first national cleaner production centre implanted in Latin America and the 10th in the world, after the acceptance of SENAI to be the host institution of the Brazilian Cleaner Production Centre of the UNIDO-UNEP CP Network. Besides being member of this global network, CNTL SENAI/UNIDO/UNEP is also a member of the Latin American Cleaner Production Network – CP Latin Net.

CNTL SENAI/UNIDO/UNEP offers consulting, capacitation, technological information, technology exchange and special projects focused in Cleaner Production and in several topics related to the environmental and energy areas, having also actuated in Latin America and Africa. Additionally, develops projects and offers technical support for the creation and implementation of environmental policies and programmes for the public sector (federal, state and municipal governments) and private (specially CNI, the National Confederation of the Industry and the Federations of Industries existing in each Brazilian state).

In 2002, CNTL SENAI/UNIDO/UNEP was appointed by the Federal Government as the Brazilian focal point for Cleaner Production matters to the UNIDO Cleaner Production Programme for the Latin America and the Caribbean.

From 2008 on, CNTL SENAI/UNIDO/UNEP started, with the support of CNI and SENAI, the implementation of the CNI Cleaner Production Network, which aims to implement a Cleaner Production Nucleus in each Brazilian state's Federation of Industries.

The work presents information about the actions of the Latin American Cleaner Production Network - CP LATIN NET and of CNTL SENAI/UNIDO/UNEP activities.

A University Centre for CP in Cienfuegos (Cuba)

Luc Hens
Vrije Universiteit Brussels, Belgium
Carlo Vandecasteele
Applied Physical Chemistry and Environmental Technology, KULeuven
Pedro A. Ochoa George
Studies on Energy and Environment, U Cienfuegos (Ucf)

The Belgian developmental cooperation among universities granted a project allowing to develop a centre for cleaner production in the province of Cienfuegos, Cuba. The project started in September 2008. This project roots in the needs of the Cuban society to transit from traditionally equipped, outdated industry and services to modernization that brings on board more rational resource use and less pollution. To this end this project aims at establishing in the University of Cienfuegos a Centre for Cleaner Production.

The centre will deal with training, research and information on cleaner production and environmental management. A focal output of this project is the establishment of a master degree in cleaner production and environmental management. The 35 audits programme entails 10 compulsory and 6 optional courses. The programme puts emphasis on knowledge and skills, including research skills, related to cleaner production. Professors are trained and the facilities for the programme are being realized. The maestria programme will be organized for the

first time during the academic year 2009-2010. A limited number of research lines started to support the training.

Currently the research includes cleaner production in a coffee plant, in the line industry, in a sugar refinery and waste management in a regional hospital. These issues were selected because they are all most relevant for the socio-environmental development of the province of Cienfuegos.

Initiatives will be initiated to make the centre a point of reference where information on cleaner production can be gathered and to promote awareness raising on cleaner production in the region and Cuba wide. In the long term the master degree and the related activities might act as templates for similar initiatives in other Cuban universities.

Contributions from experts at this conference are most welcome.

14h30-16h00

20th May 2009

**Session 4A
room 1**

Barriers to the Implementation of Cleaner Production as Ecoefficiency Practice in Small and Medium Enterprises in the State of Rio de Janeiro

Aggregating the Environmental Benefits and Economic Benefits: A case study with application of CP

Cleaner Production applied to the Hotel Sector

Analysis on Cleaner Production policy and its results in China

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Barriers to the Implementation of Cleaner Production as Ecoefficiency Practice in Small and Medium Enterprises in the State of Rio de Janeiro

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Abstract

The objective of this paper is to identify how small and medium business in the state of Rio de Janeiro, can overcome the implementation barriers of cleaner production and as a consequence become more eco-efficient. In that context, the methodology used was the research and exploration of the available biography in order to identify the main known barriers for the implementation of cleaner production in the world and in Brazil, and its application and similarities to small enterprises located in Rio de Janeiro. As a result, a proposal for a strategic plan was developed including enabling actions for the adoption of cleaner production directed to the specific cases found in the small and medium companies of the Rio de Janeiro State.

Keywords: Cleaner Production, Barriers, Eco-efficiency, Strategy

Aggregating the Environmental Benefits and Economic Benefits: A Case Study with Application of CP

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The new economic context, based on fierce competition in the quest for market leadership, coupled with the rigid posture of customers, focused on the expectation to interact with organizations that are ethical, with good corporate image in the market and act in environmentally responsible, makes that companies seek to increase efficiency in the use of raw materials, water and energy through the non-generation, minimization or recycling of waste and emissions generated, bringing environmental benefits, occupational health and economic. This article describes the implementation of a program for cleaner production (P + L) in a typical metalworking firm, located in the cluster's production serra gaúcha. The methods used were the single case study and action research. We used several sources of data such as: documents, index, written reports and spreadsheets used by the company. This study aimed to contribute to the clarification of this issue, considered in the emerging globalized world. We tried to also provide information that could help with the learning of other organizations that are in this same context, and emphasize the benefits of P + L for businesses. With the implementation of cleaner production methodology of the company significantly reduced the generation of waste and the costs associated with them. It also reduced costs to the consumption of raw materials. With minimum investment return in that small space of time could accumulate economic and environmental benefits.

Keywords: Cleaner Production. Productive efficiency. Economic benefits. Environmental benefits.

Cleaner Production Applied to the Hotel Sector

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Centro de Producción Más Limpia del Bajío
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This paper presents the results of the Bajío Cleaner Production Center (Bajío CP Center) in its project conducted jointly with the Tourism Development Secretariat (SEDETUR) and the Guanajuato's Environmental Protection Office (PROPAEG). The project called "Cleaner Production - Clean Company" focused on the hotel sector in the major cities of the state of Guanajuato. 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 achieved by the Cleaner Production (CP) and Energy Efficiency (EE) Implementation, PROPAEG joined efforts to design guidelines based on terms of reference for conducting environmental audits in the state of Guanajuato, to complement the Cleaner Production Diagnosis and Implementations. Therefore, under this scheme all the hotels that make a Cleaner Production project can get the "Clean Company" Certificate issued by PROPAEG, so in a single project the hotel can get environmental regulatory compliance, financial savings, improves public image, increases competitiveness, minimizes negative environmental impacts and the efficient use of raw materials, water and energy. So far, 34 hotels in the cities of León, Irapuato, Guanajuato, Silao and San Miguel de Allende have participated in this project. Some of the results obtained are: awareness and training to over 100 employees from the participating hotels, in terms of productive efficiency, pollution control and pollution prevention. The detection of areas of opportunity in CP and EE in 34 hotels can lead to an estimated savings potential of \$3 million of Mexican pesos (around 250,000 USD). The implementation of CP and EE at four different hotels is being translated in a decrease in water consumption of 52,987 m³/year, a decrease in polyethylene bag of 1740 kg/year, a decrease of 1,532 l/year of liquid chemicals and 2,065 kg/year of solid wastes. In regard to energy, there will be a decrease in diesel consumption of 5,790 l/year, a decrease in the consumption of LP gas of 47,374 l/year and a reduction in electricity consumption of 20,308 kWh; all this translated also in a decrease in CO₂ emissions to the atmosphere of about 135 ton/year. The economic benefits are savings for \$ 1,191,300 pesos/year, with a required investment of about \$ 218,592 pesos, which has a simple recovery rate of 2 months. Also, 3 hotels obtained the "Clean Company" certificate with a total compliance with environmental laws of the state of Guanajuato.

Keywords: Cleaner Production, Guanajuato, Hotels.

Analysis on Cleaner Production Policy and its Results in China

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Divided into three stages, this paper elaborated the practice courses of Cleaner Production in China in last two decades, analyzing the characteristic of Chinese Cleaner Production policy in the different historical periods. It also analyzed the results of Cleaner Production policy in China according to the investigation and study data of Cleaner Production audit of national key enterprises from 2004 to 2007. The result indicated that the advancement pattern of the voluntary Cleaner Production audit and compulsory Cleaner Production audit effectively promoted the advancement of Cleaner Production in Chinese industry. The consciousness on Cleaner Production of the government, the enterprise and the public have had essential enhancement. The quantity of enterprises which implement Cleaner Production audit has been increasing. The Cleaner Production technical advisory services system was preliminary established. It is obvious to see the energy saving and emission reduction realized by Cleaner Production.

Keywords: Cleaner Production; Policy; Results; Analysis

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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

São Paulo - Brazil - May - 20-22 - 2009

14h30-16h00

20th May 2009

**Session 4A
room 2**

Proposal for a construction system based on sustainable use of sawmill waste

Reduction In Waste Of Firewood And Raw Material Applying The Methodology Of Cleaner Production In The Sector Of Red Ceramic In Seridó Region

Proposal to the Residues Reduction in the Process of the Plasma Cutting of a Manufacturer of Building

LEGOLEVE Blocks

Fencing Blocks Using Recycled Rubble

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Proposal for a Construction System Based on Sustainable Use of Sawmill Waste

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We present an application of the methodology of environmental accounting in emergy, comparing the environmental impact generated by a house designed in a timber production system of "exploitation", the second wood of the first use and third, masonry type, from the same architectural project. By using the graphical tool - ternary diagram -, rates the emergy flow and environmental indicators in emergy, in the three models studied. The results showed a favorable trend for the home designed in wood production system of "exploitation", all indicators were higher than the other two cases under study, highlighting the environmental sustainability index of 125 times larger than the house of masonry. This system proved to be less constructive aggressive to the environment, which may allow the adoption of this house as a habitation solution of Vilhena in the state of Roraima, the city adopted as a model for this study.

Keywords: Environmental sustainability, emergy account, environmental indicators, sustainable constructive system, "exploitation" wood.

Reduction In Waste Of Firewood And Raw Material Applying The Methodology Of Cleaner Production In The Sector Of Red Ceramic In Seridó Region

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This work shows and discusses the outcome of opportunities for cleaner production in 05 Potteries located in Seridó - RN, precisely in the region of Carnauba dos Dantas, using the cleaner production methodology. Due to the amount of waste that occurs in the red ceramic industry, this study aims at mapping opportunities for cleaner production, generating improvement options for the identified opportunities to support the implementation of these

options and show a reduction in the consumption of firewood on that region. The stages consisted of advice from a rapid diagnosis, awareness meeting, measurements, generation of options and action plan. Data logger, pyrometers, Digital Pliers and Dynamometer were used to the step of measurements in order to quantify losses and consumption and the behavior of the burning curve. The results show that all companies had potential for improvement, especially in the following aspects: the preparation of clay, the burning process, in electric power consumption and the large amount of rewor. It was concluded that the predicted total environmental benefit (reduction in consumption), due to the changes in the process was: 3.546 st of firewood; With good operating practices: 1340 st of firewood; improvement in the control of the process was: 216 st of firewood.

Keywords: red ceramic, cleaner production, Energetic Efficiency

Proposal to the Residues Reduction in the Process of the Plasma Cutting of a Manufacturer of Building Systems

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The paper aims to develop a proposal for a reduction in the residues volume in the process of the plasma cutting in a manufacturer of building systems. For this, specific studies on the cleaner production and residues reduction supported a better understanding of these concepts and on the environment in the company serving as a theoretical basis for practical application in the development of specific objectives from the main objective, that is to reduce the volume of residues from the process of the plasma cutting, mainly from scrap metal derived from this process. Thus, the specific objectives have been met regarding the proposal, but the effectiveness of the result can only be measured after the actions implementation to continue getting future due to demand of time for implementation. However, it is clear that to have sustainable development as a guarantee of competitiveness, the company should focus its strategies in prevention and correction actions of problems rather than only attack their effects.

Keywords: cleaner production, residues, reduction of residues.

LEGOLEVE Blocks

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Topics like the urban solid waste management, the housing deficit, the increasing consumption of natural resources and the waste generation in the building industry are concerning for the majority of countries. The development of LEGOLEVE project is presented as a potential solution to minimize these problems. The use of EPS (styropor) and PET bottles as components of material for constructions shows several advantages, such as:

reduces of natural resources consumption (ex. sand); reduce the urban solid waste volume to be disposed; it has a low production cost, reduces the overall time for completing the project and its application can be conducted by anyone with some technical habilities. Finally, these materials do not need nesting mortar. The proposal of this work is discuss about the properties of the LEGOLEVE blocks, which is made of lightweight concrete using recycled EPS

aggregate and joined by PET bottles. The development of LEGOLEVE blocks has been based on the following definitions: the amount of EPS in the light concrete, the casting mould design and the processes of casting and setting point, using in this stage cylindrical specimens. After defining the best composition (amount of EPS) and the process parameters, several blocks had been prepared and analyzed, comparing the results with values from ceramic blocks. The water absorption level and mechanical results show that LEGOLEVE blocks partially reach the values set by NBR 15270/2005, although the LEGOLEVE has no specific standard to be evaluated. Additionally, it was observed that the blocks are horizontally connected by bottles, substituting with advantages the lime-based mortar. Comparing ceramic blocks with LEGOLEVE blocks, in regards to productivity and costs of masonry, shows the following advantages of the last one: use 75% less of constructive elements, very low consume of mortar (about 100 times less) and allows executing the task in 75% less time with reduced effort of the workman.

Keywords: Lightweight Concrete Blocks, Styropor, PET

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Fencing Blocks Using Recycled Rubble

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The study checks the possibility of making fencing blocks from civil construction rubble and residues, RDC, the latter in compliance with the classes established by Resolution 307 of the CONAMA, which are residues of class A, B and C. Two methods of blocks production were prepared: the first one using wooden forms in non commercial sizes and smaller scales; the second method using forms and industrial equipments which are currently in use for the production of commercial concrete blocks. The results showed the viability of making fencing blocks by recycling the rubble.

Keywords: Recycling, rubble, blocks of fence.

14h30-16h00

20th May 2009

**Session 4A
room 3**

Cleaner Production and Environmental Aspects in Sugar-alcohol Industries

Crude Coconut Oil for Biodiesel Synthesis

Production Of Biofuels From Cassava Starch Producing wastewater

Environmental Assessments of Transportation Biofuels in Europe

Cleaner Production and Environmental Aspects in Sugar-Alcohol Industries

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The sugar-alcohol sector can provide an important form of production with an efficient and environmentally correct. The problem of burning the straw of the cane for hand made harvest is already near-end. The law that puts an end to the burns, the current advance in the agro-mechanization and the increasing technological advancement of the cane harvesters are contributing in a systematic way to eliminate the problem of pollution from carbon dioxide. The management model used by the Cleaner Production of sugar mills and alcohol is not always what actually characterizes what happens in many sugar-alcohol industries. Moreover, the production of electric energy made by the sugar cane bagasse, the way of waste bagasse and filter sediments released to the environment weakened the production really clean. These are released to the ground often disregard the ability of the soil behaves.

Keywords: Sugar-alcohol Industries; Sediments emission; Cleaner Production.

Crude Coconut Oil for Biodiesel Synthesis

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Biodiesel production has become an attractive process, aimed at stimulating the production of alternative fuels. This study presents the results of biodiesel produced from coconut oil (*Cocos nucifera* L.), using acid catalysis (with H₂SO₄), followed by basic catalysis (with NaOH). A 1L jacketed pyrex glass reactor with 3 outlets was used. A mechanical agitator, thermocouple and bath for thermostat regulated refrigeration were introduced. The analysis of oil composition was carried out by gas chromatography and esters compounds were identified. The effect of oil/alcohol molar ratio, reaction time, and temperature on conversion was assessed using experimental 23 planning with a central point, in triplicate, for the route analyzed. The molar ratio variable had the greatest effect according to statistical planning analysis. The maximum conversion reached was 85.3% for a molar ratio of 1:6, temperature of 60°C and reaction time of 90 minutes. The Coconut oil was characterized by their physical and chemical properties and key constituents in the oil. The lauric acid was its main component and even showed high acidity. The biodiesel produced was characterized by its main physicochemical properties that had very satisfactory results when compared with the standard values from the National Petroleum Agency.

Keywords: Biodiesel, catalysis, Cocos nucifera, crude oil, coconut.

Production of Biofuels from Cassava Starch Producing Wastewater

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Greenhouse gases and global warming are current problems caused by the high fossil fuels demand. In this context it is important to search for alternatives energy sources. Biofuels, as methane and hydrogen can be produced from organic wastes or wastewater rich in carbohydrates. In the present work it was studied the possibility to use the cassava processing wastewater, named manipueira, for fermentative biofuels production. An anaerobic bioreactor with 2 liters volume was used applying an organic loading of 2997.5 mg/L.d of COD. The performance of the bioreactor was monitored daily by the determination of COD, acidity and pH in the manipueira and in the bioreactor effluent. It was observed a COD consumption of about 22%. The average of the total biogas volume produced daily was 469 mL. The theoretical composition of this biogas was calculated as 35.93 and 64.07% of methane and hydrogen, respectively. Such values were very similar to the experimental ones, 37.67% of methane and 62.32% of hydrogen. This work showed the possibility to use cassava processing wastewater, a high concentrated organic pollutant, as substrate for production of hydrogen, a very energetic and clean biofuel.

Keywords: wastewater, manipueira, fermentation, biofuels.

Environmental Assessments of Transportation Biofuels in Europe: A Survey

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A substantial transportation biofuels sector is present in the EU-27 countries raising controversy about their environmental impacts. A survey of the literature regarding assessments of these impacts is presented, following a brief outline of the EU-27 biofuels production. The main assessments' results, based on extensive search in sources of scientific evidence and information related to the paper's topic, are cited and compared, combined with a discussion about these findings. Several conclusions are drawn and comments are made regarding, among others, the "splash and dash" system of European biodiesel, the uncertainty in the parameters related to LCIA of biofuels, the economic basis of their environmental impacts, the insufficient treatment of the land use impact category, etc.

Keywords: biodiesel, bioethanol, environmental impacts, LCIA

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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

São Paulo - Brazil - May - 20-22 - 2009

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20th May 2009

**Session 4A
room 4**

Adsorption of Reactive Black 5 Dye From Aqueous Solution By Coal Fly Ash

Thermogravimetric Analysis Of The Polyurethane Biodegradable Foam Of The Project Gasolimp Product As A Power Cogenerating Agent

Study of viability of use of a natural polymer (TANFLOC) in substitution to aluminum sulphate in the water treatment for human consumption

Application of electrochemical degradation of wastewater composed of mixtures of phenol – formaldehyde

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Adsorption of Reactive Black 5 Dye From Aqueous Solution By Coal Fly Ash

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The fly ash (CC6), a waste generated in a coal-fired electric power generation, was used as adsorbent to remove Reactive Black 5 (RP 5) dye from aqueous solutions. The effect of contact time was investigated on the adsorption process. The amounts adsorbed at equilibrium were measured. The Langmuir and Freundlich isotherm models were tested for their applicability. The isotherm adsorption data fit accordingly to the Langmuir model with maximum adsorption capacity of 0.58 mg/g. The experimental results showed a high percentage removal of 44 to 91% for CC6. The high percentage removal of RB 5 dye onto fly ashes revealed that these materials could potentially be used as adsorbents in the reactive dye removal from textile wastewater.

Keywords: adsorbent, dye, fly ash, reactive black 5.

Thermogravimetric Analysis Of The Polyurethane Biodegradable Foam Of The Project Gasolimp Product As A Power Cogenerating Agent

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This paper presents the results of tests made for analysis of combustion of substances that remain impregnated in biodegradable polyurethane foam resulting from continued action of the oil, after 35 days of use Gasolimp, project of a protective biodegradable foam product for fuel pump and cogeneration Power, placed in an injection pump for gasoline during the period February-March 2008, at a gas station in the city of João Pessoa – PB, Brazil. Our main objective was to diagnose the thermogravimetric properties to assess the thermal properties of a sample as a function of time or temperature. The thermogravimetry (TGA) is a method used to determine the rate of decomposition of substances used in the application of additives and organic material if you want to evaluate the thermal and oxidative stability of these. The analysis of thermogravimetry were carried out LACOM (Laboratory research in the area of fuels and materials) of the Federal University of Paraíba. This laboratory works in the area of research of new materials (pigments, catalysts and photoluminescent materials), production of biodiesel (babassu (native nut), soybean, corn, cotton, pine nuts gentle, coconut oil, frying oil), among others. The laboratory has a thermogravimetric analysis, brand TA Instruments, model SDT 2960, the rate of heating 20 ° C / min up to 600 ° C. The sample used was approximately 5.0 mg of platinum using a port in air atmosphere with 110 mL / min. The analysis of differential scanning calorimetry were performed in a differential calorimeter exploratory pressurized, mark TA Instruments, DSC Model 2920 coupled to a unit of pressure, the rate of heating of 10 ° C / min up to 600 ° C. The mass of sample, approximately 5.0 mg was placed in a door sample of platinum in oxygen atmosphere with pressure of 1,400 kPa. The thermogravimetric analysis carried out showed very satisfactory results on the content of combustion and burning of the sample, giving a residue amounting to 3% depending on the mass diagnosed. It was found also in the analysis of PDSC that the process of burning of biodegradable foam there was a release of energy of 5184 J / g. In brief and conclusive, the results obtained by the TGA tests and differential scanning calorimetry, demonstrated and proved that the Project of the Product Gasolimp as a power cogenerating agent is highly viable.

Keywords: Combustion, Power Cogenerator, biodegradable polyurethane foam

Study of Viability of Use of a Natural Polymer (TANFLOC) in Substitution to Aluminum Sulphate in the Water Treatment for Human Consumption

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This study aimed to demonstrate the technical viability of one natural polymer in substitution to the aluminum sulphate as coagulation and flocculation agent in the water treatment for consumption. Focusing in comparing the efficiency, basic physical-chemical parameters such as pH, turbidity, alkalinity, settling solids and organic matter were analyzed, and then measured after jar test, utilizing coagulant concentrations pre-established between 10 and 60 mg.L⁻¹, in interval of 10 mg. The results obtained in the finish of the experiment, indicates that the natural coagulant had shown more efficiency in regards to pH and alkalinity parameters and got results very near regarding the other parameters analyzed. The preliminary results proof that the natural polymer utilized (Tanfloc) can be a potential substitute of the aluminum sulphate for the water treatment.

Keywords: Natural polymer, Water treatment, Superficial water.

Application of Electrochemical Degradation of Wastewater Composed of Mixtures of Phenol – Formaldehyde

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Environmental problems caused by industrial processes are of great concern to society due to the possible introduction of toxic waste from products generated by the industry. Thus, researchers increasingly study new techniques to reduce or eliminate the toxicity of industrial effluents, always respecting the laws and regulations aimed at environmental protection. Electrochemical degradation is a promising alternative for the treatment of wastewater that contains organic compounds. In this work a dimensionally stable anode (DSA®) of nominal composition Ti/Ru_{0,3}Ti_{0,7}O₂ was used to study the degradation of solutions containing a mixture of phenol and formaldehyde. The oxides electrodes were characterized by Scanning Electron Microscopy and Energy Dispersive X-ray analysis (EDX). The galvanostatic degradation of mixtures of phenol – formaldehyde were monitored by High Performance Liquid Chromatography (HPLC) and Total Organic Carbon Analysis (TOC). The effect of current density (10, 20, 40 and 50 mA cm⁻²), pH (3, 5, 7, 9 and 12) and supporting electrolytes (NaCl, NaNO₃ and Na₂SO₄) was investigated. Energy consumption during electrolysis is also presented. The electro degradation of mixtures of phenol – formaldehyde proceeds via two different mechanism: active and non-active. The non active mechanism results in the complete combustion of organics to carbon dioxide. The active mechanism results in a selective oxidation, via degradation products. The results demonstrate that the electrochemical removal of organics is pH- dependent. In the most an effective current density (40 mA cm⁻²) 60% of TOC is removed.

Keywords: dimensionally stable anodes, phenol, formaldehyde.

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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

São Paulo - Brazil - May - 20-22 - 2009

14h30-16h00

20th May 2009

**Session 4A
room 5**

Reuse Of Water And Process Waste From The Dairy Industry

Waste Management of Salt Solar Distillation

Case Study for Recovering of Landfill Landscape of Toledo-PR

Evaluation of the Pollutant Removal Mechanisms of a Reed Bed System:
Biochemical Parameters

Reuse Of Water And Process Waste From The Dairy Industry

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Dairy industry is an activity of great importance in the global economy, and in Brazil, the seventh largest producer. This sector has lived with the consumption of water for cleaning, which represents more than 80% of the demand for water in agro industries and subsequently treated in waste treatment system. Some suggestions were made to decrease the pollution potential of the effluent of the dairy industry, by proposing the inclusion of a technology using membranes, as part of the process, seeking the recovery and concentration of milk solids in the rinse water from the first equipment, and application of these solids in the manufacture of products derived from milk source and water from the permeate water as the return of industrial process, considering the volume of production of UHT milk and cream of the dairy industry at large to Carazinho / RS - Brazil. To minimize the generation of effluents, one of the main roads is the reuse of water and incorporated into the plant. Treat the surplus of production may not only allow its reuse, but its recovery through the recovery of protein and fat for later incorporation. The fractionation of the dairy effluent through the use of technology for separation membranes in permeates and reject suggests the use of two currents. A promising alternative is the use of this concentrate, rich in protein and fat in dairy products, replacing them is part of the raw material for this concentrate. The use of wastewater as the process is possible through its return to water for cleaning. The reduction of the volume released and minimizing the load of the effluent are the main advantages of applying this type of technology in the dairy industry. Assuming the volume of production of the dairy industry from large to Carazinho / RS - Brazil, the volume of effluent to be removed from the TEE would be approximately 435,200 L / day and shall have the reintegration of about 130,500 L / day of reclaimed wastewater in the industrial process. Moreover, the insertion of soluble solids recovered in a line of dairy sugar products as an ingredient partial leverage the economic benefit through a production of approximately 304,700 L / day of waste milk.

Keywords: dairy industry, reuse, effluent, milk industry wastewater

Waste Management of Salt Solar Distillation

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The solar desalination is an efficient technique for removal of salts. This work aims to show the matter of management of salts in a distiller powered by solar produced water with oil reduced. The work was carried in Natal / RN - Brazil during the months of August and September 2007. The equipment used is a single solar still passive two water with inclination of 20 ° in coverage. The operation of the equipment is batch to food and continuous to collection of distilled water. Was determined the parameter of Chloride, that it is the most representative element of salinity, and pH and still held the mass balance. The results showed a distillate with 12.40 mg Cl in opposition to 700.00 of chloride inle . Thinking themselves in an industrial scale, which would be fed volumes of the order of thousands of cubic metres, these values would be the order of tons of salt a day, so that strategies should be established destination for such waste. Based on the results analyzed, there was a removal of approximately 99% of Cl- The mass of Cl in waste was 3487, where it can infer that, for sewage or water production with high salinity, waste generated will reach, the order of tonnes daily.

Keywords: Solar energy, Solar distiller, Waste management, Chloride.

WSD as a Sustainable Tool for the CP Practices: Water/Wastewater Minimization in Industrial Processes

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Cleaner Production (CP) practices in the industry require an adequate understanding of the characteristics of the manufacture processes. If the aim is to minimize the water consumption and the environmental impact due to the generation of effluent, then water processing in the industry are very important. In this way, it's necessary to provide environmental sustainable practices, such as reusing water and wastewater. The necessity in developing water reuse programs in several areas, mainly in the industrial sector, has been related to the use of technologies as the tools for an adequate water resources management. Process Integration is a part of the Process Systems Engineering, which has been allowing improvements techniques applied to waste/wastewater minimization. Hence, an important tool is called Water Sources Diagram (WSD), an algorithmic procedure that uses heuristics rules and searches the best connections between sources and sinks of water within the industrial processes. It allows the synthesis of the mass exchange networks with maximum water reuse, including regeneration and recycle processes. The objective of this work is to focus on the WSD algorithmic procedure as a useful tool for evaluation of practical analysis on the water and wastewater minimization, in the Cleaner Production approach. In this work a case study is used to illustrate the application of this procedure showing the reduction of water flow rate obtained compared to the original flowsheet. Besides, the WSD performs calculations quickly, even by hand, and generates process mass exchange network without process modifications simultaneously. The application of the procedure in the industry requires the characterization of water and wastewater with respect to flow rate and contaminants concentrations in the respective streams.

*Keywords: Industrial water management; Water/wastewater reuse;
Environmental friendly strategies*

Case Study for Recovering of Landfill Landscape of Toledo-PR

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The work was to propose guidelines for the recovery of landfill landscape of Toledo - PR. The development of a technology coverage aimed specifically end the establishment of a vegetation, initially was based on an established diagnosis of physical and chemical characteristics of soil used in the final layers of coverage. We collected samples of soil in the depth of 0-20 cm, which were established some parameters such as pH, Saturation of bases, cation exchange capacity, macro and micro nutrients. The spontaneous flora of the area studied is composed of species that escaped from cultivation; from the remnants of species in natural surroundings. In this study may notice that there were no significant differences in relation to the relevant witness, therefore, the results allowed the suggestion of studies and definitions of species that can be used revegetated in the cell and closed the surroundings of the landfill in the municipality of Toledo-PR. The determination of the chemical analysis of soil from landfill showed great concentration of organic matter, derived from waste, can avail of nutrients already deposited in the soil, however, requiring small levels of application of fertilizer and lime to promote better development and resistance of the species recommended.

Keywords: Sanitary embankment, degraded Area, revegetation, Slope.

Evaluation of the Pollutant Removal Mechanisms of a Reed Bed System: Biochemical Parameters

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This study was aimed to evaluate the key biochemical mechanisms that occur within a reed bed system or constructed wetland during the treatment of landfill leachate. Soil respirations, dehydrogenase activities and urease activities within a horizontal subsurface flow reed bed were extensively examined to determine these mechanisms. Variations in biochemical parameters because of change in space and leachate applications were investigated. Correlations among the biochemical parameters and between biochemical parameters and pollutant removal efficiency were undertaken. No biochemical activities showed any horizontal variations across the reed bed. For both preloading and during-loading conditions, soil respirations and dehydrogenase activities did not have any vertical variations whereas urease activities at 5cm depth were significantly higher ($P < 0.001$) than those at 50cm and 90cm depth. When during-loading conditions were compared with preloading conditions, soil respirations showed no variation at any depth, whereas significant reductions were observed at 50cm ($P = 0.034$) for dehydrogenase activities and at 50cm ($P = 0.018$) and 90cm ($P = 0.004$) depths for urease activities. A modest correlations ($r = 0.474$, $P = 0.023$) between soil respirations and dehydrogenase activities was observed. A strong correlation ($r = 0.777$, $P < 0.001$) was found between dehydrogenase activities and urease activities. No correlation existed between the biochemical parameters in the reed bed soil and the pollutant removal efficiencies for chemical oxygen demand (COD) or total kjeldahl nitrogen (TKN). Aerobic microbial activity showed equal potential for the degradation of pollutants in the wastewater which suggests the importance of creating suitable conditions for aerobic microbes within the root zone in the reed bed. Significant reduction of total microbial activities at the middle depth suggests that it was influenced more by heavy metals due to more exposure to leachate. The top layer reed bed soil needs to be properly utilised to maximise the reduction of nitrogenous pollutants from leachate. A biochemical activity can be utilised to predict another biochemical activity but not the removal of COD and TKN.

Keywords: Reed beds, leachate, respiration, dehydrogenase, urease

16h30-18h00

20th May 2009

**Session 4B
room 1**

Environmental Requirements on the Product Process Development
Applied in Furniture Industries

CO₂ Flow Accounting in a Commercial Bamboo Plantation Aiming the
Paper Production

The Cleaner Production Applied to a Small Industry of the Furniture
Sector: Economic and Environmental Efficiency

New Weld Fume Chamber Design to Assess HAP Emissions Potential and
Promote Cleaner Production

Environmental Requirements on the Product Process Development Applied in Furniture Industries

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This study aimed at identifying the environmental requirements adopted by small industries of furniture to make to order process of product development, the internal and external factors that led to the adoption and those needed for greater sustainability in the production system. In recent years, the complex issues that cross the process of industrial transformation and the interest in the environment have multiplied, increasingly affecting the micro and small enterprises, the most affected by the difficulties of adapting their corporate culture to the new challenges of environmental compliance and sustainable development. To that end, 18 were considered micro and small enterprises in the Furniture Pole of Itatiba – SP on the adoption of environmental requirements in the PDP. Data were collected through semi-structured interviews and site visits, analyzing each activity of the PDP and environmental requirements associated with them, identifying the end of testing the feasibility of improvement for the industry. The results indicate that economic factors also dictate the way businesses respond by environmental issues, is the adaption by the laws and regulations or by reducing production costs. Moreover, the absence of trained professionals in the field of sustainable development of products provides the increased difficulties in structuring the sector.

Keywords: products development process, environmental requires, furniture industry.

CO₂ Flow Accounting in a Commercial Bamboo Plantation Aiming the Paper Production

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Given the significance of climate change for the sustainability of human society, the need for studies that address the storage of CO₂ is increasingly important. Thus, this study evaluates the potential for mitigation of global emissions of CO₂ in commercial plantations. In this case, the system chosen for study is a commercial plantation of bamboo for the paper production industry, located in northeastern Brazil. Besides the main activity of the plantation, additional scenarios has been adopted, heading a more complete evaluation of CO₂ released and stored in the lifetime of the bamboo plantation (25 years). Alternatives for reducing the CO₂ released in the use of plantation's resources were also studied.

Keywords: Commercial plantation, bamboo, CO₂ emission, CO₂ storage, paper production.

The Cleaner Production Applied to a Small Industry of the Furniture Sector: Economic and Environmental Efficiency

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Applying the methodology of Cleaner Production promotes observation and assessment processes under the focus of the economy in the use of resources and minimizing waste generation. Thus, it is possible to reconcile the productive and economic efficiency with environmental performance. With the data collected in the furniture sector industry that have successfully implemented the practice of Cleaner Production, this article will present a case study on the approach discussing the results achieved by the company in relation to water consumption, consumption of electric energy, generation of waste from steel plate, generation of waste polymer and final destination of the waste industry. The aim is to demonstrate how Cleaner Production contributes to the sustainability of production processes, especially in small and medium enterprises.

Keywords: Cleaner Production, efficiency, small and medium enterprises.

New Weld Fume Chamber Design to Assess HAP Emissions Potential and Promote Cleaner Production

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Metal welding is an important production process in many industry sectors including automotive, aerospace, oil and gas exploration/refining/transportation, heavy manufacturing, and maritime. Though welding emissions are insignificant based on a mass basis within the maritime industry, their contribution to the overall risk to human health and the environment is significant because of the high toxicity associated with heavy metals emitted. These heavy metals include Cr, Cr+6, Mn, Ni, Pb and others which may pose carcinogenic and noncarcinogenic effects to exposed workers and the public. United States regulatory agencies including the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (U.S. EPA), have recently increased pressure on the industrial sector to reduce their annual emissions of these heavy metals. This recent concern from the regulatory community has led to increased research efforts to better quantify the actual amount of these metals emitted, and to develop a better understanding of their potential to cause adverse effects to public health and the environment. Welding emission characteristics and quantities depend on a number of factors such as electrode and base metal composition, welding method, shielding gas characteristics and power supply characteristics. When considering the various combinations of these factors, thousands of welding scenarios are expected in the field, each of which presents a unique emissions scenario. Emission factors for the numerous welding scenarios are not available, and will require an extensive amount of research to develop and document. However, these emission factors are essential for several purposes including facility permitting, risk assessment, compliance demonstration, and to achieve cleaner production. This paper documents the unique challenges faced by the authors to design and fabricate a weld fume chamber capable of capturing 100 % of weld fumes on filter media suitable for heavy metals analysis. The weld fume chamber had to meet the requirements of regulatory agencies, data quality objectives, approved analytical methods, and filter efficiency. Design parameters such as chamber size, blower capacity, experimental speed, filter size and type, and fume loading, along with their inter-relationships will be discussed. This paper provides valuable insight into welding emission evaluation methodology, which should be useful across many sectors.

Keywords: Welding emissions, heavy metals, health risks, fume chamber design, emission factors

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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

São Paulo - Brazil - May - 20-22 - 2009

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20th May 2009

**Session 4B
room 1**

Management of the Use of Vegetable Oils in Order to Restaurant Cleaner Production

Used Cooking Oil Recycling: a Contribution to Increase the Process Productivity

Comparative Study with Emphasis on Energy Environmental Sustainability of food with nutritional similarity

Organic Food Consumers in Vitória da Conquista, Bahia

Management of the Use of Vegetable Oils in Order to Restaurant Cleaner Production

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The process of frying is an operation that provides characteristics of scent, flavor, color and texture to food. The oil can become an ingredient capable of introducing chemical changes provoked by a lingering warming. This work has the objective to develop strategies of management of the use of vegetable oils in restaurants through opportunities of PML, viewing the minimization of consumption of energy and raw materials, and the reuse of waste for the production of biofuels. In this work, it was studied the soybean oil used in frying of immersion in two restaurants, viewing to evaluate in what conditions the oil used for frying is discarded and relating these conditions with its use as raw material for the production of biodiesel. As a result, materials with different degrees of oxidation and contaminant material were obtained, and it was identified that the oil that was discarded after being used for too long can be inadequate for feeding animals, and for this reason they are collected in restaurants of the region, and they demand more care for the production of biodiesel. From the monitoring of production activities of the restaurants, stages in the preparation of food with higher consumption of raw materials and generation of waste were identified, and based on approaches of a cleaner Production it was developed a prognosis to minimize environmental impacts.

Keywords: Biodiesel; Frying oil; PML, cleaner production.

Used Cooking Oil Recycling: a Contribution to Increase the Process Productivity

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The increasing importance of the environmental preservation and the incessant search for competitive advantages between the companies shows us the evident relevance of the reverse logistics evaluation about the cooking oil. This article explores the methods applied by some used cooking oil collectors organizations, the problems found out by oil consumers when throwing it out and the initiatives of the legislative power in laws creation about the return of the discard, focusing on understanding the reasons why sometimes the residue is not being gathered in great scale and returned to the productive cycle.

Keywords: Reverse logistics, Cooking Oil, Recycling, Competitive advantage

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Comparative Study with Emphasis on Emergy Environmental Sustainability of Food with Nutritional Similarity

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Well known and traditional foods such as potatoes, tomatoes, cabbage and beans have important place in the world's alimentation. Options for not so well known foods in the West, but rather consumed in Asian countries such as bamboo shoots, offer nutritional value comparable to many of these traditional aliments. In this sense, aspects of environmental sustainability of these aliments were evaluated and compared. Among them, bamboo shoots are more sustainable. When the study considers the production efficiency, the potato is the better option. The main nutrients of each aliment according to the emergy per unit invested were also evaluated to find more sustainable options for obtaining a specific nutrient from these aliments.

Keywords: bamboo shoot; ternary diagram; emergy; sustainability.

Organic Food Consumers in Vitória da Conquista, Bahia

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Knowledge of consumers about organic food, their willingness for organic food consumption and criteria they use to buy it are analyzed. A sample of 207 people were interviewed, between 17 and 79 years old, going to do purchase at two largest super-marketed in the city of Vitoria da Conquista, Bahia, Brazil. This research confirms that women are more influential than men on food purchasing, therefore, on organic food consumption too. However, our findings diverge from other researches that show concentration of organic food consumption among more mature people, specifically around the 40s. Our findings also show that relationship between schooling and income with organic food consumption is much more complex than previous research have shown. No association between participation on any environmental movement and consumption of organic food was registered here. Data confirms other findings showing that, in Brazil, most consumers read labels of merchandises, before purchasing. Once again, data show that consumers associate organic food with health and feeding security, in the first place; environment and other aspects come after. Finally, findings show that, in terms of organic food consumption, consumers pay attention professionals of the area, such as nutritionists, in the first place, followed by physicians, professors and environmentalists.

Keywords: Organic food, consumers` knowledge, consumption willingness, decision criteria, sustainable community.

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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

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**Session 4B
room 3**

Segregation of Waste Health Services as a Cleaning Production Process:
Case Study of the 7th Region of São Paulo

The Solid Waste treatment used by Port of Santos administration

The contribution of Cleaner Production in the improvement of work
conditions and workers health: a case study

Sustainable Production: an approach of occupational health and safety
in the auto parts industry in Hermosillo, Mexico

Segregation of Waste Health Services as a Cleaning Production Process: Case Study of the 7th Region of São Paulo State.

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This paper addresses to the importance of correct segregation of Waste Health Services (RSS) like main factor of the practice of the cleaner production inside the generators enterprises, and examines through the case study, the situation of the Waste Health Services in the region of the CODER ((Council of Regional Economic Development) that has Bauru as a headquarter. The objective was to improve data, evaluate the current situation and the issue of Waste Health Services ant the influence of the correct segregation. To complete these objectives, the analysis by the author lead to a picture of the current status of health waste services in the region, exposing the weaknesses of laws, that includes mainly the major producers and the low qualification of the workforce, and, in consequence, reduces the issues and discussions about the quality by process of segregation, and, in the final destination, the environmental problems.

Keywords: Waste Health Services, Health Services Management, Regional Research.

The Solid Waste treatment Used by Port of Santos Administration

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This article analyzes the positioning of the administration of Port of Santos in what refers to the implantation of the Plan of Administration of Solid Residues (PGRS) in relation to the solid residues generated by the port operators and ships, and the concern with the Environmental Education. The research was of bibliographical stamp.

Keywords: Solid Residues Management Plan, Environmental education, Port of Santos.

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The contribution of Cleaner Production in the Improvement of Work Conditions and Workers Health: A Case Study

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The present article brings to discussion a very interesting and up to date aspect: the synergy between Work Security, Health and Hygiene, Ergonomics and Cleaner Production. A case study has been developed in a chemistry laboratory of a university in order to assess the main causes of sonorous pollution and the consequent use of disposable ear protectors (EPI's). Noise level measurements were conducted in some specific points of the laboratory. Results showed two main causes of noise generation: i) maintenance plans that were not fulfilled, and ii) lack of concern for keeping the laboratory environment free of noise. Based on the concepts of Cleaner Production all the centrifugal machines were submitted to corrective maintenance, including cleanliness and substitution of parts. This procedure resulted in the reduction of pressure noise levels in approximately 17 dB, below de noise level that required the use of EPI's. This also created better working conditions and economy by the reduction of solid residue generation. It was verified strong synergy between Work Security, Health and Hygiene, Ergonomics and Cleaner Production in the improovement of the work conditions, besides the elimination or reduction of residues and increasing in the workers security and health.

Keywords: Work Conditions, Sonorous Pollution, Cleaner Production.

Sustainable Production: An Approach of Occupational Health and Safety in the Auto Parts Industry in Hermosillo, Mexico

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The Mexican Association of the Auto Industry (AMIA), together with the Secretariat of Economy of Mexico, has proposed the goal of duplicating the productive capacity for the auto parts industry by 2010. This implies that every place where an auto assembly plant exists become a manufacturing center for this productive sector within the country. As a consequence, the large amount of the implicit work in this industry includes processes, operations and materials that, in a major or minor extent, create risks for the workers health as well as the neighboring communities and the environment. In particular, occupational risks may result on ergonomic problems, or occupational diseases and accidents; besides of diminishing employees' health, this can affect the productivity of the companies in a negative way or can prevent the generation of desirable healthy conditions for the surrounding communities. This paper aims at presenting the preliminary outcomes of a case study carried out into six auto parts facilities in the city of Hermosillo, Mexico, which include the following elements: a characterization of the auto parts industry; an evaluation of the health and safety programs in each of the studied companies through the US OSHA's Program Evaluation Profile (PEP); an identification of cleaner production and pollution prevention practices implemented; and the workers' perspectives about the occupational health and safety conditions through a questionnaire applied in their workplaces. Finally, a preliminary proposal is included about implementing sustainable production strategies, with emphasis in occupational health and safety issues, to improve the working conditions within the auto parts sector.

Keywords: Sustainable Production, Occupational health and safety, Auto parts industry

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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

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**Session 4B
room 4**

The Correct Fate of the wastes of a cheese manufacture - an Analysis of Economic Viability

Matter study case: the present situation of recycle selective of sorocaba city and study for partners between zone factories to more cleaning production

Public Environmental Management: Risks and Problems of Garbage in the City of Pelotas / RS

Accounting Contributions in Emnergy for the National Solid Waste Policy

The Correct Fate of the Wastes of a Cheese Manufacture - an Analysis of Economic Viability

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The cheese serum is rich in proteins, lactose, fats and proteins but considered a great one pollutant of the industry of dairy products. Currently is low used in the food industry and the great wasted volumes in effluent treatment correspondents to animal nutrition or sent to treatment systems with low efficiency, contaminating receiving bodies drastically and generating environmental problems as the biochemical demand. The objective of the present study is consider economically alternatives for the use and correct destination for the cheese serum originated from of cheese dairies of small, medium and big scale. Was used as methodological base a qualitative experimental research, with experimental data obtained in laboratory from of industrial cheese dairy. The analyses showed a cheese serum with average percentage of 93,70 % ($\pm 0,49$) of total solids, 0,84 % ($\pm 0,04$) of proteins and 4,99 % ($\pm 0,22$) of lactose. With to present organic load, presented as viable system, that where the serum can be destined for the concentration of solids through micro and ultrafiltration membranes, directing the proteins for the increase of the yield cheeses process, and the lactose for biofermentation, reducing DBO of the liquid sent to sources, and aggregating value to the industrialized product. Thus, concluded that economical viability of the use of the cheese serum can be obtained through some viable alternatives for industries with different scales of production.

Keywords: Cheese whey, separation for membranes, ultrafiltration

Matter Study Case: The Present Situation of Recycle Selective of Sorocaba City and Study for Partners Between Zone Factories to More Cleaning Production

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The organizations need the maximization of their profits and life time. The consciences that the factory is involved in big environment, in the biosphere, it is almost none, such as the moment, in any time, the changes cause though its activities, in biosphere, influenced in results. The most of parts of bibliography, materials logistics, will be treat with some perspective of supply efficiency and the collaborative relation with some factories of productive chain, so this subject was mapped exhaustively in the Supply Chain Management. Increasing the studies in the materials production area and power consumption, we enter in the universe of Cleaning Production. This task has been main goals analyze in Sorocaba environment that is state of recycle´s selective collective. The second goal is to start a macro exploratory study with some industries residues discard in the main productive chains for futures studies and give some solutions that take advantage for everyone. Involving the Executive, the factories and the organized society. The principal results prove in the big progress of recycling with City Hall supports, in the recycling cooperatives. For that some industries residues should be start serious study, because some residues could be reutilized how prime substance for others industries. So if you have in a detail studies could be contribute for improving the process and eco-design.

Keywords: Management Environmental, Recycling, Clearing Production.

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Public Environmental Management: Risks and Problems of Garbage in the City of Pelotas-RS

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Nowadays, the humanity faces the accelerated depletion of planet's natural resources in a pace never seen in history. The disorderly growth of the population to levels far above the natural ecosystems and supported by the pressure exerted by this phenomenon, is certainly one of the most important factors for the ecological damage. The large-scale production and wasteful consumption, are other factors that cause, besides the depletion of natural resources, the involvement of whole environments, as people not knowing who to target as many packages and objects into disuse just throwing them in rivers, streams, soils, forests, etc.. Besides the increase in the amount of trash each other due to the growth in levels of consumption, we should consider the fact that this garbage becomes every day less organic, and therefore less digestible. Only Brazil produces 240 tons of garbage per day. Environmental management is a large management mechanism and must be assimilated by all social sectors. With the direct action of communities, these problems could be minimized by organizing, for example, the selective waste collection, among other programs. A selective collection, simplified, which educates the public to separate their garbage at home, at least two groups, the organic and recyclable, it is something essential that urban management can no longer postpone. This study was performed in the city of Pelotas, in the company Sanep - Autonomous Service of Sanitation of Pelotas, where were identified projects under implementation, related to environmental issues most pressing in the city. Due to the exploratory nature of this work, with the content analysis was possible a more complete and adequate knowledge of the reality. This perception was through interviews with the engineer responsible for managing the city's garbage. Evidence shows that the participation of citizens, communities and civil society as a whole is essential to sustainability and the minimization of risks and environmental problems caused by trash in the city of Pelotas.

Keywords: Environmental Management; Garbage; Selective Collection; Sustainability.

Accounting Contributions in Energy for the National Solid Waste Policy

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The current Brazilian Bill for Solid Waste will impact 5564 Brazilian municipalities, which need to be mobilized to adopt policies and actions for waste treatment in accordance with the Act. The project may empower millions of businesses and individuals, because in case of damage involving solid waste responsibility for the implementation of corrective measures, they will be charged from the causer of the damage, jointly with its generator. Product life cycle, environmentally appropriate final destination, and flow of solid waste integrated management are objects of this Project Act. It presents the accounting in emergy as an alternative to consistently assess the impacts of solid waste on the biosphere, because its amplitude goes beyond the frontiers of economic and production systems (extraction, production, use and disposal), breaking into the environment of ecosystems. It also presents some experiences with this methodology as a tool to support integrated management of solid wastes, establishing performance indicators and assessment of environmental impacts. Mankind has walked to the degradation of the natural environment, and needs to decide whether "homo sapiens" will pollute the natural resources with enormous damage to the biosphere, or manage the waste in an integrated manner with the ecosystems in order to keep them sustainable. The accounting in emergy is an important step to assess the ability of Earth to sustain our species.

Keywords: Solid waste, legislation, life cycle, emergy, indicators of sustainability.

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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

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**Session 4B
room 5**

Sustainable Development and Participation Governance: Local Productive Arrangement and Technological Park of the Santos

Proposal for Integration of Sustainability in the Process of Rational Planning

Socio Environmental Survey of Vera Cruz do Oeste Municipality

Investing in Clean Development Mechanism (CDM) Projects

Sustainable Development and Participation Governance: Local Productive Arrangement and Technological Park of the Santos

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The article analyzes the strategy of local, integrated and sustainable development projected in the diverse sectors of the economic activity of the Baixada Santista, in the state of São Paulo, Brazil, with Santos as city that serves of reference in the application of the Participation Governance, objectifying to redirect and to extend the economic vocation of the city, leaving of the matrix of the development, mainly, with the new discoveries of oil and gas in the Basin of Santos, of the Local Productive Arrangement and the implantation of the Technological Park. The actors of this Participation Governance are: Prefeitura Municipal de Santos, ACS – Associação Comercial de Santos, CIESP/FIESP – Federação das Indústrias do Estado de São Paulo, Escritório Regional do SEBRAE e A Agência Metropolitanas do Estado de São Paulo, Escritório Regional da SEMESP – União de Entidades Mantenedoras dos Estabelecimentos Ensino Superior do Estado de São Paulo, including the Universities established in the city: Universidade Paulista - UNIP, Universidade Católica de Santos - UNISANTOS, Universidade Santa Cecília - UNISANTA, Universidade Lusíada - UNILUS, Universidade Metropolitana de Santos - UNIMES and Universidade Federal de São Paulo – UNIFESP e Centro Universitário Monte Serrat - UNIMONTE.

Keywords: Development, Sustainable, Governance, Participation.

Proposal for Integration of Sustainability in the Process of Rational Planning

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Since the presentation of Sustainable Development concept by United Nations Conference on Environment and Development, many initiatives to reach the sustainability can be found in the literature. This article originates from the literature review of sustainability and planning theory and propose a simple structure, which applies the concepts of sustainability within the steps of a process of rational planning to move towards sustainability. It also provides a conceptual and practical understanding of sustainability to be tested in practice.

Keywords: Sustainability, Planning Approaches, Racionality.

Socio Environmental Survey of Vera Cruz do Oeste Municipality

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The present work consisted of the realization of the lifting sócioambiental of the local municipality of Vera Cruz of the West Paraná, through the lifting data of the municipality and the realization of interviews with residents and authorities of public organs on the perception as for the quality of the rivers and the environmental question. The lifting boarded questions on the perspectives of population growth, economical developed activities, rate of mortality, and they wrapped also the environmental questions of the local authority, like data on the supply of water, destination of the residues, instruments of environmental management, principal communitarian organizations and the existence of projects of Environmental Education. The study was carried out through inquiries road Internet, bibliographies and, in some more specific cases, visit to the General offices of Agriculture and of Health of the local authority, what they were extremely receptive regarding the supply of informations, being of basic importance for the conclusion.

Keywords: Lifting socioambiental, Vera Cruz of the West.

Investing in Clean Development Mechanism (CDM) Projects

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The discussion about the Clean Development Mechanism (CDM) began with the effects of global warming and its consequences. Al Gore who produced *An Inconvenient Truth*, which was granted the Oscar of Best Documentary in 2007, kept the flag of climate defender flying. 2005 International Energy Agency Statistics show that developed and developing countries like the United States (21.4%), Japan (4.5%), China (18.7%), Russia (5.7%) and India (4.%) are responsible for just about 55% of the global CO₂ emission. Apparently, no one is discussing the need for radical measures aiming to reduce the emission of Greenhouse Gases (GHG). Bjorn Lomborg, in his 2007 book *Cool It*, questions the practicality of CO₂ reduction with respectable economic arguments; he recognizes the problems, but questions the way to face them and the Kyoto Protocol (KP) itself. In this context Brazil appears as a bastion with a very small contribution of just 1.2% of the global CO₂ emission, especially considering its vast territorial extent. The main contribution of this research is to answer the following questions: CDM projects are profitable? What is the role of Brazil in reducing GHG emission? What is the future of the market for carbon credits after Kyoto?

Keywords: Clean Development Mechanism (CDM), Greenhouse Gases (GHG), Kyoto Protocol, CO₂ emission, Carbon Credits (CC)

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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

São Paulo - Brazil - May - 20-22 - 2009

20th May 2009

18h00-19h30 **Conference**

Yu Xiuling

National Cleaner Production
Center - NCPC, China

**CP Promoting Systems
and its Results in China**

CP Promoting Systems and its Results in China

Xiuling YU

Deputy Director of China National Cleaner Production Center

Cleaner Production has been introduced into China since 1993. After the development in nearly two decades, a comparatively completed cleaner production promoting system has been established in China. This paper makes a detailed illustration on the regulatory system, administrative system, technical supporting system and educational system for promoting cleaner production in China. In particular, this paper elaborates the practice courses of Cleaner Production in China in last two decades, analyzing the characteristic of Chinese Cleaner Production policy in the different historical periods. It also analyzed the results of Cleaner Production promoting system in China according to the investigation and study data of Cleaner Production audit of national key enterprises from 2004 to 2007. The result indicated that the advancement pattern of the voluntary Cleaner Production audit and compulsory Cleaner Production audit effectively promoted the advancement of Cleaner Production in Chinese industry. The consciousness on Cleaner Production of the government, the enterprise and the public have had essential enhancement. The quantity of enterprises which implement Cleaner Production audit has been increasing. The Cleaner Production technical advisory services system was preliminary established. It is obvious to see the energy saving and emission reduction realized by Cleaner Production. Furthermore, the paper proposes some recommendations for the further development of cleaner production in China.

Key words: Cleaner Production; Promoting system, Results, Recommendations

Conferences
and
Oral Presentations

21st May 2009

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21st May 2009

13h00-14h30 **Conference**

Cam Metcalf

University of Louisville, USA

**Industrial Water
Management**

Industrial Water Management

Cam Metcalf
University of Louisville, EUA

The Industrial Water Management Workshop's objective is to define and explain the Kentucky Pollution Prevention Center's (KPPC) process water management (PWM) program, provide examples of the benefits and outcomes of PWM services, and discuss strategies to enhance knowledge sharing.

The University of Louisville's Kentucky Pollution Prevention Center (KPPC) is using technology diffusion approaches to accelerate the adoption of innovative pollution prevention (P2) and energy efficiency (E2) technologies in industrial sectors. Traditional technical assistance that just promotes P2/E2 technologies has not resulted in the implementation of these technologies to the level most technical assistance programs (TAPs) would like to achieve. Technology diffusion can help companies realize that pollution prevention and energy efficiency are a technically and economically viable alternative over pollution control and treatment. The Technology Diffusion Initiative (TDI) program is a unique, market-driven approach to environmental protection that helps business and industry implement pollution prevention and energy efficiency (P2/E2) technologies that solve environmental problems faced by their organizations. The model uses a multi-step, risk-reduction, confidence-building process that provides market conditioning for penetration and accelerates the adoption of technology innovations.

KPPC found that most companies assume that water is relatively inexpensive and not worthy of a significant management effort. They assumed the cost of water was simply the price at the incoming meter. However, when companies are educated that the cost just starts at the meter, then accumulates more costs as it passes through each process, and finally incurs significantly more costs in waste treatment, a totally new perception of water use costs evolves. KPPC realized the need for process water management was sorely needed by manufacturers and TDI could fill this need with a specific process water management focused program. KPPC developed a seven step water management process that initially focuses on building a system and team approach for water use and management. Because the cost savings from efficient water management and implementing P2 technologies went beyond expectations, a behavioral change occurred and companies became more proactive in searching for more P2 opportunities. With the PWM approach, KPPC can positively influence and change the behavior of many Kentucky companies that utilize water intensive processes and save millions of gallons of water per day.

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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

São Paulo - Brazil - May - 20-22 - 2009

14h30-16h00

21st May 2009

**Session 5A
room 1**

Principles Of Thermoelectric In Small Properties

Determination of Relevant Environmental Impacts and Benefits Caused by Balbina Hydropower at Amazon

Energy Efficiency Management

Solutions for Energy Savings and Environmental Compliance Leading to Cleaner & Lower Cost Production

Principles of Thermoelectric in Small Properties

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Among the various types of renewable energy, biomass stands out as chemical energy with high energy density and ease of storage and transport conversion. The residues forming the biomass are from the anaerobic biological degradation of organic matter, and consist of a mixture of methane and carbon dioxide, where these materials are submitted by biomass reactor combustion for the production of biogas. The reactor is a device designed to contain biomass and its product: the biogas. There are several types, are generally composed of two parts: a tank to house and allow the digestion of biomass, and gas tank to store the biogas. Biogas is a mixture of methane, 65% of the volume, and other gases in smaller quantities that represent the remaining 35%. By comparison, one cubic meter of biogas is equivalent to: 0,613 liters of gasoline, 0,553 liters of diesel, 0,454 liters of gas for cooking, 1,536 kilos of firewood, 0,790 liters of hydrated alcohol, 1428 w of power. Creativity allows multiplication of the use of biogas in an agricultural property, just for this, that the scale producers the ability to generate its bioreactor. Therefore, it can becomes a factor of real energy independence. The experimental part of this work is the production of biogas through the cattle, taking the first good results, however, with still some adjustments to achieve the main objective is the production of electricity through the gas. This gas is used as fuel for a stove that burns after heating the water thereby generating a certain pressure, the steam will be led by a simulated turbine that is connected to the generator thereby producing enough energy to meet the consumption and especially with the use of energy sources available, which provides clean and environmentally sound solutions for energy generation and low financial cost.

Keywords: biomass, bioreactor, biogas and generate electric.

Determination of Relevant Environmental Impacts and Benefits Caused by Balbina Hydropower at Amazon

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While Brazil exploits less than 30% of its hydrological potential to generate electricity, the hydroelectric generation system operates near the limit of capacity. In parallel, more than 10 projects, totaling approximately 2,500 MW (megawatts), are hampered, some of them about from 20 years, without generating electricity, due to environmental issues. There is uncertainty in terms of new investments, and controversy about the losses and environmental benefits, this the central point. This study engages in determining relevant environmental impacts and benefits beyond the generation itself, using the methodology of accounting emergy (Odum, 1996), which based on the ecology, thermodynamics and systems analysis, is able to assemble in a common unit (joules of solar energy), values both physical, as social and economic. For both is studied the hydropower Balbina, in the Amazon, selected, first by being considered the worst Brazilian example in terms of environmental performance, second because the northern region of Brazil is that most shows potential to be exploited. This paper presents that Balbina shows favorable environmental sustainability. There are apparent signs, but left doubts about the beneficial role socio-economic. The most representative environmental damage is represented by the emission of gases causing the greenhouse effect, CO₂ (carbon dioxide) and CH₄ (methane), mainly due to the extensive and shallow flooded area, and their inappropriate preparation for flooding, in combination with the natural and complex climatic condition of the Amazon.

Keywords: Production of hydroelectric power; Emergy; Environmental sustainability; Balbina hydropower; Amazon.

Energy Efficiency Management

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Starting from the evidence that, in their forms of natural resources extraction, transformation, transportation, storage and energy use, the energy systems interfere in socio-environmental sustainability components, this work establishes the direct and irrevocable correspondence between kilowatt-hour (kWh) or tons of oil equivalent (toe) produced units, which their equivalent pollution emissions, like tons of carbon dioxide (tCO₂), nitrogen oxides (tNO_x), etc, or human contingents that have to leave their habitat to hydroelectrical plants, etc. In front of this absolute certainty and the high industry energy demand, it's revealed the crucial necessity of the industrial systems for sistematic **energy efficiency** programs. This article also demonstrates that, in its activities of planning, production and treatment of final products and waste (of increasing entropy) and in its high level activities, as research and development of new technologies, processes, materials and products whose result in best efficiency of resources, the Cleaner Production has connection with the energy and with the **energy efficiency**.

Keywords: cleaner production, energy efficiency, energy efficiency management.

Solutions for Energy Savings and Environmental Compliance Leading to Cleaner & Lower Cost Production

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Present dilemma is with 'how to manage the global warming resulting from energy guzzling manufacturing sectors like power, petrochemical, steel, mining, and minerals industries'? Although these operations are essential to sustain the global economy, their impact on climate change can't be ignored. This paper addresses scientific and engineering approach to transform these operations and minimize their impact in our eco-friendly world. The primary objective is in providing total solution for energy savings in vibration and noise reduction for achieving safe, energy-efficient, and cleaner production. The methodology has been substantiated with several practical examples that have been implemented in North America, Europe and other parts of the world, where 15% ~ 25% energy savings have been achieved. "Noise and Vibration" are integral part of critical equipments and processes in the heavy industry sector. These symptoms are indication of turbulent airflow and wasted energy. This paper focuses on "optimization of airflow in plant draft systems" and therefore minimizing the use of energy to generate same amount of work. The present work elaborates on design optimization for achieving energy efficiency and environmental compliance leading to cleaner production – realized by modifying plant draft systems and fan systems using CFD simulation tool, including mathematical modeling and numerical simulation. Implementation of this technology has improved the health & safety constraints in the industry. The outcomes of selected case studies are included for demonstrating the energy savings and the corresponding financial return through the proposed design innovations. In addition, improved inlet and outlet conditions of any pollution prevention equipment (*e.g.*, SCR, ESP, FGD) facilitate enhancement of environmental compliance of these equipments. Further, stream lining the plant draft system has also demonstrated improvement in process yields, improvement in fan and related equipment life as well as flexibility to use lower grade raw materials (*e.g.*, high ash content coal in boilers). The major design innovation is the aerodynamic diffusion system. In the mining industry, such solutions when integrated with CFD modeling would enhance the total systems approach. This is a growing area and gradually receiving corporate attention for conducting studies in improved ventilation system management. Finally, various solutions and technical approach recommended by the authors integrate the three pillars (Economics, Environment, and Society) of sustainable development and helps the operating companies to meet their Corporate Social Responsibility.

Keywords: Aero-acoustics, Energy-efficiency, computational, Fluid Dynamics (CFD), Cleaner Production, Waste minimization, Cleaner production.

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14h30-16h00

21st May 2009

**Session 5A
room 2**

New paint without the use of Coal Tar

Application of Cleaner Production tool in Plastic Recycling Process

The Implementation of the Cleaner Production in the rubber industry - a case study

Substitution of Non-Biodegradable Surfactants Used in Emulsion Polymerizations - A Study of the Polymerization Process and Performance of Products Obtained

New Paint without the Use of Coal Tar

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Due to the Sherwin-Williams concern about the environmental impact and reduction of the hazards in all the supply chain, Sherwin-Williams has developed low toxicity coatings, EPOXY TAR FREE. This painting was developed and introduced in the market with the intention of substitution of EPOXY TAR BASE coatings, which exhibit high inherent toxicity, due to the PITCH, the main raw material of these types of paints. This work has as objective, to demonstrate through comparative tests among TAR base coatings, traditionally used versus the new product TAR Free, some laboratory tests and economical study to show the efficiency of the new product.

Keywords: Tar Free, Epoxy coatings, clean production.

Application of Cleaner Production tool in Plastic Recycling Process

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This work shows suggestions for the accomplishment of the plastic recycling process in an environmentally friendly way, based in the Cleaner Production tool. Besides reduction of plastic consumption or reuse of packing, it is necessary to invest in recycling technology and the selective garbage separation for guaranteeing the minimization of sending waste to landfills. The recyclers, which receive as raw material the plastic waste, carry out the recycling in stages that might guarantee the minimum quality standards for production of new objects. As a tool of environment management, Cleaner Production can be used by companies to reduction of consumption of energy and water, as well as minimization in generation of waste. The stage of laundering, for example, is the one that involves greater water consumption that needs to be saved, treated and reused. The extrusion of the plastic material for molding in new products generates solid residues that also need to be recycled. Although the recycling process treats of garbage generally dirty and contaminated, it shall be carried out with an environmentally correct process.

Keywords: Recycling, Plastic, Cleaner Production

The Implementation of the Cleaner Production in the Rubber Industry - A Case Study

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The increasing ecological awareness, ambient preservation, social justice and concern with the future generations directly are related the support of the companies. This article approaches the concept of Cleaner Production in an industry of rubber manufacture. The economic and ambient advantage in the rubbish recycling is boarded, applied in a small company of rubber manufacture in Brazil in the search for the modifications in its processes and the phases of the production cycle that can adjust the acceptable and ambiently conscientious criteria. Thus the financial benefit acquired in the recycling in the rubber production will be mentioned and the ambient benefit. For this intention the methodology of Intensity of Material will be used (Wuppertal Institute). The tool was applied to evaluate the benefits in the scale of the biosfera as consequence of the reduction of emissions on account of intervention Clean Production.

Keywords: Cleaner production; Rubber production; Rubber recycling; Sustainable.

Substitution of Non-Biodegradable Surfactants Used in Emulsion Polymerizations - A Study of the Polymerization Process and Performance of Products Obtained

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Emulsion polymerization is considered a safe, economic, versatile, and consequently of interest as an environmentally friendly process. However, surfactants utilized need to be biodegradable, and still guarantee a good film quality, with an adequate performance according to its end use. We investigated the substitution of an alkyl phenol ethoxylated (APE) surfactant, commonly for a sulfosuccinate surfactant, which degrades in a week in contact with soil. Replacement was conducted keeping in mind the properties obtained in the final latex, in addition to the biodegradability of the surfactant. To adequately understand the behavior resulting from the replacement, it was necessary to study the surfactant kinetic effect, as well as the effect on particle size distribution, considering that water soluble and water insoluble monomers are utilized, as needed for paint formulations. Different copolymerization and terpolymerizations were conducted, with combinations of the monomers styrene, n-butyl acrylate, acrylic acid, methacrylic acid, and acrylamide, which are of very significant industrial interest for the film performance of paint formulations. Particle sizes were measured and related to the dual mechanism of polymerization, with the contribution of the aqueous phase polymerization, and which also affects to the final emulsion viscosity.

Keywords: polymerization, emulsion, surfactants, biodegradability.

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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

São Paulo - Brazil - May - 20-22 - 2009

14h30-16h00

21st May 2009

**Session 5A
room 3**

Glycerol: An Innovative Energy Source From Biodiesel Production

Energetic & Environmental Framework of Biofuels Plants

Obstacles for Brazil's Consolidation in Cleaner and Renewable Energy Production

Environmental Impacts and Biodiesel Production in Pilot Scale

Glycerol: An Innovative Energy Source from Biodiesel Production

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The world concern on applying public policies focused mainly on environmental-friendly energy production is observed in a great deal nowadays. In this viewpoint biofuels assume an outstanding position since they present a large number of benefits and advantages when compared to the fossil ones. Among those benefits it is possible to point out the reducing emanation of gases responsible for the greenhouse effect, possibility of carry out regional, social and agricultural development and both in a sustainable way. Biodiesel is an example of biofuel that has been carried a great deal of effort to become applicable in the productive net. This fuel is obtained from biological and, consequently, renewable sources as vegetable oils and animal fat, and it presents a strong biodegradable characteristic. No less important, biodiesel produces a low amount of pollutant gases from its oxidation process and it can replace with advantages several fossil derivative compounds. Biodiesel is obtained from the transesterification reaction of distinct kind of oils that, under the action of a catalyst, chemically react with an alcohol (usually methanol or ethanol) producing esters (biodiesel) and glycerol as sub-product. Brazil has assumed a remarkable position in the world energy scenario with the biodiesel production and policy of use in its fleet oh heavy duty vehicles. As a consequence of this policy (PROBIODIESEL) is it planned for the next decades a gradual addition of the biodiesel to regular diesel (up to 20% rich biodiesel fuel in 15 years). It can be easily predicted a real problem concerning the use of the waste glycerol from this growing demand of biodiesel. As a matter of fact, for each ton of produced biodiesel it is parallely obtained 100kg of waste glycerol that can become an adverse result to the biodiesel economy. This paper proposes the use of waste glycerol from biodiesel production as a fuel in fuel cells. This highly promising proposal corresponds to the oxidation of this alcohol in a Direct Alcohol Fuel Cell. The reaction can potentially produce three times more energy than methanol under the same experimental conditions, with the additional advantages of non-flammability and non-volatility characteristics. In conclusion, the paper will discuss the state-of-the-art of this technology in the light of the future Brazilian bio-energy scenario.

Keywords: biofuel, biodiesel, glycerol, fuel cell

Energetic & Environmental Framework of Biofuels Plants

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This article addresses the variables of energy and environmental of Biofuels Plants, especially when licensed in the State of São Paulo, with focus on the National Planning of the Electricity Sector, the National Plan of Proálcool and Agroenergy, the Bioenergy in São Paulo State Environmental and Licensing Biofuels Plants. Under the National Energy Policy are considered the studies that prioritize the long-term vision of the sector of energy and are developed by the Ministry of Mines and Energy (MME) and National Energy Plan 2030 (PNE-2030) and the Ten Year Plan for Expansion Electric Energy (PDEE). It is then reviewed the Proálcool, program for the production of ethanol from sugar cane that the federal government sought to encourage in the 70s, the production of alcohol in place of pure gasoline, reducing imports of oil. Recently established the National Plan of Agroenergy, which presents some challenges for ethanol such as the development of technologies sparing of inputs and the elimination or mitigation of environmental impacts. The State of São Paulo, in turn, has said and also established a goal to create a Bioenergy Plan Paulista, considering not only the issues related to national and international markets for ethanol, but also the environmental aspects as management, legal reserve, emissions weather and fire, mechanized harvesting, water consumption and carbon emissions. Finally, this article discusses the administrative procedure of environmental licensing of Biofuels Plants, giving emphasis to studies and reports on environmental impact (EIA / RIMA) of such business, and stating the main environmental variables related to licensing, such as: Public Hearing ; Strategic Ethanol Project Green and Agro-Environmental Protocol; Zoning AE, Agricultural Policy, Master Plan, Soil Use and Occupancy; Impact Assessment Neighborhood, Fauna, Flora; Permanent Preservation Area (APP); Legal Reserve (Reserve Legal); harvest of the Cana - -Sugar; Conservation Units; Compensation Environmental, Water, Waste and Wastewater; Fertirrigação System - Vinhaça, noise emission, Atmospheric Emissions, Environmental Education and Heritage Paleólogos, Archaeological and Historical Monuments of Cultural Value.

Keywords: Energy; Environmental; Licensing; Biofuels Plants.

Obstacles for Brazil's Consolidation in Cleaner and Renewable Energy Production

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The discussions concerning the use of natural resources (the ways they are explored and their possibility of being lack) have intensified. Considering it from a historical view, several meetings have been conducted worldwide and were important to consolidate the notions related to Sustainable Development and Cleaner Production. In the first case (Sustainable Development), the concept was affirmed in the 1970s and 1980s, with the concern that the present development would not jeopardize the future generations development. Also to complement this idea, the Cleaner Production notion starts to rise in the following decades trying to improve the country's efficiency in productive aspects, mainly in the use of raw material, water and energy, aiming the generation of economic and environmental benefits in the production process. In Brazil, the alignment with this new development paradigm has been applied in energy production. The sugar / alcohol sector, by producing and processing the sugar cane, contributes to the clean and sustainable production of technologies: ethanol (as fuel) and the energy from biomass – using the sugar cane bagasse. The advantages of the use of ethanol compared to other energy use (fossil and from other vegetable crops) are mainly economic and environmental ones, besides providing a greater energy balance. Another favorable aspect in using the sugar cane bagasse to produce energy is the fact that Brazil has great natural richness, topography and favorable physical features to agriculture, which would reduce the exploration of scarce hydric and fossil resources. However, it is necessary to underline the obstacles that make the sustainable production difficult. Thus, this article aims to discuss the problems, which are found inside and outside the country and which makes the country consolidation difficult as an important world producer of clean energy, as well as the strengthening of these productive activities. As for the ethanol, there are some politic-economic, environmental and social problems that must be solved, like the protectionist measures established by importers; the effective reduction of polluting gases by adopting more efficient productive processes; working conditions and wages for the sugar cane activity. As for producing electricity from sugar cane, there are some legal obstacles related to the regulation of the sector. Thus, some efforts are necessary to make this consolidation possible, by adopting public policies that ensure the investments made so far, considering the local and global markets; better organization management; the definition of areas used in sugar cane exploration, etc. Surely, sugar cane activity is a promising business, though promoting a sector development by damaging the development of others, might be a mistake.

Keywords: sustentability; renewable; sugar cane; ethanol; energy.

Environmental Impacts and Biodiesel Production in Pilot Scale

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The biodiesel production in pilot scale could be accomplished with minimum environmental impact. In this work was evaluate a prototype produces at UNISC for production of sunflower oil biodiesel using Leopold interaction matrix. It was consider the process stages and the actions for minimization of the environmental impact this equipment. It was observe that after the needs environmental actions for improvement of equipment it was reduce the environmental impact during biodiesel production. Therefore, the impact in relation to order (direct or indirect), time (long, average or short term), dynamics (permanent or temporary) and of plasticity (reversible or irreversible) was reduces and, it can be observed as a positive actions control, when adopted, they had affected the ambient factors in its excellent characteristics and allow to greater the sustainability of the process.

Keywords: biodiesel, environmental impacts, pilot scale.

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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

São Paulo - Brazil - May - 20-22 - 2009

14h30-16h00

21st May 2009

**Session 5A
room 4**

Industrial Ecology as strategic tool for environmental policy-making process in Brazil

Comparative Study of the Sustainability and the Human Development Index

Environmental Public Policy and Performance Improvement Induction: an Initial Review

CP Promoting System in China

Industrial Ecology as Strategic Tool for Environmental Policy-Making Process in Brazil

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Most of today's environmental policies in Brazil rely on controlling the growth of pollution by "command and control" techniques. During the last two decades, these instruments have been designed to control sources of environmental impacts using industrial zoning, environmental licensing, and emission standards. The present structure of environmental law and policy focuses almost entirely on the activities of manufacturing companies and does not recognize strategies related to pollution prevention and/or cleaner production — such as product life cycle assessment, environmental labeling, environmental management systems, interconnectivity of production process, extended producer responsibility strategy, and environmental certification — as important instruments for auto-regulation. Recognizing that environmental policy must become more focused on "command and covenant" than "command and control", this article attempts to provide an expanded perspective of environmental policy innovation based on a more holistic approach — Industrial Ecology — as a strategic tool for environmental policymaking process in Brazil.

Keywords: industrial ecology; environmental policy; cleaner production.

Comparative Study of the Sustainability and the Human Development Index

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This paper presents the environmental and economic study of the city of São Luís was used in the accounts came to calculate the ESI. It develops also study about the HDI and related method is by comparison with other cities. It is the result that the city of São Luís has a medium ESI, equal to 2.9. The ESI is much better than the other cities under study have a high HDI, thus generating a discussion between the development model adopted by the cities.

Keywords: Emery, Human Development Index, urban sustainability, ternary diagram.

Environmental Public Policy and Performance Improvement Induction: an Initial Review

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Recently it has been possible to verify great advances in corporate environmental management, in part due to environmental regulation - that imposing cost for legal accomplishment stimulates the search for preventive solutions and cost reduction. Environmental public policy instruments on this sense have grown beyond traditional standards and permits to economic tools, and more recently to innovative mechanisms called as "performance based". This kind of instrument, characterized by the consideration of the enterprise own environmental performance as a criteria to regulation enforcement has been adopted on several countries, mainly United States. The present article, preliminary result of a doctorate research on the theme, brings an analysis of some important studies concerning corporate (and more specifically industrial) environmental public policies, environmental performance measurement and tool, to summarize and evaluate some performance based experiences. At the end it is possible to perceive a high potential to implement this kind of instrument in Brazil, and more specifically on São Paulo State, both to allow differenced sector criteria negotiation and to face new environmental challenges still not covered by actual legislation, as greenhouse gas emissions and endocrine disruptors.

Keywords: environmental public police; environmental management; environmental performance; regulation; cleaner production.

CP Promoting System in China

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Cleaner Production has been introduced into China since 1993. After the development in nearly two decades, a comparatively completed cleaner production promoting system has been established in China. This paper makes a detailed illustration on the regulatory system, administrative system, technical supporting system and educational system for promoting cleaner production in China. Furthermore, the paper proposes some recommendations for the further development of cleaner production in China.

Keywords: cleaner production, China, promoting system, recommendations

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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

São Paulo - Brazil - May - 20-22 - 2009

14h30-16h00

21st May 2009

**Session 5A
room 5**

Assessment of the Presence of Ecodesign Principles in a Chemical Company

LCA of Public Luminaires: Proposal for Mapping Production Flow for Inventory

Saving Productive Resources through Simulation Models Studies

Physical-chemical characterization of residues from plum (*Prunus salicina*) orchards

Assessment of the Presence of Ecodesign Principles in a Chemical Company

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This paper presents a case study about ecodesign constructs assessment based on a multicriterial decision support method, the Analytic Hierarchy Process (AHP). The assessment took place in a chemical firm. The methodology was developed considering that the application in other organizations, belonging to other industries, is available. Firstly, a theoretical framework about ecodesign concepts and practices was prepared. Then, a focus group with multidisciplinary team of experts in eco-conception identified seven ecodesign constructs describing the top term ecodesign. The constructs are: materials, product components, product and process characteristics, use of energy, product distribution and stocks, packing and waste. Each construct was deployed in items. Using the AHP, the ecodesign constructs were weighted by the company respondents and it was possible identified the relative importance of each construct. The constructs with higher degree of importance were product and process characteristics and waste. At the end, a questionnaire was answered by the company team in order to check the performance of each item. Compiling the items performance, we can assess the construct performance. By comparing the assessed performance with the relative importance of each ecodesign constructs, it was possible to measure the gaps between importance and performance.

Keywords: ecodesign; design for environment; Analytic Hierarchy Process.

LCA of Public Luminaires: Proposal for Mapping Production Flow for Inventory

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Considering the efforts of the various instances of government and the productive sector to minimize the consumption of electricity for lighting and thereby budget gain, there is a generalization of procedures exclusively towards the replacement of technology from a simple analysis focused only on saving energy. However, there is a number of parameters whose analysis should compose an inventory and thereby assist the decisions of the energy concessionaires of municipality administration, and to subsidize manufacturing projects. This inventory could aid decisions with a focus on sustainability in the use of equipment for lighting and so there would be an aggregation of value and promote greater environmental responsibility within the framework of public policies apply. This paper proposes a mapping of the flow of production of luminaires for street lighting to be used as reference for the application of the Life Cycle Assessment - LCA methodology. With this methodology, the results may provide support for product development from the perspective of sustainability.

Keywords: public luminaires lca, street lighting production inventory.

Saving Productive Resources through Simulation Models Studies

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The necessity of sending goods produced in several different geographical positions highlights the logistics strategy so that the involved costs may become minimized. The presented study points the importance of the knowledge about simulation, using it as a support tool for the decision in the transport logistics, focusing the size of a truck's fleet. It will be added the concept of simulation with the logistics strategy, intending to improve the way of spending the resources. The research develops in a highway transporter loads station. Through simulation the actual results will be compared to the supposed one. The productivity increase in the use of different transportation ways reflects positively in the environmental preservation reducing the energy and raw materials consumption used in the production of these equipments and the fuels to move them.

Keywords: Simulation; Logistic; Environmental preservation; Productivity

Physical-Chemical Characterization of Residues from Plum (*Prunus salicina*) Orchards

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Thinning fruits are considered as a residue from plum fruit orchards. Until the crop the culture goes by several common processes in the horticulture, belonging one to them the practice of the thinning that is characterized by the retreat of the fruits still green, 45 days after the to budding totaling in 80 to 90% of the fruits of the plant, could represent 5 thousand tons of residue approximately for harvest, these are discarded in idle areas of the property without defined use. Valorization from this residue, on clean technology concept, needs a profound knowledge of its chemical composition. The aim of this work was characterize the chemical-physical property of the thinning fruits (*Prunus salicina* cv. Harry Pickstone), to study its possible application as minerals, organic acids and natural antioxidants sources. Mineral composition of this residue shown the manganese as the principal element, of the sequence: Mn > Na > K > Zn > Fe > Cu > Mg > Ca. High Performance Liquid Chromatographic assay detected: gallic, caffeic, protocatechuic, syringic, p-coumaric, vanilic and chlorogenic acids on phenolic fraction. Result suggests the use of this thinning fruits as potential raw material of antioxidant compounds.

Keywords: Orchards, waste, physical-chemical characterization.

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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

São Paulo - Brazil - May - 20-22 - 2009

16h30-18h00

21st May 2009

**Session 5B
room 1**

Minimization of Foundry Sand Generation Using Tools From the Cleaner Production Program

Sustainable Raw material use and Reduction of Effluent Residues and: Cases of Success

Cleaner Production in Sector for the Manufacture of Leather Artifacts: Overview and Considerations

Environmental Technology for Tanneries and their Adequacy for Projects of Clean Development Mechanism (CDM)

Minimization of Foundry Sand Generation Using Tools from the Cleaner Production Program

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The metal casting process generates several kinds of solid wastes, where the used foundry sand is the main one and most of it is generated during the check out of the solid metallic parts from the molds. The increase of the solid waste deposition costs, the creation of specific environmental legislation, and the low environmental performance of *end of pipe technologies* have brought efforts in the development of more effective solutions. The waste minimization means to change paradigms, because it constitutes a new concept of environmental management based on the principle of prevention of pollutant generation, and the reduction of the solid waste amounts being treated or disposed. Based on the cleaner production methodology tools, the present work evaluated the process of metal casting focusing in the minimization of the solid waste used sand generation from the Foundry Company Metalcorte Metalurgia Ltda, suggesting minimization opportunities for this waste. It was also considered some environmental, technical and economical aspects, which are important to choose the best opportunities to be implemented. The suggested opportunities have several levels of complexity. Some of them may be implemented immediately, while others require research development to become viable considering technical, economical and environmental aspects, depending on the type of opportunity, such as regeneration of used molding sand, reutilization processes, and the substitution of materials, which generate toxic gases. The implementation times are variable and an implementation chronogram can be elaborated, focusing those ones which can be implemented in a short and medium term. On the other hand, the long term alternatives need more profoundly studies. It must be emphasized that from the 19 opportunities studied in this research, 9 are low cost opportunities and can be easily implemented by the company in a short term. The foundry sand waste presents a good potentiality of minimization accordingly the extensive list of opportunities which were identified. At the same time, considering the complexity of metal casting processing and also the methodology developed by UNIDO-CNTL, the implementation of a cleaner production program in this kind of company needs investigation like the one presented here to stimulate the company managers for applying efforts to waste generation prevention, using effective and viable tools to search the sustainable development in this industrial sector.

Keywords: Metal casting, used sand, minimization, cleaner production.

Sustainable Raw Material use and Reduction of Effluent Residues and: Cases of Success

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The Cleaner Production (CP) Program uses the UN Environment Programme methodology with a focus in the sustainable development. The companies that use the CP Program include their ecoefficiency indicators in an international UN network. The starting point for CP consulting is the analysis of productive processes in order to find technology solutions to reduce the wastage of energy sources, raw materials and water, as well as reducing residues, effluents and emissions. This paper will be show four successful cases about CP methodology.

Keywords: Implementation Cleaner Production, Success cases, Environment Success.

Cleaner Production in Sector for the Manufacture of Leather Artifacts: Overview and Considerations

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The environmental concern with the residues of the Sector of Manufacture of Leather Devices is justified by the high generated volume and by the degree of contamination with toxic metals of these residues. The residues of the leather contain high dosage of chromium - substance used in the tanning of bovine skin. It's not degradable, chromium is a risk of contamination of soil and groundwater in areas where residues are deposited. The substance is a heavy metal that can cause allergies and even cancer, if present in large quantities in the human body. Heavy metals, such as chromium, differ from other toxic agents because they are not synthesized or destroyed by man. Residues containing toxic metals have high power to contamination, than the cost of the high cost for its disposal in industrial landfills. Within this context, the paper presents an overview on the sector, the importance of the methodology of Cleaner Production and the first steps of this tool to evaluate the productive process and try to minimize residues generation, reduce costs, increase competitiveness and gain environmental sector and the population as a whole.

Keywords: Residues, Leather, Chrome, Cleaner Production, Management System

Environmental Technology for Tanneries and their Adequacy for Projects of Clean Development Mechanism (CDM)

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This work identifies and describes residue treatment technologies for the tannery industry. The objective was considering each technology face to its potential to fulfill the requirements of a clean development mechanism (CDM) project. The CDM offers a source of revenues that might facilitate the adoption of environmental benign technologies by the industry, and therefore, aligns global and local benefits.

Through a literature review we identified technologies that could be associated with CDM approaches and the CDM methods that already have been applied to the industry. Despite their high cost, low thermal conversion and gasification of residues are among the most promising technologies. Our next efforts consists of an emission inventory of the tanneries coupled to technical and economic feasibility studies of the most promising alternatives so that we propose a CDM road map for the sector.

Keywords: Tanneries, Alternative waste treatment, Clean Development Mechanism.

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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

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**Session 5B
room 2**

Environmental Performance Evaluation Based on the Concept of Cleaner Production

Diagnosis of the Forest Fragmentation on Watershed Córrego Poço Grande, Ouro Verde do Oeste City, Paraná

The Search for Sustainability of PET through the Supply Chain Sustainability

Evolution of Industrial Environmental Approaches

Environmental Performance Evaluation Based on the Concept of Cleaner Production

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The SENAI National Department (ND), under the NCCT - National Center of Clean Technologies of the SENAI Rio Grande do Sul technique coordination, in joint with the São Paulo, Rio de Janeiro, Minas Gerais and Bahia Regional Departments, developed a project pilot whose objective was to establish an Environmental Performance Measurement Methodology to identify and validate the environmental and processes indicators in companies who implemented the methodology of Cleaner Production developed by the UNIDO/UNEP and intended to get a Certificate of Environmental Performance. In the first phase of the project a listing of companies registered in cadastre as participant of the Suppliers Qualification Program - SQP was elaborated by the Euvaldo Lodi Institute - ELI, in which the Environment Area of the SENAI Bahia Regional

Department, located in the CETIND Unit, promoted the environment workshops. Based on the involvement level of the high administration companies, the physical structure, evaluation of the processes block diagrams and action plans were suggested for the SQP, where the possible companies candidates were selected to be part of this project, that demanded as minimal

requirements, to belong at least, of one of the following sectors: metal-mechanic, construction civil, chemical, paper-graph and editorial and clothes-textile, that have implemented action of Cleaner Production and they did not have any legal nor environmental no conformities together the regulatory environmental agency. The selected companies signed the Adhesion Term, having committed themselves to support their development of the activities foreseen in the scope of the project; which included the accomplishment of environmental diagnosis of the company, through the study of the stages of the productive process; environmental, economic and social identification of the aspects and impacts; definition of the environmental and processes indicators to be monitored during six months and in an annual basis per more 3 years, as goal proposal and was committed between the parts; fulfilling the Performance Evaluation Data with the measurements of the indicators during the six first months; justifications and evidences of the attendance; an environmental external audit carried through by SENAI ND. The project had as

premise to issue an Environmental Performance Certificate for companies who reached 80% goals and to establish a process of external audit for verification of conformity and proposal of new indicators to be pursued as continuous improvement.

Keywords: Cleaner Production, environmental and processes indicators, metal-mechanic, chemical, clothes-textile.

Diagnosis of the Forest Fragmentation on Watershed Córrego Poço Grande, Ouro Verde do Oeste City, Paraná

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The forest fragmentation resulting from the antropic action threatens the biodiversity of ecosystems, be for the extinction or record reduction in the present genetic diversity in the fragments. The great devastation in search of new arable areas and of more space for growth of the cities has result in a mosaic of forest fragments an every chance minor and more isolated, still hindering more the conservation of the genetic and biological diversity of the natural ecosystems. The environmental adaptation of the rural properties proposed by the Project Management by Basins, integral of the Program Cultivating Good Water, idealized by Itaipu Binacional together with several partners, it seeks, besides other, the reduction in the impacts caused by the forest fragmentation, through the restoration of the areas of permanent preservation and of missing reservation legal. The present work evaluated the existent forest fragmentation in the Córrego Poço Grande watershed, municipal district of Ouro Verde do Oeste, Paraná. The microbacia was object of work of the Project Management for Basins, where the rising was accomplished to field of the cadastral data, the use of the soil, environmental liabilities and georeferencing of the rural properties. The data were processed for elaboration of the cartographic maps of the properties, map of environmental diagnosis and project of environmental control, and the mosaic of use of the current soil and proposed after environmental adaptation of the watershed. Through the formed mosaics the number and the size of the existent forest fragments were quantified in the watershed, the same ones were characterized as of area of permanent preservation or of legal reservation, and classified in agreement with the busy area. 65 forest fragments were observed in the watershed, and legal reservation's areas came more fragmented, totaling 60 fragments. Most of the fragments was considered small and very small, could be the bottle mouth for the preservation and survival of the fauna and flora native of the area. The presence can be observed of only three fragments considered exceptional, whose areas would supply conditions for the development of a lot of species, tends conditions of maintaining the natural biodiversity of the area.

Keywords: Area of constant preservation, forest fragmentation, legal reserve.

The Search for Sustainability of PET through the Supply Chain Sustainability

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These instructions present to examine the reverse logistics of PET, pointing from the flaws and shortcomings, try to point out in search of sustainability. For this use two case studies: the first examines three cooperatives and profile of collectors in relation to PET, according to the census by ABIPET, lifting chain reverse data on the material. From data collected, and with the help of a literary review, indicate the sustainability of PET through a sustainable supply chain.

Keywords: Sustainability, PET, supply chain, recycling.

Evolution of Industrial Environmental Approaches

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The industrial sector has began, in the 21st century, to rethink and redesign its production processes aiming to minimize natural resources depletion, to foster the use of environmental friendly materials, to research the impact related to the products throughout their life cycle, and to recognize the interdependence between environment and industrial systems in order to change from processes based on unidirectional flows of energy and materials into closedloops systems. During this period, a number of instruments were developed to fulfill the industry needs. For that reason, this study analyzes the evolution of environmental approaches in the industrial scenario in order to discuss the instruments used to achieve the environmental sustainability of business.

Keywords: Environmental approaches. Corporate environmental sustainability; Environmental management tools; Industrial Ecology.

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**Session 5B
room 3**

Proposition of a Method for Remanufacturing Based on QFD

Application of the Concept of Industrial Ecology to the Integrated Management System: Advantages and associated environmental improvements

Innovation and Cleaner Production: The MONGEE SYSTEM – GREEN GASES TRACKING INFORMATION SYSTEM

Managing I/O material flows in industrial processes – A key step towards sustainable production

Proposition of a Method for Remanufacturing Based on QFD

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The increasing of eco-design methods during the last decade helped designers to consider the environmental issues in the product development. But many of these methods don't analyze the end-of-life strategies of the product, as for example the remanufacturing. This paper has as the goal to propose a method based on *Quality Function Deployment* (QFD) applied on the remanufacturing. This method can help designers in the early phases of the product development where the main decisions about remanufacturing must be taken.

Keywords: QFD, Remanufacturing, Product Development.

Application of the Concept of Industrial Ecology to the Integrated Management System: Advantages and Associated Environmental Improvements

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The need for making human systems part of the natural ecosystems and similar to natural environment is clearly stated. This approach, which is the basis of Industrial Ecology, aims to enhance industrial symbiosis that might contribute to mitigate process or material loss. However, it is not very common to amend Industrial Ecology principles to management systems and furthermore, to Integrated Management Systems. Therefore, the main objective of this work was to evaluate the sustainability impact of integrating the Industrial Ecology approach to the existing Integrated Management System at an electro electronic company in Brazil. The defined methodology followed the most important premises of Industrial Ecology aligned to the Integrated Management Systems requirements in the electro electronic sector. The case study was based on a worldwide company that presented all the segments within the sector, that is, microelectronics, surface mounting technology, printed circuit board, mounting and logistics. Moreover, the study considered material flow and performance analysis in order to define potential industrial metabolism and sustainability degrees, besides implementing an Industrial Ecology computer program that enabled better information communication and control. It was possible to conclude that the Industrial Ecology concept tools used in the company did benefit its industrial sustainability because it allowed more efficient processes through the use of metrics, involved most of the employees and operations, favored better process standardization, enhanced the systemic approach making the decision process easier once it was based on real time facts. It was observed that it also contributed to the adoption of methods, systems and procedures that enabled deep strategic change and improved cultural change, which is one of the essential aspects of sound sustainable development. Finally, it is suggested that Industrial Ecology be used as a fruitful metaphor for facilitating the improvement of sustainability. The tools developed in this study might be easily applied to any enterprise, independently of its size, level or production processes.

Keywords: Sustainability. Industrial Ecology. Industrial Metabolism. Balanced Scorecard. Key Performance Indicators.

Innovation and Cleaner Production: The MONGEE SYSTEM – GREEN GASES TRACKING INFORMATION SYSTEM

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Monitoring greenhouse gases information on the North Santa Catarina Plateau, at Brazil South Region, aims ensure the timber industry to share relevant and accurate information supporting positive environmental actions in an increasingly competitive export focused market. With this in mind, the deployment of an Information Management System based on Artificial Intelligence and Ontologies intends to support the process management of cleaner production to be implanted, assists and accelerate decision-making with regard to best practices on environmental management at the regional forestry activities. An intelligent storage and retrieval information system for cleaner production management at the timber industry will allow innovative technology results, integration the production chain through the use of a knowledge database in addition encouraging the establishment of an integrated management model for the industry focused on the uniform growth of the chain and improvement in environmental management.

Keywords: Intelligent Systems, Monitoring, Green Gases Effect, Environment, Cleaner Production.

Managing I/O Material Flows in Industrial Processes – A Key Step Towards Sustainable Production

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Industrial wastes consist of unused resources in the production process, which create costs and no added value. Measuring input-output material flows at a company level is therefore crucial for waste prevention, which is a key path towards higher resources productivity. Waste prevention strategies focus in particular on reducing or eliminating undesired waste streams, and managing by-products within the production process, rather than treatment and disposal approaches. In the long run, prevention strategies are more cost-effective and environmentally sound than conventional pollution control approaches. Waste prevention strategies apply to any manufacturing process and range from relatively easy operational changes and good housekeeping practices to more extensive changes such as replacing input materials, fine tuning or replacing equipment, or even making use of state-of-art technology. This paper provides insights on the development and testing of a toolbox for the inventory and management of waste flows looking forward to implementing a 'zero waste' strategy. Twelve case studies selected within seven Portuguese industrial branches were explored. The toolbox included an activity based costing methodology, as well as detailed process mapping and material balances used at company level to measure resource flows and undesired waste streams, and thus to fix optimisation targets by integrating waste prevention into business strategies. In each company, empirical results showed: a) The usefulness of the approach; b) how powerful waste prevention is providing strategic inputs for decision taking (a hierarchy built on a economic and environmental basis); c) how critical operating conditions are, and therein both branch or company's culture, in order to influence the implementation of waste prevention initiatives. Main conclusions drawn from those case studies enable to propose both: a) at a micro level, new options for strategic improvement; b) at a macro level, hypotheses about how public policies may address waste prevention and about the diffusion of eco-efficiency in those industrial branches in order to pave the way towards sustainable production.

Keywords: Manufacturing; strategy; performance-measure(s); methodology; innovation.

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**Session 5B
room 4**

Analysis of phenolic compounds, methylxanthins and antioxidant activity of erva-mate (*Ilex paraguariensis* A. St. Hil.) residue: a new potential source of antioxidants

Zero discharge of galvanoplasty's effluent - Use of a reactor for high efficiency of electrocoagulation-flotation combined with ion exchange resins for plating wastewater treatment

Plasma Processes as a Cleaner Alternative for Cleaning, Corrosion Resistance, and Functionalization of Metallic Surfaces

Modelling of a DR Shaft Operated with Pure Hydrogen Using a Physical-Chemical and CFD Approach

Analysis of Phenolic Compounds, Methylxanthins and Antioxidant Activity of Erva-Mate (*Ilex paraguariensis* A. St. Hil.) Residue: a New Potential Source of Antioxidants

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The erva-mate (*Ilex paraguariensis* A. St. Hil.) is a plant found in Brazil, Paraguay and Argentina, countries with the only producer worldwide occurrence, which holds significant social and economic importance. Due to the beneficial effects of erva-mate, its consumption is not confined only to producing countries. Among these tasks is their antioxidant properties, which can contribute to protection against oxidative processes in the human body, among these tasks is their, such as phenolic compounds and tannins the chemical compounds responsible for this effect and stimulant properties attributed to its contents of methylxanthins, such as caffeine. The aims of this research were to evaluate the phenolic, methylxanthinic and tannin composition of erva-mate residue (mate powder), to compare the quali/quantitative phenolic composition of extracts obtained from distinct solvent systems and the antioxidant potential of those extracts. Among the extracts prepared with different solvents, the 80% methanol extract showed the highest total polyphenol content (11.51 g/100g) followed by methanol acid, ethanol acid, 80% ethanol, distilled water and water acid. To compare the results of the TPC and antioxidant activity of the extracts is possible to observe that the higher phenolic content of the extracts resulted in increased antioxidant capacity in DPPH• e ABTS•+ methods. HPLC analysis showed 4,5 dicaffeoylquinic acid as the highest component of the phenolic fraction of mate powder followed by chlorogenic acid. The caffeine, teobromina and tannin contents in mate powder were 1.01, 0.10 and 0.29 g/100g respectively. According to the results, this residue can be used as an ingredient in the formulation of functional foods adding value to the waste generated during processing of the erva-mate. Consumption of mate powder would significantly contribute to the antioxidant and stimulants intake, providing high amounts of phenolic acids, tannin and methylxanthins with potentially beneficial biological effects for human health.

Keywords: Ilex paraguariensis; residues; mate powder; phenolic acid; antioxidant capacity; methylxanthins; tannin

Zero Discharge of Galvanoplasty's Effluent - Use of a Reactor for High Efficiency of Electrocoagulation-Flotation Combined with Ion Exchange Resins for Plating Wastewater Treatment

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This paper presents some results obtained after implantation of a reactor for high efficiency of electrocoagulation-flotation (ECF-AE) to replace the method of physical-chemical reactions traditionally used in plating wastewater treatment (ETEG) of the Termogal Tratamento de Superfícies Ltda , Itu-SP, Brazil. The effluent leaving the reactor after ECF-AE filtration of solid particles is percolated into ion exchangers (IER) to ensure the removal of contaminants levels of heavy metal waste. The effluent is reused continuously in a closed circuit. After the implementation of the ECF-AE reactor, there was a reduction of up to 91% in the use of chemical reagents in ETEG, and improving the quality of the effluent after removal of the reactor compared to the treated effluent by conventional physico-chemical method.

Keywords: Electrocoagulation, electroflotation, electroplating, ion exchange resin, reuse.

Plasma Processes as a Cleaner Alternative for Cleaning, Corrosion Resistance, and Functionalization of Metallic Surfaces

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The development of clean and efficient high vacuum technologies to replace traditional methods for metallic or polymeric surfaces treatments to clean, deposit thin films, and functionalize surfaces, constitutes a very important area of research. The increasing concern regarding the development of environmentally friendly and sustainable technologies consists in an important objective in the modern world. In this context, cold plasma technology represents an efficient alternative, which has been object of increasing attention. In this work we evaluate the effect of plasma treatments on the removal of oil from aluminum surfaces. Furthermore, processes of deposition, and fine film activation, were studied on the surface previously cleaned. After a first plasma application to clean the oil contaminated aluminum surface, a thin film of HMDSO was deposited to achieve corrosion protection, and finally the deposited film was functionalized to obtain a surface with a higher energy, to favor adhesion to different polymers. The evaluation of the cleanness efficiency was conducted by means of the contact angle, and XPS. The nature of deposited and functionalized film was investigated using Fourier Transform Infra Red Spectroscopy (FTIR), angle of contact, and Scanning Electron Microscopy. A very significant reduction in the carbon content of the surfaces, was observed. An increase in the surface energy of 95,48 mN/m was obtained. Cleaning, corrosion protection and functionalization utilizing high vacuum technology can completely substitute wet processes associated with undesirable high environmental impact. In the presentation other works developed by the research groups will be discussed.

Keywords: Plasma, cleaning, surface modification, hexamethyldisiloxane.

Modelling of a DR Shaft Operated with Pure Hydrogen Using a Physical-Chemical and CFD Approach

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In an effort to develop breakthrough technologies which enable drastic reduction in CO₂ emissions from steel industry (ULCOS project), the reduction of iron ore by pure hydrogen in a Direct Reduction shaft furnace was investigated. After experimental and modelling studies, a 2D, axisymmetrical steady-state model called REDUCTOR was developed to simulate a countercurrent moving bed reactor in which hematite pellets are reduced by pure hydrogen. This model is based on the numerical solution, by finite volume method, of the governing equations, including continuity and local mass, energy and momentum balances of the gas and solid species. A single-pellet sub-model was included in the furnace model to simulate the successive reactions ($\text{Fe}_2\text{O}_3 \rightarrow \text{Fe}_3\text{O}_4 \rightarrow \text{FeO} \rightarrow \text{Fe}$) involved in the process, using the concept of additive reaction times. The different steps of mass transport and possible iron sintering at the grain scale were accounted for. The kinetic parameters were derived from reduction experiments carried out in a thermobalance furnace, at different conditions, using small Fe₂O₃ cubes shaped from industrial pellets. The results were extrapolated to full-size pellets taking into account the size and shape effects. Solid characterizations (SEM, X-Ray diffraction, Mössbauer spectrometry, pycnometry and mercury porosimetry) were also carried out to further understand the microstructural evolution. The current version of REDUCTOR is suited to the reduction with pure hydrogen, but an extension of the model to CO is planned so that it will also be adapted to the simulation and optimisation of the current DR processes. First results have shown that the use of hydrogen accelerates the reduction in comparison to CO reaction, making it possible to design a hydrogen-operated shaft reactor quite smaller than current MIDREX and HYL.

Keywords: Direct reduction, hydrogen, shaft furnace, kinetics, mathematical model.

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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

São Paulo - Brazil - May - 20-22 - 2009

16h30-18h00

21st May 2009

**Session 5B
room 5**

Cleaner Production Applied in Sealer Process of Paint Shop from an Automotive Company

Cleaner Production: The Case of the Automotive Metal-mechanic Local Productive Arrangement from Serra

Cryogenics Containers for Cargo Transport

Pollution Prevention in an Auto Assembly Plant in Hermosillo, Mexico

Cleaner Production Applied in Sealer Process of Paint Shop from an Automotive Company

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In an automotive company, much kind of residues are generated diary. They are of the most variety possible and have to be disposed properly too, according to the specifications that the company has to follow. To study a specific process or residue it took much time and trained people to evaluate the best way to avoid his generation. Normally, the person responsible to realize this study is a technical or an engineer and as the companies nowadays have greats dimensions and as the work realized in a department may cause impacts in another it was decided and more convenient to create a work group to develop and solve this problem. The work described in this article was developed in a sealer process of an automotive paint shop and the author's presents here some of the steps adopted in cleaner production to reduce in the process application: quantity of material applied, numbers of operations and quantity of residues generated. A little discussion is elaborated at the end of the article and some considerations are showed to diffuse the best practices identified in this company.

Keywords: Painting Process, Protection, Residues.

Cleaner Production: The Case of the Automotive Metal-mechanic Local Productive Arrangement from Serra Gaúcha

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Industrial production allied to a vertiginous economic improvement, during the last decades, has provoked negative impacts to the planet's natural resources, what reflects in society's life quality and environmental health. Currently humanity has faced extremely complex environmental problems, whose solution seems to be in applying a preventive environmental strategy, instead of having corrective actions. Undertaker strategies, up to then summarized to the economic matter, such as competitiveness, efficiency, profitability, etc, start to concern about environmental variables, and it is, then, vital to incorporate them to productive processes. Organizations started to adopt new technological strategies, by means of implanting environmental management systems. Face the environmental matter, these systems are seen as a competitive difference, as well as a factor of organizational improvement, in order to rationalize the consumption of natural resources. The expectation is environmental management strategies, besides decreasing the environmental impacts, may generate more profit, increasing the company's competitiveness and efficiency. Within this scenery, there are different methodologies in environmental management, as well as practices of Cleaner Production, which consider the opportunity of reducing costs, once a polluting organization is usually an entity that wastes raw material and inputs. The objective of this study was to identify environmental innovations, Cleaner Production methodologies and the results of implementing all of this. Three companies were analyzed in the Automotive Metal-mechanic Local Productive Arrangement from Serra Gaúcha (South of Brazil). It is a multi-case qualitative research. From the results, it is possible to highlight companies implemented technological innovations, once the objective was to improve the productive process. Results from the implementation of Cleaner Production methodologies show the studied companies had improvements in factors related to the productive process, such as increasing the operational efficiency, reducing costs with raw material and energy, and improving the product's environmental quality. Consequently, all these improvements have generated competitive advantage for the company that is placed in a more and more global scenery.

Keywords: Cleaner production, environmental management, operational efficiency.

Cryogenics Containers for Cargo Transport

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This study aims to present cryogenics as an element in transportation systems, utilizing carbon dioxide as refrigerant. This technology is not current, although its effective application in transportation gain force after the Protocol of Kyoto, besides that studies found out new ways to sequest CO₂ at lower prices. Another feature to be considered is the difficulty and high costs of the technology, used nowadays, to transport frozen and cooled cargo, generically names reefer. This led the logistic community to search for alternatives that minimized costs and maximized profits. The market for frozen and cooled cargo has been increasing dramatically in emerging countries, such Brazil and China, and those countries don't own effective methods to evacuate and store the production of perishable goods, creating logistics bottlenecks. Comparatively the proposed technology is more ecologically correct, because uses recycle CO₂, which would be emitted to the atmosphere, in addition to that it doesn't use electrical power in its application. Studies corroborated that this technology is economically feasible, for the fact of being cheaper and is a bactericide agent, joining to the legislation related to food security.

Keywords: Transportation, Cryogenics, Carbonic Dioxide.

Pollution Prevention in an Auto Assembly Plant in Hermosillo, Mexico

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The automotive industry is one of the main contributors to different types of pollutants. For instance, waste from plastics, aluminum, cooper, rags, sandpapers, solvents and paints can be generated. In particular, automotive painting processes generates, among other issues, VOC emissions as paint solvents. Automotive painting and coating products are formulated by using resins, pigments, volatile organic solvents, and chemical additives. Unfortunately, the automotive coatings process ranks at the top of the emission volume hierarchy. For this reason, knowing the pollution sources and their characteristics in this sector is important for a proper prevention. Several initiatives have been developed worldwide to promote occupational health and safety, and environmental protection through regulations, code of practices, and guidelines for prevention. The purpose of this paper is to show relevant results about a case study conducted into a painting process within an automotive assembly facility in a northern city of Mexico, Hermosillo. This study includes a pollution prevention analysis for such process, based in the US EPA guide to pollution prevention. In addition, a literary analysis on preventive practices at regional and global levels on the subject has been conducted. The analysis within the painting process focuses mainly in the "Primer" phase which consists of several steps starting with the sanding area and finishing in the manual zone area where paint is applied in areas where robots did not apply it. Some of the wastes from this process are remaining of sandpaper, contaminated rags, and paint and solvent residuals. Particularly, the later represents a critical issue for environmental and occupational health. As a result, one of the main conclusions of the study is that the lack of control of the process is one of the main sources for solvent wastes. This can be improved by controlling application parameters and process variables.

Keywords: Automotive industry, pollution prevention, painting process.

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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

São Paulo - Brazil - May - 20-22 - 2009

21st May 2009

18h00-19h30 Conference

Carlos Fernando Zinola

Universidad de la
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**Modification of the
Uruguayan Energy
Matrix with the Use of
Non-Conventional
Energies**

Changes in the uruguayan energetic matrix by the incorporation of non-conventional energies

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The main sources of energy in Uruguay have been oil and its derivatives, which were usually 60 % of the useful energy in the country. Secondly, the hydraulic and woods with less than 20 % each other. However, in 2005 this number began to decrease to 50 % with the incorporation of biomass and biodiesel fuels. However, the use of eolic energy in the windy states of the country gives more than 20 MW of real energy. BID project gave in 2008 the possibility to study the incorporation of hydrogen, methanol or natural gas fuel cells in three main aspects: rural neighborhoods, vehicles and addition of energy to the Electric Network at prime hours.

In this sense, the tendency beneath the 2010-2030 period will change substantially with the incorporation of other sources of energy such as compressed natural gas (CNG) and of course hydrogen, from biomass reforming or specially from water electrolysis.

The firewood or logs as main autochthon fuel, could play a role for the nowadays levels of actual forestations. These fuels can be used as a substitute of oil derivatives for industrial incomes. However, they will be favored or not depending on the international prices and the availability of the fuel not used for other purposes, such as cellulose and pulp conversion to paper in our new industries.

For the long-term estimations we are considering the incorporation of renewable sources of energy. In this case, we are specially taken the cases of eolic sources because of simpleness, solar thermal and photovoltaic devices since they are reliable for summertime, hydrogen and methanol fuel cells for the rural villages and vehicles (for the latter gas natural reformat is also considered). We are not considering the use of nuclear energy since the Uruguayan legislation forbid its application, however, this is still in consideration.

It is important to notice that the contribution of renewable sources of energy such as eolic and solar they are not going to give a large input into the energetic market since they are mainly non-firm energy sources. They are able to compete with other primary sources (hydraulic) but in our country is not possible yet to consider that they are going to substitute them for complete.

We believe that the technological developments will point to auxiliary technologies to support the renewable energies in a way also to co-generate. In this aspect, the new developments in the fuel cell advances specially converting the primary sources of energy such as natural gas, reformed methane, reformed biodiesel, etc. will support to add energy of ca. 10 MW to the Electric Network of the country during prime time hours.

Table 1. Percentage distribution for short and long periods estimated considering the Energetic Balance of Uruguay of 2007, total value of 2570 ktep

EnergeticSource	Hystorical Period	2010 - 2015	2020 – 2030	Variability coefficient
	%	%	%	± %
Oil-derivates	60	40	30	10
Hydraulic	23	25	25	5
Firewood	15	15	20	5
CNG	1	15	20	5
Others (eolic, solar and fuel cells)	2	5	10	4

We are going to discuss in our conference the possible variables in a short period of time taking the following suppositions to change the uruguayan energetic matrix;

Holding of the mean level of PBI growth and the energy demand according to the tendency of the country.

New supports of CNG as a new energy source either as a primary source or a vehicle purpose. The first one will lead to the deadlock of hydraulic energy as a main source.

Economic growth to the short term will lead to the increase in the energy demand that will be consider to be supplied by fuel cells or the chemical combustion of their main products. After then, the new devices will satisfied the demand of the secondary and tertiary sectors such as the domestic ones, leveling the energies requirements of the country.

New energy networks with Brazil and Argentina for gas and hydraulic energy sources, and also the increase in the distribution network and

the variability of the energetic merchandising (contract systems and spot market).

During the first period up to 2015 and surely during the second (2030) large industries will be installed again in our country due to the security in bank transactions and economic stabilities. It is expected that this industries will co-generate energy and maybe nuclear energy will be installed in the MERCOSUR region.

The country will promote new energy sources with clean technologies such as the hydrogen economy as a consequence of the BID Project. The distributed generation with the knowledge of ecological and social consequences of the "old" thermal technologies will be considered. A change in the prices to the "clients" will be the economical consequence of working with this economy with low environmental impacts.

With the long-term expectations of the energy matrix in the country, a large variability has to be considered since the energy demand in Uruguay has been an oscillation curve instead of a slow or large increasing tendency in both the utilization and generation. Two main tendencies are considered; 1 % per year of generation because of increasing new efficient methodologies and environmental restrictions, and 3 % per year of economic and social welfare for unsatisfied domestic demands before 1999.

Therefore, we are going to take a 2 % of mean annual value because of the concepts of initial developments for the passage to the secondary level and the growth of the distribution. In other words, the domestic consume is still in the development stage and is meanly lower than the annual growth, that is, first the economic growth and then the uses and expenses.

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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

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Conferences
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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

São Paulo - Brazil - May - 20-22 - 2009

22nd May 2009

18h00-19h30 Conference

Phillip Fearnside

(National Research
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**Global Warning and
Sustainable
Development**

Global Warning and Sustainable Development

Philip M. Fearnside
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Amazônia-INPA*

The term "development" implies in a change of direction that represents an improvement of the human condition, "sustainable" implies that this will continue indefinitely or at least for a very long time. One of the main impediments to the continued improvement is global warming, and Amazon is an area that is expected to suffer the worst consequences of climate change, if this change is allowed without making dramatic reductions in greenhouse gas emissions. Global warming affects both the temperature and precipitation, but the changes are very uneven throughout the world. For most of the world, the increased temperatures will bring more rainfall because, in warm oceans, more water evaporates and has to fall somewhere as precipitation. However, in the Amazon this is not expected. Instead, two different phenomena are expected, both exacerbated by global warming, intensifying droughts in the region. One is El Niño, which causes droughts and forest fires in the northern part of the Amazon, such as the Great Fire of Roraima 1997-1998. El Niño is activated by hot water in the Pacific Ocean. A second form of Amazonian drought is activated by hot water in the Atlantic. This causes drought in parts of southern and western Amazonia, as the disastrous drought of 2005. A recent modeling study indicates that the frequency of this type of drought would increase dramatically in the next few years if it is allowed that the atmospheric concentrations of greenhouse gases increase following the pattern of

"business-as-always." The annual probability of a drought of the magnitude of the event in 2005 was 5% in 2005 but increases to 50% in 2025 and 90% in 2060. These changes threaten the survival of the Amazon forest and with it the prospects for sustainable development in the region, including the proposal of this author to sustain the rural population of the region based on the environmental services of the forest. Future climate changes in the Amazon depend on decisions on emissions. As one of the countries most threatened by global warming, Brazil should be taking the lead in reducing emissions, with commitments to reduce Amazon deforestation which is the main source of significant emissions of Brazilian greenhouse gases.

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14h30-16h00

22nd May 2009

**Session 6A
room 1**

Water Quality Management: the Brazilian and the American Models

Waste Generation Diagnosis in Furniture Production as Subsidies for Enterprise Management

Valorization of Solid residues: egg shell as raw material to new products development

Organic Food: Challenges for a Public Domain of a Concept

Water Quality Management: The Brazilian and the American Models

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All over the world, the continuous population growth, the increasingly urban and industrial concentration and the increasingly expansion of the irrigated agriculture, lead to an increase in the water demand and depletion, which can lead to water scarcity for many of its designated uses. In Brazil, Law 9433, enacted in 1997, established the National Water Resources Policy and created the National Water Resource Management System, introducing a new integrated approach to environmental management policies and economic-based instruments. This Law defined the hydrographic basin as the unit of planning, considering the water multiple uses, introducing many changes at the institutional and policy instruments levels. From the policy instruments perspective, the Law established new management instruments and worked towards the integration of these new instruments with the other instruments defined by the Brazilian environmental legislation: water bodies designated uses x water bodies framework. The Resolution 357 enacted in 2005 from the National Environmental Council (Conselho Nacional de Meio Ambiente - CONAMA), set the environmental guidelines for implementing water bodies' framework, and established the classification of water bodies and the conditions for discharging effluents into them. However, this Resolution left much to be improved. For instance, this Resolution established fixed limits for effluent discharges, making no distinction between these discharges according to the related industrial activity or technology. Furthermore, it did not consider the carrying capacity of the water bodies that will receive the discharges, and it is not linked to the other instruments set forth in Law 9433. This might reduce the efficacy of the instruments and generate diseconomies for public and private agents. As a result, many criticisms in this respect prompted CONAMA to promise a revision of the effluent discharge limits. The wisest course would be to base this revision mainly on the international water management experience. This article aims at contributing to this effort, by analyzing the case of the United States (US), which can provide valuable insight in terms of defining water quality standards and effluent discharge limits based on control technologies and industrial typologies. Some of the main water pollution control instruments predicted in the US Clean Water Act (CWA, 1972), the policy that regulates the water resources management in the US, are analyzed in this paper: the Total Maximum Daily Load (TMDL), the National Pollutant Discharge Elimination System (NPDES) and the Assessment Total Maximum Daily Load Tracking and Implementation System (ATTAINS). Finally, based on the US model this paper made some suggestions that could be incorporated in the Brazilian legislation.

Keywords: Water Resources Management, Water quality, Effluent Discharges, Brazil, United States.

Waste Generation Diagnosis in Furniture Production as Subsidies for Enterprise Management

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The purpose of this study was to identify the residues generation in certified and noncertified wooden furniture production aiming the availability of subsidies for decision making in relation to the company's environment management and economics. This case study was conducted in a furniture industry located in the city of Praia Grande-SP, which represents its industry sector on using not just certified exotic species but certified native wood as raw material. The yield on production was evaluated for two types of chairs produced with certified wood of sucupira and non-certified wood of sucupira. The generated types of residues and the factors of generation were identified. Significant differences were found for the results related to wooden type, chair model, and the interaction between types of wood/model of chair. The smallest residue generation was obtained on the processing of non-certified wood; in the model with arm; and in Product 3, arm chair made up with noncertified wood. Considering the current situation, is impracticable for the company only certified wood production of furniture. To make it feasible, some fundamental actions are needed: bigger offers of certified wood for a smaller price; quality improvement of certified raw material and application on part of the company of acquisition quality criteria control; development of products considering the characteristics and properties of the wood, reducing the residues generation; investment in man power qualification and equipment.

Keywords: Forest residue, furniture, wood mechanical processing.

Valorization of Solid Residues: Egg Shell as Raw Material to New Products Development

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Chicken egg is very used in food industries, due to its technological properties. The industrialization produces an expressive quantity of shells, being yet considered as waste, especially destined to agriculture. Egg shell has a rich composition in minerals that can be the basis to several industries. Beside this advantage, it is not valued. This work have the objective of joint information's on technological potentialities of minerals and protein membrane of the chicken egg shells, that until this time are non appropriately used; as well analyze the economical viability of implantation of industries enable of this residues processing, increasing its value and giving some idea of the environmental impact generated from this suggested process.

Keywords: Chicken eggs, calcium carbonate, protein hydrolyzed, protein hydrolyzed, wastes valorization.

Organic Food: Challenges for a Public Domain of a Concept

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In order to be sustainable, any productive process should follow economic, social and environmental demands. Regarding to environmental demand, the focus of this paper, organic food production represents a clean production model that needs to be supported by consumers in order to become viable. Consumers` knowledge in respect to organics products is an unquestionable factor in the process of buying decision taking. This paper aims consumers` perception analysis of organic food and associations they do with such kind of food, how information reaches real and potential consumers, which communication channels enter for mind perception making. Field research data were collected by questionnaire application to 204 consumers doing shopping at two most important supermarkets of Vitória da Conquista, Bahia, Brazil. Findings show that consumers know objectively defining what organic food is. They get information through mass media communication, such as TV, but there is a growing access to other information channels like magazines, schools, friends, internet and others. They associate organic food consumption, first of all, to health and, secondly, to environmental preservation. But a series of aspects, defined by law, which characterize organic products, are still unknown by consumers of those products.

Keywords: Organic products, clean production, knowledge, consumers, communication means.

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São Paulo - Brazil - May - 20-22 - 2009

14h30-16h00

22nd May 2009

**Session 6A
room 2**

Promoting Cleaner Production through Innovative University Research Methods

Development of a Environmental Methodology for Solid Wastes Management in Higher Education Institutions

Emergy-based Environmental Accounting of the Engineering Course at a Paulista University *Campus*

Sustainable Water Management in the University of Sonora, Mexico

Promoting Cleaner Production through Innovative University Research Methods

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Using private and government funding, researchers at the University of New Orleans (UNO) designed and built an Emissions Test Facility (ETF) under their clean technologies initiative which is being used to train graduate and undergraduate students. The role of Emissions Test Facility (ETF) is very important in developing clean/environmentally-friendly technologies. The ETF at UNO is scalable to the needs of the processes to be optimized and allows monitoring of process parameters and the quantity/characteristics of waste streams. This ETF also contains a twostage air pollution control system to prevent contamination of the site being used for the research. An exhaust fan with flow controller is equipped to study the emission variations under variable ventilation conditions. Exhaust rates can also be related to wind speeds in case of processes performed in open-air conditions. UNO's ETF has been successfully used to optimize dry abrasive blasting process commonly used to remove paint, rust and other surface contaminants before new paint application of metallic surfaces. Blast pressure, abrasive feed rate, type of abrasive, level and type of contamination, and many other process conditions influence (1) energy consumption, (2) material consumption, (3) productivity (how fast the surface is cleaned), (4) used-abrasive generation, and (5) quantities and characteristics of air emissions. By simulating the process within the ETF, various process, performance, and environmental (waste potential) parameters were measured. Thus ETF was helpful in understanding the inter-relationships among process parameters, types of abrasives, and emission potential which helped in developing predictive mathematical models. These models now can predict (1) productivity, (2) material/energy consumption, (3) air emissions, (4) used-abrasive generation rates, and (5) life cycle costs. ETF is being used to simulate and optimize other industrial processes to increase understanding of inter-relationships and develop predictive and decision-support tools. This research setup and approach greatly supports the concepts of green engineering, design for the environment, clean/environmentally-friendly technologies, environmentally-preferred material selection, life cycle cost reduction, pollution prevention, health risk reduction, and overall improvement of quality of life. This paper presents some salient features of the research approach, recent experiences, and outcomes.

Keywords: Abrasive Blasting, Particulate Emission Factors, Emissions Modeling, Waste from Abrasive Blasting, Abrasive Ranking.

Development of a Environmental Methodology for Solid Wastes Management in Higher Education Institutions

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This work aimed to present a critical analysis about the development of a methodology for solid wastes management in Higher Education Institutions (HEI). Researches were undertaken on technical rules and on the specialized literature on Environment over the last ten years. In a comparative study between methodologies ISO 14001 and Cleaner Production (CP), it was verified convergent and complementary points to its implantation in a HEI. It was done a case study at UTFPR-PG, where factors like environmental aspects and impacts, initial environmental diagnostic, purposes and targets and the way the campus fits with CP were surveyed and analyzed. It was possible to conclude that the application of ISO 14001 altogether with CP can effectively contribute for an improvement in the competitiveness of HEI's and magnify the vision about the environmental tools application in this sector.

Keywords: Higher Education Institution, Cleaner Production, ISO 14001.

Emergy-based Environmental Accounting of the Engineering Course at a Paulista University Campus

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This study applies emergy accounting to assess an Engineering course offered in an educational building at Paulista University- UNIP. The building used by the Engineering course at *Campus* Indianópolis is occupied by teachers, students and staff. Energy and material flows used for construction and use of the building are evaluated. Information provided to students is also accounted. The total emergy of the building (construction and use) is 1.25×10^{18} sej / year, where the concrete presents the most significant contribution due to the large number of classrooms and laboratories used by the Engineering course. The second major contribution is due to the large investment in equipments, suggesting a concern of the University with an appropriate engineer training. The total emergy of the Engineering course (including information) is 5.20×10^{19} sej (for a course with duration of five years). This value is much higher than that corresponding to the building construction, due to the high emergy of information. The emergy of the building contributes with 12.1% in the engineers training and the emergy from information received by students accounts for 87.9%. The transformity of the graduated engineer is 7.4 times higher than that of students entering the University. This increase is mainly associated to the knowledge acquired during the five years course.

Keywords: Environmental accounting; emergy; University; Engineering, information.

Sustainable Water Management in the University of Sonora, Mexico

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Although water is an abundant resource in the planet, its quality has declined dramatically all over the world. Water pollution has affected oceans, rivers, lakes, and ponds, but mainly drinking water sources. Water scarcity is not only exacerbated by pollution but also by droughts. As a consequence, many countries around the world are experiencing water shortages and/or water crisis. Mexico is not the exception to this; neither does the state of Sonora which has been one of the most affected since its residents have suffered 12 years of drought and the effects of a growing urbanization. Therefore, water management has become a major challenge to sustain the economic growth in the region. Most of water pollutants are originated from human activities; consequently, it is possible to avoid them by implementing cleaner production and pollution prevention principles. With the purpose to take responsibility for conserving this resource, the University of Sonora, has implemented a Sustainability Management System (SMS) on campus which was third-party certified in July 2008. Thanks to this, the University of Sonora has become the first public higher education institution to get the ISO14001:2004 certification not only in Mexico but also in Latin America. This higher education institution is the biggest, most important and most prestigious university in both the capital city of Hermosillo and the state of Sonora, at the northwestern region of Mexico. It is a public university with 31,830 students in five campuses in the state.

The purpose of the SMS is the protection of natural resources and the prevention, reduction and/or elimination of environmental and occupational risks generated by the members of the university community when using resources in order to fulfill its substantive functions of teaching, research, outreach & partnership, and stewardship. Although this presentation focuses on the sustainable management of water, the reader must be aware that this effort is part of a wider strategy for transforming the University of Sonora in a sustainable university. Water consumption is one of the significant environmental aspects along with energy consumption, hazardous materials and non-hazardous materials use. The aim of this presentation will be at describing a case study constructed through direct participation in the design, operation and maintenance of the University of Sonora's

Sustainability Management System during the last six months. Updated qualitative and quantitative indicators will be available at the time of the presentation.

Findings of this presentation will provide more insights for enriching the actual debate about how to prevent, eliminate and reduce water use inefficiencies on campus, and in that way, contributing to the actual stock of knowledge towards achieving sustainability in universities.

Keywords: Water quality, Sustainability Management System, ISO 14001.

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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

São Paulo - Brazil - May - 20-22 - 2009

14h30-16h00

22nd May 2009

**Session 6A
room 3**

Model of analysis of Performance of Healthcare Waste (HW)
Management by indicators, São Carlos-SP, Brazil

Contributions of Environmental Accounting in Emergy for Understanding
of Soybean Production System on the Perspective of Sustainable
Agriculture

Environmental Impact Assessment under the view of the elaborators
and their Knowledge Management activities

Contribution of Packaging to Cleaner Production Goals

Model of analysis of Performance of Healthcare Waste (HW) Management by Indicators, São Carlos-SP, Brazil

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Healthcare Waste (HW) management in Brazil has been discussed since last years, mainly by RDC 306/2004 and Resolution Conama 358/2005, which laws require improvements in all stages of this management (segregation, internal collection and packaging, external transport and storage), and give the responsibility of these wastes to theirs generators. The city of São Carlos produce, monthly, about 20 tonnes of HW and, approximately, 50% come from Santa Casa of São Carlos. The management of the realized procedures in this hospital was never evaluated until now considering performance improvement. Investigated methods pointed to some applications using performance indicators and these can be evaluated by Factorial Analyses (FA) and Analytic Hierarchy Process (AHP). A framework of interview was elaborated containing 29 qualitative observation variables, which questions were applied to 98 employers in this hospital. The obtained information were associated a different scales of response, according suggestions of Saaty. The *SAS* and *Statistica* programs were used to generate several simulations by FA, which results (performance indicators) were analyzed by experts. AHP method was used to compare the indicators to both groups (workers and experts). This paper illustrated the application of two different methods as analyze model to identify satisfactory performance indicators to evaluate HW management in the health establishment.

Keywords: Performance indicators, healthcare waste, Factorial Analyses, AHP method, waste management.

Contributions of Environmental Accounting in Energy for Understanding of Soybean Production System on the Perspective of Sustainable Agriculture

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Brazil is considered the world's granary because of its territorial extension and the possibility of transforming into agricultural land. In this context, the most outstanding commodity produced by the country is the soybean crop. About 21 million hectares of soybean are planted and approximately 61 tons are produced (harvest 2008-2009). The introduction of this Asiatic species in Brazil was recent, about 120 years ago, and so was its genetic and transgenic improvement. Due to these processes and advanced technology, improved knowhow of nutritional demands and greater access to information by the farmers, Brazil has stood out in the international scenario as a region with excellent production and productivity indices. Currently, other important issues have appeared that need to be managed such as the principles and methods that guide this type of production, the economic, social and environmental sustainability as well as the costs and environmental impact involved in obtaining these indices. The objective of this article is to discuss some examples of soybean production using the environmental accounting methodology and applying the Emergetic Ternary Diagram.

Keywords: Sustainable Agriculture; Sustainable Soybean; Energy Accounting; Emergy.

Environmental Impact Assessment under the View of the Elaborators and Their Knowledge Management Activities

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Multidisciplinary action, founded on team's experiences, but few systematized and highly individualized. These are some of the features of the nowadays Environmental Impact Assessment (EIA) practices according their elaborators. This paper presents a theoretical scheme developed to analyse Knowledge Management in EIA, and some results of a survey carried out with 33 EIA's consultants. We investigate acquisition, validation and integration knowledge processes, as well as the elaborators' perceptions regarding to the EIA's aims.

Keywords: Environmental Impact Assessment; Knowledge Management; Sustainability.

Contribution of Packaging to Cleaner Production Goals

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Packaging industry is faced with challenges of using different strategies to prevent emissions at the source and to initiate continuous preventive improvements of its production processes.

However, numerous other industries and services use packaging products which gives packaging products a specific feature. Thus, firms should be aware of modern trends of packaging products. Dematerialization of packaging is a continuous trend which has important role in source reduction but at the same time has detrimental effects on recyclability. However, the latter is still often believed to be one of the most important environmental criteria for packaging in different cleaner production programmes. Considering such dilemmas, two major questions arise with regards to packaging role within the concept of environmental protection and cleaner production. First, how to quantitatively evaluate its environmental impacts and, secondly, to what extent packaging contributes to the reduction of overall (life-cycle) pollution prevention. Namely, protective role of packaging is too often neglected in discussions on packaging and environmental pollution problems. In a paper different aspects of packaging in line with the environment are discussed which confirm that packaging must be viewed in a wider context as usual because not only technological but also demographic and social changes significantly influence its environmental image. This effects not only the production optimization but also the environmental profile of the whole product supply chain.

Keywords: Packaging, environmental impacts, dematerialization, supply chains.

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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

São Paulo - Brazil - May - 20-22 - 2009

14h30-16h00

22nd May 2009

**Session 6A
room 4**

Cleaner Production Evaluation System (SAPmais): Encouraging The Continuous Improvement

Infrastructure as a Key Factor for the Sustainability of Logistic Agricultural Production

The cleaner production applied in a group of restaurants in Paraíba

Proposals for the Recovery of Waste Processing of Orange Juice

Cleaner Production Evaluation System (SAPmais): Encouraging the Continuous Improvement

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This report presents the experience carried out for the development and validation of a methodology based on the concepts of the Cleaner Production (CP) through a checking system on the continuous improvement of the CP actions implemented by the companies, with the aim to monitor and contribute for the reduction of the environmental impact generated by them. The study was developed as the extent of a Project under the technical coordination of Cleaner Technologies National Center – CNTL – at SENAI RS, with the financial support by SENAI – National Department and the Regional Departments of the states Rio Grande do Sul, Paraná, Rio de Janeiro, Minas Gerais and Bahia. Twenty three (23) companies took part on the study as pilot companies. The standard environmental performance evaluation methodology was developed based on the concepts of the CP. The norm worked out defined the following: the selection criteria of the companies to take part on the pilot project, the requirements of the Cleaner Production Evaluation System (CPES) which were verified by specialists, the certification steps in compliance to the CPES, the goals, the conditions to make pre evaluations, the issue of the CPES Support Certificate, the criteria used in order to reach the goals and the evidences to prove the compliance, the evaluation criteria, how would the company be recommended, how would this recommendation be validated, the expiring date of the certificate and how would the evaluation cycles be. The pilot companies have defined three (3) Environmental Aspects which were monitored during three (3) months, through Operational Performance Indicators. After that, in each state a technical consultancy was made in order to adjust the companies, with the aim to validate the methodology of Environmental Performance Evaluation, based on the concepts of CP. A group of specialists was selected and trained to make environmental performance evaluation at the companies, based on the concepts of CP. The results were presented by the companies showing the environmental benefits and the economic outcomes obtained. Finally, it was made a Verifying Auditoria on the compliance of the proposed goals by the trained specialists and the companies who showed the proposed reductions received the CPES Approval Certificate and the CP Seal. This study presents as an example the case study of a pilot company in RS that took part in the study.

Keywords: Indicators, Cleaner Production, Environmental Performance Evaluation, Environmental performance indicator, Operational performance indicator.

Infrastructure as a Key Factor for the Sustainability of Logistic Agricultural Production

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Infrastructure as a key factor for the sustainability of logistic agricultural production. Agricultural production has showed some paradoxes with their competitiveness, when you see its system of storage, distribution and logistic delivery of system as a whole. This paper has goal analyse some issues related to infrastructure of the distribution of soybeans, because logistics has represented 30% of final costs.

Keywords: Infrastructure, agricultural, logistic.

The Cleaner Production Applied in a Group of Restaurants in Paraíba

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In the cooking process, the waste related to the water, energy, gas and another sources consumption, are so significant that they represent a big impact in the Brazilian Gross Domestic Product and it is considered a great damage in a country's economics. The Cleaner Technologies use presents as an essential tool on the modern society to fulfil the environmental needs of a sustainable development, besides it is useful to take the companies to get new customers, energy and natural resources savings, and reduction of losses and waste. In this way, this paper had, as general goal, the analysis of the food processing of five restaurants in Campina Grande – Paraíba, using for this analysis the Cleaner Production methodology to identify potentials to reduce waste, and optimize the process and the energetic efficiency. The result of this study shows that the Cleaner Production adoption allied to the construction of an environmental politics, written and communicated to the whole staff can improve the competition for the companies, since one of its advantages is the image improvement of the company besides the keeping of current and future customers.

Keywords: Cleaner Production; Restaurants; Waste

Proposals for the Recovery of Waste Processing of Orange Juice

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The Brazil is the world's largest producer of oranges. Most of the Brazilian production, concentrated in São Paulo State, is for the juice industry. One of the main problems faced by industrial processing of orange juice is the large volume of solid and liquid waste produced. The present work proposes alternatives to the minimization and recovery of solid and liquid waste generated in the processing of juice, based on processing a large company in São Paulo State. The alternatives were proposed based on information and data from literature and the concepts of clean technologies.

Keywords: Recovery of waste; orange peel; by-products.

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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

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**Session 6A
room 5**

Clean Development Mechanism (CDM) Projects and Generation of Clean Technologies in Brazil

Proposal of Environmental Recovery of the Urban Area of the Ouro Monte River Watershed

Environmental Management on the Project of Serra do Mar's New Immigrants Highway: Study case

Environmental Performance of Cement Industry in Vietnam: The Influence of ISO 14001 Certification

Clean Development Mechanism (CDM) Projects and Generation of Clean Technologies in Brazil

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One of the Kyoto Protocol's innovations was stipulating mechanisms that aim at the cooperation among countries to mitigate the climate change. Only the Clean Development Mechanism (CDM) makes the participation of developing countries possible. The article's goal is to evaluate the contribution of Brazilian CDM projects related to the Energy Industries for the generation of clean technologies. From the analysis of the 37 projects that had received carbon credits up to 2007, it is possible to conclude that this contribution remains incipient: only 3% of them could be characterized by the development of clean technologies focused on cleaner production. Thus, considering that clean technology and cleaner production are the most adequate environmental strategies to reach a sustainable development, it is not possible to affirm that these 37 Brazilian CDM projects are effectively contributing for this target. So, the analysis of the Brazilian projects related to the Energy Industries reveal that, at least in Brazil, CDM is far from achieving the fundamental purpose of minimizing the global warming via the stimulation of a cleaner development model relied on the cooperation among countries.

Keywords: Clean Development Mechanism (CDM), Clean Technologies, Cleaner Production, Brazilian Energy Industries.

Proposal of Environmental Recovery of the Urban Area of the Ouro Monte River Watershed

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The transformation of the rural environment into urban environment will always result in important ecological changes. The planning of a city mustn't be linked only with the urban center, but also with the rural places, including an ample region, inclusive hydrographical basin, if they exist. It's necessary to do a study of the soil use and its discipline, verifying the areas of using, occupations and activities to be done to keep its quality and its balance in an acceptable level.

Therefore, the purpose of this project is to assess the environmental aspects of the "Monte Ouro" river source and to propose solution to recover the same one. Also, to the stretch which goes through the neighborhood "Parque Independência", located in Medianeira borough, proposing conscientious alternatives to the soil treatment, creating a drain treatment system, generated by the drain of rain waters residences. It also suggests a plan of environment control to possible future problems in the neighborhood.

Keywords: Urban, Ecological planning, Sustainable environment.

Environmental Management on the Project of Serra do Mar´s New Immigrants Highway: Study Case

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The Environmental Management System considers restrictions on the project, on the product or on the service, by environmental agencies as challenges to innovation and creating solutions that will provide sustainable development. This is the ecological philosophy that can be found in this project of the New Immigrants highway, where specialists through a scientific methodology solved a complex equation, involving the environmental aspect versus the impact, whose solution produces sustainable development. The implementation of Environmental System in the project brought the commitment in favour of two pillars of management: to prevent the environment impact and the continuous improvement of this project. One could say that the project met the goal to satisfy the socio-economic interests of the population of São Paulo, and produced benefits such as: environmental benefit, through the production of a work environmentally clean, with a reduction of the intervention in the forest reserve, technical advantage, to enter the rock mass, reduced the trajectory of the highway with more quality and institutional advantage, by providing a good institutional image among the public and governmental departments.

Keywords: Environmental Management, New Immigrants highway, Sustainable Development, Environmental Impact.

Environmental Performance of Cement Industry in Vietnam: The Influence of ISO 14001 Certification

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The cement industry is one of the oldest and most important industries in Vietnam's developing economy. It is also one of greatest environmental polluters, especially in terms of air pollution. Several causes contribute to the adverse environmental impacts of cement industry, including backward technology (many factories use stand kiln production technology), weak environmental management, and lack of environmental awareness, etc. To reduce environmental impacts of industries and improve environmental performance, the Vietnamese Government encourages introducing ISO 14001-based environmental management systems into businesses. While much has been written on Western experiences, there are hardly documentation and analysis the effectiveness of ISO 14001 in Vietnam. This research examines the influence of the international ISO 14001 norm in the environmental performance of Vietnam's cement factories. The study focuses on: i) finds out the changes in environmental performance between pre- and post- 14001 certification; ii) compares the environmental performance between certified and uncertified cement factories. The impact of ISO 14001 certification on the industry is studied by using a self-assessment questionnaire survey mailing to 56 factories in the whole country and the response rate is 26% overall (15 factories). In addition to the self-assessment, the annual environmental data, focusing on air emission from 15 responses are used. For the management performance, the preliminary results demonstrate that the environmental awareness and attention among certified factories was clearly better than those in uncertified factories. For the operational performance, the results show that there is no clear different between certified and uncertified group as well before as after adopting the ISO 14001 standard. The emission values are all below the Vietnamese National Standards for Air Quality. These results advocate the need for more research on environmental management systems, to explore the causal links between EMS and environmental performance in Vietnam.

Keywords: Environmental management systems; ISO 14001, environmental performance.

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14h30-16h00

22nd May 2009

**Session 6A
room 6**

Cleaner Production in Construction Sector: a proposal of minimization of residues in the source

Environmental accounting in emergy for a house construction

Sustainability and Cleaner Production in Construction Sites

Sustainability index to civil construction: A brazilian check-list proposal

Comparative Analysis of Houses Construction Using Emergy Accounting

Cleaner Production in Construction Sector: A Proposal of Minimization of Residues in the Source

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The industrial residues make possible to verify an enormous inefficiency in the productive processes, being been that the same ones directly affect the conditions of life of the humanity. The construction sector possesses an enormous parcel of contribution in the deterioration of the ambient quality, since one of its characteristics is the used raw material wastefulness and assistant in the constructive processes of urban enterprises. The present work has as objective to consider a solution to minimize the generation of solid residues in Construction Sector, through the application of the Clean Production methodology. Thus, the main contribution of this work was to demonstrate the possibility of if acting in the cause of the generation of the residues of the sector of civil construction, that is, to breach the paradigm of that wastefulnesses are characteristic of the sector and that the techniques of external recycling are the only exit to reduce the ambient degradation of constructive processes.

Keywords: Construction solid waste; Clean Production; environmental impacts.

Environmental Accounting in Energy for a House Construction

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The present study uses the environmental accounting in energy to analyze a house construction. The energy and materials inflows are evaluated for each stage of the construction. The final energy flow for the building manufacturing process is $2,07E+17$ sej (solar energy joules). The results highlight the environmental cost relative to the different constitutive parts of the building as groundwork, building frame, walls and covering. Materials that are the major energy contributors are cement, sand and stone.

Keywords: Energy; environmental accounting; building manufacturing.

Sustainability and Cleaner Production in Construction Sites

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This work addresses the concept of sustainability and cleaner production and its application in construction sites. Construction firms are portrayed as having a role in conveying changes in the productive chain of the construction industry. Although the main focus of sustainable initiatives in building has been in the architectural design phase, the building site—where construction firms have more leverage—may contribute significantly to reduce the environmental liabilities in the industry. The sustainable construction site may be actualized in different ways from the pursuing of strategic actions, which are classified as: responsible procurement; community relations; occupational health and safety management; quality management project; reduction of construction waste; solid waste management; land use and occupation (construction site design); water consumption; energy consumption and transportation; local vegetation and wildlife conservation; and education of partners. Assuming that sustainability will only be attained by means of strengthening the learning system of construction firms, three sorts of corporate culture instruments are analyzed: management systems (ISO 9001, PBQP-H, ISO 14001, OHSAS 18000, SA 8000), green building certifications (LEED and AQUA) and local programs (PGM and PRAS), from the standpoint of each instrument's contributions to the development of sustainable construction sites.

Keywords: Sustainable construction, construction sites, certifications.

Sustainability Index to Civil Construction: A Brazilian Check-List Proposal

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In 2005 The Environmental Committee of SINDUSCON-RS, knowing the needs of building companies to search for compliance to environmental requirements, created a proposal for a national check-list which could be used as an evaluation of companies on environmental sustainability grounds. At that time, there were approaches to the concept of Green Buildings, but the search was for something similar, yet Brazilian, with items with national significance and applicable to national reality and also accessible to as many companies as possible. SINDUSCON-RS looked for a partnership with SENAI National Centre of Clean Technologies – CNTL, whose work focuses mostly on small and medium size companies and was then working on a project for online consulting for Cleaner Production and Waste Management in civil construction. The concepts and initiatives of CNTL and SINDUSCON were convergent and the partnership was created. The work started up at the beginning of 2007, with advice by the Federal University of Rio Grande do Sul. Initially, a reference review was done of the main index worldwide and of other existing works in this area. A comparative table of the most renowned indexes worldwide was created and, after that, the major items and the scoring method of each one were evaluated. Then the creation of the sustainability index developed by this group started. This work last about one year and a half, with periodical meetings until the software was finished, and then the basic check-list was created. In October of 2008, this national check list was showed at 80^o ENIC under the title "Sustainability Index – A national Check-List Proposal". The first version of the "Sustainability Index to civil construction– A national Check-List Proposal" will be open to everybody for about six months to test and in order to create a data bank with the answers of the chosen options and suggested options. After this period the fist version will be revised and, if necessary, changes will be undertaken. Thereafter it will be officially released to be used as a tool in search of environmental suitability, or even as an evaluation and validation method that will bring a final result related to the sustainability of the assessed enterprise.

Keywords: Sustainability, building a checklist, civil construction index.

Comparative Analysis of Houses Construction Using Emergy Accounting

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We present an application of the methodology of environmental accounting in emergy, comparing the environmental impact generated by a house designed in a timber production system of "exploitation", the second wood of the first use and third, masonry type, from the same architectural project. By using the graphical tool - ternary diagram - , rates the emergy flow and environmental indicators in emergy, in the three models studied. The results showed a favorable trend for the home designed in wood production system of "exploitation", all indicators were higher than the other two cases under study, highlighting the environmental sustainability index of 125 times larger than the house of masonry. This system proved to be less constructive aggressive to the environment, which may allow the adoption of this house as a habitation solution of Vilhena in the state of Roraima, the city adopted as a model for this study.

Keywords: Environmental sustainability, emergy account, environmental indicators, sustainable constructive system, "exploitation" wood.

14h30-16h00

22nd May 2009

**Session 6A
room 7**

Modification of the Sour Cassava Starch Production Process to Improve Organic Acids in the Wastewater

Environmental Benefits of Water Recovery in a Tilapia Production System, by Using Emery Environmental

Factors Analysis on Promotion of Cleaner Production in Compulsory Enterprises

SusUrbia – Sustainable Urban Life Beyond Peak Oil

Modification of the Sour Cassava Starch Production Process to Improve Organic Acids in the Wastewater

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Sour cassava starch is a very typical Brazilian product used as raw material in bakery products. It is produced by a natural submerge fermentation, with about 20 cm of superficial water, during a period of 45 – 60 days. However its manufacture produces the fermentation wastewater with high organic matter content which is normally discharge in the environment. The chemical composition of this wastewater is not very well known. However, many compounds present in this wastewater could be commercially interesting. In this way could be cited the organic acids formed during the fermentative process. Lactic, acetic and propionic acids have been used in many kinds of industrial activities, mainly in the food and veterinary industries. In the present work, 0.5 % (w/v) of glucose syrup and different concentration of nitrogen, as ammonium chloride, was added in the cassava starch fermentation water. It was observed the effect of such nutrient supplementation on the organic acids production and on the characteristics of the final product, the sour cassava starch. The concentrations of ammonium chloride tested in the fermentation water were: 0.1, 0.25 and 0.5 % (w/v). The process was monitored during 45 days. In the fermentation water were periodically evaluated the pH, the acidity and the organic acids concentration (acetic, lactic and propionic) by high performance liquid chromatography (HPLC). It was verified that the nutritional supplementation, promote an increase on the organic acid concentration, mainly on the propionic one. The better results were obtained by the addition of 0.1% (w/v) of ammonium chloride, increasing about 50% in the organic acids content. On this condition the sour cassava starch maintained its expansion property. This work reveals that the enriched sour cassava starch wastewater could be used as organic acids source.

Keywords: Sour cassava starch, fermentation water, organic acids.

Environmental Benefits of Water Recovery in a Tilapia Production System, by Using Emergy Environmental Accounting

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The emergy environmental accounting developed by Odum was applied to evaluate the water recovery system used to treat water released from a tilapia production system known as aquaponic. For this purpose, the whole aquaponic system (including the water recovery process by a coupled rhizospheric-hydroponic system) was compared with the same tilapia production system but in the absence of the water recovering system. The present work aims to quantify the emergy environmental benefits when water is treated and recover through the coupled rhizospheric-hydroponic system. Benefits related to renewable inputs (R) were negligible but purchased inputs (F) show an emergy decrease of 29% when water is recovered inside the aquaponic system. Also tilapia transformity shows an improvement of 24 % with water recover. Emergy flow difference resulted from water recovering is $5,86 \times 10^{15}$ sej, representing an improvement of global efficiency of 25%. The emergy sustainability index shows that both systems are within the range of non-sustainability. Even so, water recovering inside the aquaponic systems enables an improvement of 50%.

Keywords: Environmental accounting; Emergy; Aquaculture; Water recovery; Tilapias.

Factors Analysis on Promotion of Cleaner Production in Compulsory Enterprises

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Effects of economy, pollution press and external conditions on promotion of cleaner production (CP) in compulsory enterprises were analyzed by regression method. As results, promotion of CP in compulsory enterprises depend on economy and pollution press presently. This drives greater role of the driving forces are internal, external role to be strengthened. At present, the per capita GDP for each additional 10,000 Yuan increases compulsory enterprises audited rate by 5.9 percent, sulfur dioxide emissions per capita for each additional 10kg will lead to compulsory enterprises audited rate increased by 0.8%. In future, the main power for promotion of CP in compulsory enterprises come from improving external conditions such as relevant systems, regulatory policies, incentives and public participation.

Keywords: Compulsory enterprises, Cleaner production, Promotion, Factors analysis.

SusUrbia – Sustainable Urban Life Beyond Peak Oil

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Cities are highly dependent on fossil energy. Mechanization of agriculture has resulted in a situation where food is produced and transported to urban areas by using significant quantities of fossil fuels. While there is little dispute that oil will ultimately peak, recent estimates indicate that fossil energy use in food production also contributes some 25% of global CO₂ emissions. With less available fossil energy, and to reduce climate change, providing future urban populations with food hence imply a major challenge. This paper therefore explores urban agriculture as a strategy for reducing climate change derived from food production, and for sustaining urban life in times of increasing energy and resource scarcity. Past experiences are examined, mainly from Cuba, with the purpose to explore some common opportunities and constraints of urban agriculture as a strategy for sustainable development. The paper also presents a recently initiated research project on urban agriculture in Brazil. The project will run until the end of 2010 and includes case studies and participatory fieldwork on urban agriculture in Rio de Janeiro. By applying a trans-disciplinary approach to urban agriculture, the study explores opportunities and constraints for increasing urban self-sufficiency, sustainability and food security, while decreasing energy consumption at aggregate levels of society. In the study, the methodologies Energy Synthesis, Participatory Learning and Action and Participatory Rural Appraisal are used in parallel. Few previous studies have in this way applied physical and social science methodologies simultaneously to urban agriculture. At this point, some preliminary results from the study are discussed, emphasizing methods of farming and experiences among urban dwellers. The paper then concludes by relating these local aspects to global issues of energy use, climate change and sustainable development.

Keywords: Urban agriculture, peak oil, climate change, sustainable development, Brazil.

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22nd May 2009

18h00-19h30 Closing Conference

**Enrique Ortega
Rodriguez**

Campinas University,
UNICAMP, Brazil

**Strategies for Changing
the Future**

Strategies for changing the future

Enrique Ortega Rodriguez
Campinas University, UNICAMP, Brazil

The Earth took millions of years to isolate the CO₂ and CH₄ in the form of carbonates in the land and seas, with gases dissolved in various forms of ice (permafrost, glaciers, icecaps), as methane hydrates in the ocean floor and also to convert the surplus of biomass ecosystems in oil, gas and coal. The new aerobic environment allowed the production of biomass and genetic diversity. But in two centuries mankind put all back in the air and caused global warming that puts at risk the existence of the human species. In front of this huge risk, the solution requires more than the view of the profit as single parameter. Accordingly, planning should consider the renewability, the natural productivity, the maintenance of environmental services, and the sustainability of lifestyles. The integration of sciences (Ecology, Thermodynamics, Biogeochemistry, Psychology and History) and traditional knowledge can lead to ecological economics and the concept of Eco-Unity and Eco-Region, fundamental keys to benchmark the new generations. In the transition to truly sustainable development (based on renewable resources) it will be necessary to produce the things needed human survival (food, raw materials, fibers, fuels and environmental services), but using fewer oil and recovering the air and the biodiversity. This can be possible only if we use lower scale production, if we adopt the Ecological ruralization and if we get a new education showing the interactions between causes and effects of socio-environmental phenomena. The projects for production and

consumption should be reviewed to determine: (a) its renewability, (b) the release of greenhouse gases, (c) the forest needed to recover the atmospheric damage, (d) the intensity and the quality of work and (e) compliance with laws that guarantee the preservation of ecosystem functions of the native vegetation.

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"KEY ELEMENTS FOR A SUSTAINABLE WORLD: ENERGY, WATER AND CLIMATE CHANGE"

214 *In* Giannetti, B. F.; Almeida, C. M. V. B.; Bonilla, S. H (editors): *Advances in Cleaner Production, Proceedings of the 2nd International Workshop, UNIP, São Paulo, SP, Brazil. May 20-22, 2009.*

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