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Suggestions for Implementation of Cleaner Production in Cassava Starch Industry

BOHN, C.; GEITENES, S.; OLIVEIRA, L.; MEES, J. B. R;
Apresentação Profa. Dra. Juliana Bortoli Rodrigues Mees
Universidade Tecnológica Federal do Paraná, câmpus Medianeira

Academic Work

INTRODUCTION

Cassava Industry

Agro-industries stand out as large polluters in Brazil, particularly because of the large amounts of waste rich in organic substances, nutrients, solids, oils and greases. In this category, cassava starch industry are known for their high polluting potential.

Cassava (*Manihot esculenta Crantz*) is a native plant originating from South America. Over 80 countries produce cassava, while Brazil participates with over 15% of world production (EMBRAPA, 2012).

INTRODUCTION

Cassava Industry

Paraná state is the leading national producer, contributing close to 70% of the total Brazilian starch production (GROXKO, 2011). The higher productivity is in the region west of the state, reaching 25 ton/ha, above the national average of 12 ton/ha (PARIZOTTO, 1999).

INTRODUCTION

Cassava Industry

In Brazil, cassava is broadly used in industry in the processing of a typical cassava flour as well as in starch extraction, and at homes for culinary purposes.

The amount of cassava waste produced depends on the processing method used.

INTRODUCTION

Wastes from cassava processing

Waste materials from cassava processing (e.g. starch) are divided into four categories:

a) Peelings from initial processing (the peels can constitute 20 - 35% of the total weight of the tuber);

b) Fibrous by-products from crushing and sieving (pulp waste);

c) Starch residues after starch settling; and

d) Wastewater (effluent).

INTRODUCTION

Wastes from cassava processing

The liquid wastes are obtained from the wash tank (root wash water) and from the extraction and separators during the starch extraction process (*manipueira*).

The liquid waste, technically called *manipueira*, contains minerals: nitrogen, carbon, phosphorus, potassium, calcium, magnesium, sulfur, zinc, manganese, copper, iron, sodium and cyanogenic glucosides (toxic compound).

INTRODUCTION/OBJECTIVE

Cleaner Production

The continuous application of an integrated preventive environmental strategy applied to processes, products, and services to increase overall efficiency and reduce risks to humans and the environment (UNEP).

The objective is the suggestion of applying actions of Cleaner Production in cassava starch factories, as these industries are found in large number in the state of Parana and have a potential pollutant due to the toxicity of *manipueira* (cassava wastewater).

MATERIAL AND METHODS

The production process was mapped, in accordance with the literature, and was identified in each step opportunities of improvement and implementation of Cleaner Production.

According to the CNTL / SENAI (2003) methodology based on Waste minimization opportunity assessment manual - EPA (1988) was proposed cleaner production opportunities.

Etapa 1 – Planejamento e Organização
Passo 1 – Obter o comprometimento e envolvimento gerencial
Passo 2 – Estabelecer a equipe do programa (Ecotime)
Passo 3 – Estabelecer metas e limites do programa
Passo 4 – Identificar barreiras e buscar soluções
Organização da equipe e definição do escopo do estudo

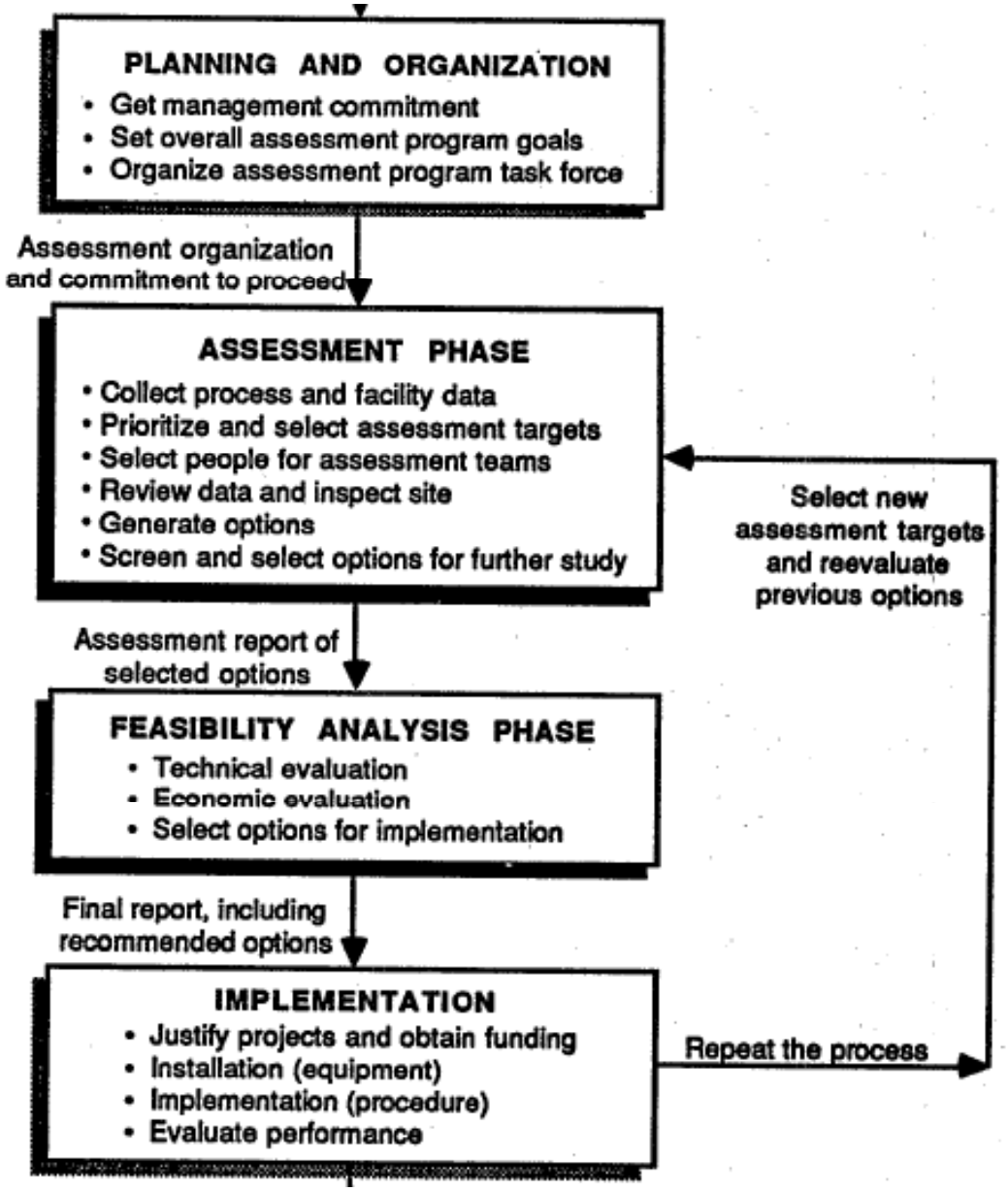
Etapa 2 – Diagnóstico e pré-avaliação
Passo 5 – Desenvolver o fluxograma do processo
Passo 6 – Avaliar as entradas e saídas
Passo 7 – Selecionar o foco de avaliação do P+L
Foco de avaliação selecionado

Etapa 3 – Avaliação
Passo 8 – Organizar um balanço de material
Passo 9 – Conduzir uma avaliação das causas de geração de resíduos
Passo 10 – Gerar oportunidades de P+L
Passo 11 – Selecionar oportunidades
Conhecimento do processo e conjunto abrangente de oportunidades de P+L

Etapa 4 – Estudos de Viabilidade Técnica, Econômica e Ambiental
Passo 12 – Avaliação preliminar
Passo 13 – Avaliação técnica
Passo 14 – Avaliação econômica
Passo 15 – Avaliação ambiental
Passo 16 – Selecionar as oportunidades a serem implementadas
Lista de oportunidades viáveis

Etapa 5 – Implantação e planos de continuidade
Passo 17 – Preparar o plano de implantação do P+L
Passo 18 – Implantar as oportunidades de P+L
Passo 19 – Monitorar e avaliar os estudos de caso
Passo 20 – Manter as atividades e o programa de P+L
Implantação dos estudos de caso e acompanhamento

Implementação de Programas de Produção mais Limpa. Brasil: **CNTL/SENAI, 2003.**



Waste minimization opportunity assessment manual. Ohio: **EPA, 1988**.

Application of Methodology

Assessment phase (*Identify sources, Identify waste/ pollution causes, Generate possible options)*

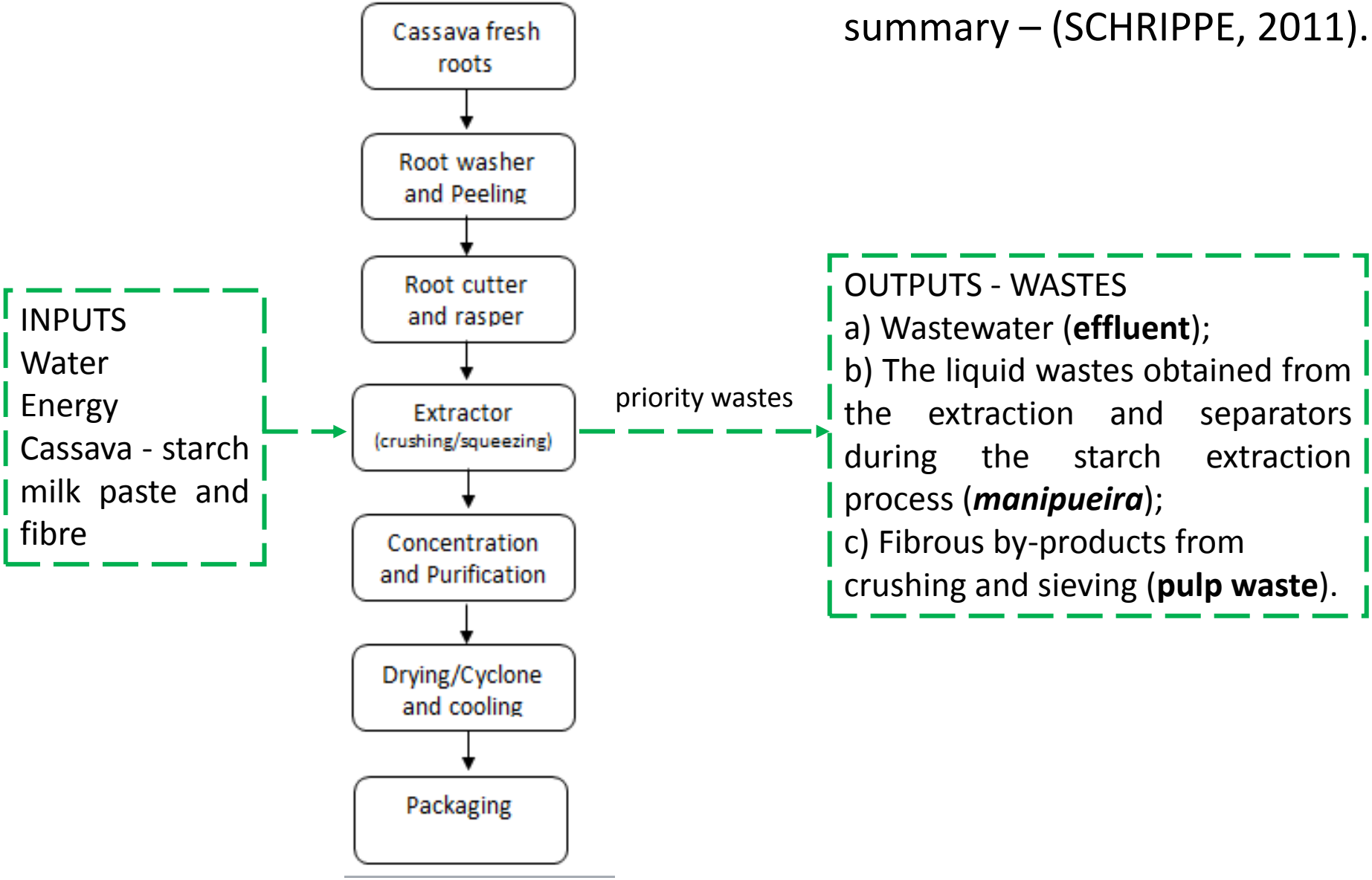
Process and facility data were collected (process flow diagrams), material balance for production and pollution control processes.

For prioritizing waste streams to assess was considered:

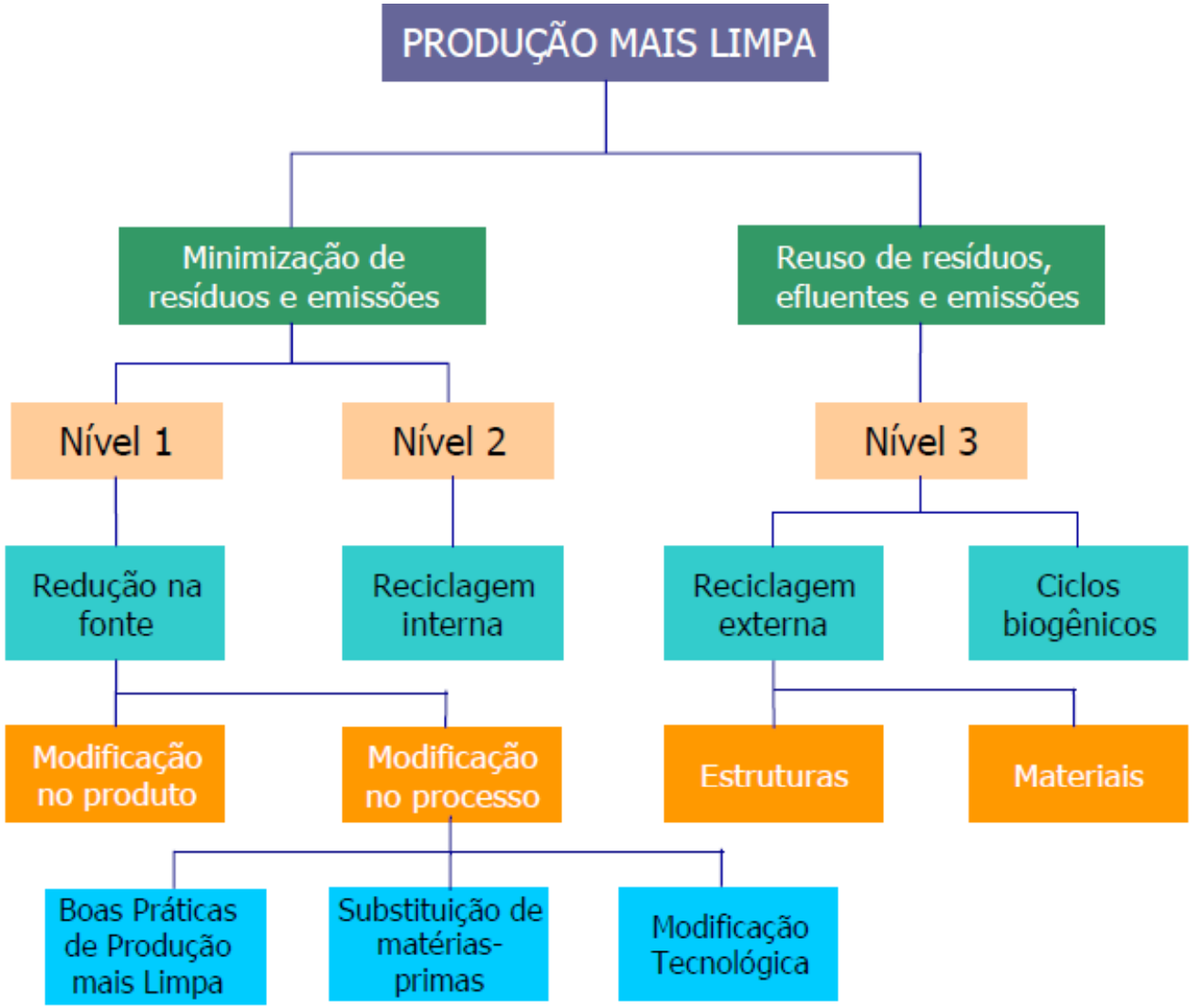
- ✓ Compliance with current and future regulation;
- ✓ Costs of waste management (treatment and disposal);
- ✓ Potential environmental safety liability;
- ✓ Quantity of waste;
- ✓ Hazardous properties of the waste;
- ✓ Other safety hazards to employees;
- ✓ Potential for (or ease of) minimization;
- ✓ Potential recovery of valuable by products, etc.

Application of Methodology

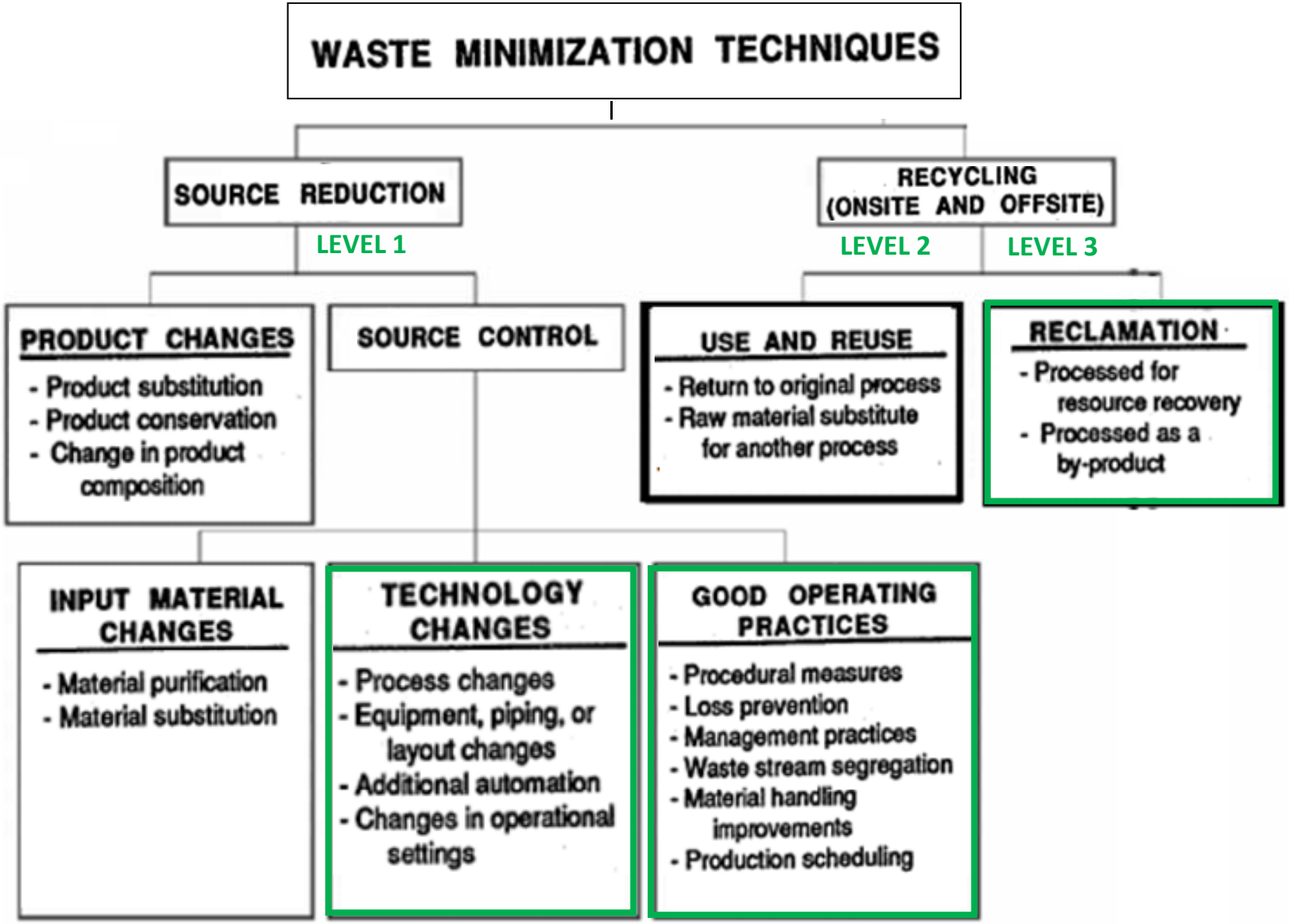
Flowchart of the cassava starch production summary – (SCHRIPPE, 2011).



Waste minimization opportunities

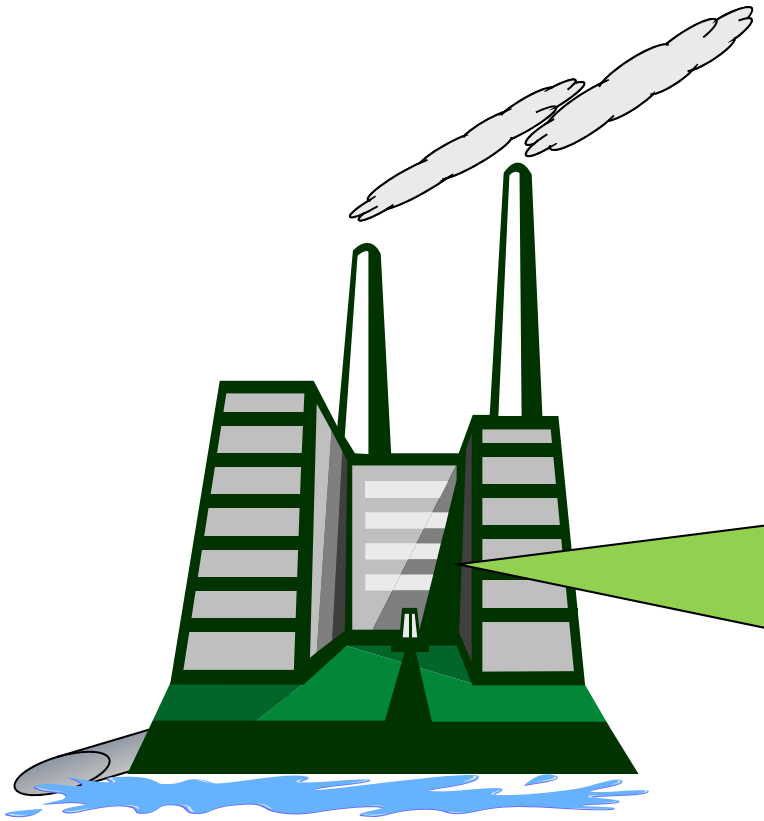


Implementação de Programas de Produção mais Limpa. Brasil: **CNTL/SENAI, 2003.**



Waste minimization opportunity assessment manual. Ohio: **EPA, 1988.**

Generation CP opportunities



Prevention of Waste generation:

- Good housekeeping
- Technology change
- Recycling/recovery/reuse

Waste minimization opportunities (Proposed)

a) Wastewater (effluent)

Proposed: Level 1 (Source control:)

Technology changes:

- Addition automation (cleaning in place - CIP).

Good operating practices (housekeeping):

- pressurized water and reduction nozzle to control the flow of water;
- cleaning the equipment immediately after use (reducing the wastewater);
- training of employees to perform cleaning efficiently without waste;
- use of dirty water taken from the first centrifuge, peeler at, while water from the second centrifuge can be reused in the process of grinding and extraction of starch.

Waste minimization opportunities (Proposed)

b) The liquid wastes obtained from the extraction and separators during the starch extraction process (*manipueira*)

Proposed: Level 3 (Recycling onsite)

- Production of biogas (anaerobic digester), allowing the use of the gas generated in the substitution of electricity purchased from the utility company, resulting in improvement in the treatment system.

c) Fibrous by-products from crushing and sieving (pulp waste)

Proposed: Level 3 (Recycling onsite)

- Replacement of corn by cassava bagasse as a concentrate for feeding beef cattle;
- The recovery of starch through double grinding is also an opportunity to be implemented.

CONCLUSION

The use of a Cleaner Production program brings many benefits to businesses, such as cost reduction, positive image to the community in which it operates and compliance with current regulation.

The cleaner production is a viable alternative to combat environmental problems of the companies, whatever its segment of industry. While there are some barriers, companies that proposes to implement the program have obtained competitive advantages.

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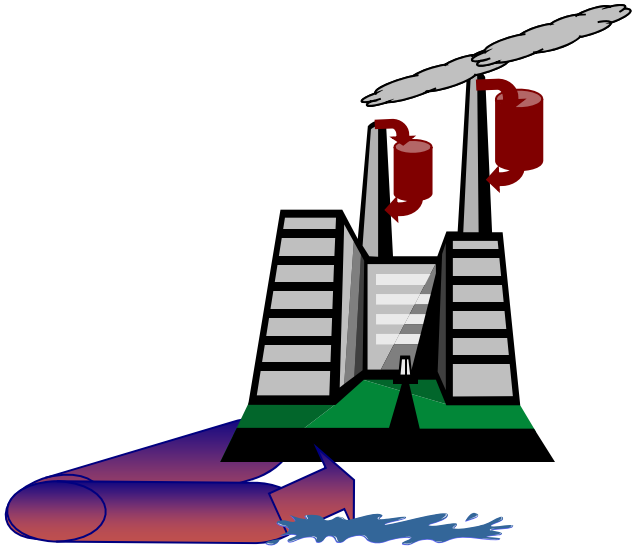

"An understanding of the business value to be gained from efficient use of natural resources is an important first step toward sustainability: toward building a world in which resources are managed to meet the needs of all people now and in the future."

(J. Lash, President of the World Resources Institute)

THANKS!