ENVIRONMENTAL ASSESSMENT OF PARBOILED PADDY PRODUCTION BY LIFE CYCLE ASSESSMENT

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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Abstract

Rice is the most popular food in Sri Lanka where approximately 70% of the paddy production goes through the parboiling process. Parboiling process is a hydrothermal treatment method. This treatment process consumes energy, water and other environmental resources and adds air and solid emissions, effluents and wastages back to environment which cause adverse environmental impacts. Total environmental input and output emissions of the parboiling process depend on the selected treatment method and the type of equipment used. Therefore the total environmental effects of each and every step in the life cycle of the production process needs to be considered in order to identify the most environmental friendly paddy parboiling method.

The overall objective of this work is to assess environmental impacts of different parboiled paddy production methods adopted in Sri Lanka by using life cycle assessment (LCA) approach. LCA is a methodological context to estimate the environmental effects caused by the life cycle of a product, service or process. Goal and scope definition, life cycle inventory analysis, life cycle impact assessment and interpretation are the four major steps in LCA methodology.

The environmental performance of three parboiling methods named as modern method with hot soaking and mechanical drying, modern method with hot soaking and sun drying and semi modern method with cold soaking and sun drying were assessed and compared quantitatively and qualitatively. Processes from paddy harvesting to rice cooking are included in the system boundary.

According to the results, highest impact of parboiled rice production is given by the cooking step. The highest impacts from cold soaking operation method were observed in eutrophication, depletion of abiotic resources and climate change impact categories. The hot soaking method resulted highest impacts on human toxicity, photo oxidant formation and acidification.

Keywords:
Paddy parboiling, Life cycle analysis, Environmental Assessment

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LIST OF ABBREVIATIONS

Abbreviation	Description
BOD	Biological Oxygen Demand
CEB	Ceylon Electricity Board
CH_4	Methane
CO	CarbonMonoxide
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
GHG	Green House Gas
HC	Hydrocarbons
IPCC	Intergovernmental Panel on Climate Change
IQF	Individually Quick Frozen
ISO	International Organization for Standardization
KTN	Total Kjeldhal Nitrogen
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory
LCIA	Life Cycle Impact Assessment
LPG	Liquefied Petroleum Gas
LSU	Louisiana State University
N_2O	Nitrous Oxide
NREL	National Renewable Energy Laboratory
NMHC	Non Methane Hydro Carbon
NMVOC	Non-Methane Volatile Organic Compounds
P	Phosphorous
PM	Particulate materials
PO_4^{-3}	Phosphate
RPRDC	Rice Processing Research and Development Centre
TSP	Total Suspended Particle
USA	United State of America

LIST OF APPENDICES