

# **ENVIRONMENTAL ASSESSMENT OF PARBOILED PADDY PRODUCTION BY LIFE CYCLE ASSESSMENT**

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## DECLARATION

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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 <sub>4</sub>               | Methane   |
| CO                            | Carbon Monoxide                                 |
| CO <sub>2</sub>               | 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 <sub>2</sub> O              | Nitrous Oxide                                   |
| NREL                          | National Renewable Energy Laboratory            |
| NMHC                          | Non Methane Hydro Carbon                        |
| NMVOC                         | Non-Methane Volatile Organic Compounds          |
| P                             | Phosphorous                                     |
| PM                            | Particulate materials                           |
| PO <sub>4</sub> <sup>-3</sup> | Phosphate                                       |
| RPRDC                         | Rice Processing Research and Development Centre |
| TSP                           | Total Suspended Particle                        |
| USA                           | United State of America                         |



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