

LB/TH/39/2025
TH5970

**INVESTIGATING THE ENVIRONMENTAL IMPACT
OF COMMON COSMETIC PRODUCT PACKAGING
FOR IMPROVED SUSTAINABILITY**

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Thesis/Dissertation submitted in partial fulfilment of the requirement for the degree
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Declaration

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Acknowledgement

I would like to express my deepest gratitude to all those who supported and guided me throughout the course of this research.

First and foremost, I extend sincere appreciation to the leading supermarket in Sri Lanka generously provided the essential data required for selecting the fast-moving cosmetic products. Although confidentiality agreements prevent me from disclosing the name of the organization, their invaluable contribution made this study possible.

I am also grateful to my former supervisor, Dr. Hirushie Karunaratne, whose early guidance and encouragement were instrumental in shaping the foundation of this research. Although no longer affiliated with the department, her insights and direction during the initial stages of the project were greatly appreciated.

I would like to acknowledge the Department of Chemical and Process Engineering, University of Moratuwa, for providing access to the LCA software tools, particularly SimaPro, which was crucial for conducting the analysis presented in this thesis.

Finally, I thank all academic and non-academic staff who extended their support in various capacities during the course of this work.

Abstract

Investigating the environmental impact of common cosmetic product packaging for improved sustainability

The cosmetic industry is a significant contributor to global plastic waste, largely due to the extensive use of plastic-based packaging materials. In Sri Lanka, a rapid growth in personal care consumption is also evident. This study investigates the life cycle environmental impacts of three widely used cosmetic packaging types in Sri Lanka, namely a plastic bottle with flip cap, a collapsible squeeze tube, and a thick-bottom plastic tub. The life cycle assessment is carried out by using, SimaPro 9.3.0.3, along with the ReCiPe 2016 Endpoint (H) method under the World (2010) H/A scenario.

The study evaluated each packaging under two functional units, packaging required for 100ml of product and packaging based on the original SKU size for clarity purposes. Environmental impacts were assessed with and without the inclusion of filling and sealing energy to determine the sensitivity of energy use in the total life cycle impacts. The findings reveal that packaging material selection significantly outweighs energy consumption in terms of total environmental impacts. Across both functional units, the collapsible squeeze tube made of LDPE showed the highest environmental impacts.

A sustainable packaging design framework was developed based on the LCA results by recommending the use of mono material structures, lightweight packaging, clear recycling labels and right size SKU selection. The framework aims to guide Sri Lankan cosmetic manufacturers in making informed, data driven decisions with a best compromise of the functionality and environmentally friendliness.

In conclusion, the study shows the importance of material selection, design simplification and system compatibility in minimizing the environmental footprint of cosmetic packaging. Future research may further explore consumer behaviour, end of life infrastructure development and comparative assessment involving bio based and refillable packaging alternatives.

Life Cycle Assessment, Cosmetic Packaging, Environmental Impact, SimaPro, Sustainable Packaging in Sri Lanka, Plastic Waste Reduction

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List of Abbreviations

LCA	life cycle assessment
PET	polyethylene terephthalate
HDPE	high-density polyethylene
ISO	international organization for standardization
PLA	polylactic acid
LCI	life cycle inventory
ABS	Acrylonitrile Butadiene Styrene
PP	polypropylene
FU	functional unit
SKU	stock keeping unit
LDPE	low-density polyethylene
DALY	disability-adjusted life years
species.yr	species lost per year
PHA	Polyhydroxyalkanoates