

ABSTRAK

Industri es krim merupakan sektor pangan yang memiliki konsumsi energi tinggi serta berpotensi menimbulkan dampak lingkungan dan biaya operasional yang signifikan, khususnya pada tahapan pendinginan dan penyimpanan. Pendekatan *Life Cycle Assessment* (LCA) dan *Life Cycle Costing* (LCC) telah banyak digunakan untuk mengevaluasi kinerja lingkungan dan ekonomi, namun penerapannya pada industri es krim umumnya masih dilakukan secara terpisah dan sering berhenti pada tahap identifikasi hotspot tanpa analisis mitigasi perbaikan secara kuantitatif. Oleh karena itu, diperlukan pendekatan terintegrasi yang mampu menilai aspek lingkungan dan ekonomi secara simultan dalam kerangka *eco-efficiency*. Penelitian ini bertujuan untuk menganalisis besaran dampak lingkungan menggunakan metode *Life Cycle Assessment* (LCA) dengan batas sistem *gate-to-gate* serta menghitung biaya siklus hidup menggunakan metode *Life Cycle Costing* (LCC) dengan pendekatan *gate-to-gate* pada produksi es krim jenis loly stroberi di PT XYZ. Unit fungsional yang digunakan adalah 1000 liter produk. Selanjutnya, hasil *Life Cycle Assessment* (LCA) dan *Life Cycle Costing* (LCC) akan diintegrasikan melalui *eco-efficiency* untuk mengevaluasi kinerja keberlanjutan sistem produksi. Penelitian ini sejalan dengan tujuan *Sustainable Development Goals* (SDGs), khususnya SDG 9 *Industry, Innovation and Infrastructure* pada poin *industrial emissions & mitigation* dan SDG 12 *Responsible Consumption and Production* pada poin *energi efficiency*. Penelitian ini juga akan menyusun mitigasi perbaikan yang disesuaikan dengan karakteristik operasional perusahaan, kemudian dilakukan perhitungan ulang dampak lingkungan dan biaya. Hasil penelitian diharapkan dapat memberikan dasar analitis dalam menentukan alternatif perbaikan yang lebih efisien secara lingkungan dan ekonomi guna mendukung peningkatan keberlanjutan sistem produksi es krim.

Kata Kunci: *Life Cycle Assessment*, *Life Cycle Costing*, *eco-efficiency*, industri es krim, *energi efficiency*.

ABSTRACT

The ice cream industry is an energy-intensive food sector that has the potential to generate significant environmental impacts and operational costs, particularly during the cooling and storage stages. Life Cycle Assessment (LCA) and Life Cycle Costing (LCC) have been widely applied to evaluate environmental and economic performance; however, their application in the ice cream industry is generally conducted separately and often limited to hotspot identification without quantitatively assessing improvement and mitigation strategies. Therefore, an integrated approach is required to simultaneously evaluate environmental and economic aspects within an eco-efficiency framework. This study aims to quantify environmental impacts using the Life Cycle Assessment (LCA) method with a gate-to-gate system boundary and to calculate life cycle costs using the Life Cycle Costing (LCC) method with a gate-to-gate approach for the production of strawberry loly ice cream at PT XYZ. The functional unit employed in this study is 1,000 liters of product. Furthermore, the results of the Life Cycle Assessment (LCA) and Life Cycle Costing (LCC) analyses will be integrated through an eco-efficiency assessment to evaluate the sustainability performance of the production system. This research is in line with the objectives of the Sustainable Development Goals (SDGs), especially SDG 9 Industry, Innovation and Infrastructure on the industrial emissions & mitigation point and SDG 12 Responsible Consumption and Production on the energy efficiency point. This study will also develop improvement and mitigation strategies tailored to the company's operational characteristics, followed by a reassessment of environmental impacts and costs. The findings are expected to provide an analytical basis for identifying improvement alternatives that are more environmentally and economically efficient, thereby supporting the enhancement of sustainability within the ice cream production system.

Keywords: *Life Cycle Assessment, Life Cycle Costing, eco-efficiency, ice cream industry, energi efficiency.*