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Cleaner Production Opportunity Assessment for a Concentrate Fruit Syrup Manufacturing Plant in Sri Lanka

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Abstract

After industrialization, industries consume more and more natural resources and contribute to the environmental pollution. Therefore, major global initiatives started to find ways of environmental management and protection, and Cleaner Production (CP) is one of the results of those initiatives that focused on pollution prevention. Specially, food and beverage industry consume a lot of natural resources. Although the beverage industry consists of a less complex manufacturing process compared to the food industry, it consumes raw materials, energy and chemicals in greater quantities that results in large amount of waste and emissions causing lot of risks to health and the environment. Therefore, this study selected beverage manufacturing plant which is a leading concentrate fruit syrup manufacturer in Sri Lanka to identify the potential of CP opportunities of the selected industry and to recommend suitable CP alternatives to the industry. Also, this study conducted a SWOT analysis in order to determine strengths, weaknesses, opportunities and threats associated with CP implementation of the selected company. The standard CP assessment methodology which was presented by United Nations Environment Programme and United Nations Industrial Development Organization was followed in the study. During the assessment, primary and secondary data was collected and interviews with the cross section of the employees were conducted. CP assessment was conducted in the plant to estimate the water consumption, product carbon footprint and the total raw material wastage from the manufacturing process and activities in the plant. The material balance showed that there were only 2.475% of unaccounted losses for a batch of product manufacturing. Also, the water balance showed the intensive water consumption activities and losses, while the carbon footprint analysis disclosed the total greenhouse gas emissions generated at the plant was 300.206 tonnes CO_2e in 2022. Since the raw material consumption efficiency was 97.525%, the study focused on five major CP opportunities including air rinsing of bottles, installing automatic clean-in-place system, installing a highly efficient air curtain, resource improvements for diesel boiler and personal training and awareness raising to reduce water usage and product carbon footprint in the plant. Furthermore, another potential CP options were recommended on the basis of cost of implementation. The SWOT analysis revealed strengths: fully optimized raw material usage, availability of resources; weaknesses: lack of knowledge regarding CP, limited flexibility of the production process; opportunities: demand for eco-friendly products; threats: uncertainty of the market etc. Additionally, this study showed that CP options are not only efficient from the environmental point of view, but also provide economic benefits to the industries through saving resources, raising productivity as well as minimizing or avoiding treatment and/or disposal costs.

Key words: Carbon footprint, Cleaner production, Concentrate fruit syrup manufacturing, Water