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**Comparison of Environmental Impacts of Orthodox and CTC Tea Processing Methods Using Life Cycle Assessment: Gate-to-Gate Approach in Pasgoda DS Division, Sri Lanka****Liyanage, A.I.G. \*, Gunawardena, U.A.D.P., Pasan Dunuwila***Department of Forestry and Environmental Science, Faculty of Applied Sciences,**University of Sri Jayewardenepura, Nugegoda, Sri Lanka**\*[arudhiliyanage@gmail.com](mailto:arudhiliyanage@gmail.com)***Abstract**

Sri Lanka is the fourth largest tea producer in the world, with tea serving as the country's main export agricultural crop. In Sri Lanka, black tea is processed primarily through two distinct factory level methods, Orthodox and Crush-Tear-Curl (CTC), which differ in their leaf handling and energy requirements. Orthodox processing accounts for about 90% of production, while CTC represents around 9%. Low-country tea (cultivated up to 600 m elevation), characterized by its blackish appearance and strong cup color and taste, contributed approximately 61% of the national output in 2023. Tea processing however generates significant environmental impacts and analysis of environmental impacts of different tea processing methods in Sri Lanka remain limited. This study therefore conducted a gate-to-gate Life Cycle Assessment to compare the environmental impacts of orthodox and CTC tea processing within factory boundaries. The assessed processing stages included withering, rolling or CTC, fermentation, drying, sorting and grading, and packaging. Primary data related to these processing stages were collected from five tea factories in Pasgoda DS Division, Matara District. The functional unit was defined as 1 t of processed tea at the factory gate. Eight environmental impact categories were evaluated using the CML-IA Baseline method in SimaPro: Global Warming Potential (GWP), Abiotic Depletion (Fossil Fuels and Elements), Acidification, Human Toxicity, Eutrophication, Terrestrial Ecotoxicity, and Freshwater Aquatic Ecotoxicity. Results show that Orthodox processing exhibited higher environmental impacts than CTC across all eight impact categories assessed. Overall, the GWP from Orthodox processing was approximately 1.25 times higher than that from CTC. Withering was identified as the largest GWP hotspot in both methods, contributing nearly half of the total impact, with Orthodox showing a slightly higher share. Abiotic depletion of fossil fuels under the Orthodox method was approximately 1.5 times higher than that of CTC, while human toxicity potential was around 1.4 times higher for Orthodox. The study identifies energy efficiency improvements in withering and drying as key mitigation opportunities, with recommendations including waste-heat recovery, optimized air circulation, and lower-carbon energy sources.

**Keywords:** *Tea, Life cycle assessment, Orthodox, CTC*