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Environmental Life Cycle Assessment of Selected Drinking Water Treatment Plants in Kurunegala District**Herath, H.M.P.K. *, Gunawardene, U.A.D.P.***Department of Forestry and Environmental Science, Faculty of Applied Sciences,
University of Sri Jayewardenepura, Nugegoda, Sri Lanka***pabodaherath01@gmail.com***Abstract**

Population growth in Sri Lanka has significantly increased the demand for clean drinking water, requiring expansion of water sources and well-purified water delivery. Conventional water treatment plants rely on continuous 24-hour pump operation and the use of chemical processes that generate residuals or by-products, which may pose risks to both environmental sustainability and human health. This study compares the environmental impacts of three drinking water treatment plants, Kurunegala (Daduru Oya), Nikaweratiya (Magalla Wewa), and Narammala (bore holes), using Life Cycle Assessment across river, tank, and groundwater sources. The study employed a gate-to-gate approach with 1 m³ of treated drinking water as the functional unit, meeting Sri Lankan standards (SLS 614:2013). Data collection included site observations, daily and monthly reports from January-December 2024 and discussions with field personnel from each treatment plant. Life Cycle Inventory quantified inputs and outputs per functional unit. Emission modeling followed IPCC 2006 Guidelines. Environmental impact assessment used ReCiPe 2016 Endpoint and midpoint methods in SimaPro 10.2.0.1, evaluating 18 impact categories. Results indicate that Narammala demonstrated the best performance in most midpoint categories, achieving reductions of approximately 11% in global warming, terrestrial acidification, and ecotoxicity compared to Nikaweratiya, primarily due to the absence of alum coagulation and associated sludge generation. Mineral resource scarcity was also lower for Narammala, reflecting minimal chemical usage in groundwater treatment. At the endpoint level, Narammala exhibited the lowest human health damage, and 10% lower resource depletion compared to Nikaweratiya. Kurunegala consistently demonstrated intermediate performance across all categories. Treatment complexity, particularly chemical coagulation intensity, significantly influenced environmental performance. These findings indicate opportunities for optimization through energy efficiency, reduced chemical dosing, and the integration of renewable energy sources.

Keywords: *Life cycle assessment, Drinking water treatment, Environmental impacts, Water sources*