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INTEGRATING LIFE CYCLE ASSESSMENT AND COST ANALYSIS FOR HEALTHCARE WASTE MANAGEMENT IN ULAANBAATAR

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Abstract – The safe, environmentally friendly, and cost-effective management of healthcare waste still remains a major concern for public health and environmental sustainability. Despite recent and ongoing efforts to improve treatment technologies and waste disposal in Mongolia, the current management of the bio-hazardous solid fraction of the healthcare waste in Ulaanbaatar capital city still presents significant room for improvements. As part of an international cooperation project, an electric steriliser based on frictional heat technology was installed in one of the main hospitals in the city to treat the bio-hazardous waste on-site. By using the Life Cycle Assessment (LCA) and cost analysis methodologies, this study aims to evaluate the environmental performance and the costs of two scenarios: the status-quo and the on-site sterilisation. The study combines data from semi-structure interviews and private data collections mainly from one hospital and two companies, with literature and databases. The LCA was conducted in accordance with ISO 14040/44 standards, and the environmental impacts were assessed using the ReCiPe 2016 method implemented in SimaPro based on Ecoinvent v3.9.1 data. The results of the Life Cycle Impact Assessment point out that the on-site sterilisation shows reductions for all the impact categories. The cost analysis encompassed operating, capital and environmental costs. The findings indicated that if the first two are higher for the on-site sterilisation scenario, environmental costs are considerably higher for the off-site treatment scenario, resulting in a total cost increase of only 9 % for on-site treatment when considering a functional unit (FU) of 250 kg of healthcare waste. Finally, the paper highlights the limitations of the applied methodologies in a context of data scarcity and with models based on European or global environmental parameters. The study advocates for greater transparency and accessibility to data when evaluating the impacts of such a potentially hazardous sector, having clear the differences of perspective between global and local environmental impact studies.

Keywords – Bio-hazardous waste; Frictional Heat Treatment (FHT) sterilisation; incineration; sustainability; steam autoclave sterilisation

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