Designing of Mixed Municipal Solid Waste Processing Line to Produce Refused Derived Fuel: under Life Cycle Assessment

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Waste disposal is one of the most significant challenges many countries face globally. In Pakistan, municipal solid waste (MSW) is mostly treated by landfilling and waste management is given less priority. Pakistan is the 5th largest populous country in the world, generating 32.6 Mt/year MSW with 0.43 kg/capita/day average waste generation rate Kaza *et al* (2018). Approximately 14 M and 10 M of MSW are generated in the country's urban and rural areas, respectively Javed *et al* (2016). Open dumping, landfilling, and non-utilization of MSW, with respect to their heating value, contribute significantly to greenhouse gas emissions (GHG). Only 60% of the urban MSW in Pakistan is collected properly, while the remaining is openly dumped without considering any treatment Pujara *et al* (2019). MSW is a resource that can contribute effectively in meeting energy demand as refused derived fuel (RDF). The RDF produced could be used in complete or partial substitution with conventional fossil fuels. In this paper MSW of Lahore city was assessed and RDF production line was designed further. RDF's environmental and economic performance was determined by life cycle assessment (LCA) and life cycle costing (LCC). The combustible portion of mixed MSW was used for making RDF and is passed through various stages, including, separation, sorting, screening, drying, shredding, and palletizing. The calorific value of RDF was 14.7 MJ/kg, making it a good alternative fuel option. LCA modeling was conducted in Gabi software, equipped with a database and primary data from the field. Attributional LCA was conducted using ReCiPe (H) life cycle impact assessment. LCA modeling results showed that RDF production from MSW is more eco-friendly than the existing landfilling practices with climate change 239 kg CO_2eq; human toxicity 0.0145 kg 1,4 DBeq; ozone depletion potential 1.08E-05 kg CFC-11eq; eutrophication potential 33.88E-03 kg Peq; acidification potential 0.25 kg SO_2eq; and phototropic ozone formation 0.144 kg NO_xeq. Scenario modeling and hotspot identification were conducted to identify the individual impact categories' impacts. Furthermore, the economic analysis showed that 1622.46 USD/day revenue

could be generated. It was concluded that RDF production from mixed MSW and utilizing it as an alternative fuel is an environmentally and economically viable option for energy generation. Besides, emissions reductions, the proposed system will also help the government generate revenue.

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