Sustainability Assessment of Biodiesel and Bioproducts from Organic Waste Using Transesterification and Liquefication

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Abstract

The global energy demand is likely to increase 28% by 2040 which increase the global warming and decrease the energy resources. Renewable resources are the promising cost-effective and efficient to sustainable production of green fuel which ultimately can alter the use of fossil energy. Concurrently, the current study aims to evaluate the techno-economic and environmental aspects of biodiesel and bioproducts production form biomass through transesterification and hydrothermal liquefication. The separated lipids friction from organic friction of municipal solid waste (OFMSW) mixed with alcohol of 1:7 mass/mass ration in the presence of Heterogenous catalyst chitosan/polyvinyl alcohol-sodium hydroxide to produce biodiesel (fatty acid methyl ester) through transesterification. The remaining biomass converted into torrefied pellets by providing 200-300 ℃ through hydrothermal liquefication. The techno-economic analysis revealed the technological viability and economic feasibility of biofuel and bioproduct. In addition, the technological area explains the characteristics of the required equipment such as cyclone (A=45.3 m^2), reactor (V=548.3 m^3), compactor (Q= 1435.8 m^3/h), and grinder (Q = 1742.1 m^3/h). Moreover, the economic analysis estimated $1.3 million per year after the recovery of capital investment of 1.8 payback year. A gate-to-gate life cycle assessment evaluate the environmental impact through Gabi software using ReCiPe 2016 Midpoint (H) and Endpoint (H) with functional unit of 1000 kg of municipal solid waste (MSW). The life cycle inventories evaluated by characterization, classification, and normalization into 18 distributive environmental impact categories. the midpoint results shows that climatic change potential is the most vulnerable categories contributes 689 kg CO_2 eq. to the environment. Fossil energy is the main hotspot contributes more than 65% to the total emission. Sensitivity analysis determined that decreasing 10% of the dominant substance we can reduce the total environmental impact and later the

biorefinery system ecofriendly, cost-effective and efficient production of biofuels and bioproducts. Thus, it is proven that biofuels and bioproduct generation is notably technologically, economically, and environmentally feasible project.

Keywords: Biofuel, bioproduct, bioeconomy, waste-to-energy, sustainability, life cycle analysis, Techno-economic analysis, environmental assessment