Abstract No: 158 ***Earth and Environmental Sciences***

EXPERIMENTAL FEASIBILITY OF BIODIESEL PRODUCTION USING WASTE COOKING OIL FROM A LARGE-SCALE HOTEL AND A RESTAURANT IN SRI LANKA

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Rising concerns about energy security, evident climate change, and depleting petroleum resources have accelerated the exploitation of potential renewable fuels around the globe. Biodiesel is one such renewable liquid fuel that has attracted significant research interest, as it can be easily blended with petro-diesel or directly used in diesel engines without modifications. Edible oils, non-edible oils, waste cooking oil (WCO), animal fats, and algae have been tested as commercial feedstocks for biodiesel production worldwide. WCO generated from the large-scale hotel and restaurant chains within the country can be identified as a potential feedstock to implement decentralized biodiesel production systems requiring minimum transportation for feedstock collection. However, the Free Fatty Acid (FFA) content and dissolved impurities in WCO can adversely affect biodiesel processing by promoting soap formation and other issues in the transesterification reaction as well as in the layer separation stage. In this study, filtered WCO samples from a five-star hotel and a large-scale restaurant were experimentally analyzed for the FFA content using the phenolphthalein indicator. Next, transesterification with 20% ($v_{methanol}/v_{WCO}$) methanol and 1% (w_{NaOH}/w_{WCO}) NaOH, phase separation and purification steps were conducted at the laboratory scale to determine the feasibility of biodiesel production. According to the results, the FFA contents of the WCO samples were below 2%, while samples from the hotel showed a slightly higher FFA content than that of the restaurant oil samples. Hence, the FFA reduction step was bypassed, and biodiesel was prepared *via* direct transesterification. Both WCO samples from the hotel and the restaurant recorded a 91% (v/v) biodiesel yield. Properties of biodiesel samples were obtained as; flashpoint: 175 ºC and 182 ºC (Cleveland open cup tester), density (at 29 ºC): 859.32 kg m^{-3} and 863.04 kg m^{-3}, viscosity (at 40 ºC): 3.36 mm^2 s^{-1} and 3.65 mm^2 s^{-1} for hotel and restaurant samples, respectively. This study demonstrates the feasibility of biodiesel production from WCO and thus can be further extended to economic analysis.

Keywords: Biodiesel, Free Fatty Acid, Renewable Fuel, Transesterification, Waste Cooking Oil