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Application of different bio-catalysts for bio-diesel production from waste cooking oil as sustainable and green energy process

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Abstract

In Egypt, solid municipal wastes density averages 300 kg/m^3. The organic materials constitute up to 60% of these wastes. The annual consumption of vegetable oil in Egypt exceeds million MT/year. Consequently, millions of liters of waste cooking oil WCO are annually discarded. All of these add to the cost of waste management and cause a lot of environmental and economic problems. The depletion of conventional petro-diesel with its accelerating and frequently fluctuating price, together with growing environmental concerns have led to the steadily gaining attention for bio-diesel production.

In this study, some domestic wastes; animal bones, eggshells and mollusks shells were used to produce heterogeneous bio-catalysts by simple calcination process. The physico-chemical characteristics of the prepared bio-catalysts were done by thermo-gravimetric analysis TGA/DSC, X-ray diffraction XRD, laser raman spectroscopy, scanning electron microscopy SEM and Fourier transform infrared FTIR spectroscopy. A comparative study for bio-diesel production from WCO using the produced bio-catalysts, standard Novozym 435 and laboratory chemical calcium oxide CaO was carried out. All the prepared bio-catalysts show high bio-diesel production activity (> 90% fatty acid methyl esters FAME in 1 h). The produced bio-diesel shows a high quality product with good and acceptable fuel properties compared with those of Egyptian petro-diesel standards and ASTM D6751 and EN 14214 standards of bio-diesel.

The production of bio-diesel from WCO using heterogeneous bio-catalysts produced from domestic wastes offers a triple positive impact solution to economic, environmental and energy problems.