# ABSTRACT

The proper disposal of organic waste at landfill sites is a main environmental concern now a days. Improper handling of organic waste causes many environmental and human health problems. The aim of present study is to produce biodiesel using fish waste oil and organic waste derived heterogeneous catalyst through transesterification. Fish waste oil was extracted through soxhlet setup and 28 % of FWO yield was obtained. Organic waste based heterogeneous catalyst were prepared through calcination method. For this purpose, banana, orange, apple, watermelon, potato, pea and pumpkin peels were utilized. Synthesized catalysts were characterized through FT-IR analytical technique. FT-IR spectroscopy confirmed the catalyst synthesis through stretching and bending vibration of various functional groups and chemical bonds at different peaks. Main functional groups identified in each catalyst are O-H, C-O (carbonates), Si-O-Si, M-O-K and M-O (metal oxides) at 3100 to 3300 $cm^{-1}$, 1100 to 1400 $cm^{-1}$, 950 to 1050 $cm^{-1}$, 2200 to 2300 $cm^{-1}$ and 500 to 800 $cm^{-1}$ wavelengths respectively. Metal oxides like Ca-O, K-O, Mg-O and Si-O are the main component of interest for transesterification. Biodiesel was produced through two step transesterification process due to high acid value of 25 mg KOH/g. Highest biodiesel yield obtained 95 %, 93 %, 92 %, 90%, 88 %, 86% and 85 % with PoPC, BPC, WPC, PPC, PuPC, APC and OPC. Biodiesel was characterized through GC-MS that confirms the highly conversion of fatty acids into fatty acid methyl esters. Number of peaks obtained are 9, 10, 12, 8, 11, 7 and 12 in BPC, OPC, PoPC, PuPC, WPC, PPC and APC biodiesel respectively. C11- C18 are the main carbon numbers present in each biodiesel sample. The methyl esters with major percentage area are Oleic acid (38 %), Palmitic acid (36 %), Ricinoleic acid (18 %), Stearic acid (28 %), Linoleic acid (7.5 %), Palmitoleic acid (6.1 %), and Myristic acid (3.3 %). The produced biodiesel with all catalysts aligns the international standards for physicochemical properties as well. Study findings reveal that fish waste is a sustainable feedstock for biodiesel production. Moreover, utilization of organic waste as catalyst is also a cost-effective option as compared to homogeneous and enzymatic catalysts.