Abstract

In the current study, waste acid oil was assessed for its efficiency to get converted into biodiesel. Waste oil sample was collected from seasons canola limited, Pakistan. Physicochemical analysis of the sample was performed by measuring its density, acid value and saponification value. Various pretreatment procedures i.e., heating, glycerolysis, metal (zinc dust, $SnCl_2$, $MnCl_2$, $CdCl_2$ and $NiCl_2$) catalyzed glycerolysis and acid (H_2SO_4, H_3PO_4 and HCl) treatments were carried out to decrease the free fatty acid number of oils. The influence of all the reaction parameters including time, temperature, catalyst, methanol and glycerol concentration was observed. Maximum reduction in acid number with glycerolysis and acid (H_2SO_4) treatment was 0.44 mg KOH/g and 0.944 mg KOH /g, respectively. Pre-treated waste acid oil was subjected to biodiesel synthesis with different alkalis (KOH, NaOH, and $NaOCH_3$) and lipase (10.08 U/mL/min). Maximum product formation was obtained by using 1% NaOH and 20% free lipase i.e., 88.91% and 94.3% respectively. Two different purification procedures including wet wash (hot water washing) and dry wash (using silica and amberlite as adsorbents) were employed to eliminate unreacted methanol, catalyst and soaps from the product. Purified biodiesel was characterized by measuring the specific gravity i.e., 0.86. Fuel properties of produced biodiesel, i.e., carbon residue (0.01%), kinematic viscosity (6.43 mm^2/s), distillation temperature (325°C), flash point (193°C), fire point (270°C), pour point (-13.5°C) and cloud point (-8.2°C), were in standard ASTM ranges. Emission properties including NOx, SOx and NO_2 of lipase biodiesel were found better than alkali and conventional diesel.