

Catalytic plastic pyrolysis fuel separation and its combustion behavior using pyrolysis oil/diesel blends in a 5 kW boiler

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Plastic pyrolysis oil, obtained from the plastic waste pyrolysis, was upgraded over a catalytic separation in a 2-kg-scale pyrolysis oil separator using nickel and copper based catalysts. The middle (F2) oil (diesel-like fraction (C₁₁-C₁₂)) was obtained about 65 wt.% yield, which showed much similar characteristics to petro diesel. Therefore, the combustion of plastic oil/diesel blends (the plastic oil content: 0, 10, 30 and 50 wt.%) was performed in a 5 kw scale boiler to evaluate the combustion and emission performance. The efficiency of combustion efficiency using 10% plastic oil/diesel blend showed about 59.0% at a fuel-air equivalence ratio (Φ) of 0.91. The highest boiler internal temperature was observed at about 1060 °C ($\Phi=0.91$). In addition, flue gas analysis indicated that the blends and diesel had similar concentrations of CO (about 13ppm at $\Phi=0.91$) and CO₂ (about 13 vol.% at $\Phi=0.91$). However, a lower NO concentration of 52 ppm was obtained with diesel as compared to blends (80-130 ppm) at a Φ of 0.91 due to the higher nitrogen content in plastic oil. Similarly, almost no N₂O was found in the diesel whereas a little amount of N₂O (<4ppm) was observed.