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PLASTIC WASTE RECYCLING TO PRODUCE OIL BY PYROLYSIS: PHYSICO-CHEMICAL AND FTIR ANALYSIS OF THE PYRO-OIL

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Abstract

Plastic waste transformation has short comings like land wastage, air pollution, surface heating etc. The main objective of this study was to recycle single and mixed plastics through pyrolysis to produce pyro-oil. Pyrolysis of six different plastic types was carried out in a batch reactor. The density, acid value, saponification value, pour point, viscosity, iodine value, specific gravity, heat of combustion, cetane number, and FTIR were used to characterize the products. From the physical properties, it was seen that single plastics gave better properties, and their mixtures also improved the properties; for instance, the density of polystyrene was 0.907 g/cm³, however, when mixed with high-density polyethylene, low-density polyethylene, and polypropylene, the densities were 0.851, 0.856, and 0.872 g/cm³ respectively. Highest oil yields of 92% and 86% was obtained for PP-PS and LDPE-PS mixtures respectively. Highest cetane numbers of 2224.71 and 2005.75 were obtained for oils from LDPE-PP and LDPE-PS respectively. The specific gravity, density and viscosity of the oils obtained from all the plastics and mixtures were within the standards for commercial diesel. Oils from HDPE/LDPE, HDPE/PS have the same groups (C=O, C-H, C=C) as in diesel from local petrol station. However, oils from single and other mixed plastics contained N-H, and C-N groups found in petrol from local petrol station. This indicate that oil from plastics can be used as diesel or petrol. FTIR analysis of each individual and mixed plastic fuel oil showed that they contained some undesirable groups such as S-H, C-Cl that needed to be eliminated to make the oil 100 % suitable. Hence, further purification is required to improve the quality of the obtained oil for different applications and for environmentally friendly usage.

Key words: waste, plastics, plastic recycling, pyro oil, pyrolysis

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