

PLASTIC WASTE TREATMENT BY PYROLYSIS

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ABSTRACT

The increase in the global plastic production resulted serious environmental problems including the accumulation of plastic waste. Various treatments of the waste like recycling or energetic utilization are able to lower the environmental pollution, however a significant amount of the used plastic is still landfilled. Pyrolysis can be an effective method to decrease the environmental impact of plastic waste generation. In this study, the thermal degradation of high- and low-density polyethylene, polypropylene, and polystyrene was investigated. These plastics results in valuable hydrocarbon oils containing mainly paraffins, olefins and aromatics. Experiments were performed in a laboratory scale batch reactor using the individual plastics and two mixtures (with and without PS). The oils produced were separated into gasoline and diesel fractions (210 and 350 °C cuts). The gasoline fractions were further analysed by GC-MS. The results showed that the concentration of olefins in the pyrolysis oils significantly exceeds the maximum amount stated in the EN-228 European gasoline standard. The olefin concentration of pyrolysis oils can be lowered by hydrotreatment, thus an additional catalytic hydrogenation experiment was carried out by utilizing the gasoline fraction of the mixture not containing PS.

Another valuable product of the process is the pyrolysis gas. An average gas yield of ~20 wt% could be achieved, which is heavily influenced by the ratio of plastics utilized. The composition analysis of the pyrolysis gas showed a significant amount of ethane, ethene, propane and propene, which enhances the heating value. The combustion of this gas may be able to cover the energy requirements of the process.

Key words: plastic waste, pyrolysis, energy, fuel