

Pyrolysis of Mixed Plastic Fractions with PP, PET and PA

Authors : Rudi P. Nielsen, Karina H. Hansen, Morten E. Simonsen

Abstract : To improve the possibility of the chemical recycling of mixed plastic waste, such as municipal plastic waste, work has been conducted to gain an understanding of the effect of typical polymers from waste (PP, PET, and PA) on the quality of the pyrolysis oil produced. Plastic fractions were pyrolyzed in a lab-scale reactor system, with mixture compositions of up to 15 wt.% PET and five wt.% PA in a PP matrix and processing conditions from 400 to 450°C. The experiments were conducted as a full factorial design and in duplicates to provide reliable results and the possibility to determine any interactions between the parameters. The products were analyzed using FT-IR and GC-MS for compositional information as well as the determination of calorific value, ash content, acid number, density, viscosity, and elemental analysis to provide further data on the fuel quality of the pyrolysis oil. Oil yield was found to be between 61 and 84 wt.%, while char yield was below 2.6 wt.% in all cases. The calorific value of the produced oil was between 32 and 46 MJ/kg, averaging at approx. 41 MJ/kg, thus close to that of heavy fuel oil. The oil product was characterized to contain aliphatic and cyclic hydrocarbons, alcohols, and ethers with chain lengths between 10 and 25 carbon atoms. Overall, it was found that the addition of PET decreased oil yield, while the addition of both PA and PET decreased oil quality in general by increasing acid number (PET), decreasing calorific value (PA), and increasing nitrogen content (PA). Furthermore, it was identified that temperature increased ammonia production from PA during pyrolysis, while ammonia production was decreased by the addition of PET.

Keywords : PET, plastic waste, polyamide, polypropylene, pyrolysis

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