

A method for pre-treatment of waste plastic pyrolysis oil allowing the evaluation by pyrolysis gas chromatography

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Waste plastic pyrolysis has been the center of interest of many research groups since this process is very promising way of chemical recycling. The products are usually split into three material streams – gas, pyrolysis oil and char. Our goal is to perform micro-pyrolysis experiments on the pyrolysis oil stream using pyrolysis gas chromatography apparatus, in order to evaluate the pyrolysis oil as potential feedstock for steam-cracking process.

Unfortunately, the examined samples contain substances that cause deactivation of the chromatography column. Therefore, the mixture needs to be treated prior the experiment, so that the negative effects on pyrolysis apparatus would be removed, but the chemical nature of the mixture would stay intact. A three steps distillation method has been developed to cope with the problem. The sample is firstly distilled under atmospheric pressure, then under a lowered pressure and finally under a deep vacuum. It was revealed, that the harmful substances are contained at the heaviest fraction with the highest boiling points and therefore, the distillation residue was not pyrolyzed. Pyrolysis experiments could be performed with all lighter fractions. But the contribution of the heaviest one to the final composition of the products cannot be ignored. The method offers not only a possibility for removal of negative effects on the analytical device, but also an extrapolation of missing data. Because the sample is fractionized during the distillation, the product composition of the distillation residue pyrolysis can be extrapolated from information gained during experiments with lighter fractions.

Preliminary results suggest, several tested samples of waste plastics pyrolysis oils would be possible and potentially attractive feedstock for the steam-cracking process. As shown, the pyrolysis chromatography connected with appropriate pre-treatment of the sample is very promising tool for the evaluation of waste plastics pyrolysis oils in order to determine their potential as steam-cracking feedstock.

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