Post-pyrolysis Processing of Mixed Polymeric Waste to Obtain Useful Organic Raw Materials

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Following my last year’s project, I continue to be concerned by the environmental impact of polymeric waste – how it scars the land and poisons water – and ways to improve its recyclability in my country and the world, using pyrolysis. Now I want to understand if a specific combination and order of post-incineration processing will yield more useful substances. I again conducted low-temperature non-catalytic pyrolysis of a mix of polymers, then atmospheric distillation of the hydrocarbon fraction. I outsourced gas chromatography-mass spectrometry then analyzed the results myself. Next, I rectified the condensate using a nozzle-type column to isolate and identify individual substances. I studied the obtained fractions by physicochemical methods of analysis. After establishing the fractional composition of the mixture and isolating the components of interest to industry, t the high-temperature fraction was subjected to hydrotreatment, to remove the unsaturated C=C bond. The resulting hydrocarbons are useful for basic organic and petrochemical synthesis. Through isomerization, I obtained high-octane gasoline, too. Resulting soot was caught by a filter which was subsequently ecologically disposed. The resulting low molecular weight hydrocarbons, soot and CO were burned off to form carbon dioxide, which can be used in an industrial setting as part of a closed energy cycle. The tested processes produced 50-60 % less CO2 per (extrapolated) ton than simple burning of polymer waste. The specific processing arrangement of polymers after pyrolysis yields harmful substances and useful ones. Additional research and experimentation should lead to better ways to minimize the former and maximize the latter.

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