Using Pyrolysis to Recycle Polymers into Synthetic Fuels

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Polymer waste processing is a pressing issue because disposal requires much energy and the garbage must first be sorted –adding labor costs. Scientific and engineering literature showed that thermochemical processing of mixtures of polymeric materials can be an efficient recycling method. Furthermore, there is evidence that pyrolysis can yield a useful by-product: synthetic motor fuel. My project investigated pyrolysis of individual polymers and polymer mixtures. Component ratios were based on weight and prevalence in municipal solid waste. During the first stage, I studied the pyrolysis of individual polymers: polyethylene terephthalate, polystyrene, polyethylene, polypropylene and styrene-butadiene rubber to show that each is suitable for this processing method. The second stage involved pyrolysis of a polymer mixture and atmospheric distillation of reaction products, followed by rectification of the condensate and cracking of the still residue. The work was conducted in the low-temperature range (500–600°C). Non-condensable gaseous products produced during the destruction-reaction were recycled through a gas bubbler and incinerated to heat the pyrolysis reactor. Compounds with double bonds ?=?; ?=? and ?=? were then hydrogenated on a nickel catalyst. The composition of fractions was monitored at all stages using 1H NMR and IR spectroscopy, chromatography-mass spectrometry and gas chromatography. Gasoline and diesel-type fractions corresponding to industrial analogues resulted. The method allows important environmental & economic aspects to be addressed: disposal of waste polymers, production of synthetic fuels, and environmental protection. A full cycle of processing polymer mixtures was created: pyrolysis, rectification, cracking and hydrogenation.

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