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Efficient Depolymerization of Polyethylene-Based Plastics

-Background Discarded polyethylene-based plastics are not usually recycled because of their resistance to depolymerization due to stable carbon bonds. Pyrolysis is a quick thermochemical treatment technique that destroys plastic structures and turns them into fuels and chemical products. For the pyrolysis process, however, feedstock drying is required, and the reaction must be carried out at high temperatures (450–800°C). Furthermore, pyrolysis has low oil yields without catalysts, and the oil produced requires upgrading for fuel applications, resulting in a high processing cost. Invention Description Research at Arizona State University has led to the development of a depolymerization method for plastic materials, particularly polyethylene-based plastics. This is achieved by processing polyethylene under hydrothermal conditions with different solvents to form a gaseous product, an oil-phase product, and solid residues. Experiments show that under optimal conditions, 74.8% of the polyethylene samples could be converted into gaseous and liquid products. With the use of 1-Butyl-3-methylimidazolium tetrafluoroborate (BMIM-BF4) catalyst at 350°C, up to 90% of polyethylene samples could be converted to gaseous or liquid products, including ethylene, ethane, butane, and propane. Potential Applications • Depolymerization of polyethylene via hydrothermal liquefaction (HTL) • Recycling of plastic electronic waste • Production of butane, propane, and other gases • Pavement rejuvenation using partially unconverted plastic residuals Benefits and Advantages • Conversion yields as high as 75–90% through depolymerization of polyethylene to liquid and gaseous products • All products (gas, liquid and solid) can be recovered, separated, and reused • Lower cost and higher oil yield compared to the pyrolysis process Research Homepage of Professor Shuguang Deng