HYDROCRACKING OF A PLASTIC MIXTURE OVER VARIOUS MICRO-MESOPOROUS COMPOSITE ZEOLITES

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Conventional plastic waste management methods such as incineration and landfilling are not benign to the environment. Landfilling results in the accumulation of gigantic volume of plastic waste to occupy the land for a longer period of time and incineration emits poisonous gases. These methods are considered unacceptable from environmental point of view whereas chemical recycling methods such as cracking and hydrocracking are considered more environmentally friendly. Hydrocracking of a plastic material in which longer chain hydrocarbon molecules are broken down to shorter chain hydrocarbons is a promising method of converting waste plastic materials to high quality liquid transportation fuels. It is exothermic in nature, carried out at lower temperatures, and gives higher quality liquid products compared to catalytic and thermal cracking processes. In the present work, various micro-mesoporous zeolite catalysts are synthesized and well characterized using XRD, BET, SEM, EDX, and Py-FTIR techniques. The catalysts are tested in a high pressure autoclave reactor to study the hydrocracking of a model plastic mixture with initial H2 pressure of 20 bar, 400 °C, residence time of 50 min, and feed to catalyst ratio of 10:0.5 (by wt). The conversion of plastic material and yields of the products are obtained by solvent extraction using tetrahydrofuran (THF) and n-heptane and GC-MS and GC-FID are used for the analysis of gas and oil fractions. A few of the composite catalysts used in the study are found highly active and selective towards liquid yield and show the ability to be used on the commercial scale.