

Recycling of Polymers in the Presence of Nanocatalysts: A Green Approach towards Sustainable Environment

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Abstract : This work involves the degradation of plastic waste in the presence of three different nanocatalysts. A thin film of LLDPE was formed with all three nanocatalysts separately in the solvent. Thermo Gravimetric Analysis (TGA) and Differential Scanning Calorimetric (DSC) analysis of polymers suggest that the presence of these catalysts lowers the degradation temperature and the change mechanism of degradation. Gas chromatographic analysis was carried out for two films. In gas chromatography (GC) analysis, it was found that degradation of pure polymer produces only 32% C3/C4 hydrocarbons and 67.6% C5/C9 hydrocarbons. In the presence of these catalysts, more than 80% of polymer by weight was converted into either liquid or gaseous hydrocarbons. Change in the mechanism of degradation of polymer was observed therefore more C3/C4 hydrocarbons along with valuable feedstock are produced. Adjustment of dose of nanocatalyst, use of nano-admixtures and recycling of catalyst can make this catalytic feedstock recycling method a good tool to get sustainable environment. The obtained products can be utilized as fuel or can be transformed into other useful products. In accordance with the principles of sustainable development, chemical recycling i.e. tertiary recycling of polymers along with the reuse (zero order recycling) of plastics can be the most appropriate and promising method in this direction. The tertiary recycling is attracting much attention from the viewpoint of the energy resource.

Keywords : degradation, differential scanning calorimetry, feedstock recycling, gas chromatography, thermogravimetric analysis

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