

Polystyrene Waste Management via Catalyst Assisted Modified Thermal Cracking Process to Form Less Toxic Organic Byproducts**Malalasekara P.P., Karunarathne P.K.D.M.C.****Department of Chemistry, University of Sri Jayewardenepura***mck@sjp.ac.lk*

Polystyrene is one of the most widely used polymers in the world today. Polystyrene production has been increasing dramatically, mainly due to its low cost and ease of manufacturing. Furthermore, polystyrene materials are useful in producing a multitude of products in a wide spectrum of applications including packaging, insulation, construction, automotive and medical. The ever increasing demand for polystyrene articles has created unique problems as well. As a matter of fact, the natural decaying time of a polystyrene material is very long though, the service life of polystyrene products are very short and a large waste stream pile-up each year. Waste polystyrene materials are either burnt or discarded as municipal solid waste. Burning of polystyrene release hazardous gases including poly aromatic hydrocarbons (PAHs) which are identified as carcinogenic compounds and the disposal as a solid waste creates various environmental problems due to their low density, high volume and non-degradable nature. Discarded foam materials often obstruct the drainage systems are a major culprit for flash flooding. Hence, a proper recycling method is required as a better solution for this highly overlooked environmental damage caused by polystyrene. During this research, it was investigated a modified waste polystyrene recycling method. Polystyrene cracking was conducted by using a lab scale batch reactor and all the samples collected during the study were analyzed by using GC-MS. Thermal and catalytic cracking conditions were optimized at the initial stage. Styrene monomer was obtained as almost only by product and maximum yield of styrene monomer was reached by heating at 350° C for two hours using waste polystyrene and BaO catalyst 100:1 mixture. Polystyrene was dissolved in toluene and mixed with BaO to maximize the dispersion of the catalyst in polystyrene. In the second phase, waste polystyrene was cracked in the presence of a Friedel Crafts alkylation reaction precursor; anisole and a catalyst; BiCl₃ under the optimized cracking conditions. Through this process, more toxic styrene monomer can be converted to less toxic product. After the cracking and the reaction insitu, 1,1-diphenylethane (DPE) was obtained as one of the products and can be considered as a product obtained from the reaction between styrene monomer and anisole. DPE has been reported as a useful organic building block. However, the formation of this product is not supported by the available literature.

Keywords: Polystyrene waste, Thermal cracking, Catalytic cracking, 1,1-diphenylethane