Development of Poly Urethane based Composite using Plastic Waste of PET Bottles and Agro Waste

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In general, more than 75% of the materials which are daily used by a human being are made out of polymers. But most of them are very hazardous to the environment and human health. If these polymers are recyclable at least waste problems can be mitigated. Most of the plastic products contain fillers in order to minimize the production cost. Silica is one of the commonly used filler which is mostly produced from the sand rich with silica. The silica production involves hazardous chemicals too. We found that silica can be effectively extracted from the rice husk ash using precipitation method. This silica may be used as a filler to improve the mechanical properties of the polymer. Also, we are mainly focusing to give a solution to waste management of Poly Ethylene Terephthalate (PET) based plastics and rice husk. Specifically, in this work we degrade PET waste using glycolysis method to get hydroxyl terminated-PET (h-PET) molecules that can be used as a precursor to make polyurethanes (PUs) with commercially available diisocyanates. Further, the synthesized PU is reinforced by introducing silica extracted from rice husk ash. Series of PU samples were made from varying the wt% ratio of hydroxyl terminated-PET molecules and methylene diphenyl diisocyanate (MDI). Formulated PUs were characterized using Fourier transform infrared spectroscopy (FT-IR). The optimum ratio of MDI to h-PET was found to be 1:1 which was confirmed by the results of FT-IR. Extracted silica was characterized using FT-IR, X- ray diffractometry, X-ray fluorescence spectrometry and scanning electron microscopy. Different wt% of extracted silica was incorporated to the synthesized PU. Interestingly, we found that the free diisocyanate of MDI form new chemical bonds with silanol groups present in extracted silica which was confirmed from FT-IR analysis. Thus, the enhanced mechanical properties in the composite were accounted due to the formation of well mixed silica particles in the PU matrix.

Keywords: Polyurethane, Rice husk, Silica, PET waste