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Preparation and Characterization of High Molecular Weight Polyamide 6 via Anionic Polymerization of ε-Caprolactam by Using Mixture of Di & Tri Functional Chain Initiator

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In the present work an attempt was made to synthesis polyamide 6 through anionic polymerization of ε-caprolactam by using a mixture of Diphenylmethan 4, 4'-di and tri isocyanate and sodium caprolactamate as a chain initiator and catalyst, respectively. Polymerization was carried out in a laboratory internal mixer (Brabender). The rotor speed, reaction temperature and reaction time were among processing variables studied. The samples were characterized by Thermo Gravimetry Analysis (TGA), Differential Scanning Calorimeter (DSC) and FT-IR spectrometer. The melt flow behavior and viscoelastic properties of the samples were studied by using a Rheometric Mechanical Spectrometer (RMS). The polymerization reaction was found to be very fast such that it completed within 6 minutes as could be detected by following the mixing torque which reached to a steady state after passing a maximum. The prepared samples showed high viscosity and storage modulus (G') particularly at low shear rate range indicating that the polyamide 6 prepared in this work had much higher molecular weight and slightly narrower molecular weight distribution in comparison with all the commercial grades of the polyamide 6. The crystallinity of the samples was also higher (1.5 times) than that of commercial polyamide 6. These results were attributed to the long chain branches formed due to three functional nature of the chain initiator.