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SYNTHESIS, CHARACTERIZATION AND INVESTIGATION THE EFFECTS OF TWO PROCESS PARAMETERS ON MOLECULAR WEIGHT OF POLY(BUTYLENE TEREPHTHALATE)

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(PBT) is a thermoplastic elastomer used extensively as an engineering plastic. PBT has excellent mechanical and processing properties and is, therefore, used in the electronics and automotive industry, and also in consumer goods and films.

PBT was synthesized by terephthalic acid (TPA) and 1,4-butanediol (BDO) during melt condensation in a semibatch reactor.

To increase the molecular weights of samples, The first synthesis step was conducted under two different pressures, 3.5 and 4 bar, also feed composition was changed from 1:5 to 1:7 mole fraction of OH groups to COOH groups. The second step was performed under vacuum at high temperature (240–260°C).

TPA and 1,4-BDO with a hydroxyl group/acid group molar ratio of 1.7 were mixed before transferring into the reactor so that the mixture would be homogeneous. The overall weight of the material was 650 g. A total of 300 ppm antimony trioxide was added to the mixture as a polycondensation catalyst. The paste was mixed for 30 min at 45-90°C under atmospheric pressure. The temperature and absolute pressure under nitrogen purge were then increased to 240-245°C and 3.5,4 atm, respectively, as fast as possible. The esterification step was continued for up to 3 h. The temperature was then raised to 260°C, and the pressure was reduced to 0.04 atm. Polycondensation was the predominant reaction in this step. BDO, as a byproduct of the polycondensation reaction, was removed by a vacuum pump. This step was continued for 3–3.5 h. Finally, the pressure was changed to atmospheric pressure, and all the materials were evacuated by nitrogen pressure.

The synthesized PBTs were characterized by means of Fourier transform infrared spectra (FTIR), viscosity measurements, differential scanning calorimetry (DSC), X-ray diffraction(XRD) and thermogravimetry analysis(TGA) measurements.

It was found that inherent viscosities and the molecular weights of the samples were remarkably increased under the applied condition, leading to a increase in the crystallinity.