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Microwave-assisted catalytic synthesis of bio-based copolymers from waste cooking oil

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Solvent-free copolymerization of epoxides derived from fatty esters of waste cooking oil with phthalic anhydride using (salen)$Cr^{III}Cl$ as catalyst and n-Bu_4NCl/DMAP (tetrabutylammonium chloride/4-(dimethylamino)pyridine) as co-catalysts was carried out for the first time under microwave irradiation, where reaction time was reduced from a number of hours to minutes. The polyesters were obtained with molecular weight (M_w = 3100–6750 g/mol) and dispersity values (D = 1.18–1.92), when (salen)$Cr^{III}Cl$/n-Bu_4NCl was used as catalysts. Moreover, in the case of DMAP as a co-catalyst, polyesters with improved molecular weight (M_w = 5500–6950 g/mol) and narrow dispersity values (D = 1.07–1.28) were obtained even at reduced concentrations of (salen)$Cr^{III}Cl$ and DMAP. The obtained products were characterized and evaluated by attenuated total reflection-Fourier transform infrared spectroscopy (ATR-FTIR), proton nuclear magnetic resonance (1H-NMR) spectroscopy, gel permeation chromatography (GPC), thermogravimetric analysis (TGA) and differential scanning calorimetric (DSC) techniques. This renewable (waste/recycled cooking oil) based biopolymers with good molecular weight have a great potential to replace petroleum based products in the future. This study will contribute greatly to making waste cooking oil useful for the polymer industry.

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