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Catalytic copolymerization reaction of CO_2 and propylene oxide over polyalcohols under subcritical conditions

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Abstract

CO_2 can be used in copolymerization reactions as a C1 feedstock. Propylene oxide is a perfect candidate for such reaction. Through the mechanism of Ring Opening Polymerization, CO_2 can be inserted into the polymer chain. Zinc glutarate (ZnGA) and Zn-Co double metal cyanide (DMC) have been studied as active heterogeneous catalysts for the study. An exhaustive characterization of these catalysts (prepared and used under different conditions) in copolymerization reactions. Catalysts were analyzed by different techniques such as Fourier transform infrared spectroscopy (FTIR and FTIR with pyridine), Inductively coupled plasma optical emission spectrometry, Light scattering, Scanning Electron Microscopy and Energy-dispersive X-ray spectroscopy, N_2-physisorption, X-ray photoelectron spectroscopy, X-ray powder diffraction and Thermogravimetric analysis-mass spectrometry. A number of reaction conditions have been tested, demonstrating the effect of pressure, temperature, amount of catalyst, catalyst deactivation and catalyst preparation. The obtained copolymers were analyzed by infrared spectrometry and gel permeation chromatography. High active DMC catalyst (2.5 kg polymer/g catalyst) could be synthetized obtaining 0.4 % of the byproduct cyclic carbonate. This reaction can be the base of a future chemistry to obtain polymers based in bio-alcohols.

Keywords: ZnGA, DMC, copolymerization, catalyst, carbon dioxide, zinc hexacyanocobaltate, ring opening polymerization, propylene oxide, polypropylene carbonate, bioalcohols

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