HETEROGENIZED POLYMER COMPLEXES AS CATALYSTS FOR BIODIESEL PRODUCTION

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Background

Biodiesel (fatty acid methyl esters) has become very attractive, because of its environmental benefits and the fact that it is produced from renewable sources. Recently traditional acid and alkaline catalysts are being replaced by Lewis acid catalysts because of a number benefits provided by Lewis acids (for instance, homogeneous alkaline catalysts in the transesterification of such types of fats and oils cannot directly be used due to the presence of large amounts of free fatty acids, and acid catalysts produce hazardous wastes). We prepared and tested as catalysts a range of polymer supported Lewis acid based catalysts with different metals.

Results

Polymer-based complexes with metals (Zn, Co, Ca, Ni, Sn, and Pb) prepared by different techniques (coprecipitation, adsorption) were tested as catalysts in transesterification of triglycerides (tributyrin was used as a model oil component). Chitosan, polyaniline, polyethylene glycol were used as carriers for catalysts. The structure and stability of the complexes were investigated by EXAFS, XPS, IR, and SEM. Catalytic testing revealed a good performance of all the catalysts for the reaction of transesterification, with Pb -chitosan complexes demonstrating the best catalytic activity, Ni, Sn-complexes demonstrate the activity comparable with the most active metal. Tributyrin conversion reached 95% for Pb-containing catalysts, and 80% for the Ni-sample, with the selectivity 98%. Sn, Pb, Ni, Zn, Ca-containing complexes were successfully applied to transesterification of sunflower-seed oil. EXAFS results testify about the catalyst stability during the catalysis. However, the reaction rate could be increased, for instance, by immobilization of the polymer complex on the surface of macroporous SiO_2. In this case, the activity of catalyst increased by a factor of five.