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Etherification of bio-glycerol to oxygenated fuel additive over sulfonated mesoporous polymer catalyst

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Transportation sector has been identified as a major polluting sector and hence the use of biofuels is important in view of the tightening of emission norms. From an Indian context, it is argued that blending ethanol with petrol and diesel will reduce import dependence on crude oil, saving on foreign exchange outflows to that extent. But, energy security can be addressed only if the supply of ethanol available to industry is adequate. However, biofuel area is much matured in the developed countries and for every 90 kg of biodiesel produced, 10 kg glycerol formed as an unwanted byproduct. One way of utilizing glycerol is to convert it into glycerol ethers and other derivatives which are potential fuel additives and blending these additives in gasoline and diesels in the range of 5 to 15% will reduce import dependence on crude oil, saving on foreign exchange outflows to that extent thereby contributing to the society and also reducing pollution. In this study mesoporous polymers (MP) were synthesized by free radical polymerization of divinylbenzene by solvothermal method followed by sulfonic acid functionalization by post synthetic modification with conc. H_2SO_4 . MP-SO₃H was characterized by various physicochemical techniques such as FT-IR, Nitrogen sorption, CHNS analysis, acid-base titration and TGA. MP-SO₃H was demonstrated to be a highly active heterogeneous acid catalyst, providing high yielding route for the synthesis of h-glycerol tertbutyl ethers (GTBEs) through the etherification of bio-renewable glycerol with tert-butanol. MP-SO₃H containing optimum acidity and a large mesoporous surface area gave 44% h-GTBE selectivity at 86% glycerol conversion under optimized reaction conditions. The catalytic performance of MP-SO₃H was found to be superior over other conventional porous solid acid catalysts.

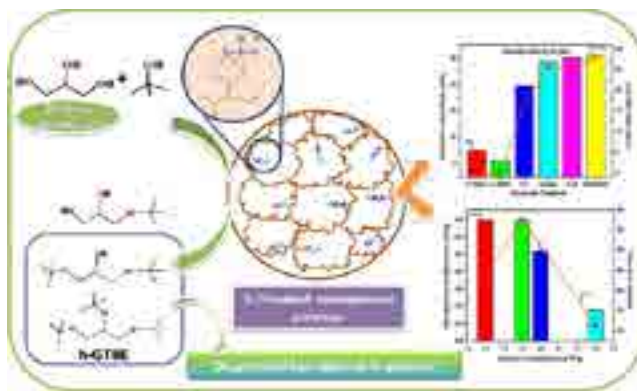


Image: Schematic representation of etherification of glycerol with tert-butanol

Biography

Sanjeev P Maradur is a PhD candidate from Shivaji University Kolhapur, India (2006) and worked as Research Scientist in Jubilant Life Sciences Ltd, Noida, India. He then moved to South Korea in 2009 for his Post-doctoral studies with Prof. R Ryoo at Center for Functional Nanomaterials, Korea Advanced Institute of Science and Technology (KAIST), and Prof. K S Yang at Alan MacDiarmid Energy Research Institute (AMERI), Chonnam National University, Gwangju Republic of Korea. He also worked at University of Oklahoma at Norman to work with Prof. K M Nicholas on catalytic conversion of biomass derived polyols to olefins. He is an Assistant Professor at PPISR Bangalore, India. He has published more than 15 papers in reputed journals and has two patents to his credit. He is a recipient of Young Scientist Research Award from Government of Karnataka, India.

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