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Novel perovskite type hydroxides and their oxide derivatives as solid acid-base catalysts for biodiesel synthesis and byproduct glycerol transformations

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Depleting availability of crude oil and increasing demand for fuels has made to look for alternative sources of energy. Transesterification of vegetable oils with alcohols to make biodiesel in presence of an acid or a base catalyst is one of the routes to make a fuel which attracted many researchers. The commercial synthesis of biodiesel mainly involves the use of homogeneous base catalysts like NaOH, NaOET. To overcome the issues related to homogeneous catalysts, heterogeneous acid-base catalysts were developed to make an eco-friendly process of biodiesel synthesis. Glycerol is obtained as a byproduct which accounts for one tenth of every gallon of biodiesel produced. To improve the economics of the process, the byproduct glycerol needs to be converted into value-added chemicals like acetins and glycerol carbonate *via* transesterification and carbonylation reactions respectively. In this study, a novel metal tin hydroxide is reported as a strong base catalyst for biodiesel synthesis and glycerol transformations. It has a perovskite type crystal structure with metal atoms octahedrally coordinated with corner sharing hydroxyl groups to form $Sn(OH)_6$ and $M(OH)_6$ octahedra (where M is Ca, Zn, Mg or Sr). It is found that calcium tin hydroxide acts as a strong solid base catalyst with very high activity for biodiesel synthesis from vegetable oils and synthesis of acetins from glycerol. On the other hand, zinc tin hydroxide acts as bifunctional acid-base catalyst with hydroxy groups contributing as basic sites and zinc as Lewis acid center. This catalyst was successfully applied for glycerol carbonylation with urea to make glycerol carbonate. Further, calcination of metal tin hydroxides at high temperatures resulted in composite metal oxides which also found to exhibit good acidity and basicity. They were successfully applied for glycerol transformation reactions.

Image: Transesterification of vegetable oils using solid base catalyst

Biography

Ganapati V Shanbhag obtained his PhD from National Chemical Laboratory, Pune, India in 2008 and a 2-year Post-doctoral degree from Korea Advanced Institute of Science and Technology (KAIST), Republic of Korea. He is presently an Asst. Professor at Poornaprajna Institute of Scientific Research, Bangalore, India. He has published 37 papers in reputed journals, one book chapter and is a co-inventor in 2 PCT patent applications. He has been serving as an Editorial Board Member of Journal of Catalyst and Catalysis. He has guided 3 PhDs and 3 MTech theses. Currently he is PhD supervisor for four research scholars. He is also the Principal Investigator of industry projects sponsored by GTC Technology Inc LLC, Houston, USA and Hindustan Petroleum Corporation Ltd, India.

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