Synthesis and Applications of Reusable Solid Acid Catalysts for Biofuels Production

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Environmental protection, food availability and energy production are the most important issues in the 21st century. In comparison with traditional liquid base catalysts, solid acid catalysts possess the advantages of easy separation, regeneration, and less environmental impact. In the present study, solid acids were chosen in the production of biofuels. This is of significant global importance to reduce the environmental impact of energy production and to conserve finite energy resources. A new type of solid acid catalyst, TPS-SBA-15-p, and several known solid acids were prepared. In comparison with known solid acid catalysts, this new catalyst demonstrated excellent catalytic activity and reusability in the esterification of palmitic acid, and transesterification of tripalmitin with methanol. TPS-SBA-15-p was also studied in the hydrolysis of dioxane, a model compound of cellulose. The results showed that both the nucleophilic group and Brønsted acid site are needed in the hydrolysis of dioxane. The high conversion rate of TPS-SBA-15-p, in comparison with other catalysts demonstrated the requirement of synergistic effect in the hydrolysis of dioxane. After the study of dioxane hydrolysis, TPS-SBA-15-p was used as the catalyst in the hydrolysis of cellulose, which is the most abundant component in holocellulose, found in most plant waste. The main products were found to be levulinic acid and decane. The mechanism for the production of decane, a potential biofuel, is under investigation.

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