STUDY ON SYNTHESIZING BIODIESEL CATALYZED BY SOLID BASE CATALYST

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Biodiesel is being developed as one of the most suitable substitutions of fossil fuels in solving energy problems as well as the relative environmental problems. In this work□two kinds of solid bases were studied for producing biodiesel with rapeseed oil and methanol□which were considered to be environmental benign process.

The solid base catalyst KOH/γ-Al_2O_3 was prepared by impregnation method. The experimental results demonstrated that the catalyst KOH/γ-Al_2O_3 has high activity under the optimized preparation conditions. With the prepared KOH/γ-Al_2O_3, the biodiesel yield can reach as high as 84.20%. The prepared catalyst was characterized by Hammett indicator method, CO_2-TPD, XRD, SEM, BET, IR and XPS. It can be found that the Al-O-K species is produced and both the basic strength and the basicity of the catalyst are increased after γ-Al_2O_3 is loaded with KOH upon calcinations. Moreover, the heterogeneous base KOH/γ-Al_2O_3 is more tolerant to free fatty acid and water contents compared to homogeneous KOH.

The solid base K/KOH/γ-Al_2O_3 was also prepared by impregnation followed with high temperature reaction. It was firstly used in catalyzing the transesterification of rapeseed oil with methanol to synthesize biodiesel. Both the catalyst preparation conditions and the reaction conditions of the transesterification were optimized. The results demonstrated that the biodiesel yield can reach as high as 84.52% with the prepared K/KOH/γ-Al_2O_3. The characterization results of catalyst show that after metal potassium is subsequently loaded onto KOH/γ-Al_2O_3 to form catalyst K/KOH/γ-Al_2O_3, not only the Al-O-K species increase, but also the surface color centers of $F_s^{(+)}$ are produced. And thus, the surface of catalyst K/KOH/γ-Al_2O_3 has stronger electron donor sites. It was also found that only 4.2% potassium was extracted from catalyst K/KOH/γ-Al_2O_3 after the first time use. With the recycled catalyst, the biodiesel yield reached 75.61%, suggesting that the catalyst has relatively high chemical stability.