

Acetalization of glycerol with acetone over highly ordered mesoporous WO₃/rod-type SBA-15 catalyst

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Biodiesel has gained a considerable attention in recent years due to global warming and decrease of the fossil fuel. The production of biodiesel involves the transesterification of vegetable oils with methanol to afford biodiesel and glycerol, produced as byproduct [1]. Due to the high contamination of crude oil, this glycerol cannot be used in food or pharmaceutical industries. Glycerol can be transformed into diverse derivatives by various catalytic processes. Among them, acetalization of glycerol with ketones has been reported to yield five and six membered acetal [2]. The products of glycerol acetalization have been widely used as fuel additives, cents in cosmetic industries and basis for surfactants [3].

In this research, glycerol conversion with acetone has been studied using mesoporous WO₃/rod-type SBA-15 (WO₃/R-SBA-15) as a catalyst. A series of catalysts with varying WO₃ loadings (5–20 wt%) were prepared by incipient wetness impregnation method using tungsten precursor. The catalysts were physicochemically characterized with X-ray diffraction (XRD), Raman spectroscopy, scanning electron microscopy (SEM), N₂ adsorption-desorption analysis and NH₃ temperature-programmed desorption (NH₃-TPD). In the catalytic acetalization experiment, variant molar ratios of glycerol to acetone were fed, and WO₃/R-SBA-15 catalyst was added.

Among the catalysts, 15 wt% WO₃/R-SBA-15 was found to be the most active catalyst in acetalization reaction at 30 °C. The catalyst exhibited 99% conversion with 97% selectivity for the five-membered (1,3-dioxolane) cyclic product. The excellent performance of the catalyst is mainly due to their high specific surface areas, high pore

volumes and strong surface acid properties. These results suggest that WO₃/R-SBA-15 catalyst is highly active catalyst for the acetalization of glycerol.

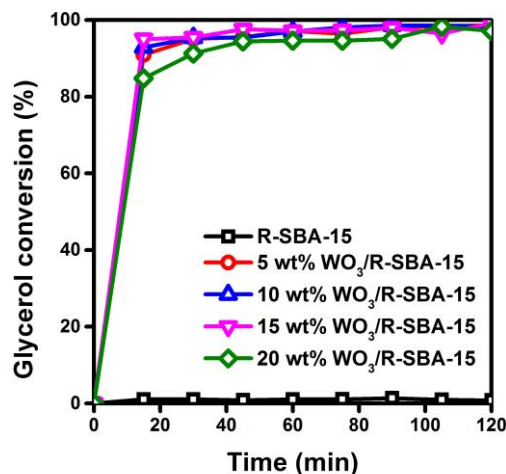


Fig. 1 X-ray diffraction patterns of R-SBA-15 and WO₃/R-SBA-15 with variant weight percent.

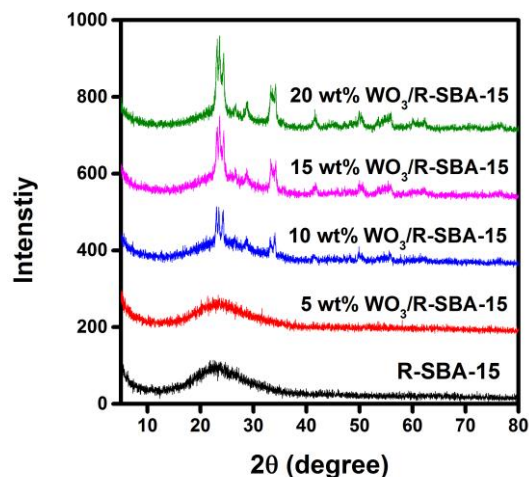


Fig. 2 Effect of catalyst weight percent on glycerol acetalization.

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