

Assessment on the Effect of Sulfuric Acid Concentration on Physicochemical Properties of Sulfated-Titania Catalyst and Glycerol Acetylation Performance

ABSTRACT

In this research, a solid acid catalyst was synthesized to catalyze glycerol acetylation into acetins. The sulphated-Titania catalysts were prepared via the wet impregnation method at different sulfuric acid concentrations (5%, 10%, 15%, and 20%) and denoted as 5SA, 10SA, 15SA, and 20SA, respectively. The synthesized catalysts were characterized using FTIR, XRD, TGA, BET, NH_3 -TPD, XRF, and SEM-EDX. The synthesized catalysts were tested on glycerol acetylation reaction at conditions: 0.5 g catalyst loading, 100–120 °C temperature, 1:6 glycerol/acetic acid molar ratios, and 2–4 h reaction time. The final product obtained was analyzed using GC-FID. An increment in sulfuric acid concentration reduces the surface area, pore volume, and particles size. However, the increment has increased the number of active sites (Lewis acid) and strong acid strength. 15SA catalyst exhibited excellent glycerol conversion (>90%) and the highest selectivity of triacetin (42%). Besides sufficient surface area ($1.9 \text{ m}^2 \text{ g}^{-1}$) and good porosity structure, the great performance of the 15SA catalyst was attributed to its high acid site density ($342.6 \text{ } \mu\text{mol g}^{-1}$) and the high active site of metal oxide (95%).