Effect of Bimetallic Co-Cu/Dolomite Catalyst on Glycerol Conversion to 1,2-Propanediol

ABSTRACT

This present study examines the efficacy of using dolomite (Dol, CaMg(CO3)2)-supported copper (Cu) and cobalt (Co) bimetallic and monometallic catalysts for the hydrogenolysis of glycerol to propylene glycol (PG; 1,2-PDO). The proposed catalysts were generated using the impregnation process before they were calcined at 500°C and reduced at 600°C. Advanced analytical techniques namely Brunauer, Emmett, and Teller (BET) method; the Barrett, Joyner, and Halenda (BJH) method; temperature-programmed desorption of ammonia (NH3–TPD), hydrogen-temperature programmed reduction (H2-TPR), X-ray diffraction (XRD) analysis, and scanning electron microscopy (SEM) were then used to characterise the synthesised catalysts, whose performance was then tested in the hydrogenolysis of glycerol. Of all the synthesised catalysts tested in the hydrogenolysis process, the Co-Cu/Dol bimetallic catalyst performed best, with an 80.3% glycerol conversion and 85.9% PG selectivity at a pressure of 4 MPa, a temperature of 200°C, and a reaction time of 10 hours. Its high catalytic performance was attributed to effective interactions between its Co-Cu-Dol species, which resulted in acceptable acidity, good reducibility of metal oxide species at low temperatures, larger surface area (15.3 m2 g-1), large-sized particles, fewer pores (0.032 cm3 g-1), and smaller pore diameter (0.615 nm).