Abstract

The present study investigates the use of SO_4^{2-}/TiO_2 Nb_2O_5 (STNO) catalyst prepared through the modified sol-gel method in the process of xylose dehydration to furfural. The reaction was carried out in a biphasic solvent consisting of toluene and water. The catalyst used in this study was subjected to several characterization methods, including Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), and X-ray diffraction (XRD). The textural properties of the catalyst were evaluated by conducting N_2 adsorption and desorption measurements using the Brunauer-Emmett-Teller (BET) method. The impact of catalyst dosage, resident time, xylose concentration, and reaction temperature in the dehydration of xylose to produce furfural was explored. The study employed response surface methodology to identify the optimal operational parameters that would result in the highest furfural selectivity. At a reaction temperature of 150 °C and a reaction time of 180 min, a maximum conversion of xylose of 98 mol%, furfural selectivity of 74 mol%, and a furfural yield of 63 mol% was obtained. The activation energy for the synthesized catalyst was determined to be 26.7 KJ/mol. The results of this investigation show the great potential that sulfated titanium-niobium mixed oxides have in transforming biomass resources into value-added compounds.