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DOI: 10.2478/auoc-2020-0008

Ovidius University Annals of Chemistry Volume 31, Number 1, pp. 38 - 43, 2020

Optimization of process factors using the Taguchi method of DOE towards the hydrodeoxygenation of acetic acid

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Abstract. This paper reports the optimization of process factors using the Taguchi method towards the conversion of acetic acid and ethanol yield during the hydrogenation of acetic acid over 4% Pt/TiO_2. The acidity of 4% Pt/TiO_2 was characterized using NH_3-Temperature Programmed Desorption analysis (NH_3-TPD). Afterwards, the effect of temperature on the hydrogenation of acetic acid as an individual feed was investigated. The reaction space explored in the following ranges: temperature 80-200 °C, pressure 10-40 bar, time 1-4 h, catalyst 0.1-0.4 g and stirring speed 400-1000 min^{-1} using 4% Pt/TiO_2, was investigated for the optimization study, while the effect of temperature was studied in a temperature range of 145 to 200 °C. NH_3-TPD analysis reveals that moderate acidity was suitable for the hydrogenation of acetic acid to ethanol. It was also found that 200 °C, 40 bar, 4 h, 0.4 g and 1000 min^{-1} for acetic acid conversion, and 160 °C, 40 bar, 4 h, 0.4 g and 1000 min^{-1} were the optimum conditions for ethanol production. In addition, the selectivity of ethanol was favored at lower temperatures which decreases with increasing temperature.

Keywords: hydrodeoxygenation, optimization, Taguchi method.

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