

Esterification of Free Fatty Acid in Used Cooking Oil Using Gelular Exchange Resin as Catalysts

Nursofia Binti Mohd Yunus^b, Nurul Asmawati Binti Roslan^b, Chin Sim Yee^{a,b}, Sumaiya Zainal Abidin^{a,b}

^a Centre of Excellent for Advanced in Fluid Flow (CARIFF), Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang, Kuantan, Pahang, Malaysia

^b Faculty of Chemical & Natural Resources Engineering, University Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang, Kuantan, Pahang, Malaysia

ABSTRACT

The esterification of free fatty acids (FFA) in used cooking oil was investigated using gelular ion exchange resins, SK104H and SK1BH catalysts. Characterization methods such as Fourier transform-infra red (FT-IR) spectroscopy, particle size distribution (PSD), scanning electron microscopy (SEM), elemental analysis (CHNS) and acid capacity analysis were conducted to determine the physicochemical properties of the catalysts. These catalysts were then subjected to a screening study to select the best performance catalyst, which further subjected to esterification reaction using one-variable-at-a-time (OVAAT) method. Using OVAAT method, the effect of mass transfer resistance, catalyst loading, reaction temperature and methanol to oil mass ratio were studied to optimize esterification reaction conditions. The conversion of FFA in the used cooking oil was successfully achieved 88% under optimal conditions of 18:1 methanol to oil mass ratio, reaction temperature of 60°C, catalyst loading of 3.0 wt. % and 300 rpm of stirring speed. Excellence catalytic performance may attributed to the smallest average particle size, high sulfur content and high acid capacity value of SK104H, resulting high conversion of FFA.

KEYWORDS: Esterification; Free fatty acid; Used cooking oil; Gelular ion-exchange resin

DOI: 10.1016/j.proeng.2016.06.450