Evaluasi Model Adsorpsi Dua Komponen Campuran Etanol-Air pada Kolom Adsorpsi Unggun Tetap dengan Adsorben Silika Gel = Evaluation of Two-Component Ethanol-Water Mixture Adsorption Model on Fixed Bed Adsorption Column with Silica Gel Adsorbent

Devina Belinda Ramadhani, author

Abstrak

Penggunaan bioetanol penting dikembangkan karena dapat dimanfaatkan sebagai bahan bakar energi bersih. Dalam penelitian ini, campuran etanol-air dipisahkan dengan menggunakan proses adsorpsi karena umumnya kandungan etanol yang dihasilkan dari proses sintesis masih dapat ditemukan air. Metode pemisahan campuran etanol-air yang digunakan adalah adsorpsi karena sangat efektif dan juga murah. Tujuan dalam peneliatian ini adalah mengobservasi proses adsorpsi kontinyu campuran etanol-air fasa cair dengan adsorben silika gel. Proses observasi dilakukan dengan membuat model matematis dari adsorpsi, sehinga diperoleh hasil akhir kurva breakthrough dengan bantuan perhitungan Finite Difference Method (FDM) menggunakan perangkat lunak Microsoft Excel. Pemodelan matematis adsorpsi disusun dengan menentukan neraca massa skala unggun dan pellet, serta kesetimbangan adsorpsi campuran etanol-air yang menggunakan persamaan isoterm adsorpsi Langmuir multi komponen. Pemodelan adsorpsi etanol-air pada unggun tetap telah dilakukan sebelumnya, namun masih belum dikembangkan untuk adsorpsi etanol-air dengan adsorben silika gel yang memasukan kedua komponen adsorbat kedalam sistem adsorpsi. Model disimulasikan untuk mengetahui pengaruh variasi laju alir umpan (5, 10, 20 ml/menit), konsentrasi awal air umpan (40%, 60%, 970% v/v) & konsentrasi awal etanol umpan (30%, 40%, 60% v/v), porositas unggun (0,1; 0,3; 0,5) serta tinggi unggun (0,2; 0,6; 1 m) terhadap profil kurva breakthrough yang dihasilkan. Dari pemodelan adsorpsi ini telah berhasil menghasilkan keterjalan kurva breakthrough yang sesuai dengan referensi percobaan yang menunjukkan laju alir meningkat seiring peningkatan laju alir umpan dan konsentrasi air pada umpan serta pengurangan tinggi unggun. Kurva tidak berubah secara signifikan pada variasi porositas unggun namun, berubah ketika variasi diiringi dengan variasi diameter partikel.
.....The use of bioethanol is important to develop because it can be used as a clean energy fuel. In this study, the ethanol-water mixture was separated by using an adsorption process because generally the ethanol content produced from the synthesis process can still be found in water. The method of separating the ethanol-water mixture used is adsorption because it is very effective and also cheap. The aim of this research is to observe the continuous adsorption process of the liquid phase ethanol-water mixture with silica gel as adsorbent. The observation process is carried out by making a mathematical model of adsorption, so that the final result of the breakthrough curve is obtained with the help of Finite Difference Method (FDM) calculations using Microsoft Excel software. The modeling of ethanol-water adsorption in fixed beds has been carried out previously, but has not yet been developed for ethanol-water adsorption with silica gel as adsorbent that incorporates both components of the adsorbate into the adsorption system. Modeling of ethanol-water adsorption in fixed beds has been made in several studies whether using silica gel adsorbents or not, but still not developed for ethanol-water adsorption with silica gel adsorbents that include both adsorption components into the adsorption system. The model was simulated to determine the effect of variations in feed flow rate (5, 10, 20 ml/min), initial water feed concentration (40%, 60%, 970% v/v) &

initial ethanol feed concentration (30%, 40%, 60% v/v), bed porosity (0,1; 0,3; 0,5) and bed height (0,2; 0,6; 1 m) to the resulting breakthrough curve profile. From this adsorption modeling has succeeded in producing a breakthrough curve that is in accordance with the experimental reference which shows the flow rate increases with the increase in the feed flow rate and water concentration in the feed as well as the reduction in bed height. The curve did not change significantly in the variation of bed porosity however, it did change when the variation was accompanied by a variation in particle diameter.