

Dehydration of Ethanol using Bio Materials

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Concentrated aqueous ethanol up 96.4 vol.% purity can be produced easily from low concentrated ethanol by traditional distillation. Ethanol as a fuel substitute for automobile engines requires a purity as high as 99.0 vol.%. Dehydration at high concentration is an energy consuming, high cost and difficult process due to the formation of an eutectic mixture. The current research was aiming at investigating low-cost, novel methods to dehydrate 96.4 vol.% ethanol using solid and liquid bio materials. Synthetically prepared 96.4 vol.% aqueous ethanol was dehydrated using three bio materials: rice straw (RS), paddy husk (PH) and Castor oil (CO). Bio solids (i.e. RS and PH), were packed in glass tubes (I.D = 2.5 cm, H = 16 cm) and ethanol was circulated at a superficial velocity 3.7 ml/min. The maximum ethanol concentration yielded was 86.85 vol.% due to the absorption of ethanol on to bio materials. Dehydration studies with the liquid bio material, i.e. CO, were carried out by differential solubility method. It was observed that in each test condition, the product after mixing and distillation contained an ethanol solution with purity above 98 vol.%. Process optimization was carried out using Response Surface Methodology considering three factors: ethanol to CO mixing ratio, mixing time and settling time. The predicted maximum ethanol concentration was 99.29 vol.% at ethanol to CO mixing ratio of 1.5:1 for 2 minutes mixing. The mixing speed was 250 rpm and settling time was 1 hour. Confirmation runs were carried out with optimized factors and noted that the actual concentration is 99.15 vol.%. Recovered CO was regenerated by heating to 250 OC and tested for multiple use and found that the CO can be successfully regenerated for dehydration.

Key words: Bio material, Castor oil, Dehydration, Ethanol, Regeneration