Kinetic Studies of the Esterification of Pure And Dilute Acrylic Acid With 2-Ethyl Hexanol Catalysed by Amberlyst 15

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ABSTRACT

The untreated waste water containing acrylic acid (AA) could have detrimental effect to the environment due to its high value of chemical oxygen demand. Reactive distillation column (RDC) could be a promising treatment method to recover AA from the waste water. In the present work, activity and kinetic studies of the esterification of AA and 2-ethyl hexanol (2EH) were carried out in a batch system to examine the practicability of this method. Ion exchange resin, Amberlyst 15 was employed as a catalyst. The effect of various parameters that affecting conversion and yield such as agitation speed, catalyst particle size, temperature, catalyst loading and initial reactant molar ratio were studied. The effect of the initial water content was studied using both the batch systems with total reflux (TR) and dean stark for continuously water removal (CWR). The increase of equilibrium conversion with the temperature indicated the endothermicity of the reaction. Temperature was the most significant parameter that affected the conversion and yield. The highest yield of 70% was obtained at the temperature of 388 K, initial reactant molar ratio of AA to 2EH of 1:3 and catalyst loading of 10 wt%. The pseudo-homogeneous (PH), Eley–Rideal (ER) and Langmuir–Hinshelwood–Hougen–Watson (LHHW) kinetic models were used to interpret the kinetic data. The best fit kinetic model for the main esterification reaction was the non-ideal ER model while the side reaction, AA polymerisation was best interpreted by PH model. The kinetic data for the esterification of dilute AA was well described by the inclusion of the correction factor to the kinetic model for the esterification.

KEYWORKS: Acrylic acid; 2-Ethyl hexanol; 2-Ethyl hexyl acrylate; Esterification; Amberlyst 15

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