

Extractive distillation of Ethanol-Water using a mixture of organic solvent and ionic liquid as entrainer

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Abstract. In this work, an extractive distillation process of ethanol-water separation was investigated using a solvent design consisting of ethylene glycol and an ionic liquid mixture. Two imidazolium-based ionic liquids were proposed, (1-ethyl-3-methylimidazolium acetate), [EMIM][OAc] and (1-ethyl-3-methylimidazolium dicyanamide), [EMIM][DCA]. The vapor-liquid equilibrium of the ethanol/water azeotropic mixture in the presence of the solvent was predicted by the NRTL model. A rigorous simulation of the extractive distillation process was carrying out. The design parameters of the separation process such as: reflux molar ratio (R), feed stage (N_F), solvent stage (N_E), solvent-to-feed molar ratio (F_E/F) and ionic liquid concentration in the solvent mixture were evaluated. The sensitivity analysis was performed to visualize the effect of the solvent-to-feed ratio (F_E/F) and the reflux ratio (R) on the purity of ethanol. The purity of ethanol in the distillate must be higher than 99.9 mol%. The energy consumption on the reboilers of both extractive distillation and regeneration columns has been optimized.

Keywords: Ionic liquids, Extractive distillation, Ethanol/water mixture.