OPTIMIZATION OF SPRAY DISTILLATION COLUMN FOR ETHANOL PURIFICATION

By

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STATEMENT BY THE AUTHOR

I hereby declare that this submission is my own work and to the best of my knowledge, it contains no material previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any other degree or diploma at any educational institution, except where due acknowledgement is made in the thesis.

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ABSTRACT

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Spray distillation principles have been proved to be one efficient method to enhance the purity of ethanol. Spray distillation worked by utilizing diffusion, which enables ethanol to evaporate at 40˚C. Due to the idealizing assumptions applied on the spray distillation model, this research aims to create a more realistic model of the apparatus. Redesigning the top head part of the apparatus, installing two nozzles, and introducing hot air into the column achieved a more realistic model. By creating vapor flux and vapor flow direction mathematical models, information regarding respectively velocity of vapor flowing through the outlet and the direction of vapor flow could be gained and used for creating a new head design. The new model was tested at various variations of feed concentrations and feed flow rates and was proven to be able to purify ethanol from 15%–70% v/v to 53%–94% v/v with ethanol yield of 33%–59% v/v. The most optimum operating feed rate was known to be 36 ml/min for all feed rates compared to the other tested feed rates. The new model was also able to produce condensate at the top outlet of the column, which was not possible at the previous model. The formation of condensate was known to have a linear effect with flow rate increase and decline with concentration increase.

Keywords: distillation, separation, ethanol–water separation, droplet evaporation, condensation

DEDICATION

This work is dedicated to my parents,
who like to complicate and exaggerate things

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