HYDRODYNAMICS AND MASS TRANSFER STUDY OF THE ABSORPTION PROCESS ON THE VALVE TRAY BY CONSIDERING THE INFLUENCE OF FLUID VISCOSITY

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ABSTRACT

Absorption is a process of fluid components separation from their mixtures using solvents or other fluids. Absorption is a phenomenon of mass displacement that is important in industry process. Besides, the world now faces big environmental problem that is high content of pollutant gases as a result of industrial activities that can be reduced by absorption process. The equipment used in the operation of absorption is similar to that is used in the distillation operation. One of them is tray column, valve tray type. The study carries out an experiment on hydrodynamics and mass transfer on valve tray. The materials used are water and oxygen. As for making the viscosity of the liquid, Carboxy Methyl Cellulose (CMC) is put into the water. Valve tray hydrodynamics observed is flow pattern and pressure drop. In principle, to determine the flow pattern on valve tray, a process of contacting the CMC solution and oxygen is done, then it is injected by 10 ml of 25% NaCl solution in a valve tray absorption column. Furthermore, the concentration of NaCl coming out of the bottom of the column is measured each time using conductometer. In addition, the difference pressure between incoming and outgoing air from the bottom of the valve tray column is measured to determine the pressure drop occurring. The result shows empirical relationship as follows: \[ \Delta P = 6505.389 \mu^{0.155} Q_l^{0.233} Q_v^{-0.093} \]. The characteristic of fluid patterns flow at the valve tray column tends to lead to a plug flow and it is
influenced by the water flow rate. The number of equivalent series tanks are N series solution with a concentration of 0.2 % CMC with CMC flow rate 0.00019 m³ / s and the air 0.00071 m³ / s as many as 9 tank s at the most. Meanwhile, the least number of N equivalent series tank is obtained at 0.00014 m³ / s flow rate of water and 0.00076 m³ / s air as many as 1 tank at concentration of 0.2 % CMC solution and the empirical correlation for the dispersion numbers is as follows D/uL= 0,006/µL0,006QL-1,248QV1,019

The second study examines the mass transfer occurred, by contacting the deoxygenated CMC solution with air. Oxygen content of CMC flow coming out of the bottom of the column (the same as the output from conductometer) is measured at any time using a DO meter (deoxygenation meter). The variables used in this study include air flow rate, CMC flow rate and viscosity of fluid in solution. The empirical relationship between the liquid side mass transfer coefficient (k_L') with a water flow rate and air flow rate as follows k_L'a'=0,1051/µL-0,253QL0,698QV-0,228.

Keywords: Absorption, hydrodynamics, mass transfer, Valve Tray, Carboxy Methyl Cellulose (CMC), Viscosity.