Characteristics of Heat and Mass Transfer in Binary Distillation System

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In a wetted-wall distillation column, the effects of partial condensation on heat and mass transfer of ethanol-water binary system were studied.
The characteristics of boundary layer behavior in vapor phase were experimentally investigated by applying laminar boundary layer theory. The thickness of thermal and concentration boundary layer was decreased and heat and mass transfer rates were increased as the degree of partial condensation increased. Dimensionless mass and heat transfer rates, $Sh/(1+\alpha_M)$ and $Nu/(1+\alpha_H)$, could be determined by the combined application of laminar boundary theory and a function of partial condensation ratio, $g(\beta)$. The function, $g(\beta)$ was linear to V_S/u_∞(dimensionless velocity) at the vapor-liquid interface boundary. The numerical analysis of experimental data resulted that the dimensionless mass and heat transfer rates were directly proportional to Reynolds number instead of square root of Reynolds number as generally known in literatures at $V_S=0$.