Chapter VI

CONCLUSIONS

A vertical film evaporator with built-in preheater was designed to study the heat transfer of the evaporating film. The liquid flows evenly as a thin film on the interior surface of the tube, by a specially designed distributor.

It is concluded from the study of heat transfer in the film evaporator that.

1. The heated wall temperature depends solely on steam temperature; feed rate has no effect.

2. Mean heat transfer coefficients decreases with increasing Re for laminar flow and increases with Re for turbulent flow.

3. Mean heat transfer coefficients decreases with increasing feed temperature. It is almost constant when the wall temperature is above 280^{o}F. The h_m of a 2-ft tube is slightly higher than that of 1-ft tube.

4. Mean heat transfer coefficients decreases with increasing liquid viscosity; a graph is constructed to predict its value (Fig 5.5).

5. The experimental values of h_m agree well with predicted values from Nusselt equation in laminar regime

and Chun and Seban expression in turbulent regime.

6. Equation 2.23 can be applied to the film evaporator of this type.

7. The suggested operating conditions for this type of evaporator are at feed rate 450 lb/hr ft with the mass flux (evaporation rate) of 12 lb/hr ft^2 and heat flux of 6×10^4 Btu/hr ft^2; the wall temperature must not exceed $284^{\circ}F$; the feed temperature must be as near the boiling point as possible.

8. The viscosity of sucrose solutions between 0-40 Brix may be represented by

$$\log \eta = \frac{17.3 + 0.18c^{0.71}}{t} - (0.62 - 0.04c^{1.09})$$

It is suggested that work may be carried out similarly with the liquid film flowing outside the heated tube. It is also of interest to study the effect of tube diameter and a very long tube on the performance of such a film evaporator.