Thesis Title	Heat Transfer in Agitated Thin Film Evaporator
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Abstract

The objective of this research was to study heat transfer in the Agitated Thin Film Evaporator (ATFE). Heat transfer measurements were made in a pilot scale ATFE used for evaporating dilute sugar syrup. The operating conditions (feed flow rate, rotational speed and temperature difference between steam and boiling point), and design considerations (type of blades and the clearance of blade from the wall) were varied. A mathematical model of heat transfer coefficient was determined as a function of the key operating and design variables. The experimental results were compared with typical results from a free falling film evaporator evaporating under the same conditions.

A so-called 'zero clearance' is the most suitable blade for an ATFE evaporation process. It results in a higher heat transfer coefficient than a 'fixed clearance blade' (1 - 1.5 mm), and therefore a higher evaporation rate because the zero clearance blade minimizes the thickness of the film which in turn decreases the heat transfer resistance.

The heat transfer coefficient of the thin film was increased when increasing the feed flow rate, rotational speed and temperature gradient between heating medium and boiling point. This was due to the fact that the film covered the complete heat transfer area and also existed in the turbulent flow regime.

Increasing the concentration of sugar syrup decreased heat transfer coefficient because of the increasing viscosity. A mathematical model of the heat transfer coefficient was developed; it correlated well with measured data and resulted in a high R^2 value.

$$Nu_{De} = 0.00538 Re_{De}^{0.285} (1+Fr_{De}^{0.0112})^{0.02} Pr^{0.539} K^{1.643}$$

where $4.12 < Pr < 7.62$

$4957 < Re_{De} < 22130$

$2.59 < Fr_{De} < 92.14$

Keywords: Evaporation / Agitated Thin Film Evaporator / Heat Transfer Coefficient / Dimensionless Equation.