CASE STUDY

Column Reboiler

COUNTRY: USA

PRODUCT: Column Bottoms

KEY BENEFIT: Recovery of High Boilers

Thin Film Evaporator as a Column Reboiler

Process:

Heat-sensitive, high-boiling compounds which contain light- or heavy-boiling impurities can be successfully and carefully treated in a combined thin film evaporator and distillation column.

When a thin film evaporator is used for evaporation of the bottoms in a distillation column, decomposition or polymerization is reduced because of the short residence time at the highest temperature point in the evaporator. Cleaner distillates and bottoms are obtained even when processing contaminated materials or products with a high viscosity; this can be either because formation of high and low volatile cracked produced in the residue is eliminated or because solids and fouling components are kept out of the column. Finally, the agitated thin film evaporator can act as a squeezer compared to conventional reboilers for higher yield.

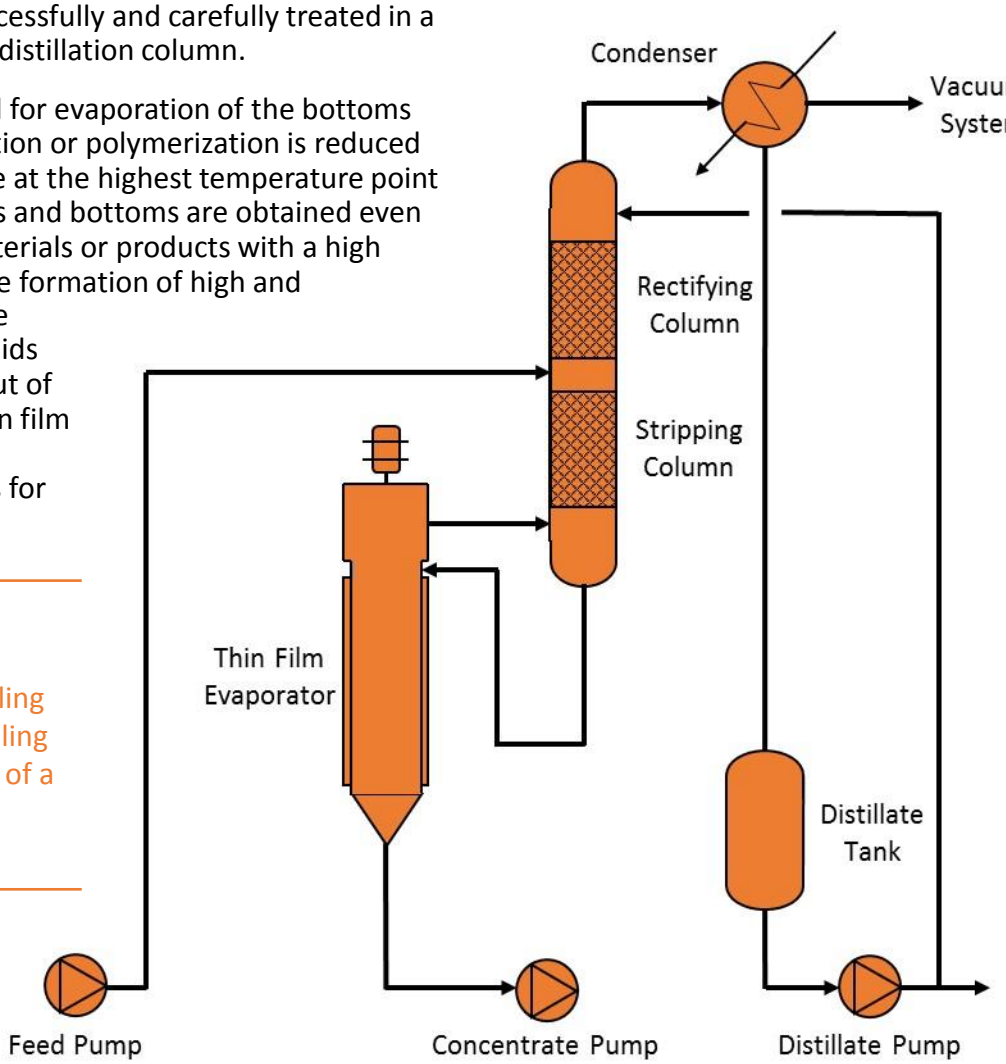

Figure 1: Typical Equipment Combination

For the separation of a lighter boiling component, so that the heavy boiling component is obtained in as pure of a state as possible; continuous operation under vacuum

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Agitated thin-film evaporation prevents degradation of high-boiling amine fraction

Problem:

Customer required a distillation column reboiler to provide the final cut between triethanolamine (TEA) and residue. Since the atmospheric boiling point of TEA is very high (635°F), and the material is subject to thermal decomposition the distillation is carried out under high vacuum. The customer needed a reboiler with a high heat transfer coefficient, a low pressure drop, and minimal product holdup, to prevent thermal degradation of the TEA and maximize yield and product quality.

LCI Solution:

The thin-film evaporator (see Figure) is essentially a large single-tube and shell heat exchanger with the heating medium on the shell side and the product flowing down the inside walls of the tube in a thin, turbulent film.

A rotor extending the length of the tube distributes the product against the wall by centrifugal forces and agitates the thin film to provide a high heat transfer coefficient.

The small liquid holdup (low residence time), high once-through processing, and heat transfer coefficient com bine to minimize thermal degradation. In addition, there is a large free flow area along the center of the tube to allow vapors to escape at very little pressure drop. The low pressure drop contributes to reducing thermal degradation by maintaining a low vaporization pressure and temperature for the TEA.

Results and Comments:

Thermal decomposition is minimized to allow production of high quality TEA at high yields. The only routine maintenance anticipated for the agitated thin-film evaporator is the scheduled replacement of a bearing every few years based on the anticipated bearing life at the high operating temperature.

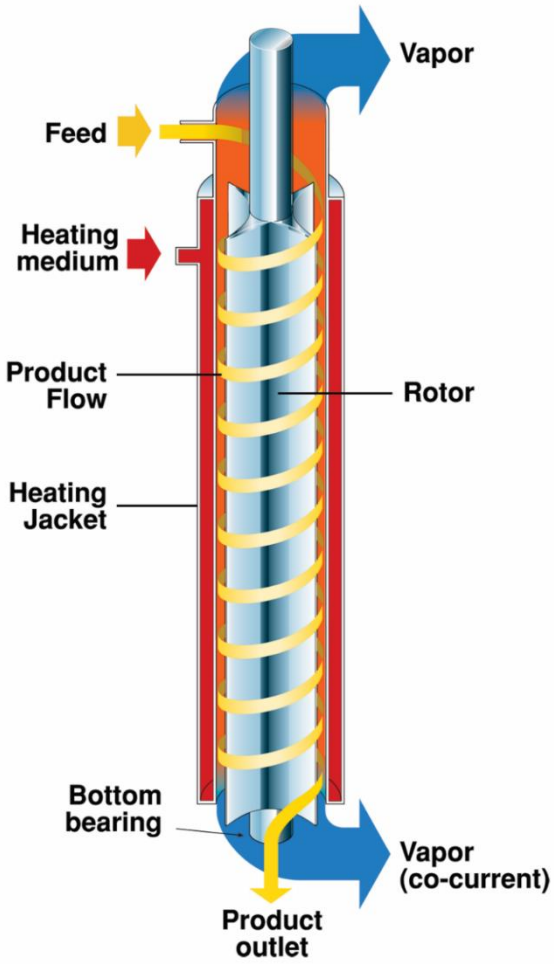

Figure 2: Agitated Thin-Film Evaporator Internal Cross-section