FENIX®
An ISO 9001:2008 Company

Evaporation Technology

ENGINEERING-EQUIPMENT-TURNKEY SYSTEMS

FALLING FILM EVAPORATOR

FORCED CIRCULATION EVAPORATOR

MULTIPLE EFFECT EVAPORATOR

AGITATED THIN FILM EVAPORATOR

SHORT PATH DISTILLATION

ZERO LIQUID DISCHARGE SYSTEM

Fenix Evaporation Technology

In the evaporation process, concentration of a product is accomplished by boiling out a solvent, generally water. The recovered end product should have an optimum solids content consistent with desired product quality and operating economics. It is a unit operation that is used extensively in processing foods, chemicals, pharmaceuticals, fruit juices, dairy products, paper and pulp, and both malt and grain beverages. Also it is a unit operation which, with the possible exception of distillation, is the most energy intensive.

While the design criteria for evaporators are the same regardless of the industry involved, two questions always exist: is this equipment best suited for the duty, and is the equipment arranged for the most efficient and economical use. As a result, many types of evaporators and many variations in processing techniques have been developed to take into account different product characteristics and operating parameters.

Our technology is supported by several test and development facilities, where the technology is being continually refined, improved, and applied to new products.

Best Technology
Outstanding Economy

Evaporation Systems

- Falling Film Evaporator
- Forced Circulation Evaporator
- Multiple Effect Evaporator
- Agitated Thin Film Evaporator
- Short Path Distillation
- Zero Liquid Discharge System

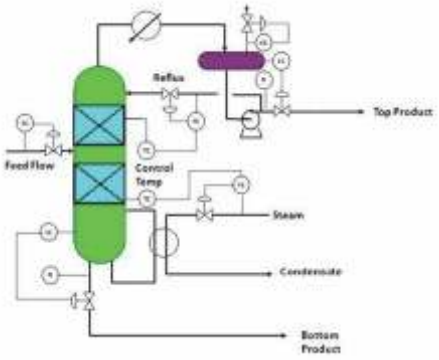
Zero Liquid Discharge (ZLD)

Zero Liquid Discharge (ZLD) is an industrial process which does not release any wastewater. This target is commonly achieved by separating streams into evaporation or crystallization paths. During these processes, contaminated elements are discharged as solid waste whilst the condensate is recovered. Typically, the effluent is a salty solution and the thermal separation is the final step of ZLD, after being exposed to pre-treatments, ultra filtration and reverse osmosis units. Every ZLD-system is unique and has to be custom made each time.

ZLD technology has characteristic advantages on wastewater concentrations:

- No wastewater discharge leaves the plant. Only solid wastes are produced and they are disposed of appropriately
- Volume reduction of the effluent can be maximized with a water content of up to 1-3%. This results in low disposal costs
- The condensate, otherwise known as distillate, can be recycled as process water.

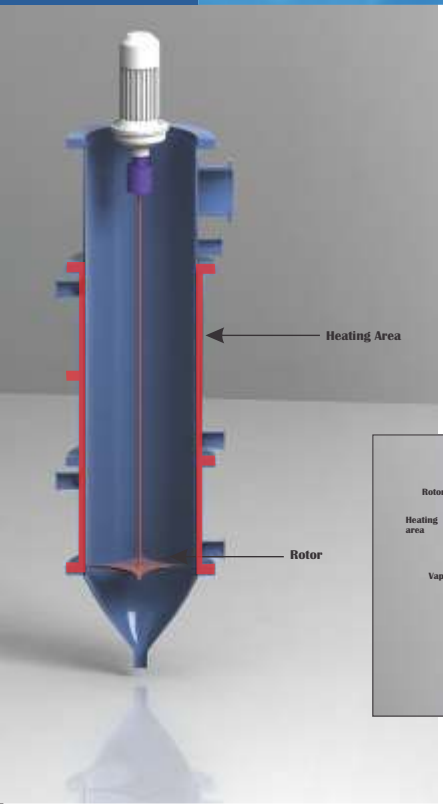
Our evaporation and crystallization systems commonly operate under vacuum and can be designed for single-duty or multi-purpose operation. Fenix has introduced technologies to achieve ZLD:



Stripping System

- Stripping works on the basis of mass transfer.
- Stripping is a physical separation process where one or more components are removed from a liquid stream by a vapor stream.
- Stripping is usually carried out in either a packed or tray column.

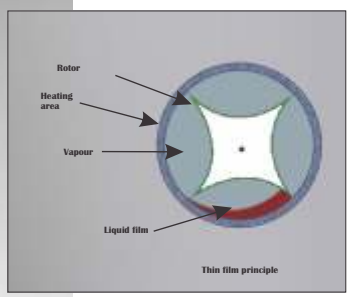
AGITATED THIN FILM EVAPORATOR



FUNCTION

The wiped or agitated thin film evaporator are used to the concentration of very viscous materials and the stripping of solvents down to very low levels. Feed is introduced at the top of the evaporator and is spread by wiper blades on to the vertical cylindrical surface inside the unit. Evaporation of the solvent takes place as the thin film moves down the evaporator wall. The heating medium normally is high pressure steam or oil.

A high temperature heating medium generally is necessary to obtain a reasonable evaporation rate since the heat transfer surface available is relatively small as a direct result of its cylindrical configuration.



- APPLICATION
- Concentration of viscous fluids
- Pure distillation of high boiling liquids
- Heating or cooling of highly viscose media
- Degassing, removal of volatile component from highly viscous products, melts and pastes.

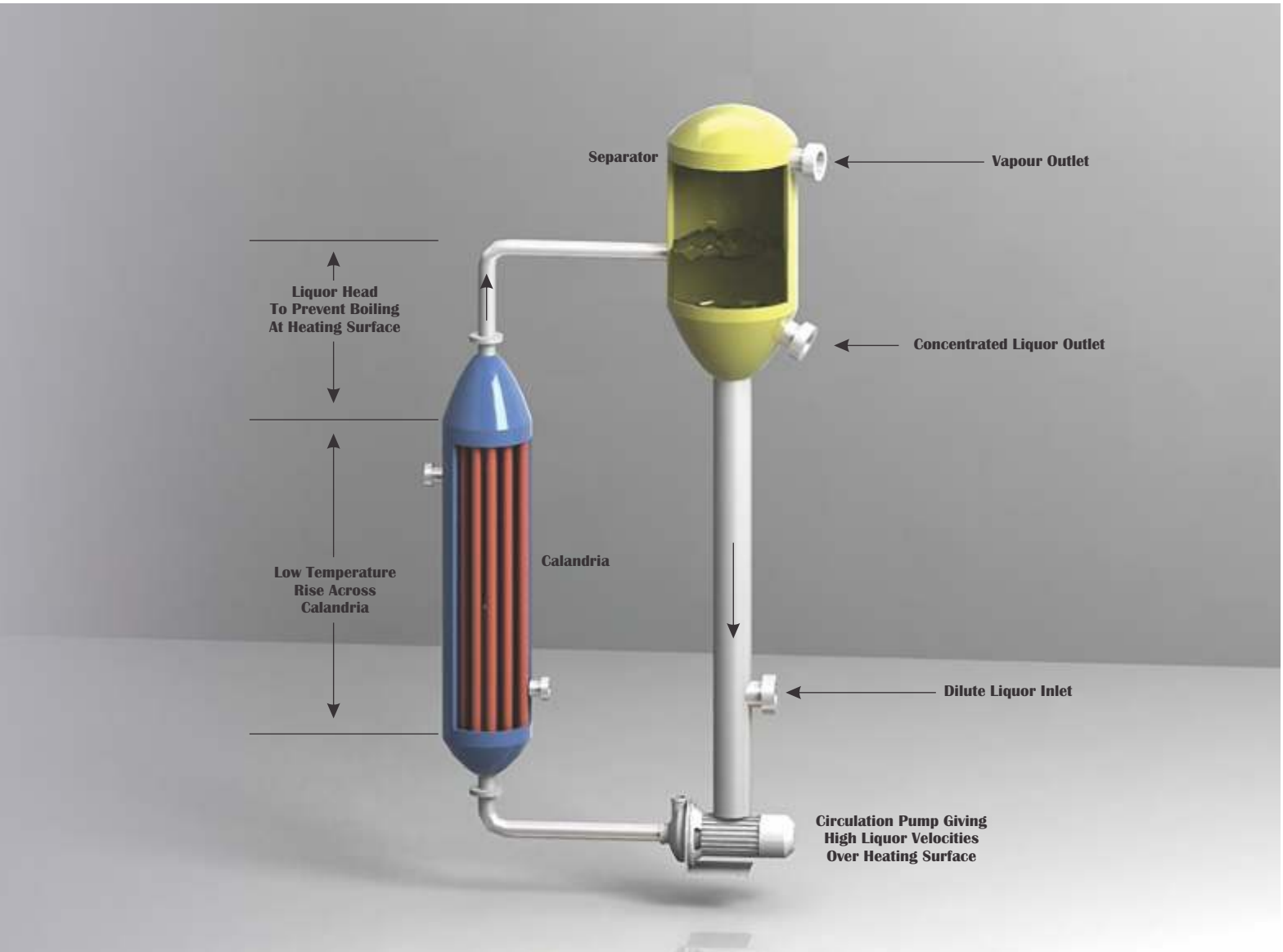
FORCED CIRCULATION EVAPORATOR

FUNCTION

The forced circulation evaporator was developed for processing liquors which are susceptible to scaling or crystallizing. Liquid is circulated at a high rate through the heat exchanger, boiling being prevented within the unit by virtue of a hydrostatic head maintained above the top tube plate. As the liquid enters the separator where the absolute pressure is slightly less than in the tube bundle, the liquid flashes to form a vapor.

APPLICATION

The main applications for a forced circulation evaporator are in the concentration of inversely soluble materials, crystallizing duties, and in the concentration of thermally degradable materials which result in the deposition of solids. In all cases, the temperature rise across the tube bundle is kept as low as possible, often as low as 3-5°F (2-3°C). This results in a recirculation ratio as high as 220 to 330 lbs of liquor per pound (200 to 300 kg of liquor per kilogram) of water evaporated. These high recirculation rates result in high liquor velocities through the tube which help to minimize the build up of deposits or crystals along the heating surface. Forced circulation evaporators normally are more expensive than film evaporators because of the need for large bore circulating pipework and large recirculating pumps. Operating costs of such a unit also are considerably higher.



MULTIPLE EFFECT EVAPORATOR

FUNCTION

A multiple-effect evaporator is an equipment system for efficiently using the heat from steam to evaporate water. In a multiple-effect evaporator, water is boiled in a sequence of vessels, each held at a lower pressure than the last. Because the boiling point of water decreases as pressure decreases, the vapor boiled off in one vessel can be used to heat the next, and only the first vessel (at the highest pressure) requires an external source of heat. While in theory, evaporators may be built with an arbitrarily large number of stages, evaporators with more than four stages are rarely practical except in systems where the liquor is the desired product such as in chemical recovery systems where up to seven effects are used.

APPLICATION

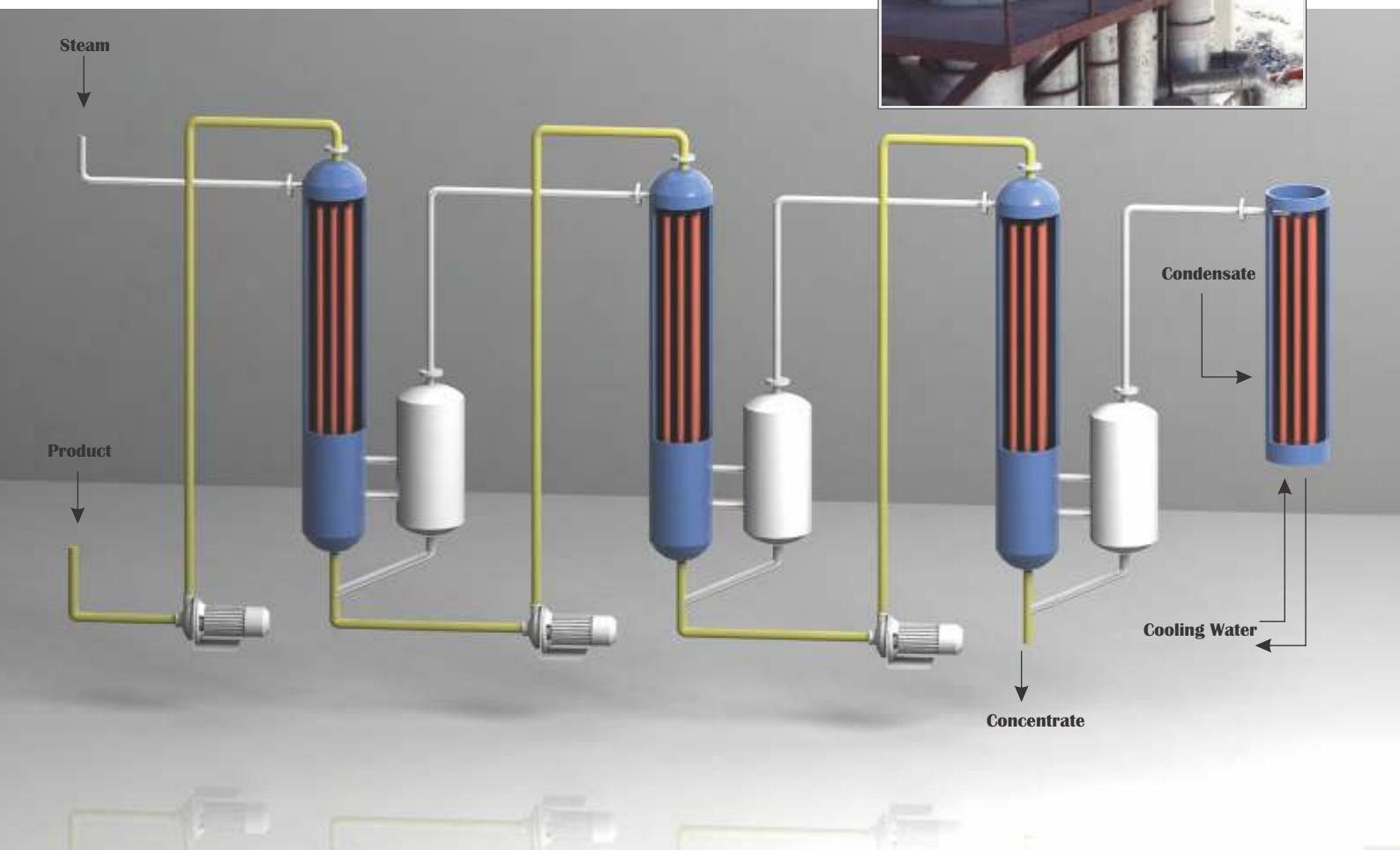
- Sodium hydroxide
- Concentration of sugar solutions to extremely high solids content
- In one case a solids concentration of 98% was achieved
- Removal of water from soaps
- Finishing concentrator on certain fruit purees such as banana and apple
- Concentration of high solids corn syrups
- Removal of solvents from vegetable oils
- Concentration of fabric softeners
- Lignin solutions
- High concentration gelatin
- High concentration chicken broth

Energy Saving

Fenix always tries to apply techniques which minimize energy consumption for its evaporation plants. Some of the methodologies we apply include:

APPLICATION

- Multiple effect arrangement (ME)
- Thermal vapor recompression (TVR)
- Mechanical vapor recompression (MVR)
- Usage of waste energy



FALLING FILM EVAPORATOR

FUNCTION: Vertical shell-and-tube heat exchanger, with laterally or concentrically arranged centrifugal separator.

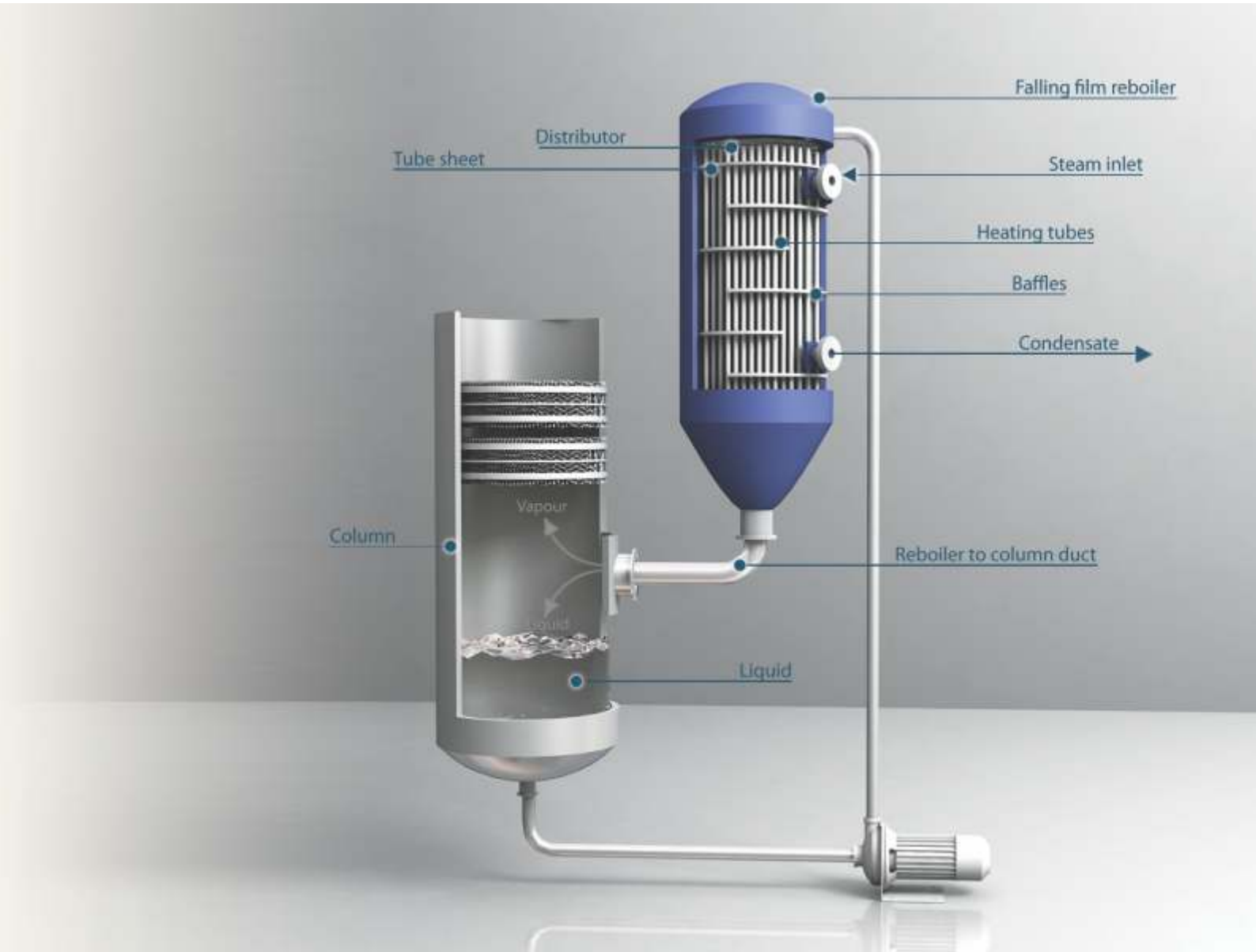
ADVANTAGE: Best product quality – due to gentle evaporation, mostly under vacuum, and extremely short residence times in the evaporator.

High energy efficiency – due to multiple-effect arrangement or heating by thermal or mechanical vapour recompressor, based upon the lowest theoretical temperature difference.

Simple process control and automation – due to their small liquid content falling film evaporators react quickly to changes in energy supply, vacuum, feed quantities, concentrations, etc. This is an important prerequisite for a uniform final concentrate.

Flexible operation – quick start-up and easy switchover from operation to cleaning, uncomplicated changes of product.

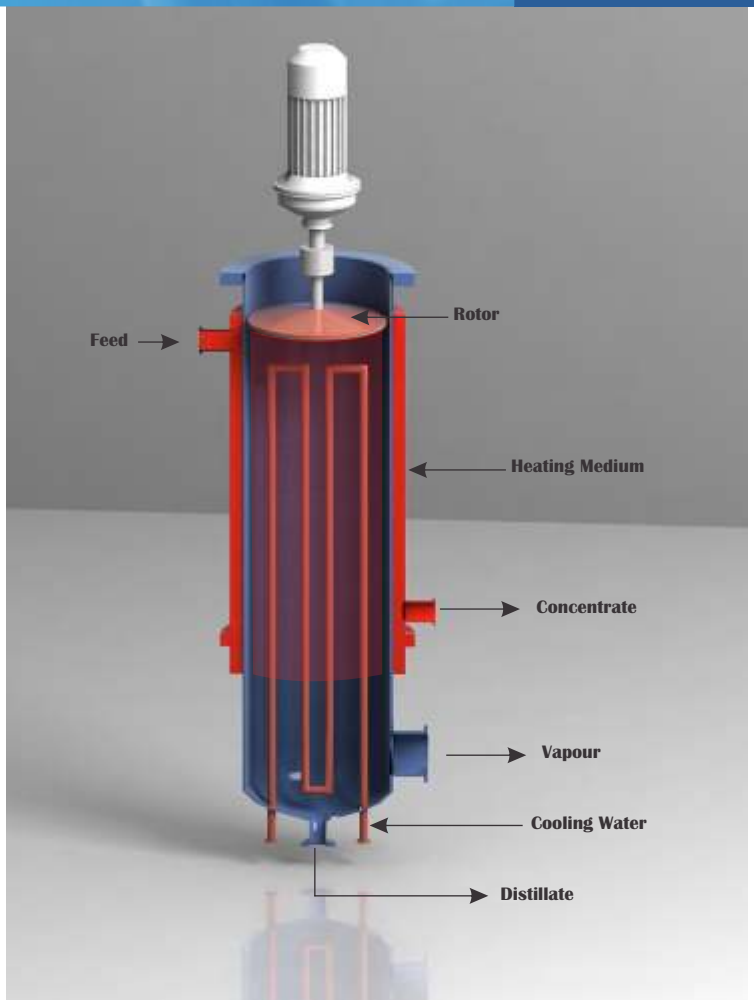
Fields of application: Capacity ranges of up to 150 t/hr, relatively small floor space requirement. Particularly suited for temperature-sensitive products.



SHORT PATH DISTILLATION

FUNCTION

Short path evaporators offer excellent results with evaporation, concentration, distillation or degassing of high-boiling, temperature-sensitive products. The internal condenser minimizes the pressure drop because of the short distance to the evaporation surface. Therefore, short path evaporators work with process pressures down to 0,001 mbar (a) and corresponding low boiling temperatures. It is therefore suitable to evaporate even extremely heat sensitive products like vitamins and flavors, without causing damage to the product.



APPLICATION

- Butene-1
- Caprolactam
- Epichlorohydrine
- Glycols
- Latex
- Maleic acid
- Maleic anhydride
- Polyacrylonitrile
- Styrene monomers
- Silicone oils

R & D

Pilot Plant - Evaluation and Testing

0.3 m2 Agitated Thin Film Evaporator fully automated pilot plant equipped with heating media upto 350 deg C and vacuum of 1 torr to test client samples and provide proper solution to the problem.

Pilot Scale Tests Provide

- Data for scale-up: Stage Efficiency, Throughput, Agitation Speed
- Demonstration of the entire process
- Process optimization
- Basis for performance guarantee

Bench Scale Tests Provide

- Estimate heat transfer area
- Mixing characteristics
- Settling times
- Evaporator type selection for pilot test

Fenix Range of Heat & Mass Transfer Evaporators and Dryers

- **AGITATED THIN FILM EVAPORATORS**
  - **TRONVAP** (SCRAPED SURFACE EVAPORATOR)
    - TRONVAP (EV)
    - TRONVAP (EH)
  - **TURBATRON**
    - TURBATRON (EV)
    - TURBATRON (EH)
  - **TURBATRON-SPE** (SHORT PATH EVAPORATOR)
- **TURBATRON** (AGITATED THIN FILM DRYERS)
  - TURBATRON (DV)
  - TURBATRON (DH)
- **ROTOTRON** (ROTARY DRYERS)
- **TRONSPRAY** (SPRAY DRYERS)
- **EVAPORATORS**
  - **EVATRON (FF)**
  - **EVATRON (RF)**
  - **EVATRON (FC)**
  - **TRONPLATE (PLATE TYPE)**
- **MEE SYSTEMS**
  - **MULTITRON / VAP**
  - **ZELTRON** (ZERO DISCHARGE)

FENIX®

Fenix Process Technologies Pvt. Ltd.

K 6/1, Malini
Erandwane Co-op. Housing Society
Near Mangeshkar Hospital
Opp. Sevasadan School
Erandwane, Pune - 411004
India.

Tel. No.: +91 20 65008772 / 73
Fax No.: +91 20 25458454

Email: info@fenix.in
Web: www.fenix.in

Representative:

Gen-Rev02 01/17

www.mantra-solutions.com