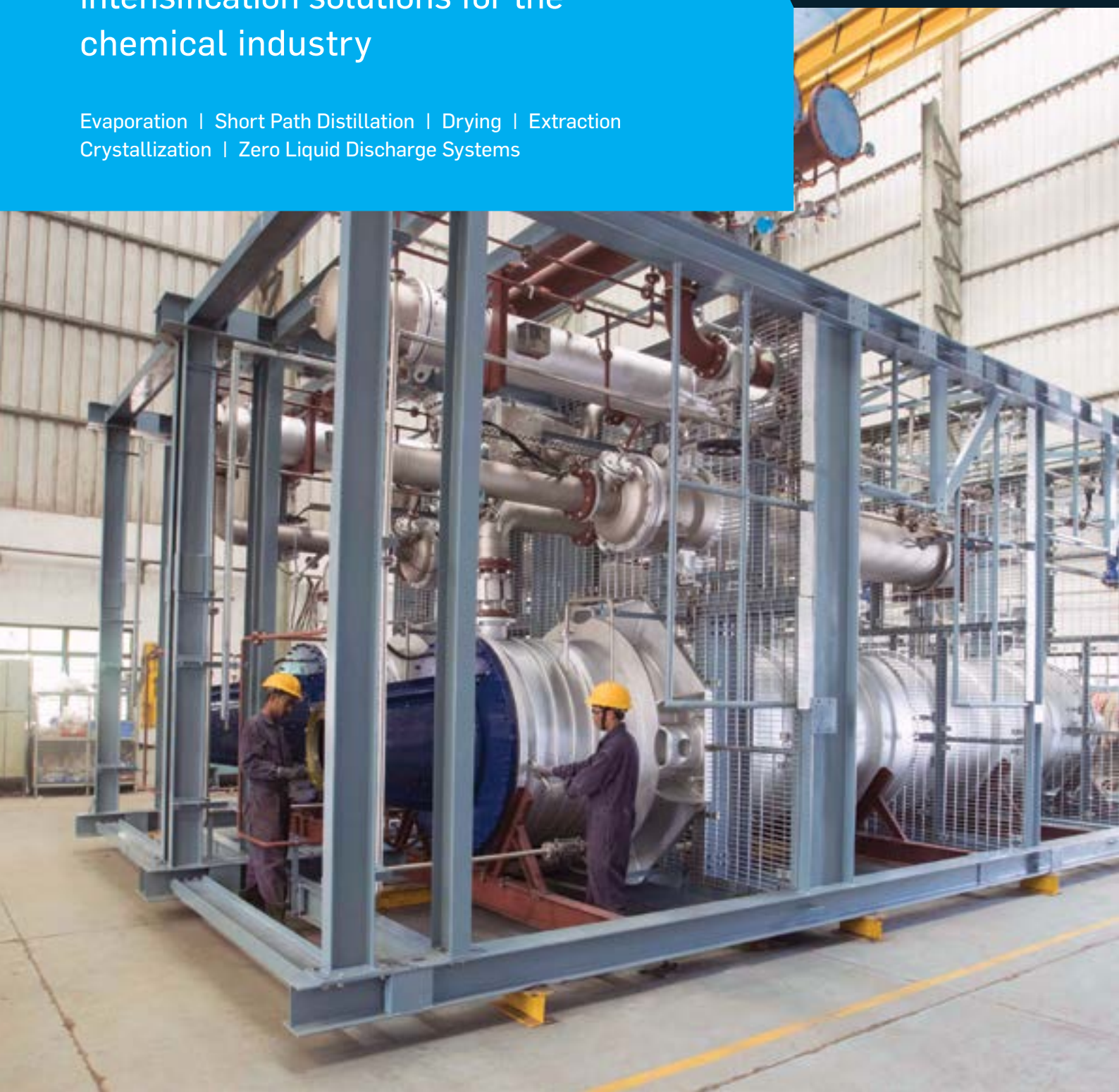
TECHNOFORCE™

Comprehensive process intensification solutions for the chemical industry

Evaporation | Short Path Distillation | Drying | Extraction
Crystallization | Zero Liquid Discharge Systems



About Technoforce

Technoforce was started in 1990 to manufacture distillation and drying equipment based on Thin Film Technology. Other technologies like Extraction, Crystallization and Zero Liquid Discharge plants for industrial wastewater were added in later years.

27
Years of Experience

06
Technology Areas

12
Products

1000 +
Successful Projects

About 140 people are working in India and Europe in R&D, pilot plant testing, design and manufacturing.

Through in-house investments and cooperation with universities, Technoforce has developed synergistically relevant technologies. Thus, the customers can avail several process steps from a single source.

Having modern manufacturing facilities with robots and CNC machines in India and pilot plant facilities in India and The Netherlands, Technoforce has uniquely positioned itself to provide competitive solutions. We work very closely with the customers to assist in feasibility studies and tests in the pilot plants for process optimization.

With an experience of more than 1000 installations and 3000 pilot plant tests, Technoforce has a proven capability to supply plants with attractive payback periods.

“

Technoforce gives excellent value added services by way of process optimization through pilot plant trials.

Mr. Prasad, Vice Chairman & CEO,
Dr. Reddy's Laboratories, India

Pilot Plant Setups

Performance guarantees of commercial scale plants are backed by trials taken in the Pilot Plants in Nashik, India or in Geleen, The Netherlands.

The following setups are available for trials in the test centres

Evaporation
Agitated Thin Film Evaporator (ATFE)
Falling Film Evaporator (FFE)
Rising Film Evaporator (RFE)
Suppressed Boiling Evaporator (SBE)

Short Path Distillation
Short Path Distillation Unit (SPDU)

Drying
Agitated Thin Film Dryer (ATFD)

Extraction
Asymmetric Rotating Disc Column Extractor (ARDC)
Centrifugal Extractor (CE)
Sieve Tray Column Extractor (STC)

Crystallization
Technoforce Plug Flow Crystallizer (TPFC)

Zero Liquid Discharge Systems
Multiple Effect Evaporator (MEE)
Sludge Dryer (SD)

Utilities
Thermic Fluid heating up to 300°C
Steam up to 10 bar pressure
Hot water
Cooling water
Chilled water
Brine down to -20°C
Vacuum down to 0.001 mbar

Analytical Laboratory
Apart from wet chemistry and gravimetric methods, GC and HPLC are available to test the samples during the trials for their fine tuning.

Design and Manufacturing

Technoforce has a 15000 sq.m of integrated manufacturing facility in Nashik, India.

The rotary equipment like Thin Film Evaporators, Thin Film Dryers or Short Path Distillation Units can be made up to 50 sq.m in size.

The materials of construction can be Stainless Steel, Duplex Steel, Alloy 20, Hastelloys and Titanium. The shops use industrial robots and CNC machines.

The supply can be in the form of modular skid mounted plants, dressed up with piping, pumps and instrumentation. The skid is subjected to Factory Acceptance Tests (FAT) in the presence of the customer. Since the modules arrive at the customer's site fully assembled and tested, months are saved from the project schedules.

The equipment and skid shops deliver plants under certifications of ASME U- Stamp, European PED and EN 1090-2 (CE Mark). Our plants and components fulfill also the requirements of the European Guidelines like Machinery Directive, ATEX etc.

We use Finite Element Analysis (FEA) and Computational Fluid Dynamics (CFD) software for simulations.

The software programs help in simulating complex design situations and analyzing problems that involve stresses due to loads and temperatures, fluid flow with heat and mass transfer.

3D modelling of skids enables the customers to visualize the installation before the start of construction. Pipe stress analysis ensures robust piping design.

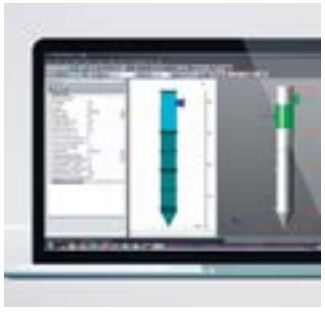
“

Our application involves extreme temperature, vacuum and viscosity. The thin film evaporator supplied by Technoforce has worked trouble free since 1987.

Mr. S. Daya, Director,
Oil Processors Pvt. Ltd., India

Project Management

We work closely with customers at every stage. Project management tool ProjecTrackTFS simplifies communications during project execution.



Lab Study

Pilot Plant Trials

Process and Mechanical Design

Project Execution

Turnkey solutions from a single source simplify project management for the customer. The results are tight control on costs and delivery times.

Equipment Manufacturing

Skid Mounted Systems

Erection and Commissioning

After Sales Service

Applications

Pharmaceuticals, Food, Spice Extracts, Vitamins, Paints, Dyes, Pigments, Agrochemicals, Petroleum, Resins, Polymers, Fine Chemicals, General Chemicals




Evaporation & High Vacuum distillation

- Concentration & stripping of enzymes, plant extracts, silicone oils, pesticides, polymer melts
- Distillation of bulk drugs, natural or synthetic vitamins, esters, fish oil, omega-3 fatty acids, tocopherol, tocotrienols, waxes, spent lube oil

Drying

- Pharmaceuticals, bulk drugs, intermediates, food products
- Recovery of solvents, DMSO from salts, Glycerin from salts

Extraction

- Extraction of APIs, fermentation streams, general chemicals
- Reactive extraction

Crystallization

- APIs and intermediates with close CSD
- Fine chemicals
- Inorganic & organic compounds

Zero Liquid Discharge Systems

- Concentration of effluent water having high TDS
- Drying of sludge for obtaining easy to dispose off solids
- Treatment of large quantity of wastewater with steam economy

TECHNOFORCE™

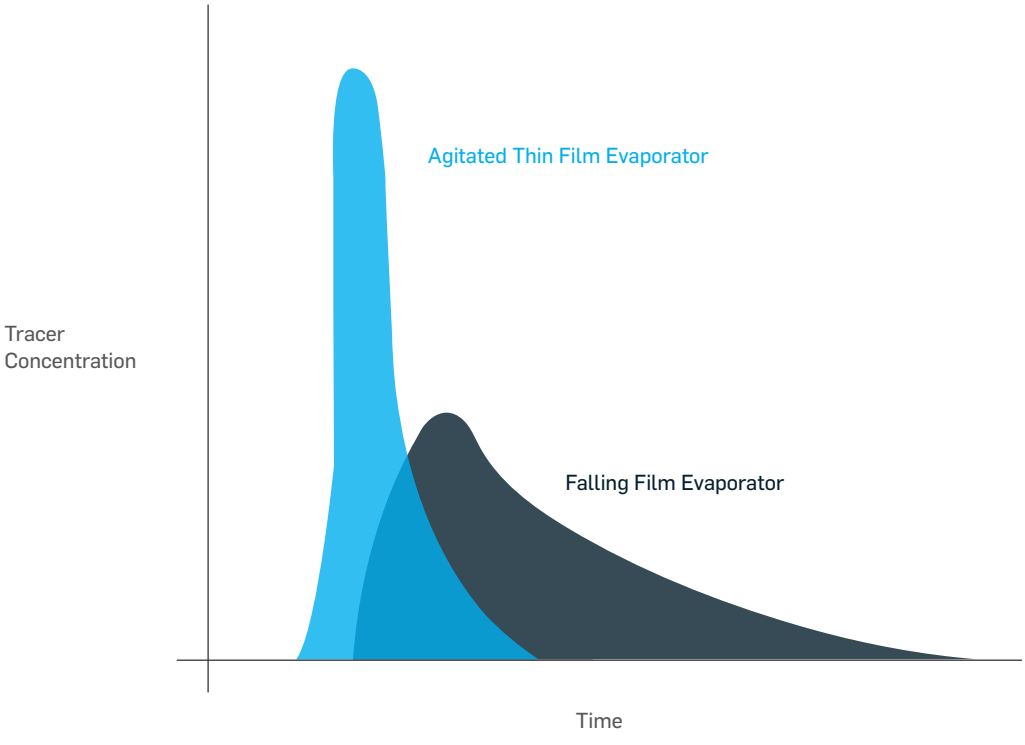
Thin Film & Short Path Technology

Agitated Thin Film Evaporator (ATFE)
Short Path Distillation Unit (SPDU)
Agitated Thin Film Dryer (ATFD)

Agitated thin film on a heated wall provides many unique features

- The small holdup in the film reduces residence time to a few seconds. The turbulent flow narrows the spread in residence time distribution. Required evaporation is achieved in a single pass, avoiding recirculation and repeated exposure of the product to the heated surface. These features provide big benefits while processing heat sensitive products.
- Absence of hydrostatic head and possibility of shortening of vapour path makes it possible to operate Thin Film units down to 0.001 mbar.
- Separation of volatiles from the non-volatile fraction is near complete. This helps improving the purity and recovery.
- The compact construction reduces the cost of vacuum generation and solvent losses by 60 to 70% as compared to conventional methods.
- It has an excellent turndown ratio.
- Several rotor options means the bottom stream can be liquid, viscous melt, semisolid or powder.

Residence Time Distribution



Rotor Options

No single rotor design is capable of meeting all the divergent process needs. Therefore Technoforce has developed several rotor options to choose from.

As distillation equipment, the feed in the form of liquid or molten mass is evaporated often at deep vacuum, resulting into flowable or viscous bottom stream of product or residue.

As drying equipment, the feed in the form of solution, slurry or filter cake is converted into semisolid mass or fine, free flowing powder.

Fixed Clearance
Rigid Blades

Fixed Clearance
Swinging Blades

Zero Clearance
Rollers

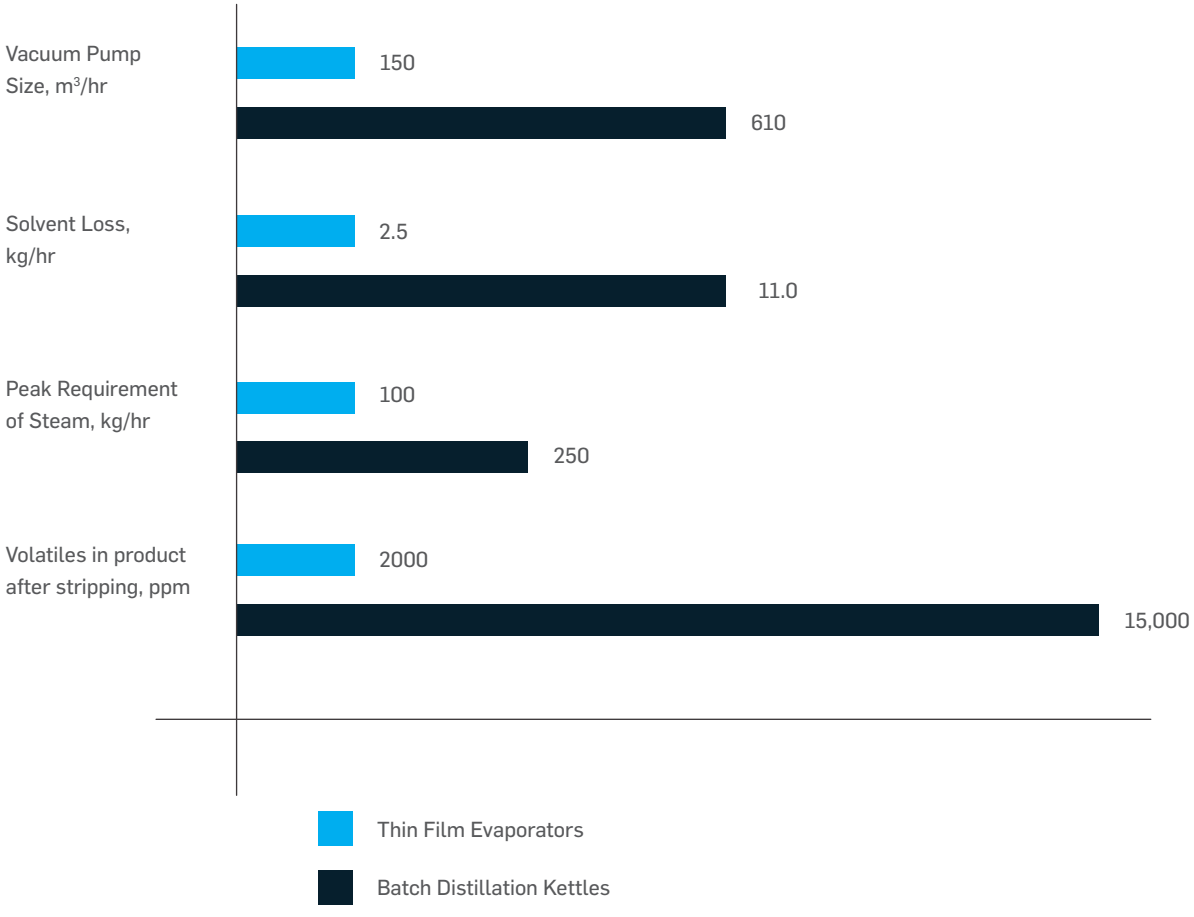
Zero Clearance
Metal Blades

Zero Clearance, Blades
with Polymer Tips

Fixed Clearance
Rigid Blades

Comparison

The advantages of agitated thin film concept are best understood with a real case. The following comparisons represent an average distillation rate of 400 kg/hr of solvent from a product at 10 mbar in a continuous thin film evaporator or a batch distillation kettle.

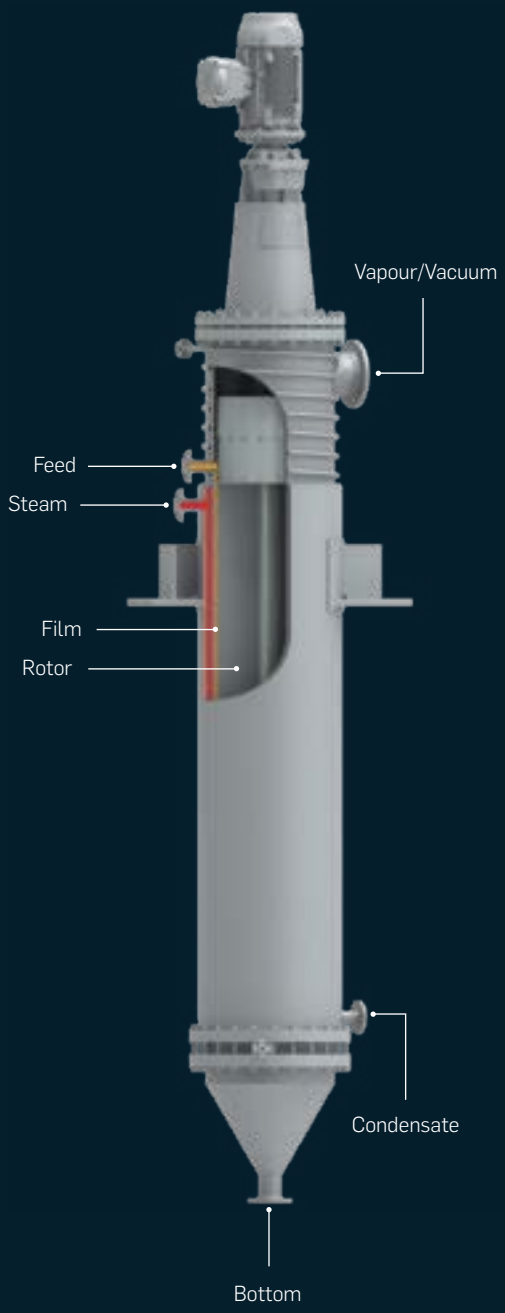


The unique advantages and process improvements are demonstrated by carrying out trial runs in the pilot scale testing facilities of Technoforce.

Agitated Thin Film Evaporator (ATFE)

ATFE rotor has rigid bearing supports at both the ends. This enhances its capability to handle applications having viscous or semisolid bottom streams.

ATFE can operate at pressures of 1 mbar and above. The jacket side heating medium temperature can be up to 400^{0}C.



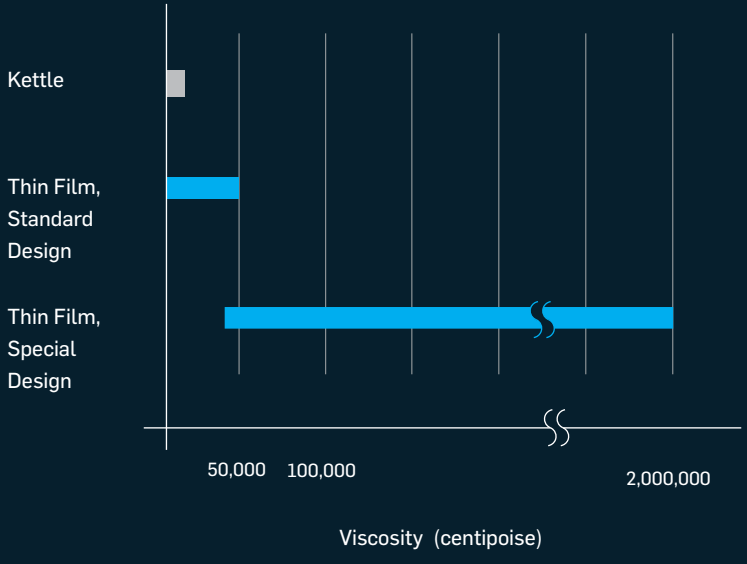
Applications

Vacuum distillation of bulk drugs, intermediates, fine chemicals, glycols, used lubricating oils, fatty acids, amines and esters.

To concentrate oleoresins, enzymes, bulk drugs, plant extracts, juices and sugars.

Stripping of silicone oils, pesticides, plasticizers and monomers from polymers.

Viscosity Handling Capability



Short Path Distillation Unit (SPDU)

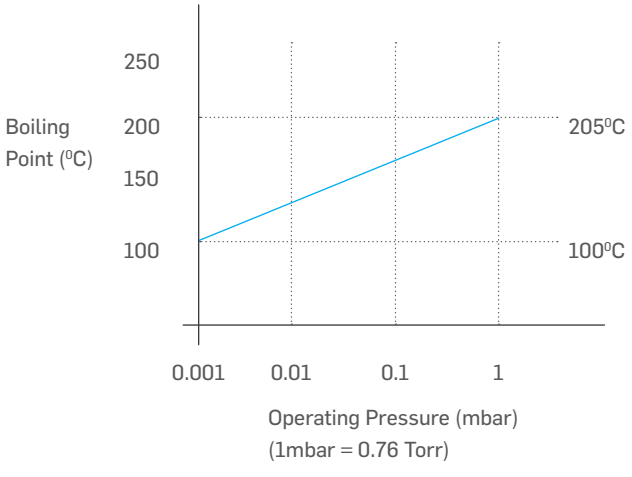
Also known as molecular distillation, the configuration with an internal condenser eliminates pressure drop between the heated film and the condenser surface. Thus, it can be operated at pressures down to 0.001 mbar.

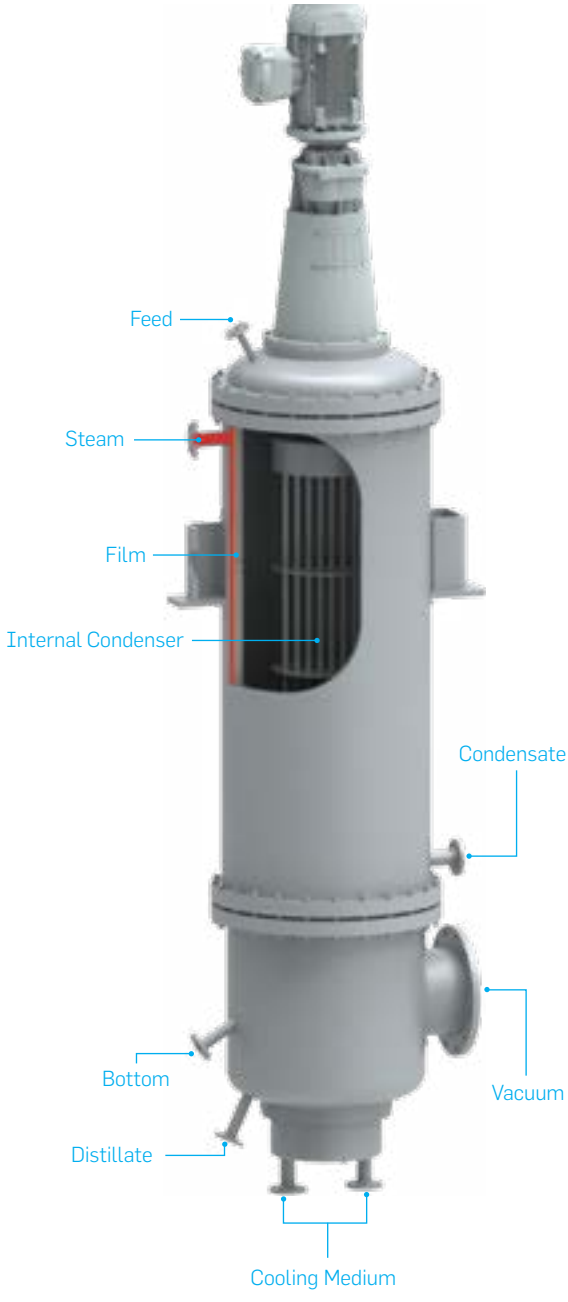
The wiper basket with a splash guard enhances the distillate quality by minimizing carry over in the distillate. Operating temperature in the jacket can be upto 400°C

Applications

Vacuum distillation of natural and synthetic vitamins, esters, bulk drugs, tocotrienols, tocopherols, fish oil, omega 3 fatty acids, glycerides, fine chemicals, silicone oils, natural and synthetic waxes, epoxy resins and used lubricating oil.

Typical Reduction In Boiling Point



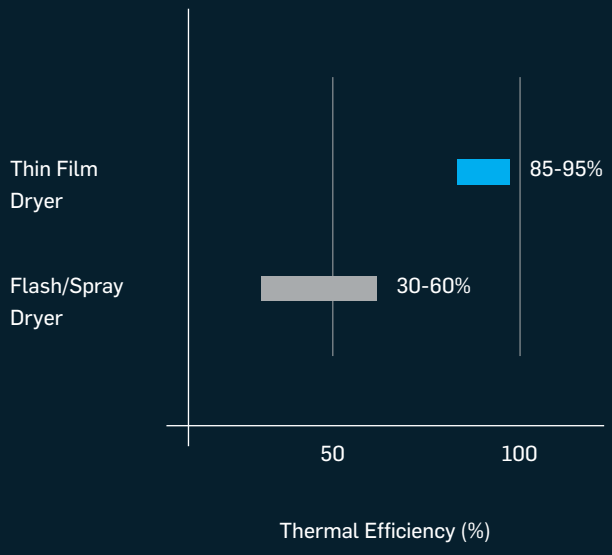


Agitated Thin Film Dryer (ATFD)

The feed material passes through phases of liquid, slurry, paste, wet powder and finally dry powder while in the form of an agitated thin film.

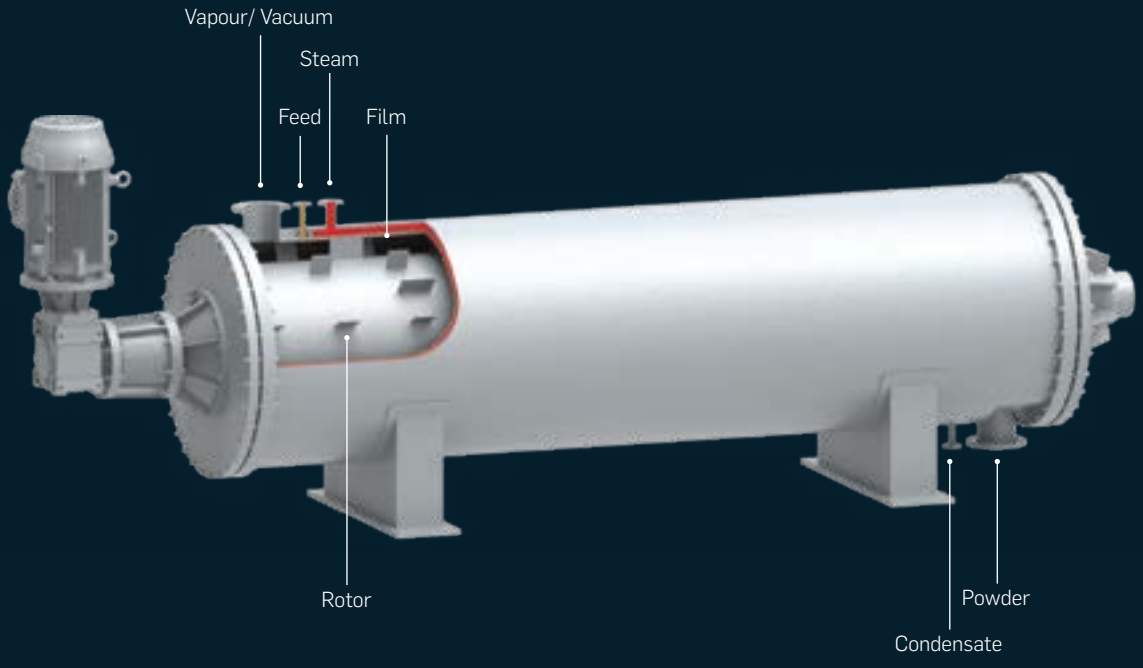
ATFD has two configurations, vertical and horizontal. The vertical dryer accepts feed in solution and slurry form. The horizontal dryer, along with solution and slurry, also accepts feed in paste or wet powder form. Thus dilution of feeds is avoided arising from such limitations.
Absence of air makes it suitable for oxygen sensitive products.
Powders are of uniform consistency, free from large agglomerates or grits.
Continuous discharge of powder from vacuum is possible.

Thermal Efficiency of Dryers



Applications

Drying of bulk drugs and intermediates, dyes and pigments, value added food products, clean room applications, possibility of amorphous powders.



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Tubular Evaporators

Rising Film Evaporator (RFE)
Falling Film Evaporator (FEE)
Suppressed Boiling Evaporator (SBE)

Concept

The tubular evaporators accommodate very large heat transfer surface area in a compact space. Therefore, they provide a cost-effective alternative to batch kettles.

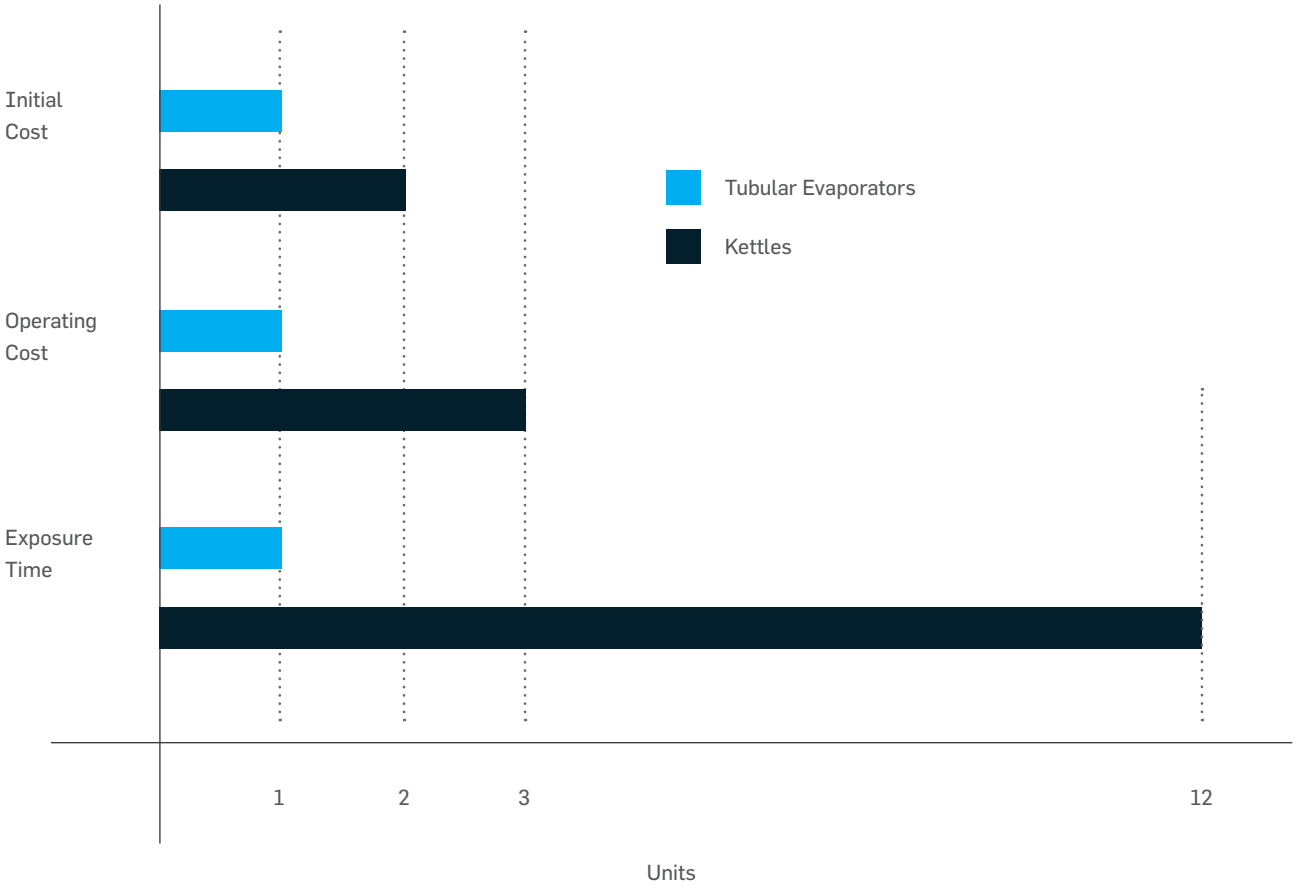
While processing large volumes of feed streams, they also provide an opportunity to arrange the evaporators in 'multiple effects' fashion so that the vapors generated are reused multiple times as the heating media. This arrangement significantly reduces the operating cost.

The products are exposed to heat for much shorter time in tubular evaporators as compared to batch kettles. Therefore, they are preferred for processing heat sensitive products.

These evaporators operate continuously and are therefore, easy to automate. Looking at the unique needs of the application, we select from one of the three configurations; Rising Film Evaporator, Falling Film Evaporator and Suppressed Boiling Evaporator.

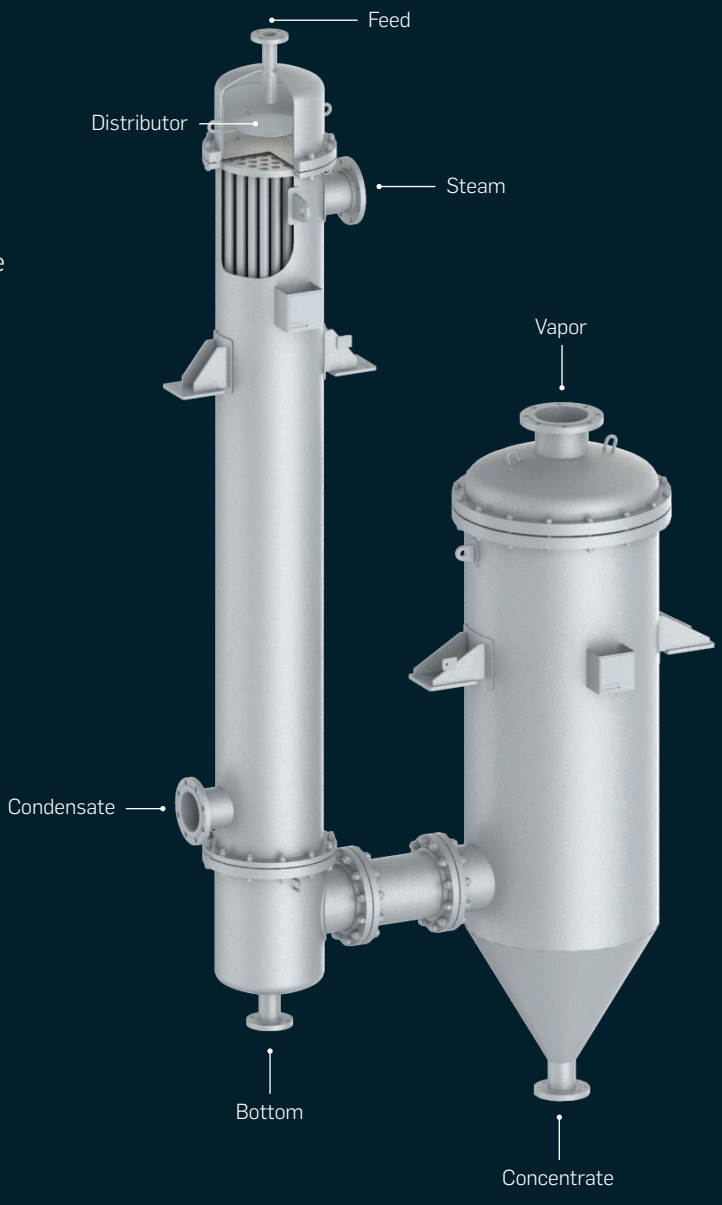
The suitability of a particular type of tubular evaporator and optimization of operating parameters is done at pilot plant test centers of Technoforce in India and The Netherlands.

The performance of commercial scale setups is backed by an experience of commissioning hundreds of installations.



Falling Film Evaporator (FFE)

A Falling Film Evaporator (FFE) is mounted vertically with a vapor- liquid separator at the bottom. The feed to be concentrated enters at the top. The distributor spreads it uniformly in such a way that if flows down the inside surface of the tubes as a thin film. As the film receives the heat, the generated vapors flow co-currently. The drag of vapors increases the turbulence and improves heat transfer performance. The vapor and the concentrated liquid are separated in the vapor- liquid separator.



Features

- Suitable for heat sensitive products
- Multiple effect arrangement for better steam economy
- Gentle evaporation, mostly under vacuum, with short residence time in the evaporator

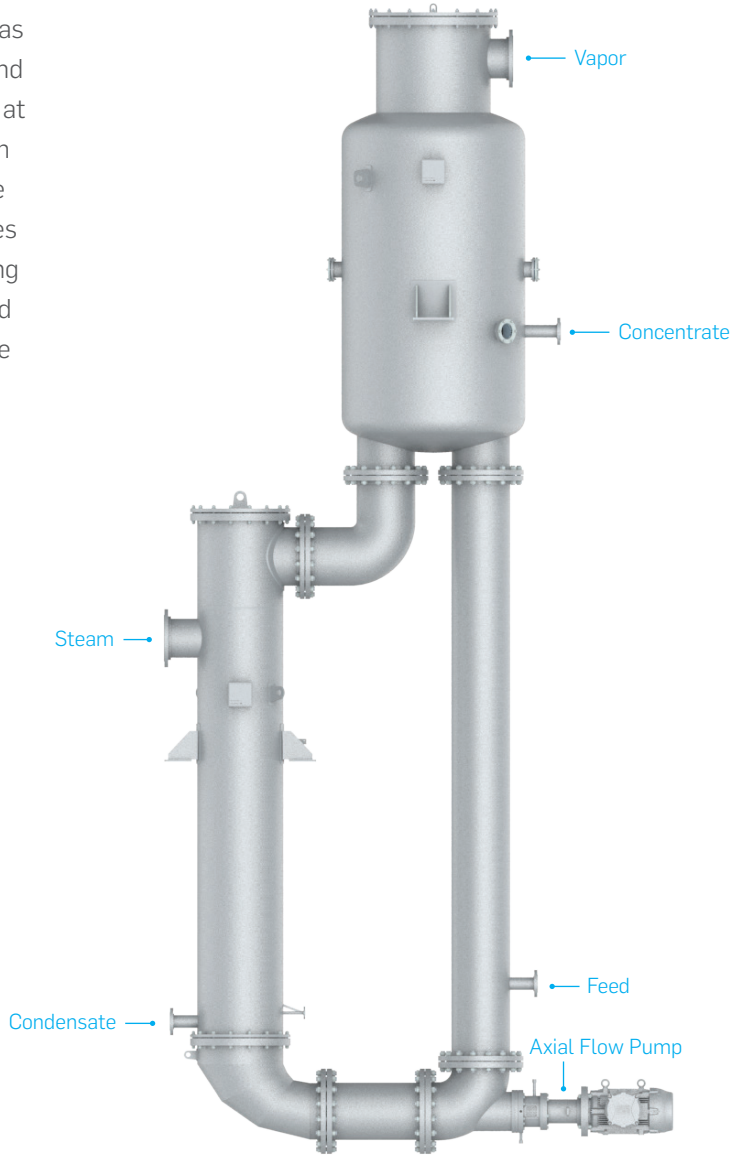
Applications

To concentrate dilute solutions of heat sensitive products containing water or solvents in applications such as:

- Plant extracts in water or organic solvents
- As a reboiler to a distillation column
- Recovery of solvents from contaminants

Suppressed Boiling Evaporator (SBE)

A Suppressed Boiling Evaporator(SBE), also called as Forced Circulation Evaporator (FCE), has a shell and tube heat exchanger as the evaporator, a separator at the top and a pump for circulation of liquid through the tubes. Good velocity in the tubes and adequate hydrostatic head suppresses boiling inside the tubes leading to its superheating. This minimises the scaling on the tube surface while concentrating saturated solutions. The superheat is flashed off as vapor in the vapor-liquid separator.



Features

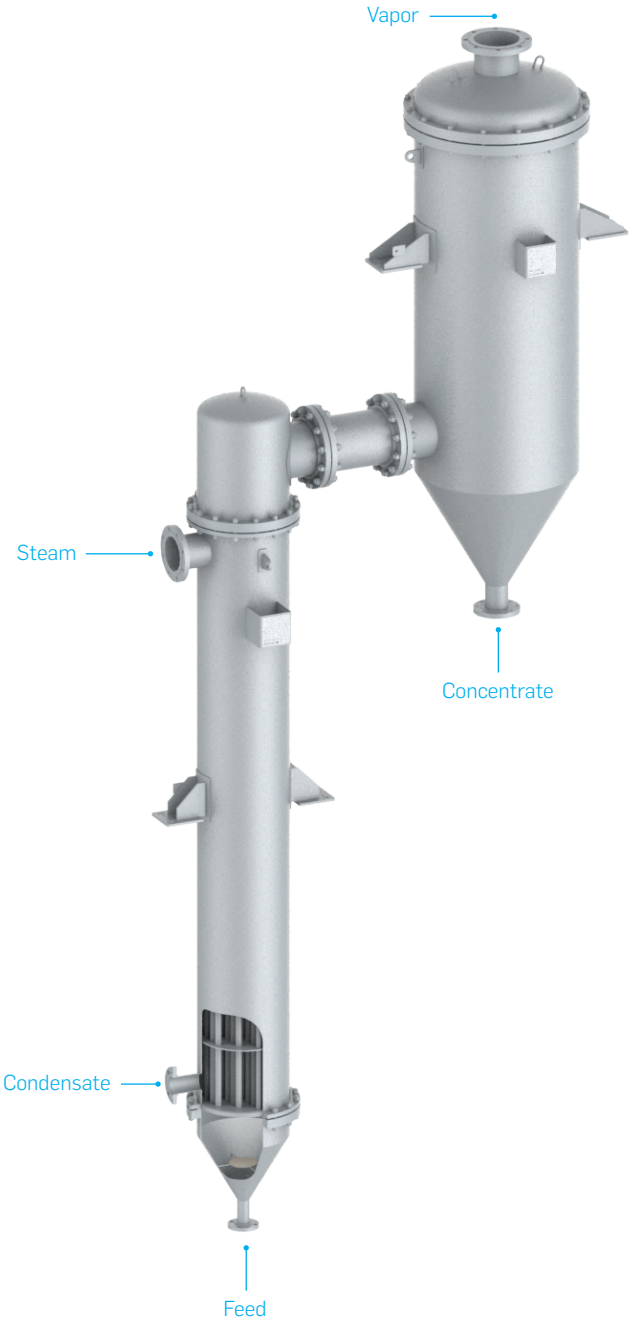
- Axial flow pump ensures high tube velocities with minimum power consumption
- Carefully balanced flow and hydrostatic head truly suppress boiling and scaling in the tubes
- Generously sized flash separator minimizes entrainment, resulting in a clear distillate

Applications

- Preconcentration of scale prone liquids before drying
- Multiple effect arrangement for reduction in the steam requirement
- Wastewater concentration for volume reduction
- Concentration of solution having organic and inorganic salts
- Evaporative crystallization

Rising Film Evaporator (RFE)

A Rising Film Evaporator (RFE) is mounted vertically with a vapor-liquid separator at the top. The feed to be concentrated enters at the bottom. As it receives the heat, the vapors generated lifts the liquid upwards and push it on the wall as a film. The velocity generated by the vapor lift is quite high, resulting in a good thermal performance. The vapor and concentrated liquid are separated in the vapor- liquid separator.



Features

- Thermosiphon action due to boiling in vertical tubes eliminates the need for circulation pump
- Multiple effect arrangement provides better steam economy
- Trace quantities of suspended particles in the feed are tolerated

Applications

To concentrate dilute solutions containing water and organic solvents in applications such as:

- Plant extracts in water or organic solvents
- As a reboiler to distillation column
- An economical alternative to falling film evaporator for moderate vacuum and moderately heat sensitive products

TECHNOFORCE™

Extractors

Asymmetric Rotating Disc Contactor (ARDC) column
Sieve Tray Column (STC)
Centrifugal Extractor (CE)

Concept

Liquid-liquid extraction is an economical alternative for separating compounds that are difficult to purify by distillation. Operation at lower temperature is beneficial to the heat sensitive products.

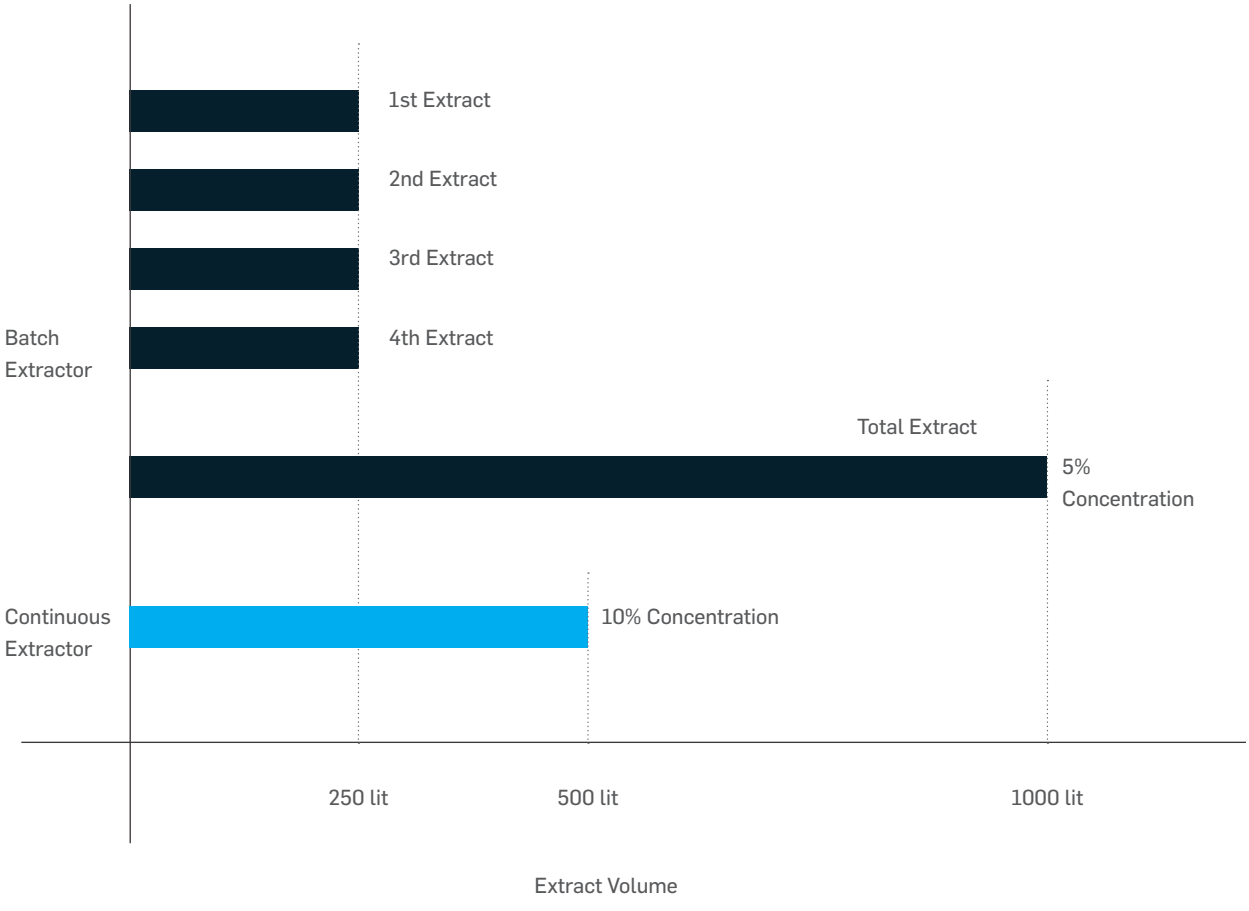
When extraction is carried out in a conventional batch kettle, fresh solvent for extraction is added several times in the same vessel.

Each washing cycle would incrementally extract the desired product from the aqueous phase, producing dilute extract in each subsequent cycle. As a result, the solvent use is high and a large volume of extract leads to higher recovery costs and solvent losses.

The extraction can also be carried out in a series of mixers & settlers and repeated continuously in a counter current fashion. As the same solvent is used repeatedly for extraction, its overall requirement can get reduced by 50 % as compared to batch extraction in kettles.

Technoforce offers 3 types of continuous extractors. Depending upon the needs of the application, we can select the right equipment from these three options. They cover almost all the possible application areas, each giving unique advantages.

The performance of production scale extractors is ensured by extensive trials in the pilot plants of Technoforce and from the experience of commissioning of more than one hundred installations.



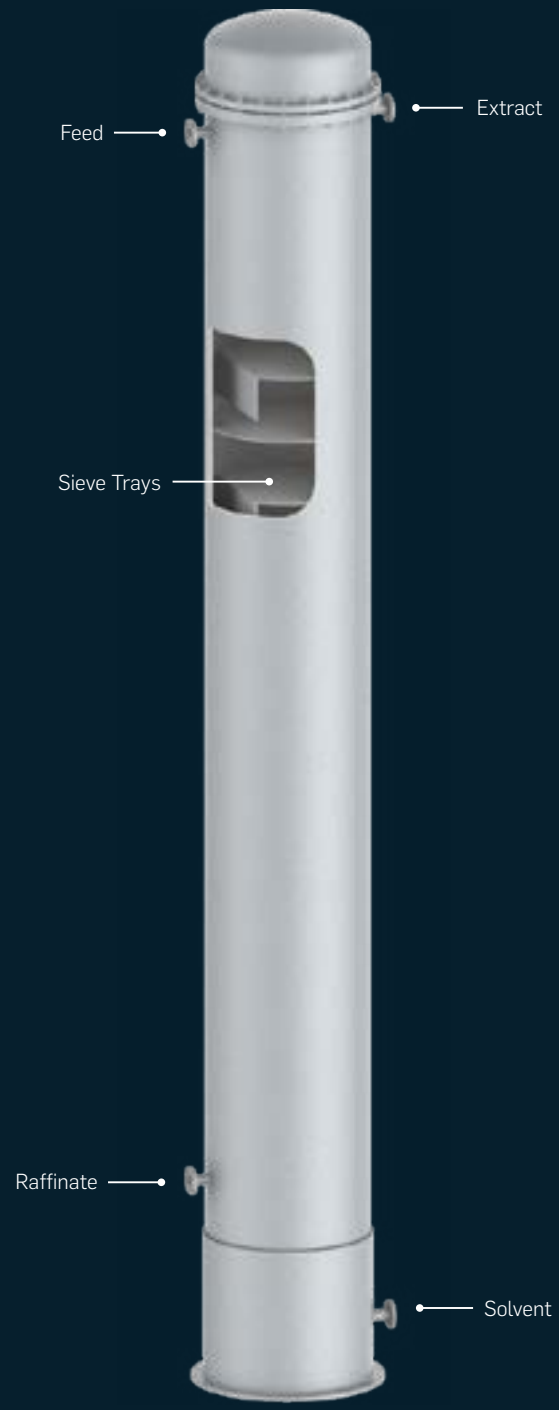
Sieve Tray Column (STC)

This classical column with sieve trays can ensure contact between the two phases by formation of controlled droplets of one phase dispersed into another phase. An optimized tray design ensures good mass transfer characteristics in a counter current and continuous operation.

Since these droplets are formed without any mechanical agitation, the shear rates involved are small.

Although this concept is not economical as compared to an ARDC column, it works well for those applications where due to very low relative surface tension values, the streams tend to form an emulsion in agitated column like ARDC or CE.

- Consistent results. Reliable operation without formation of hard to settle emulsion
- Significant reduction in space, energy and solvent loss
- No supervision required. Automated operation



Applications

- Extraction involving chemicals with small surface tension values
- Reactive extraction
- Change of pH by washing

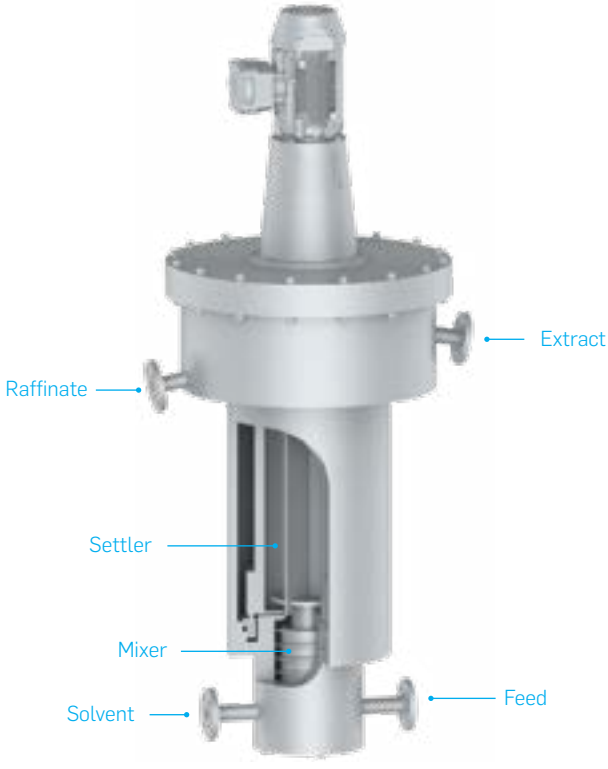
Centrifugal Extractor (CE)

The two phases are mixed with a high intensity in the mixing zone before the mixture enters the settling zone. Here the mixture experiences high centrifugal forces in the inside volume of a rotating basket.

The centrifugal extractor uses centrifugal force to accelerate the separation of the two phases. Thus both separation and mixing can be achieved in a very short time.

This results in significant reduction in liquid holdup, which is important for applications requiring quick changeover between batches.

- Small holdup
- Quick changeover
- Short contact time
- Ease of cleaning



Applications

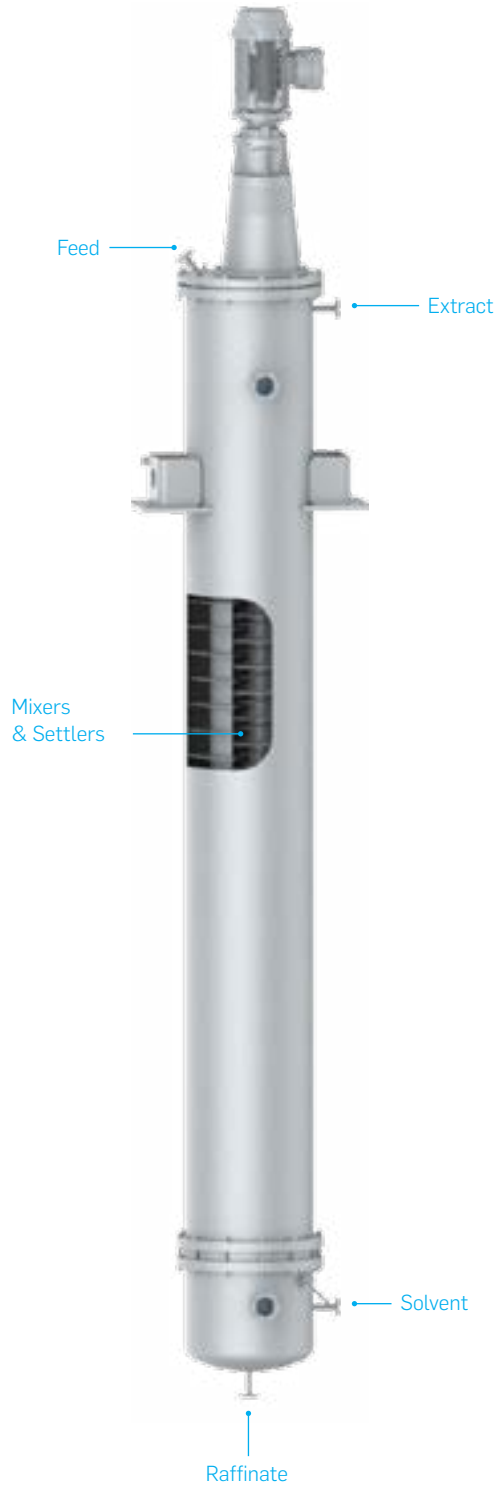
- Pharmaceuticals where batch integrity is to be maintained
- Hazardous applications where small holdups are crucial
- Simple extractions where several stages are not required
- Reactive extraction

Asymmetric Rotating Disc Contactor (ARDC) column

An ARDC column has a stack of mixers and settlers, arranged vertically inside a long vertical column. This arrangement provides several stages of extraction in a counter current fashion.

In a continuous operating mode the heavy phase enters the column from the top and the light phase from the bottom. While they flow counter currently through the series of mixers and settlers, the desired transfer of the key component takes place from one phase to the other. At the outlets we get an extract enriched with the desired component and the raffinate or the spent feed.

- Improved and consistent results
- Significant reduction in space, power and solvent
- Continuous and automated operation. No supervision required



Applications

- Purification of fine chemicals and pharmaceuticals
- Reactive extraction
- Change of pH by washing
- Separation of close boiling components, which are otherwise difficult to separate by distillation
- Separation of components which form azeotropes
- COD/ BOD reduction in waste water

TECHNOFORCE™

Crystallization

Technoforce Plug Flow Crystallizer (TPFC)

Concept

Crystallization provides a process to produce solid crystalline compounds with high purity.

Crystal Size Distribution (CSD)
When crystals are formed out of a solution, impurities get concentrated in the mother liquor. The purity of the crystals after filtration or centrifugation depends upon how efficiently the mother liquor is washed from the filter cake. Uniformity in size or narrow crystal size distribution (CSD) helps in improving the washing and purity of crystals.

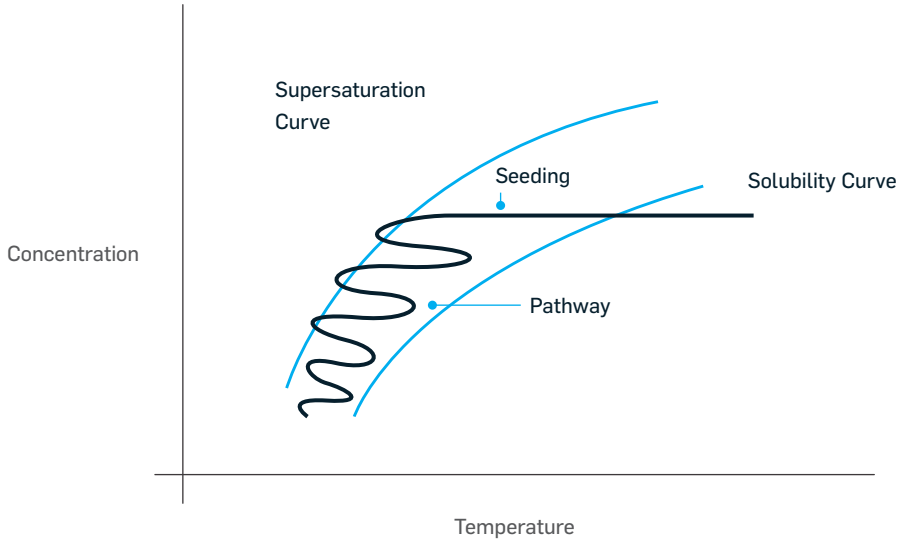
Certain important characteristics like flowability, Density and compressibility of the powders also depend upon CSD.

Conventional batch or continuous crystallizers have inherent limitations in achieving uniformity in crystal size. They tend to produce inconsistent results mainly due to uncontrolled nucleation.

Primary nucleation
The lack of uniformity in mixing leads to unintended ingress beyond supersaturation line. It leads to uncontrolled primary nucleation and undesired amounts of fine crystals.

Even if the primary nucleation is avoided in the beginning with seeding, the risk remains in subsequent period due to lack of uniformity in saturation level.

Crystallization Pathway

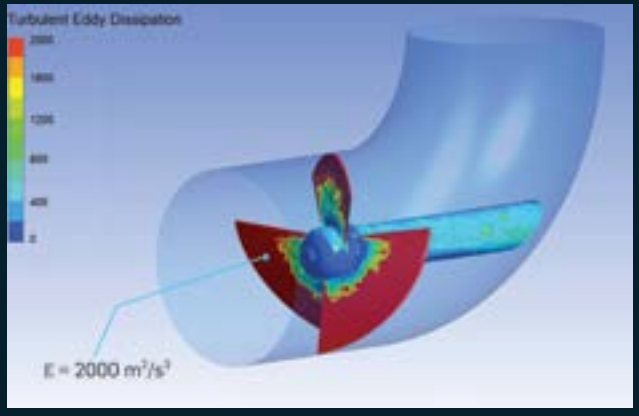


Secondary nucleation
Improvement in uniformity in concentration is usually attempted by increasing power input to the agitator for better mixing or larger capacity pump for higher recirculation.

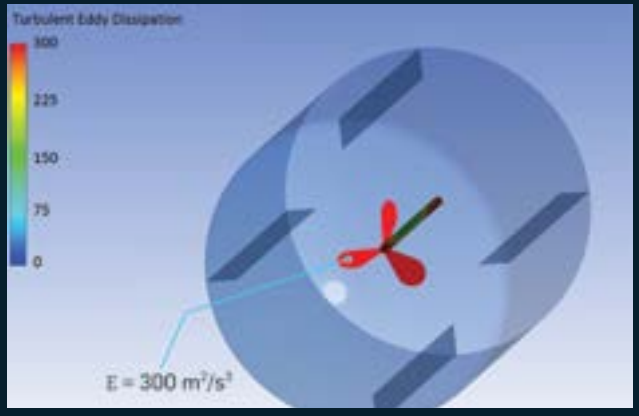
The conventional agitators and pump impellers dissipate large amounts of energy into the surrounding slurry.

The large energy dissipation from impeller surfaces break the nearby crystals leading to secondary nucleation.

Thus the design of conventional crystallizer is a trade-off in power input. Higher power input minimises primary nucleation but increases secondary nucleation.



Circulation Pump



Kettle

Technoforce Plug Flow Crystallizer (TPFC)

An improved control of crystal size distribution is obtained in a continuous flow design that has negligible back-mixing with a residence time distribution approaching that of an ideal plug flow crystallizer.

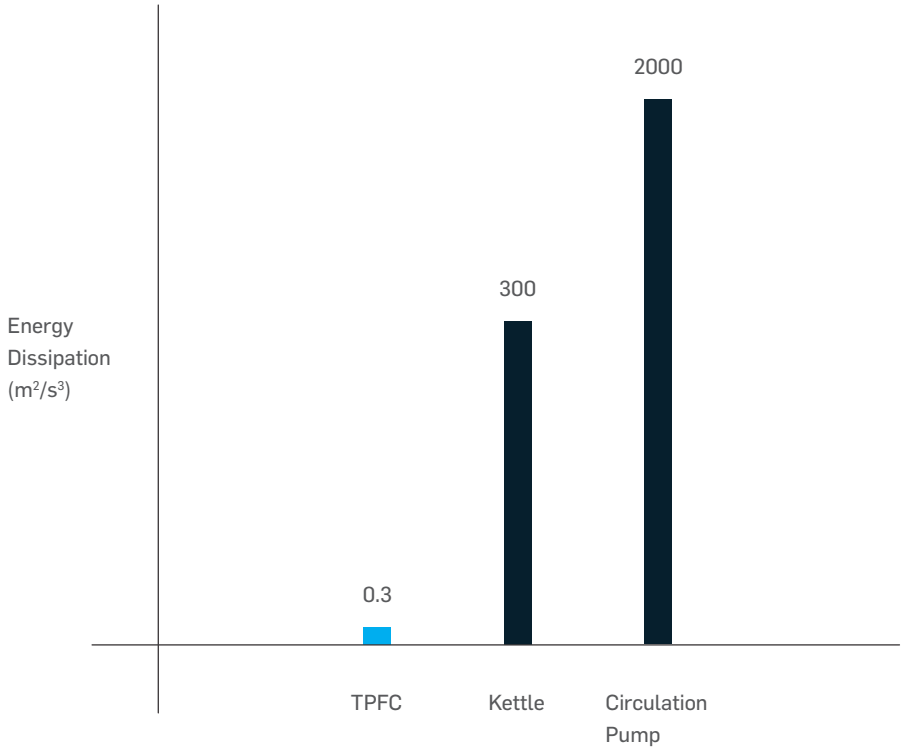
The trade off in design of conventional crystallizers is overcome by TPFC.

The unique agitator design of TPFC achieves uniformity in mixing with minimum power input. The uniform supersaturation eliminates uncontrolled primary nucleation.

The energy dissipation of agitator of TPFC is 1000 times less as compared to a batch kettle.

Therefore the formation of fine crystals due to breakage of existing crystals or secondary nucleation is minimised.

Energy Dissipation



Designed for improved results

The novel continuous TPFC design has potential to provide improved control of crystal properties, improved process reproducibility and reduced scale-up risks.

There are several compartmentalized stages in the TPFC. The feed flows from one stage to the next while experiencing different concentrations or temperatures. By the unique design of the rotor and the individual compartments, a plug flow with minimized back mixing is achieved.

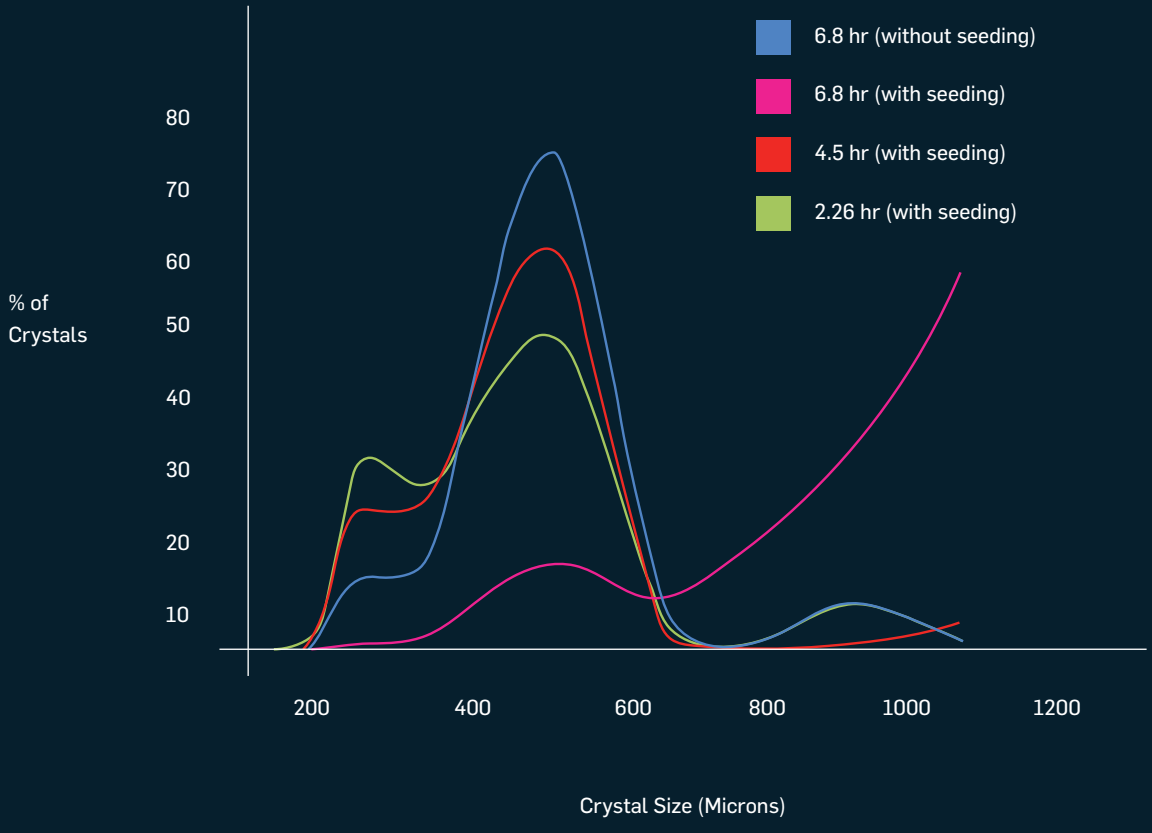
The plug flow characteristics ensure narrow residence time distribution and near equal time for the growth of individual crystals.

Crystal growth is controlled by varying the temperature profile along the length of the crystallizer.

The distinct capabilities of close control on saturation, reduced attrition and uniformity in residence time lead to significant improvements in CSD and final purity of the product.

With a judicious selection of residence time and seeding in a TPFC, it is now possible to get unparalleled control of CSD.

Effect of Residence Time & Seeding



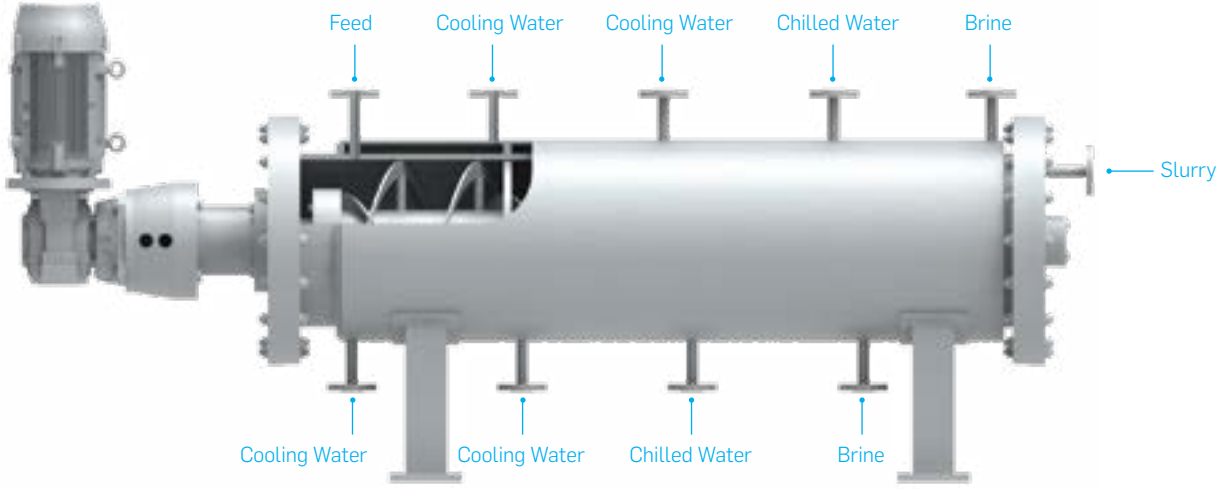
Versatile Design

The TPFC is suitable for different configurations

When used as a cooling type crystallizer, each stage is provided with a separate jacket where the provided cooling media changes from normal water to chilled water and then to brine such that a controlled temperature profile is achieved. The utility costs are reduced by 50 % by resorting to this concept.

When used as an evaporative crystallizer the vapours are collectively taken out from all the stages.
As the feed passes through one stage to the next, the evaporation rate when matched with the crystal growth rate ensures avoidance of uncontrolled primary nucleation.

Similarly the TPFC can be easily adopted for anti-solvent crystallization.



Validation tests and Scale-up

A systematic approach in understanding the saturation and supersaturation concentrations, crystal growth rates, crystal morphs in the laboratory scale investigations helps in planning the trials at the pilot plant scale.

Technoforce has the requisite laboratory scale and pilot plant scale crystallizers for conducting investigations.

With the analytical setups for CSD measurements, the operating parameters are optimised to get the desired powder characteristics and the same data is used for the scale-up.

The trials are backed by experienced technologists who are adept in the scale-up for production scale units.

TECHNOFORCE™

Zero Liquid Discharge Systems

Established Approach

The industrial waste water often is laden with dissolved salts and organic compounds. Such streams if discharged untreated will pollute the environment.

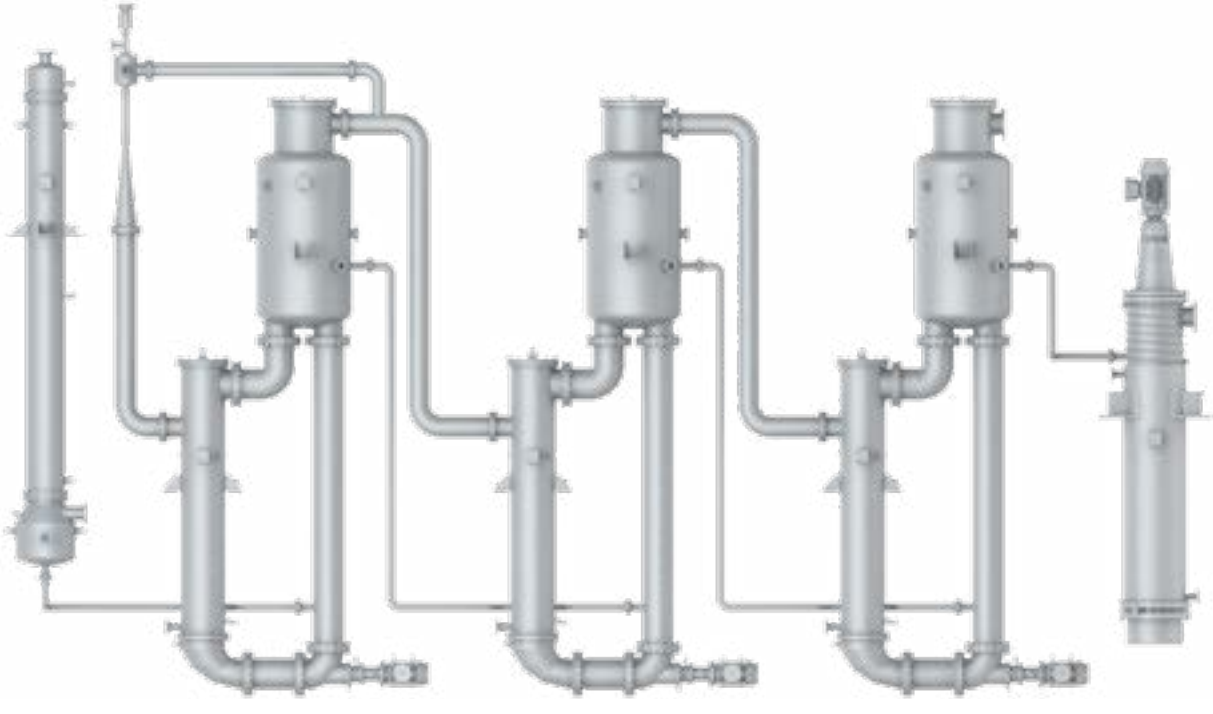
The treatment of industrial waste water involves separation of dissolved salts from water and minimisation of organic compounds before it is taken for further treatment in conventional Effluent treatment Plant (ETP) to reduce BOD/ COD values.

Stripping Column
The organic contaminants are removed to the extent possible by using a counter current steam stripping column.

Multiple Effect Evaporator (MEE)
The feed is then taken to a multiple effect evaporator to minimise the volume by evaporating the water.

The energy required and hence the operating cost of MEE is minimised by using multiple stages. The number of effects to be employed is decided by the optimization between the initial investment and the corresponding operating costs. Higher capacities justify more number of effects.

Use of thermal vapour re-compressor utilizes high pressure motive steam to further improve the steam economy.



Stripping Column | Multiple Effect Evaoprator | Sludge Dryer

The resultant slurry is taken to a sludge dryer where remaining water is driven out to get solid mass of salts and heavy organics.

The indirectly heated sludge dryer eliminates air pollution and gives unmatched thermal efficiency of more than 90 %.

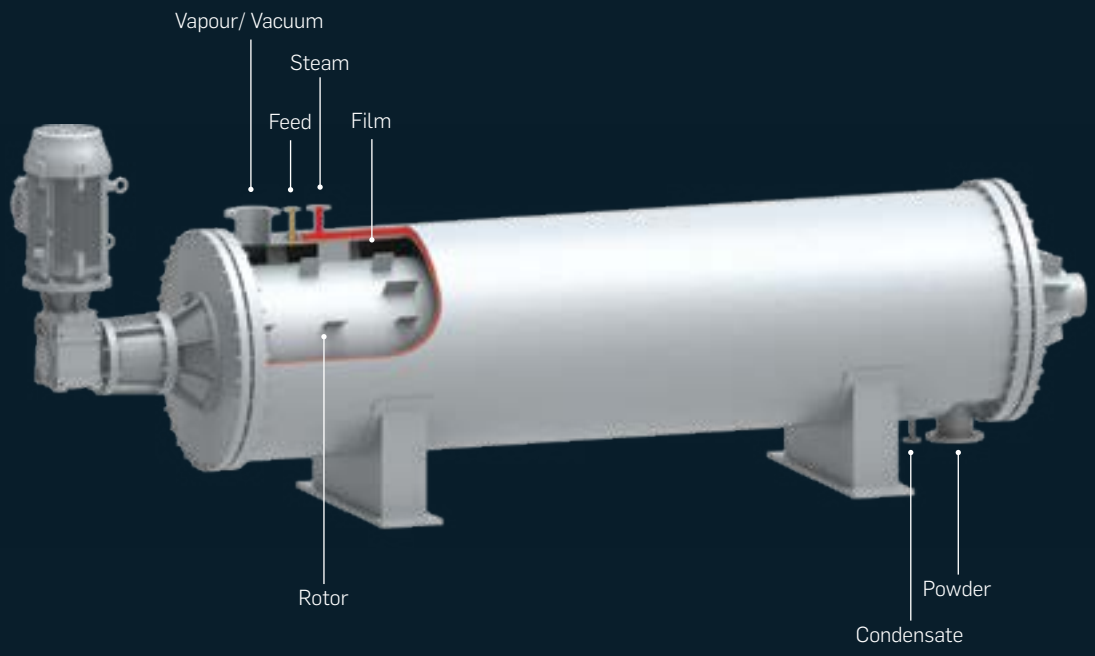
With an experience of commissioning more than 150 sludge dryers, these workhorses from Technoforce are known in industry for their robustness. There are two types of configurations available for sludge dryers.

Vertical Sludge Dryer

Technoforce introduced the first vertical sludge dryer in 1995 for the zero liquid discharge system. It suits well for feeds in the form of solutions or dilute slurries.

Horizontal Sludge Dryer

Horizontal sludge dryer is a more versatile alternative. It is suitable for solutions, dilute slurries, thick slurries, pastes or filter cakes. Therefore it is possible to have a single sludge dryer which can take slurry from MEE as well as decanted sludge from ETP plants and other sources simultaneously.



Sound Design

Suppressed Boiling Evaporator (SBE)
The boiling of saturated solution near the wall of tubes results is scaling of their surface. The scaling is minimised by suppressing the boiling inside the tubes with appropriate hydrostatic head. The superheated liquid exits the tubes and flashes off as vapour in the separator.

The supressed boiling evaporator is also known as forced circulation evaporator, although forced circulation itself may not be adequate to supress the boiling in the tubes.

Axial Flow Pump (AFP)
Use of axial flow pump improves operation of the suppressed boiling evaporator. It delivers 5 times the flow rate as compared to a centrifugal pump using the same power.

The high efficiency impellers of the axial flow pumps are designed using Computational Fluid Dynamics (CFD) software and manufactured on CNC machines.

Each pump is tested on a test rig to ensure that the desired capacity, head and efficiency are obtained.

Technoforce Scaling Monitor (TSM)

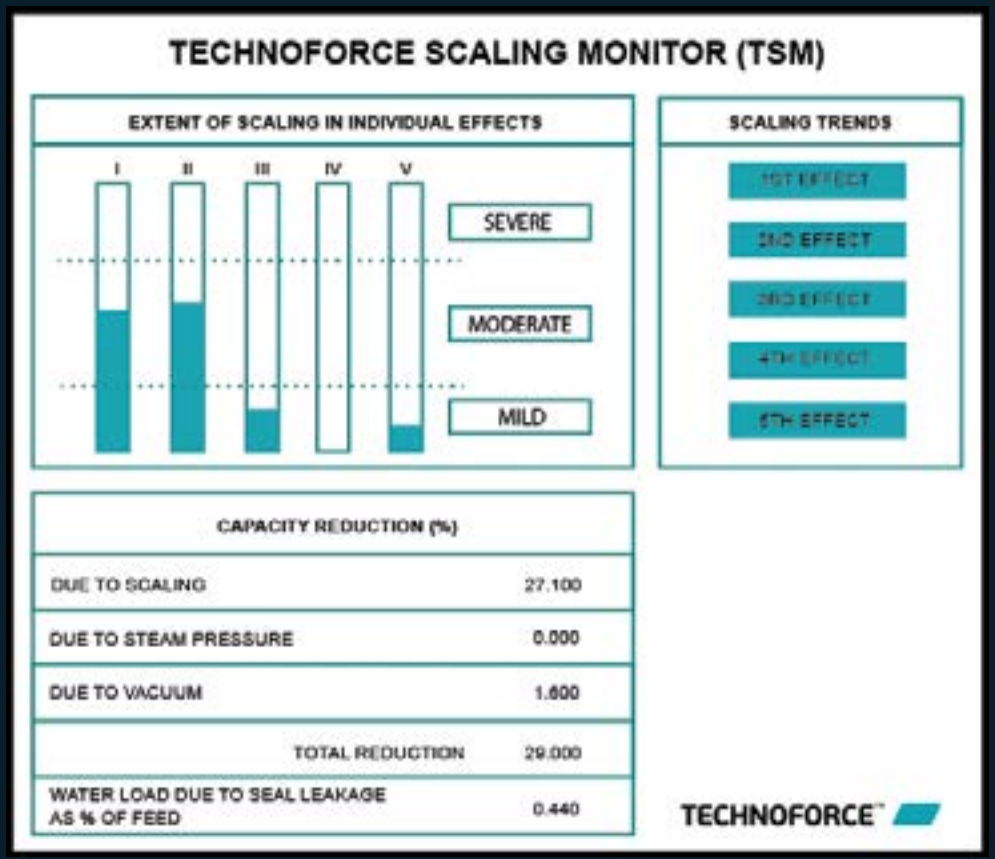
Even properly designed evaporators experience some level of scaling.

The rate of scaling of each effect is different and it is quite difficult for the operator to know the extent of scaling of individual effects.

Technoforce has developed an intelligent software called TSM (Technoforce Scaling Monitor) to overcome this limitation. The software helps the operator know scaling in each effect at any time and accordingly optimise the descaling procedure and the schedule.

It also quantifies the loss in capacity due to insufficient steam pressure or vacuum and leakages from seals of pumps so that necessary corrective actions are taken.

Thus, the TSM software helps in getting the maximum capacity from the MEE.

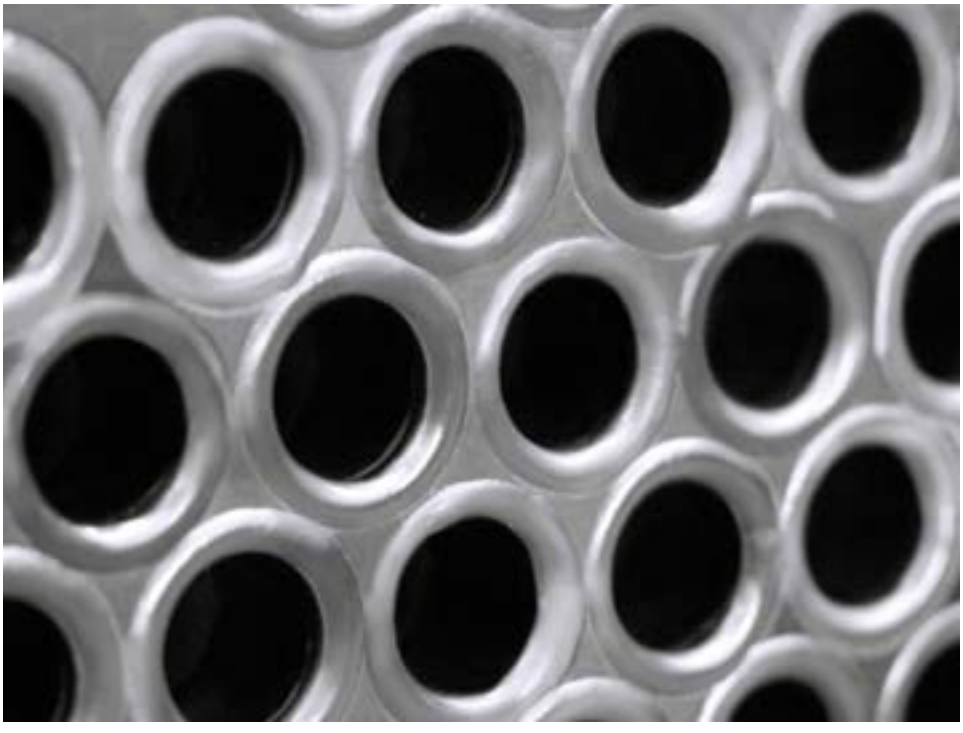


Sound Quality

Evaporator tubes are the most vulnerable even under mildly corrosive conditions. The welding joints of tubes to the tube sheet are likely to fail the first. Their reliability is improved by using automatic orbital welding technique.

The tubes available from dealers in open market are cheaper but often from mixed lots. Their quality is suspicious as inspection of 100% of the tubes is not possible.

Technoforce always buys tubes directly from manufacturers. Since the tubes are from a single lot, sample testing ensures quality of all the tubes.



Sound Execution

Technoforce supplies ZLD system as a modular skid mounted plant. The fabrication of structure and piping is done inside the Technoforce shops which are certified for European standards of manufacturing like EN 1090.

The whole setup is subjected to Factory Acceptance Tests (FAT) in presence of customers. The modules arrive at site without dismantling of piping, pumps or instruments. The whole plant gets erected and ready within 2 to 3 days after its arrival at site.

The customers are assured of a quality & timely execution, which one cannot expect when the construction is carried out at site by subcontracting the entire work.

Pilot Plant Tests

In some cases, effluent water can behave differently during evaporation.

If there is foaming, it increases the level of entrainment and loads the ETP plant with organics and dissolved salts.

For some effluents, the standard rotor design of the sludge dryer is not suitable.

These surprises are routinely identified by conducting trials in the pilot plant of Technoforce and corrective measures are taken during design and execution.

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