



Reliable

Efficient

Economical

# Distillation Technology

ENGINEERING - EQUIPMENT - TURNKEY SYSTEMS



# DISTILLATION

# TECHNOLOGY

Distillation is by far the most important separation process in the petroleum and chemical industries. It is the separation of key components of a mixture of liquids by the use of differences in relative volatility, or boiling point of the components.

Fractionation, rectification, stripping, azeotropic distillation, steam distillation, extractive distillation, reactive distillation etc. signify different functional characteristics of the process of distillation.

Solvent extraction, membrane separation or adsorption process is alternative to and competing with distillation. However, often these processes have higher investment or operational costs. Therefore, distillation continues to remain the main choice in the industry especially for large-scale separation applications.

There are many types of the process of distillation. Each type has its own characteristics and is designed to perform specific type of separation. These variations are due to the degree of difficulty in separation when the physical properties of the components in the mixture are very close to one another, such as an azeotropic mixture.

One type of variation is extractive distillation. In this type of process, an external solvent is added to the system to improve the separation. The external solvent changes the relative volatility between two 'close' components by extracting one of the components, forming a ternary mixture with different properties. The solvent is recycled into the system after the extracted component is separated from it.

Another type of distillation may include a catalyst bed and a chemical reaction occurring in the catalyst bed embedded within packing sections in the distillation column. This process is called reactive distillation. The targeted component reacts when it is in contact with the catalyst, after which the reaction product is separated from the rest of the components in the mixture while the catalyst is made available to enable further reaction taking place.

Scope of our work includes right from basic design of one piece of equipment to complete turnkey process. From the enquiry stage itself we are continually in touch with our esteemed clients at each stage of process calculation, validation of data & results, detailed design, GA drawing, process simulation if needed, engineering drawings and design package (process & mechanical) including specifications. We also provide distillation systems entirely according to customer's specifications.

## Research and Development

Fenix has its own R & D centre having well instrumented pilot plants and bench scale units where various studies on Distillation are conducted. Vapor-liquid equilibrium data generated from the laboratory can be fed to simulators like AspenPlus whenever necessary, for designing the desired distillation process and equipment. Physical properties like density, solubility, viscosity, surface tension etc. which are often required for designing the process but not available in data banks are also experimentally determined for design.



# Applications for Fenix Distillation Plants

## Alternative Fuels

Production of bioethanol as a fuel and fuel-additive

## Beverage Alcohol

Dehydration of ethanol by entrainer distillation

Recovery of entrainer from ethanol dehydration

Refining of biodiesel & glycerine and recovery of methanol from the biodiesel production

Complete plant and components for production of alcohol and neutral spirit

## Chemical Industry

Process water treatment from production of hollow fibre modules

## Crude Processing

Separation of reaction by-products

## Gas Processing

Concentration of polymer additives

## Petrochemicals Industry

Refining of extracted solutions

## Pharmaceutical Industry

Recovery of solvents

Purification of Pharma products

Crude distillation : atmospheric, vacuum

Production of ethylene, propylene and other monomers

Fractionation of products from FCC / Visbreaker unit

## Aroma Industry

Production of perfume extracts

## Food Industry

Aroma recovery and concentration

Fractionation of flavours and aroma chemicals

Treatment of miscella

Refining of precipitants and solvents

## Environmental Technology

Solvent recovery e.g. from printed circuit production

Removal of organic compounds and solvents from waste streams

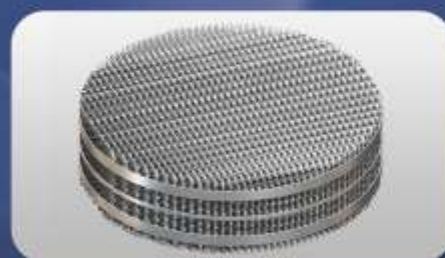
# Plant Components

## Distillation Column



## Column Internals

Columns form the core of any distillation plant. They are adapted to each application by the design and selection of different column internals. Computer modelling and pilot testing forms the basis of reliable designs.



Structured Packing



Random Packing



Liquid Distributors & Redistributors



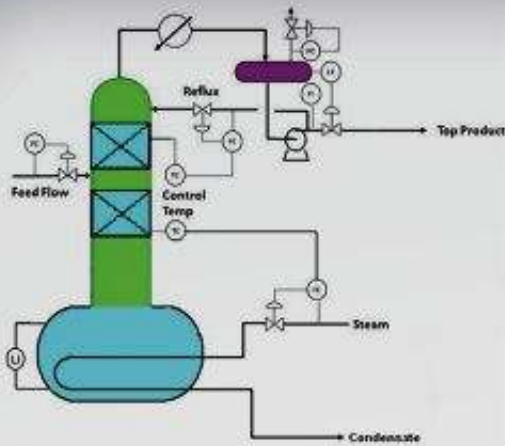
Bubble Cap Tray

## Falling Film Reboiler (FFR)

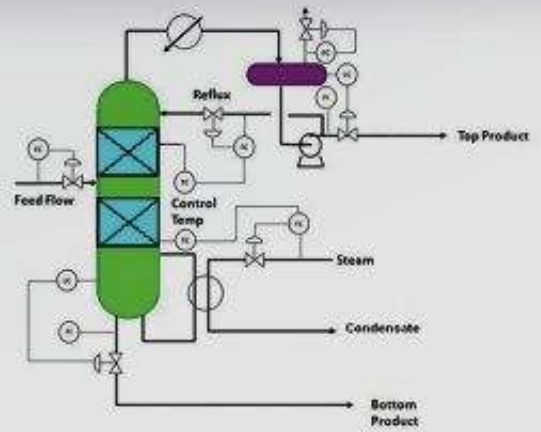
Fenix has adapted falling film evaporator to be used in place of traditional kettle type reboiler. Traditional kettle reboiler is a variant of shell-and tube heat exchanger with process fluid in shell and heating medium in tubes while in falling film reboiler (FFR) it is reverse – process fluid flowing in the tube side. Because of comparatively much lower volume of the tube-side process fluid, quick start-up and shut-down are facilitated in FFRs. Controlling it is easy as also it can be operated with very low temperature difference. It is therefore particularly suitable for distillation of heat-sensitive products and for energy saving in multiple-effect distillation systems.



# Fenix Expertise on Distillation Technology



**Batch Mode**



**Continuous Mode**

Area of Expertise	Examples
<b>Solvent Recovery</b>	Methanol recovery from Methanol-Water mixture Acetone recovery from Acetone-Water mixture Acetone, Acetonitrile recovery from Acetone-ACN mixture
<b>Azeotropic Distillation (without entrainer)</b>	Ethyl Acetate- Water separation Butanol-water separation
<b>Azeotropic Distillation (with entrainer)</b>	Ethanol recovery from Ethanol-Water mixture by Cyclohexane IPA recovery from IPA-Water mixture by Cyclohexane Methyl Acetate-Methanol separation using Toluene Pyridine-Water separation using Benzene
<b>Extractive Distillation</b>	Methanol-Acetone separation using water as solvent Benzene-Cyclohexane separation using Aniline as solvent Ethanol-Water separation using Ethylene Glycol as solvent
<b>Reactive Distillation</b>	Methyl Formate from Methanol and Formic acid Methyl Acetate from Methanol and Acetic acid MTBE from Iso-butene and Methanol
<b>Steam Stripping</b>	Effluent treatment application for solvents which are water immiscible
<b>Petroleum Fractionation</b>	Crude Distillation Unit / atmospheric tower Vacuum Distillation Unit FCC / Visbreaking columns
<b>Adsorption</b>	Moisture removal from THF-Water Moisture removal from IPA-Water
<b>Membrane Distillation</b>	Alcohols Aromatics Ketones Esters

# Engineering, Design, Studies & Tests, Manufacture, Erection, Commissioning and After-sales Service.

## Engineering and Design

Distillation system design is normally divided into two main steps, a process design followed by a mechanical design. The purpose of the process design is to calculate the number of required theoretical stages, column diameter and tower height. On the other hand, the mechanical design focuses on the tower internals and heat exchanger arrangements. Many factors are considered in designing a distillation column such as the safety and environmental requirements, sequence of separation, column performance, economics of the design and other parameters which may constrain the work. In mechanical design, process flow diagram, piping & instrumentation diagram, specifications of equipment, detailed engineering design of columns, column internals, condenser, reboiler and other accessories along with operating instruction manual are prepared for the design package.

## Studies & Tests

Feasibility study, simulation study, and energy consumption/saving study are carried out while distributor testing and hydraulics testing are done routinely.

## Manufacture

Our state-of-the-art manufacturing plant having an integrated engineering capability is established in a 10,000 square foot of plinth area. Located at Pune, 200 km away from Mumbai, it is conveniently accessible by road, rail and air. We are capable of manufacturing up to 8 metre diameter distillation components in this facility. Additional locations for manufacturing are in our planning stage.

## Erection and Commissioning

At Fenix, a team of engineers is trained to be at site of the client on call for erection and initial commissioning of any distillation plant designed by us. Simultaneously, operators of the client company are trained at site to run the commissioned plant afterwards.



## After-sales service

We do not stop at commissioning of distillation plant and handing over to the client. Our expert team is ready to visit them anytime for emergent de-bottlenecking and troubleshooting. We also revamp distillation plants, not designed by us, for improvement in capacity and efficiency.

# Total Solution from Fenix

## Process Technology

Feasibility Study  
Conceptual Design  
Process Simulation  
Testing (Laboratory / Pilot Plant)  
Design Manual  
Process Guarantee

## Control Systems

Instrumentation Diagram  
Control Specifications

## Project Management

Project Engineering  
Equipment Fabrication  
Erection & Commissioning  
Operators Training

## After Sales Service

Troubleshooting  
Spare Parts  
Revamping of Non-Fenix Plants

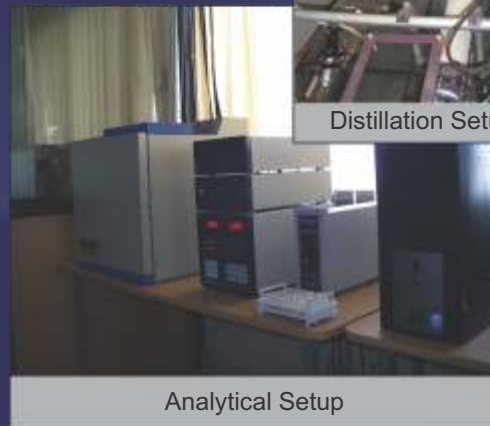
## Fenix Engineering Services

for Distillation, Extraction, Stripping and Absorption

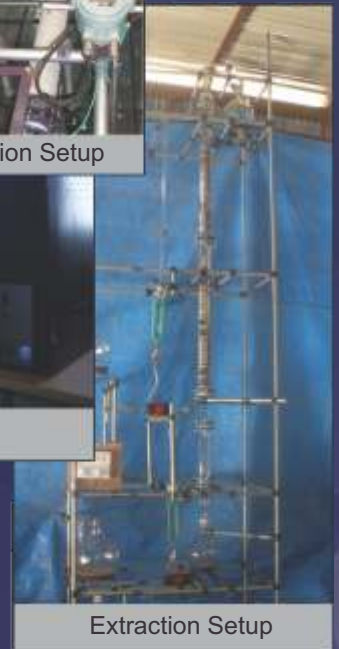
- ‡ Feasibility Study
- ‡ Process Simulation & Process Design
- ‡ Lab & Pilot Plant Facilities
- ‡ Basic Engineering Package BEP
- ‡ Detail Engineering of Key Equipments
- ‡ Startup & Commissioning Assistance
- ‡ Inhouse Analytical & Data Analysis
- ‡ Data Analysis for Plant Operations



Distillation Setup



Analytical Setup



Extraction Setup

[www.fenix.in](http://www.fenix.in)



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