



Oils, Fats & Oleochemicals Technology



ENGINEERING-EQUIPMENT-TURNKEY SYSTEMS

EDIBLE OIL REFINING
DRY FRACTIONATION
FAT SPLITTING
FATTY ACID FRACTIONATION
GLYCERINE PURIFICATION
HYDROGENATION



Edible Oil Refining

Crude Vegetable Oils contains impurities that are required to be removed to improve the quality as well as maintaining the nutritional values. The global focus on environmental issues as well as increasing energy cost makes it necessary for the refiners to adopt suitable modern technologies.

Degumming

De gumming is the starting process in refining operation. The process consists of hydration of the crude oil whereby impurities like phospholipids, gums and proteins which are soluble in oil in their anhydrous form, but insoluble once they are hydrated, are removed.

- Water Degumming
- Acid Degumming

Bleaching

Bleaching is the process which is carried out before deodorisation mainly for removal of coloring matter. As the bleaching treatment uses active earth, it will remove residual phosphatides, metals, soaps and minor components.

Dewaxing

The process consists in removing small quantities of material that cause cloudiness when the oil is kept at ambient or low temperature. These solid substances can be saturated long chain glycerides or waxes.

Deodorisation

Deodorising is the final step in the oil refining process intent to remove odoriferous material, free fatty acids and other undesired minor components to produce a bland oil with a good shelf life.

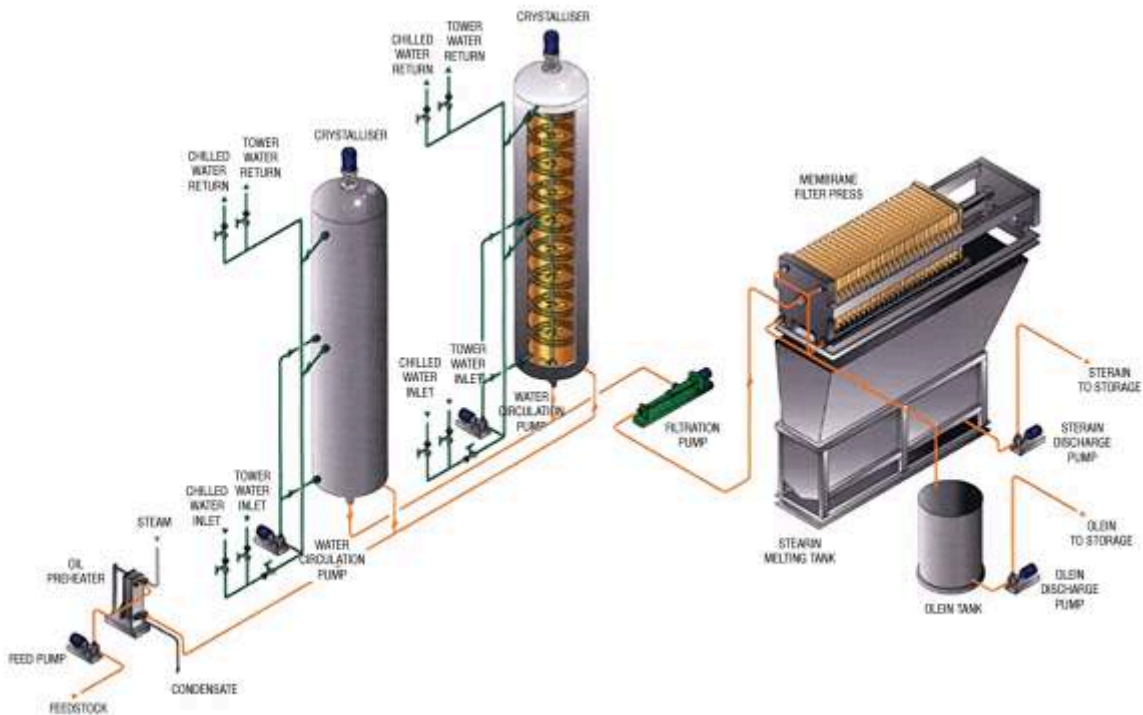
In deodorizer, structured packing is used to establish contact between oil and steam with less pressure drop.



Key Features of Edible Oil refinery by Fenix

- ▲ Less steam consumption
- ▲ Less energy consumption
- ▲ High recovery
- ▲ Multiple feed
- ▲ Quick change over time for different feeds

DRY FRACTIONATION



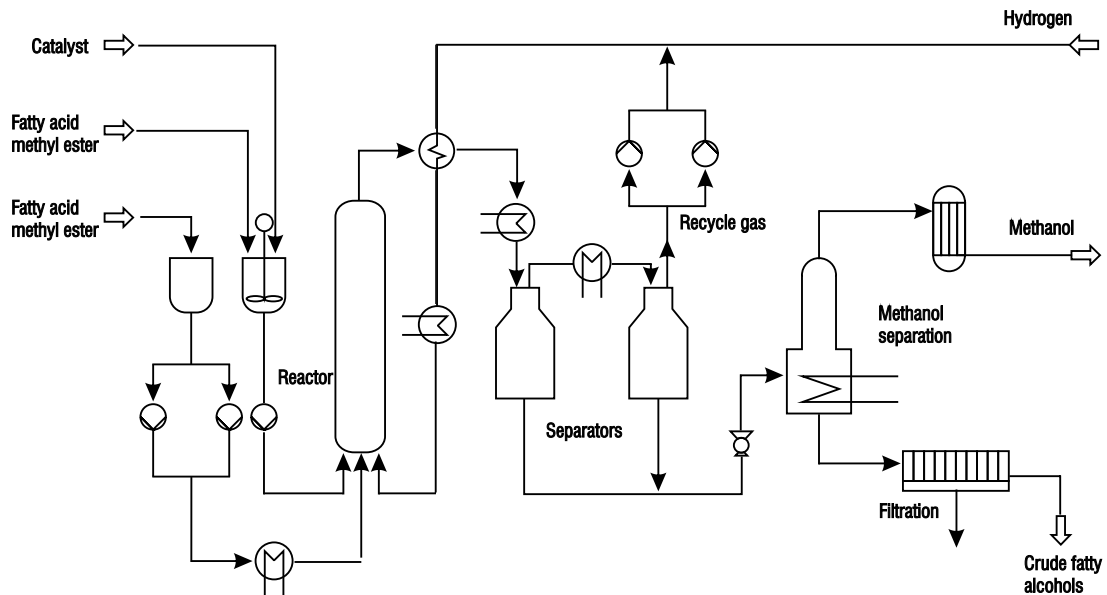
The process includes:

- Preheating the feed stock to give a homogenous mass with nil solids.
- Crystallisation under preset controlled conditions of temperature & agitation to form stable, uniform sized filterable crystals.
- Filtering on membrane press filter (or Rotary Drum Vacuum filter) to separate the solid/liquid fractions.

Salient Features of Dry Fractionation Plant by Fenix

- Combines all operations, and monitors from a fully automated centralized control station.
- Easy to operate, requires minimum supervision.
- Good flexibility. Wide range of process applications possible. Feedstock can be crude, semi refined or fully refined palm oil. Suitable for both single or double fractionation.
- Minimum operating costs
 - Low utility consumption
 - Low maintenance costs
 - No oil losses- No pollution problem
- Product quality
 - Good crystallization repeatability, yielding consistent product quality.
 - High Olein yields.
 - Low Olein cloud point, with improved cold stability, Cloud point as low as 2 °C with iodine value of 65.0 can be obtained.

HYDROGENATION



PROCESS

The reaction is conducted at approximately 25,000–30,000 kPa and 250–300°C. As hydrogenation is an exothermic reaction, care must be taken to control the reaction temperature to minimize side reactions leading to the formation of undesirable hydrocarbons. From the column, the reaction mixture is cooled, separating the hydrogen gas from the alcohol–methanol mixture. The hydrogen gas is recycled, and the alcohol–methanol mixture goes to the methanol-stripping unit where, at lower pressure, the methanol is stripped off, recovered, and recycled to the esterification or trans-esterification section. The crude fatty alcohol is filtered to separate the catalyst. A major portion of the catalyst is recycled, so that the consumption averages 0.5–0.7% of the alcohol produced. The filtered alcohol is subsequently treated with caustic soda to form soap with any unreacted ester. The alcohol is finally distilled to strip off any hydrocarbons formed, which amount to about 2–3%. The soap remains in the still bottoms.

Technical data for plant capacities of 50 t/day are (11) as follows:

Distilled coco fatty acid 1050–1100 kg
Steam (ca. 15 bar) 170 kg
Cooling water (20°C) 27 m³
Electric energy 130 kWh
Fuel gas 1:1 106 kJ
Catalyst (copper chromite) 5 kg
Hydrogen (0°C, 100 kPa, depending on hydrogen purity and fatty acid specification) 230–300 m³
Boiler feed water 185 kg
Export steam (ca. 4 bar) 120 kg

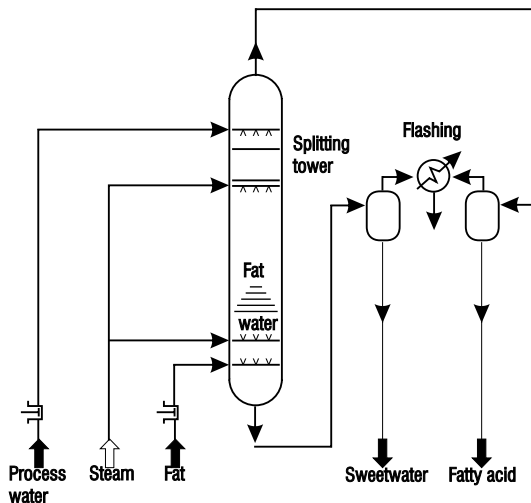
FAT SPLITTING

PROCESS

The empty volume of the tower is used as the reaction compartment. The crude fat passes as a coherent phase from the bottom to the top through the tower, whereas the heavier splitting water travels downward as a dispersed phase through the mixture of fat and fatty acid. Degrees of splitting up to 99% can be reached. The continuous countercurrent high-pressure process splits fats and oils more efficiently than other processes in a reaction time of only 2–3 h. Little discoloration of the fatty acids occur. As a result of the efficient internal heat exchange, this process affords high steam economy.

The utilities consumption per ton of feed is as follows (11).

Steam (6000 kPa) 190 kg
 Cooling water (20_C) 3 m³
 Electrical energy 10 kWh
 Process water 0.6 m³



GLYCERINE PURIFICATION

Feedstock

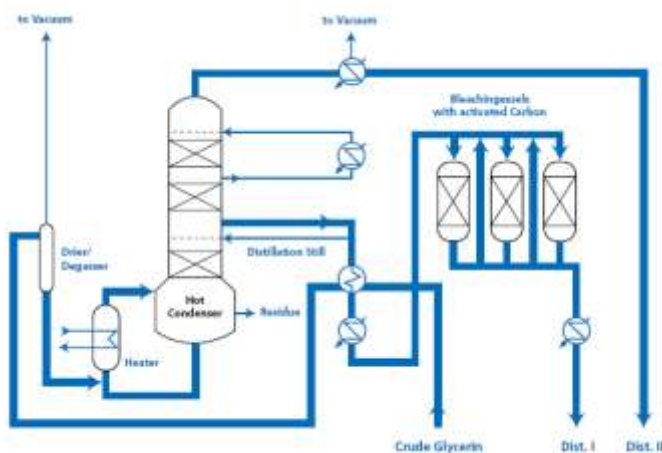
Glycerin water from the splitting of fats and oils containing 12 to 25% glycerin ("saponification glycerin")

Products

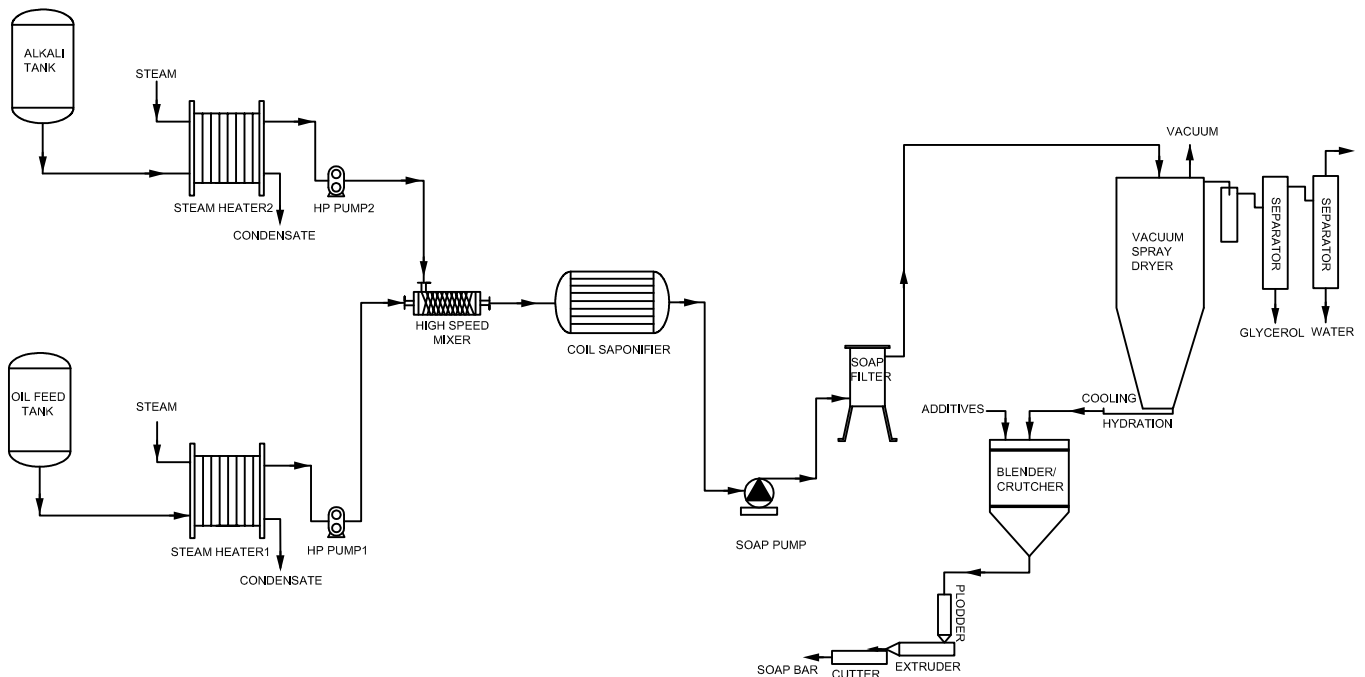
Glycerin with 99.8% purity and pharmaceutical quality.

Process

- Impurities - dissolved fatty material and proteins - are separated from the crude sweet water by the addition of mineral acids in a purification step; subsequently, the crude glycerin is treated with acid and neutralized.
- In a continuous, multi-stage evaporation unit the glycerin water is concentrated by water evaporation to crude glycerin of approx. 88%
- In a still, the glycerin is then distilled off the crude glycerin in a vacuum of approx. 15 mbar and at a temperature of approx. 160°C



SOAP PLANT



Continuous Saponification of Oils

Saponification Process:

As the prices of glycerine are decreasing, Fenix has designed a simple Saponification process without glycerine recovery to meet the new market demands with following goals:

- Energy saving
- Flexibility
- Versatility
- Quality control
- Reduced maintenance
- Reduced area requirement

Main Plant Composition:

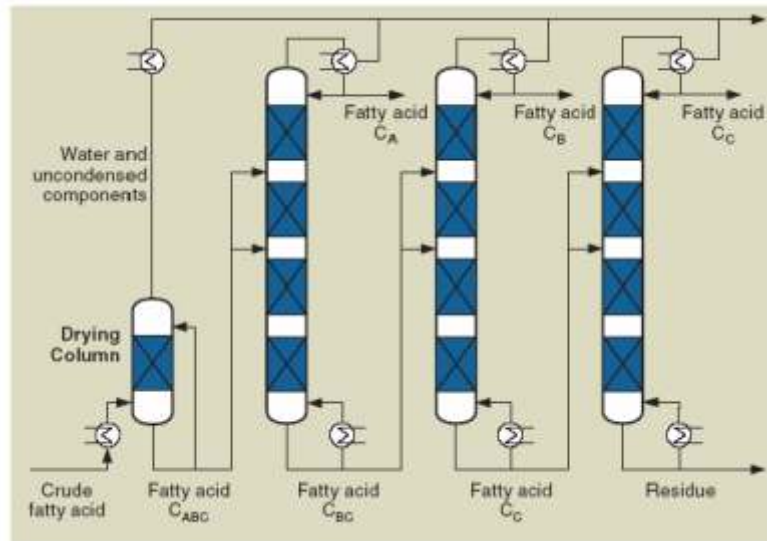
Raw material Dosing System with centrifugal Pumps and Mass Flow Meter. Automatic flow adjustment is carried out by control Valves driven by Mass Flow Meter.

Saponification Loop with special Tubular Reactor and Circulation pump designed to operate at high temperature and high pressure with reduced holding time.

pH Control Unit with self-cleaning device.

PC+PLC Control Unit for automatic process control of the plant operation reduces possible risk of mistakes and improve safety of the plant.

FATTY ACID FRACTIONATION



PROCESS

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R & D

R & D facility at Fenix

- Batch fat spitting facility
- Fatty acid distillation facility with 300 deg C heating and 0.5 torr vacuum.
- Adsorption beds for glycerine colour removal.
- Batch reactor for esterification and trans-esterification.
- Analysis facilities like GC, Carl-Fischer etc.

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



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

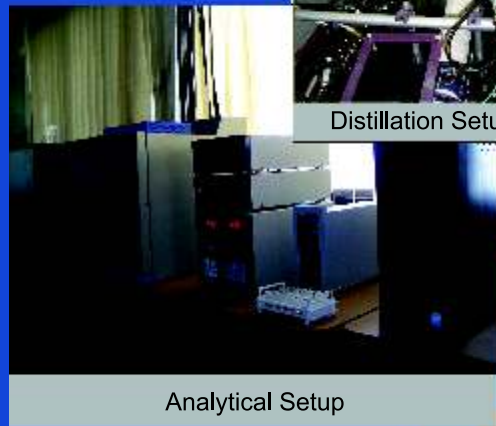
Fenix Engineering Services

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

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