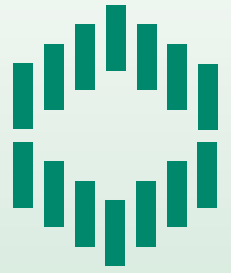


# CHEMICAL ENGINEERING



**Chematur  
Ecoplanning**  
Chematur Engineering Group

# ACID RECOVERY

## SPECIALISTS IN RECOVERY OF ACIDS

CHEMATUR ECOPLANNING has vast experience in the regeneration of acids. This technology is used in processes within the titanium dioxide, metallurgy and other branches of the chemical industry.



### Acid Recovery Technology

#### Preconcentration with contaminant separation

Diluted acid, for example 5 to 20%, must be concentrated to the level of 70%. At this concentration the solubility of most metals in sulphuric acid is lowered to such a degree that the contaminants can be precipitated and separated. The acid can then be recycled back.

Concentration up to 70% is commonly performed in a three-stage evaporator, under vacuum.

Forced circulation is most commonly applied in the evaporator, but falling film is also possible, if the acid is relatively free of metal salts.

The construction materials are highly dependent on the contaminants in the waste acid. Typical materials used by CHEMATUR ECOPLANNING are special plastics, graphite silicon iron and special alloys.

PRECONCENTRATION

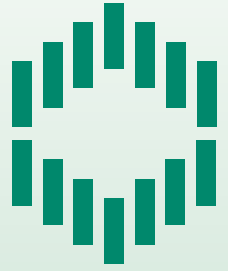
FINAL CONCENTRATION

PURIFICATION

The successfully operating acid recovery plants we have supplied have made CHEMATUR ECOPLANNING a renowned name in this field.

In the titanium dioxide ( $\text{TiO}_2$ ) industry alone more than 4,000,000 tonnes of spent acid are processed in CHEMATUR ECOPLANNING plants annually, which amounts to 1,900,000 tonnes of evaporated water.





## High Concentration

Sometimes after pre-concentration it may be necessary to further concentrate  $H_2SO_4$  of around 90% or more, including separation of solids formed. The acid produced must meet even higher requirements compared with acid from pre-concentration. Naturally, operation and investment costs are also higher.

The typical system for this application is a single or double-stage forced circulation evaporator, which is operated under high vacuum.

Requirements for corrosion-resistant materials are still greater, and it means that materials such as Tantalum and enamelled steel come into the picture. These materials are expensive, and need special care in manufacturing and installation. However, under severe conditions, the low corrosion rates of these expensive materials will compensate the higher investment by lowering the maintenance and repair costs in the long run.

## Treatment for Organic Compounds and NOx

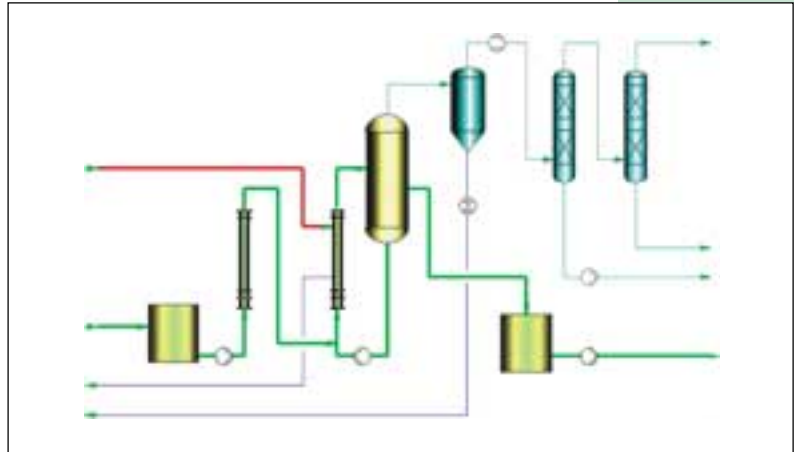
With the presence of compounds or  $NO_x$ , additional equipment for the treatment of gases from the evaporators is required. Absorption is an example of a typical unit process for organic compounds. A special column is liquid nitric acid and gases, free of  $NO_x$ .



## Application for Removing Non-Volatile Organic Contaminants from Spent Acid

### Manufacture of nitrobenzene

CHEMATUR ECOPLANNING plants consist of a single-stage forced circulation evaporator, purification and absorption columns. The spent acid can be concentrated from 70%  $H_2SO_4$  to 96%.

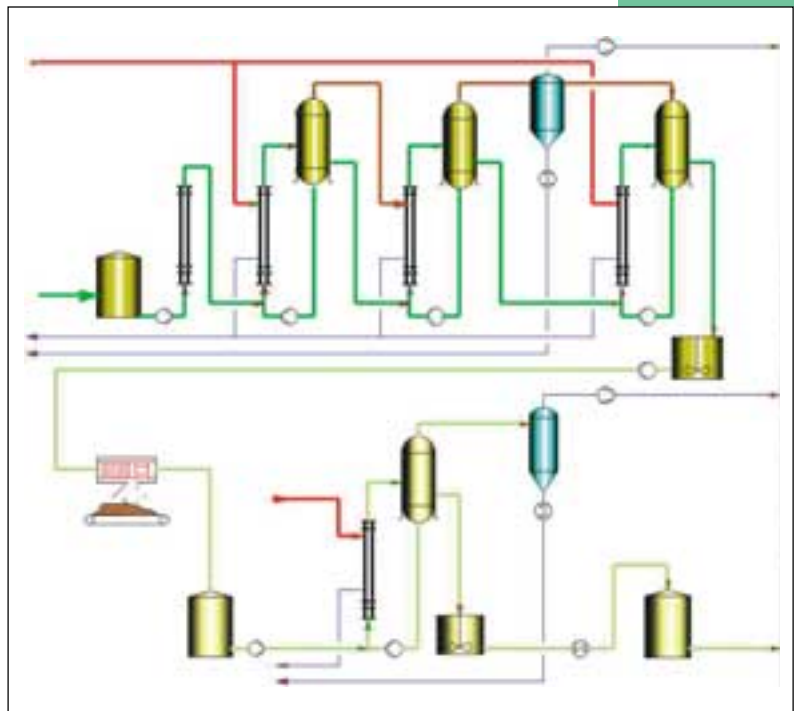


## Application for Removing Non-Volatile Inorganic Contaminants from Spent Acid

### Manufacture of titanium dioxide

The production of titanium dioxide from ilmenite or slag results in the formation of spent acid containing 20-25% sulphuric acid and 10-15% metal salts.

CHEMATUR ECOPLANNING spent sulphuric acid recovery plants use a forced circulation evaporation process in which the spent acid is concentrated from 20%  $H_2SO_4$  up to over 90%. The process consists of pre-concentration, ageing, filtration and final concentration units.



# EVAPORATION PLANTS

## Evaporation Plants for:

- sulphuric acid
- caustic soda
- phosphoric acid
- potassium chloride
- steep waters
- sweeteners and syrups
- molasses and vinasses
- waste waters
- fertilizer liquors

### 1. Falling-film evaporators

#### APPLICATIONS & ADVANTAGES:

- Suitable for heat-sensitive liquids
- Excellent droplet separation
- Good heat transfer capability
- High turndown ratio
- Low energy consumption

### 2. Forced circulation evaporators

#### APPLICATIONS & ADVANTAGES:

- Optimum heat transfer
- Capability under high vacuum
- Suitable for scaling and crystallizing liquids
- High turndown ratio

### 3. Rising film evaporators

#### APPLICATIONS & ADVANTAGES:

- Suitable for non-scaling liquors
- Low investment cost
- Suitable for natural circulation

### 4. Vapor recompression evaporators

For MR and SVR applications in the metallurgical industry, fodder industry,

sugar industry and fertilizer industry.

#### APPLICATIONS & ADVANTAGES:

- Suitable for liquids having a low boiling point elevation
- Designs for FF and FC evaporators
- Lower operating cost than with a conventional steam driven evaporator

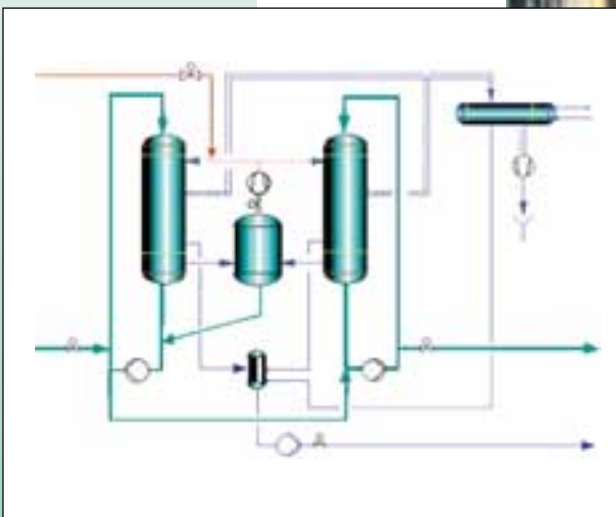


**FORCED CIRCULATION**

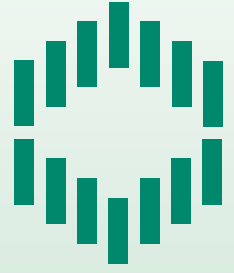
**FALLING FILM**

**RISING FILM**

**VAPOR RECOMPRESSION**



# CRYSTALLIZATION PLANTS



## Crystallization Plants for:

- Ammonium sulphates
- Ferrous sulphates
- Sodium sulphates
- Nickel sulphates
- Copper sulphates
- Potassium sulphates
- Sodium chloride
- Sodium chlorate

CHEMATUR ECOPLANNING has installed more than 50 crystallization plants over the last 30 years.

When dissolved material is separated from a solution, it is usually treated in a crystallization process.

The process can be simple cooling or concentration of the solution or a combination of the two.

Crystallization plant designs take into consideration the means of changing the temperature or the concentration of a solution and separating the crystals from the solution.



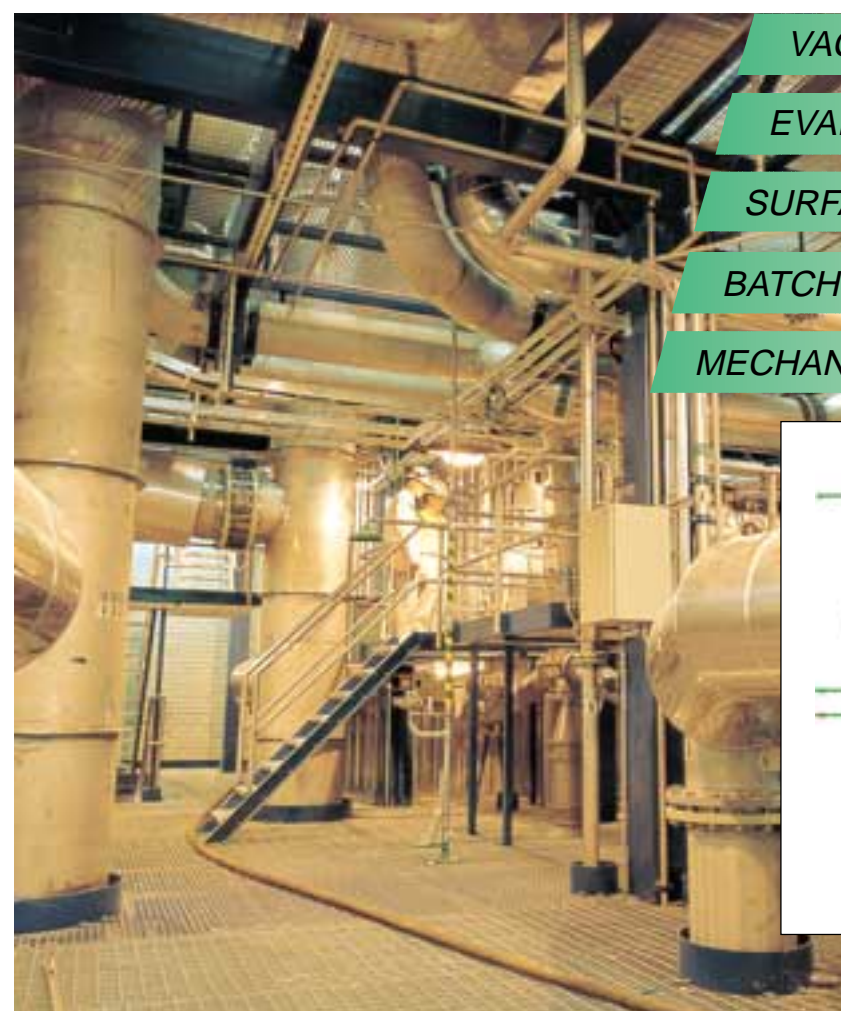
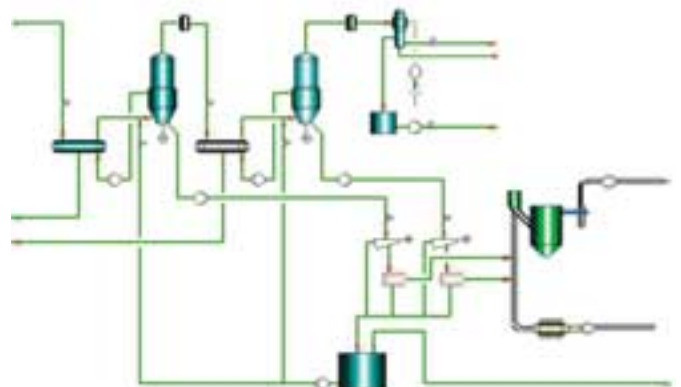
VACUUM DT or DTB

EVAPORATIVE FC CRYSTALLIZER

SURFACE COOLING CRYSTALLIZER

BATCH CRYSTALLIZER

MECHANICAL RECOMPRESSION



# CHEMICAL ENGINEERING

## FURFURYL ALCOHOL PLANTS

The hydrogenation of furfural to furfuryl alcohol is carried out in a continuously operating low pressure gas phase process. Vaporized furfural and hydrogen react in the presence of a special catalyst to form furfural alcohol vapor which is then condensed and distilled. Furfuryl alcohol is used as a raw material mainly for sand binding resins for foundries. Other uses are for instance as a selective solvent, as a viscosity reducer and as an impregnating solution for different materials.

### Specific features

- low pressure gas phase process
- continuous automatic operation
- very high selectivity of catalyst
- close to the theoretical yield

## PHOSPHORIC ACID PURIFICATION PLANTS

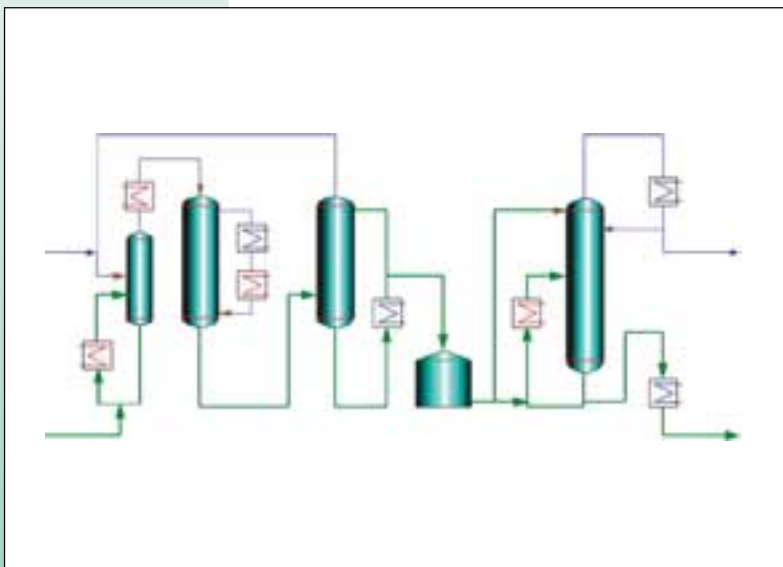
We supply phosphoric acid purification plants, starting from raw acid and producing food grade acid.

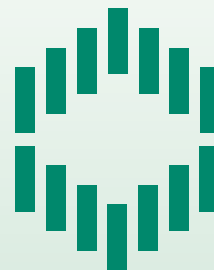
The main acid purification process is based on extraction, but in a complete system Chematur Ecoplanning applies various other techniques, such as evaporation, stripping and activated carbon filtration.



## PHOSPHORIC ACID PURIFICATION PLANTS

## FURFURYL ALCOHOL PLANTS





CHEMATUR ECOPLANNING looks forward to new challenges to combine industry and environment for the good of the human race and towards a cleaner planet.

## CHEMICAL ENGINEERING

CHEMATUR ECOPLANNING process technical know-how is based on 30 years' experience and on hundreds of installations in evaporation, crystallization and distillation plants worldwide.

Our wide experience will give you an ideal system, and our experienced management team will ensure successful project implementation. CHEMATUR ECOPLANNING selects the most suitable manufacturers in terms of quality, reliability and financing, including those in the customer's country. CHEMATUR ECOPLANNING's goal is to achieve a privileged position among our customers - through the competitiveness and quality of our work.

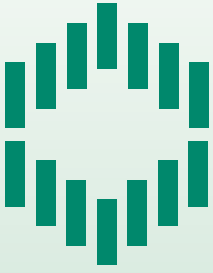
### Advantages of CHEMATUR ECOPLANNING Technologies

- Corrosion-resistant construction materials
- Minimum maintenance costs
- Minimum overall costs
- Reliable, simple plant operation
- Short delivery times/project implementation

## SOME OF OUR REFERENCES WORLDWIDE

AKZO NOBEL, Sweden  
BAODING, China  
BASF, Germany  
BAYER, Germany  
BOLIDEN MINERAL AB, Sweden  
BORZESTI, Romania  
CHONGQING, China  
CULTOR, Finland  
EKA NOBEL, Sweden  
HANKOOK TITANIUM, South Korea  
HUNGRANA, Hungary  
KEMANORD INC., USA  
KEMIRA, Finland  
LINZI, China  
MCHZ, Czech Republic  
NANJING, China  
OLTCHIM s.f., Romania  
OUTOKUMPU, Finland  
PERSTORP, Sweden  
SACHTLEBEN, Germany  
S.C. INDAGRARA, Romania  
SMITHCHEM, South Africa  
TIOXIDE, France  
UHDE, Germany





Chematur EcoPlanning is a member of the Chematur Engineering Group. Our parent company, Chematur Engineering AB in Karlskoga Sweden, is an independent engineering company whose main activities are marketing of process know-how and supply of chemical plants.

The Group has subsidiaries in Finland and the USA and an associated company in India. It also has branch offices in Hong Kong and Jakarta.

Chematur EcoPlanning specialises in the supply of equipment, process design and turnkey plants in the field of environmental technology for the process and chemical industry.

Chematur EcoPlanning has wide experience in regeneration of acids, unique expertise in evaporation, crystallization and complete plant design for the chemical industry. We also supply phosphoric acid purification plants.

# Chematur EcoPlanning

Chematur Engineering Group

Chematur EcoPlanning Oy  
P.O. Box 78  
FIN-28101 PORI, FINLAND  
Tel. +358 2 6240 200  
Fax +358 2 6240 290  
e-mail: [info@ecoplanning.fi](mailto:info@ecoplanning.fi)  
[www.chematur.se](http://www.chematur.se)