

# CHEM

## THERMAL TREATMENT OF INDUSTRIAL EFFLUENTS FOR ZERO LIQUID DISCHARGE



Vacuum ■ Evaporation ■ Crystallization ■ Heat Transfer Technologies



## CHEM

### THERMAL TREATMENT OF INDUSTRIAL WASTE WATERS/ EFFLUENTS

Large quantities of industrial waste waters/effluents with strong contaminations of different compositions are generated in the production and processes of all almost all industrial sectors. These waste waters have to be treated before they can be discharged into the specified permissible system. Hence an efficient and environmentally friendly waste water treatment is required.

Chem Process partners with you to provide the best solution for treatment of industrial waste waters. As one of the leading designers and manufacturers of thermal and mechanical process equipment with core competence in evaporation, crystallization, vacuum and heat transfer, Chem Process offers custom made plants with additional upstream or downstream process steps. Suitable combinations of processes in our plants achieve optimum results for the recovery of water and valuable substances.

#### Technologies

If the characteristics of the waste waters cannot be clearly defined and if its constituents, dry matter contents, pH or particle size change frequently and if they have to be concentrated substantially, then thermal separation is the best solution.

During the design of evaporation plants, numerous factors have to be taken into consideration viz. waste water specific product values, power and utility costs and site condition.

The type of construction and arrangement, other process engineering and operational data are based on these parameters.

Energy consumption determines the operating costs of evaporation plants. With our ingenious thermo-technical combinations, the plant energy requirement is minimal.

Energy savings are possible with

- Heating with waste heat
- Multi-effect evaporation
- Thermal vapour recompression
- Mechanical vapour recompression

Chem Process actively takes into consideration the customer's energy situation while designing a plant so that it offers the best possible economical solution. If specific particle sizes and products have to be removed, membrane filtration plants are combined with evaporation plants either for selective separation of the impurities, or as an initial effect to recover specific valuable matter, or to pre-concentrate before feeding to the evaporation plant, or to treat vapour condensate coming from a thermal treatment.

### Research and development

Chem Process has an in-house research and development centre with the required laboratory equipment, where waste waters are tested and treated for their behavior and based on the results, appropriate plant components, pretreatment and after treatment are selected and designed. Mobile pilot plants are also available which if required are sent to our customers' location for carrying out of tests.

### Salient Features

- Custom made plant designs
- Combination of several process steps which include pre and after treatment
- Maximum concentration of waste waters
- Minimal use of chemicals
- Total separation of solids
- Condensate/distillate water has salts > 100 ppm
- Minimal residual bleed and matter quantities hence low disposal costs
- Good condensate quality hence can be reused as process water in most cases
- Good performance even at partial capacities
- Operation reliability is very high
- Long life of plants

Plants designed and engineered by Chem Process are recognized for their high quality, efficient performance and economic operation. All process and functional requirements are taken into consideration and hence our plants operations are reliable and operator friendly.

Our scope of services includes consultancy, design, engineering, calculations, manufacture, quality control, delivery, supervision of erection, commissioning and after-sales service. Chem Process has

- Delivered more than 400 plants
- Extensive knowledge on products to be handled
- In-house research and development centre with laboratory equipment
- Mobile pilot plants
- A wide sales network of representatives and partner offices
- ISO 9001 certified, Asme 'U' and National Board 'R' Stamp Holders.

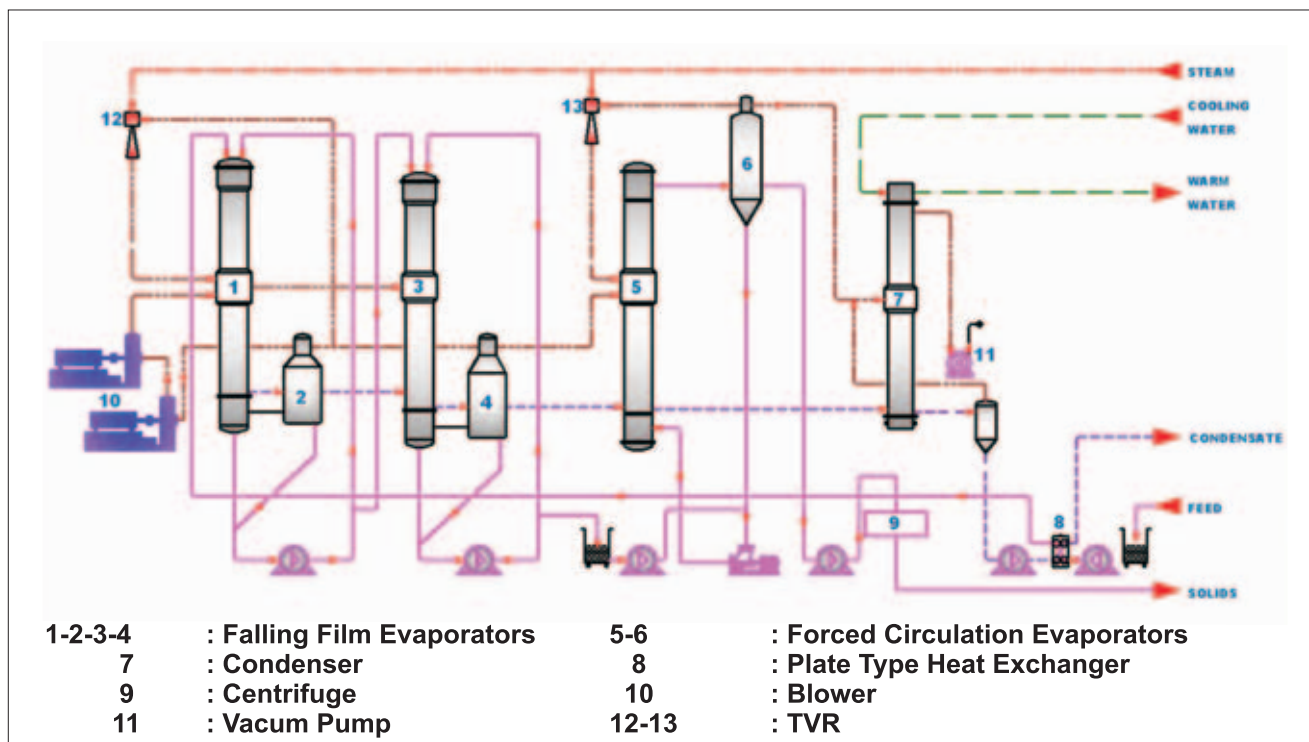


## Treatment of Waste Waters from Chemical Production/Processes

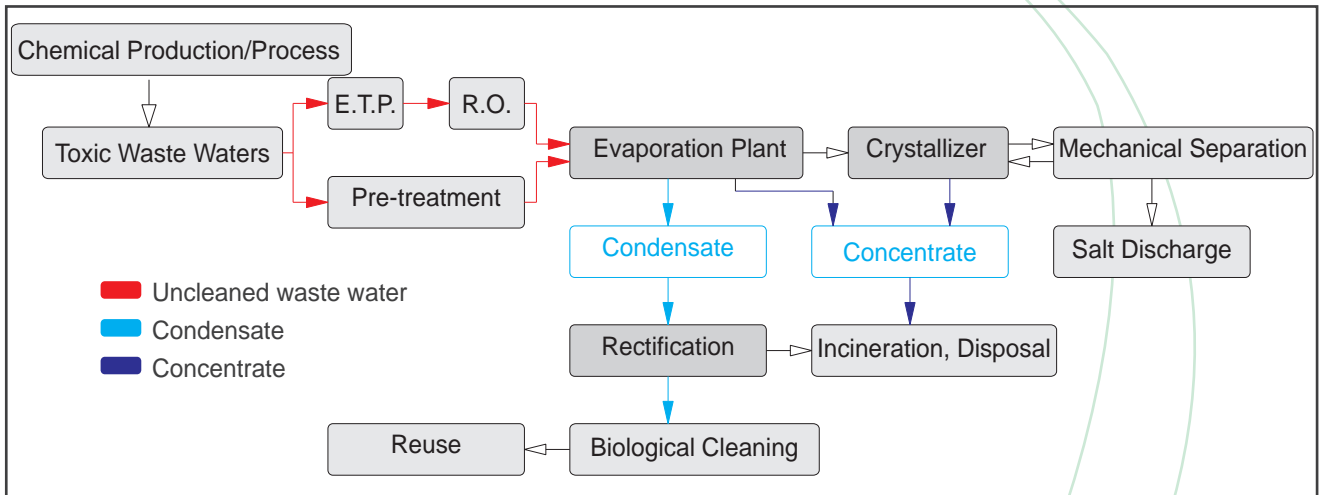
In the production processes of various pharmaceuticals, bulk drugs, agrochemicals, pesticides, dyes, dyes intermediates, textile, power, water treatment, galvanizing and various other chemicals industries, waste waters produced essentially consist of several organic components, salts and water. Treating these waste waters is very difficult as they are toxic and cannot be treated in bio-reactor due to high salt contents and hence also hinder dumping. The only method of disposal is to remove all the water, solvents and produce solid waste for reuse/disposal. In case of high COD contents having high boilers, the only option of disposal is by incineration. In such cases too, concentration prior to incineration is recommended. Both these tasks of concentration and separation can be optimally achieved with thermal treatments, primarily consisting of evaporation and crystallization.

### Process description

The water portion is concentrated in the evaporation plant. The salt is separated by crystallization which may be by way of evaporative crystallization or a separate crystallizer arranged downstream of the evaporation plant. Then if required the volatiles are removed from the vapour condensate in a rectification column / stripping. Thus only the concentrated organic matter which is very small in quantity has to be incinerated.



*Falling Film Type followed by a Forced Circulation Evaporator with Mechanical & Thermal Vapour Recompression*



## Treatment of Waste Waters from Biotechnological Production/Processes

In biotechnological production/processes, a biological treatment is not efficient, or is too complex because there is a very high level of contamination of organic substances and salts. However these contents may be suitable for the production of fertilizers and animal feeds/fodder. Hence the best treatment solution for these wastewaters is to first concentrate them in an evaporation plant and then dry the residual matters for further use in the production of fertilizers/animal feeds/fodder.

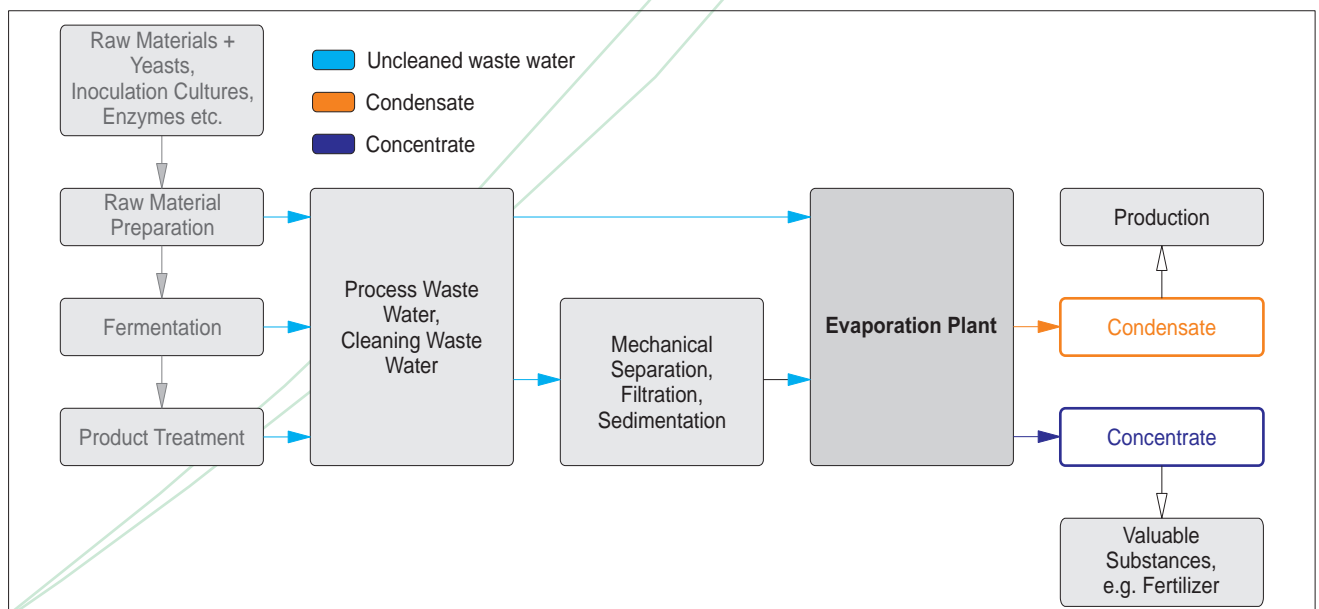
concentration of the waste waters. Heating mediums and plant layouts are based on the chemico-physical properties of the waste water and the on the available utilities. Waste energy from available sources and evaporator vapours can be utilized to optimally heat the evaporator. The condensate can most of the times be reused in the production process.

### Process description

Here usually the evaporation plant consists of a combination of multiple effect falling film followed by forced circulation effects for

Biotechnological processes:

- Yeast production
- Lysine production
- Glutamic acid production
- Drinking alcohol production
- Ethanol production





## Treatment of Waste Waters of Food, Starch and Distilleries

Raw materials for bio-gas production are so-called fermentation substrates, such as corn, grain and grass, stillage from distilleries, manure, biological waste, remains of food and other fermenting residuals. After the anaerobic fermentation there are fermentation residuals, a mixture of persistent organic substances. The disposal of these fermentation residuals is decisive for the cost-efficiency of a bio-gas plant. Its storage and its transport to agricultural areas is cost-intensive since the produced fermentation residuals are large (water contents 90 - 95 %).

Evaporation strongly reduces the quantity of fermentation residuals and therefore contributes to a solution of these problems to a large extent. The efficiency of evaporation will be particularly high if waste energy sources, such as vapour from a drying process or hot water from gas motor cooling can be used as heating medium.

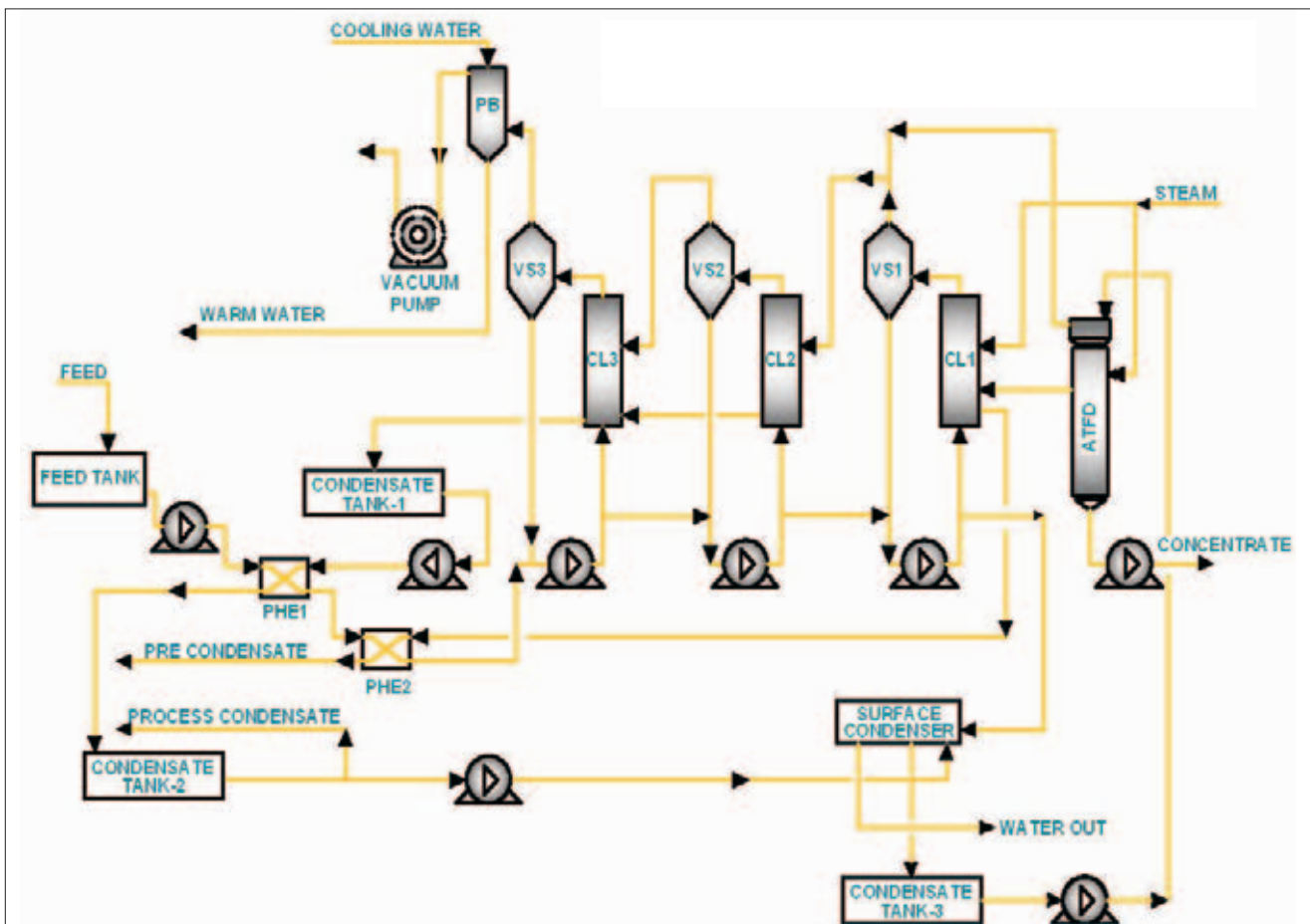
### Process description

The fermentation residuals are de-watered in decanter centrifuges.

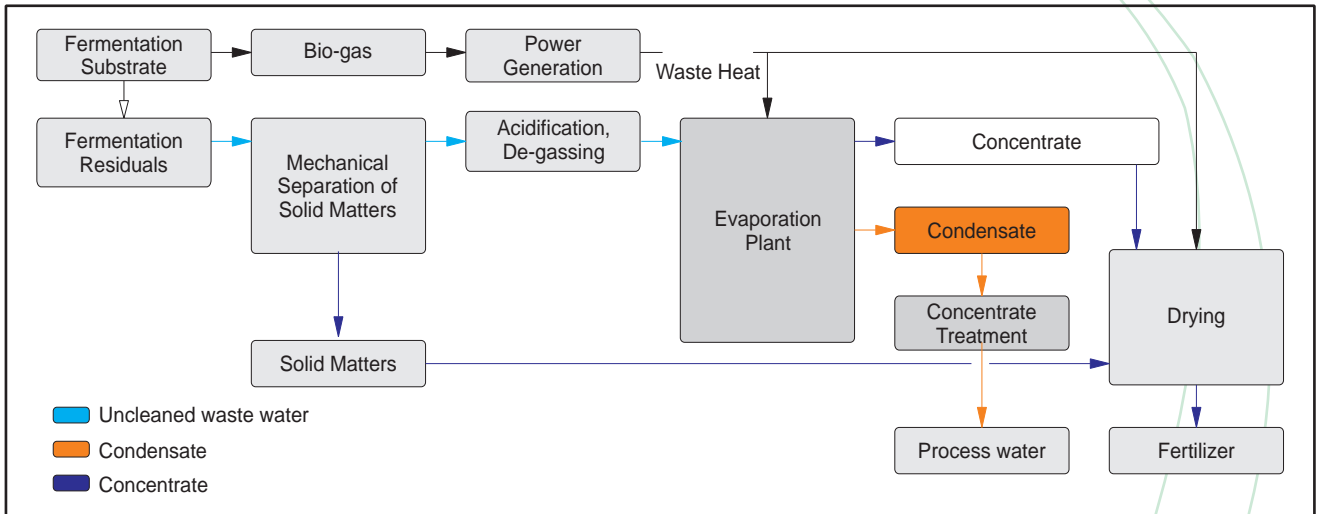
The phase with high portion of solid matters is supplied to the drier. After acidification and de-gassing, the liquid phase is evaporated. The concentrate of the evaporation plant is dried together with the solid matters from the decanter. The vapour condensate is further cleaned in a membrane filtration plant or in an alkaline water scrubber, and can then be used as process water. The energy for the plant operation comes from small de-centralized block heating power stations. Electrical energy is generated by gas motors from bio-gas and natural gas. The occurring waste heat is used as energy source for the evaporation and drying process.

### Advantages of the process:

- Cost-efficient operation thanks to the utilization of waste energy
- Generation of electrical energy from waste products
- Conversion of the waste water to process water
- Recovery of precious fertilizer



*Triple Effect Forced Circulation Evaporator followed by ATFD*



## Products Evaporated, Concentrated and Recovered

### Chemical & Pharmaceutical

- Caustic Soda
- Caustic Potash
- Sodium Chloride
- Potassium Chloride
- Sodium Chlorate
- Sodium Carbonate
- Sodium Sulphate
- Sodium Sulphite
- Ammonium Nitrate
- Ammonium Sulphate
- Calcium Chloride
- Magnesium Chloride
- Sodium Aluminate
- Pentaerythritol
- Sodium Formate
- Sulphuric Acid
- Phosphoric Acid
- Superphosphoric Acid
- Glycerine
- Fatty Acids
- Pharmaceutical

### Solutions

- Solvent Recovery
- Ammonium thiosulphate
- Benzoic Acid & Salts
- Calcium tartrate
- Copper Sulphate
- Sodium thiosulphate

### Food & Life Science

- Citric Acid
- Malic Acid
- Tartaric Acid
- Glucose
- Dextrose
- Fructose
- Erythritol
- Corn Steep Water
- Liquid Sugar
- Distillery & Yeast Vinasses
- Corn Stillages
- Vitamin C

- Monosodium Glutamate
- Amino Acids
- Fish Stick Waters
- Gelatine
- Milk & Whey

### Environmental Protection

- Landfill Leachates
- Cooling Tower & Power Plant blow-downs
- Pharmaceutical waste waters
- Radioactive effluents
- Any liquid waste reduction by concentration
- Distillery Spent Wash – Vinasses
- Photographic, Pickling and Galvanizing Effluents
- Dye Production

### Effluents

- Chemical Effluents

### Industries

- Textiles
- Dyes & Dyes Intermediates
- Chemicals - Organic & Inorganic
- Pharmaceuticals & Bulk Drugs
- Agrochemicals & Pesticides
- Food
- Dairy
- Sugar
- Petrochemicals
- Refineries
- Power
- Water Treatment

Our scope of services includes consultancy, engineering, calculation, design, manufacture, delivery, quality control, supervision of erection & commissioning and after-sales service.

## PRODUCT RANGE

### VACUUM

Steam Jet Ejectors  
Multi Stage Vacuum Systems  
Liquid Jet Ejectors  
Liquid Ring Vacuum Pumps  
Air Extraction Systems  
Ring Jets : Steam Jet Ejector-Liquid Ring  
Vacuum Pump Combination Systems  
Eductors/Jet Mixers/Jet Heaters

### THERMOCOMPRESSORS

### STEAM JET REFRIGERATION SYSTEMS

### EVAPORATION

Multiple Effect Evaporation Plants with  
Thermal/Mechanical Vapour Recompression

Forced Circulation

Falling Film

Natural Circulation

Rising Film

Combination Types

### CRYSTALLIZERS

Adiabatic Vacuum

Evaporative Forced

Draft Tube Baffle Type

Spray Evaporator Crystallizer

Oslo Type

### HEAT TRANSFER

Surface Condensers

Heat Exchangers

### ZERO LIQUID EFFLUENT DISCHARGE SYSTEMS

### CAUSTIC CONCENTRATION SYSTEMS

### SALT RECOVERY PLANTS

### PRESSURE VESSELS

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