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TM.I.P S.r.l. Termomeccanica Industrial Process

TMIP: The activities

TM.I.P. S.r.l. Termomeccanica Industrial Process (TMIP) is the Company, certified by UNI EN ISO/9001/2000, ISO/14001/2004 and OHSAS 18001 standards, of the Termomeccanica Group, specialized in the design, construction and management of environmental and industrial engineering works, developing its activities as follows:

1

Incineration*:

- Incineration of organic liquid wastes or aqueous wastes polluted by organic compounds;

2

Waste Gas Oxidation*:

- TO-Thermal oxidation plants; Acid gas thermal Oxidizer
- Catalytic oxidation plants; Ammonia removal
- RTO (Regenerative Thermal Oxidizers)

3

Solvent recovery:

- Distillation plants (continuous, batch, multiple effects);
- Adsorption plants (activated carbon);
- Absorption plants (physical and chemical absorption);

4

Gas Treatment:

- Adsorption plants (activated carbon, molecular sieve or iron scavenger);
- Absorption plants (physical and chemical absorption);
- Flue gases treatments (dry and wet abatement); DeSOx ; DeNOx

5

Liquid Treatment:

- Stripping plants;
- Water contaminated by organic compounds;
- Evaporation and concentration plants

***All this plants can be equipped by heat recovery system.**

INCINERATION

1



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Incinerators

Typical Processed Stream

Waste Liquid

Vent stream

Stream containing Chlorinated compounds

Water contaminated by organics

Stream containing Nitrogen compounds



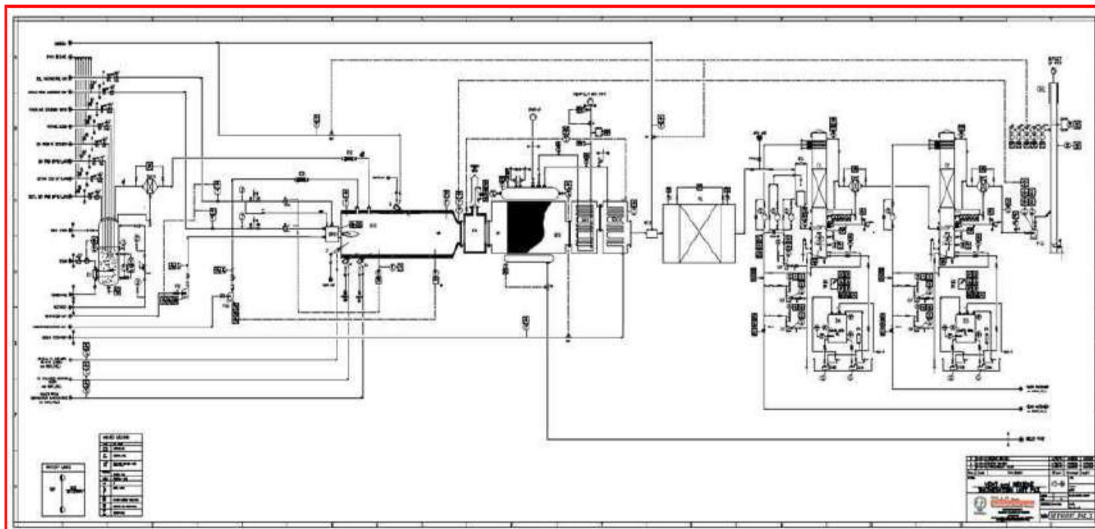
Process Solution

Static Chamber with Injection Nozzles for Waste liquid and Toroidal Distributor for Vent streams

Afterburner

Heat Recovery

Flue gases treatment



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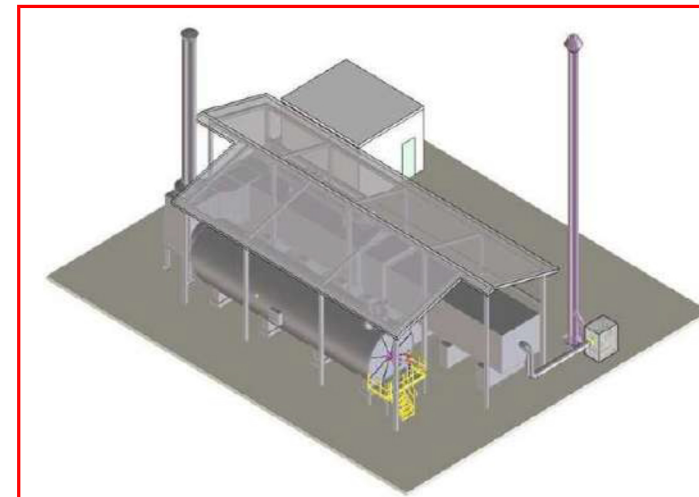
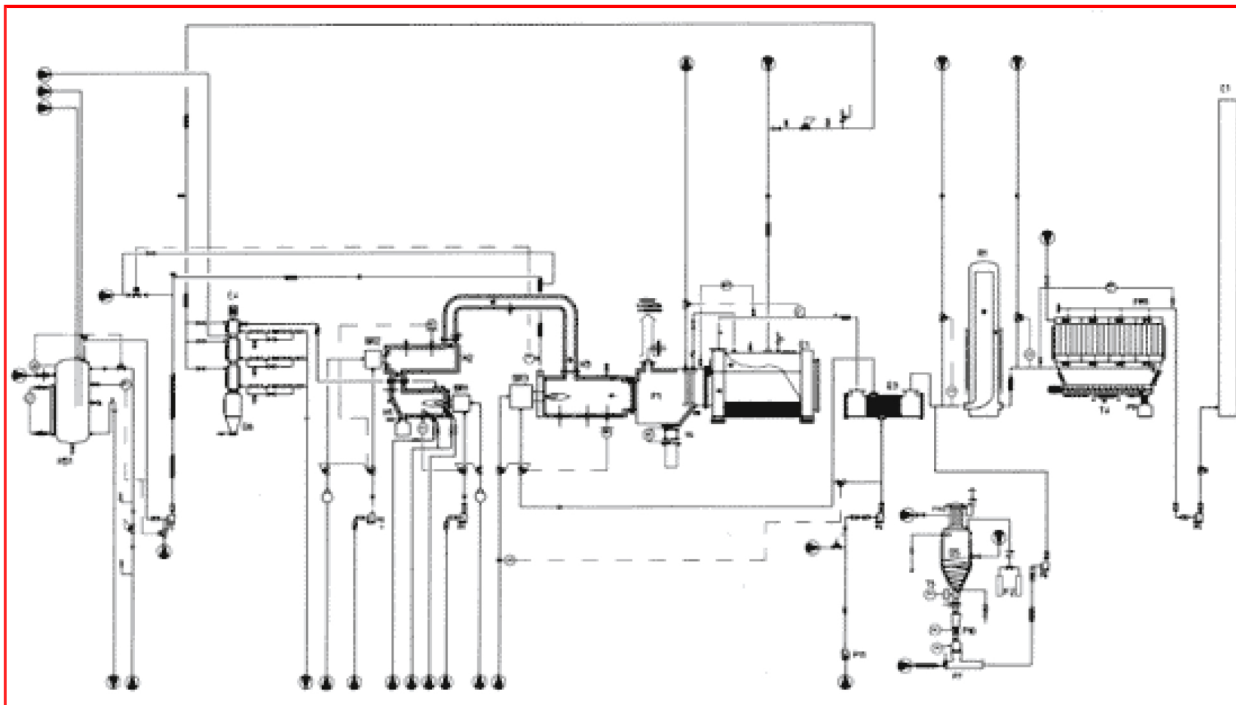
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WASTE GAS AND LIQUID INCINERATOR



Process Data	
Type	Horizontal Static Chamber with Injection nozzles for Waste liquid and toroidal distributor for Vents
Source of wastes	Pharmaceutical Wastes
Liquid Capacity	up to 2500 kg/h
Vent Capacity	up to 10000 Nm ³ /h
Oxidation Temperature	up to 1100 °C
Residence Time	2 s
Oxygen Concentration Flue Gases	6 % vol.
Plant sections	Steam Boiler, Flue Gases Treatment



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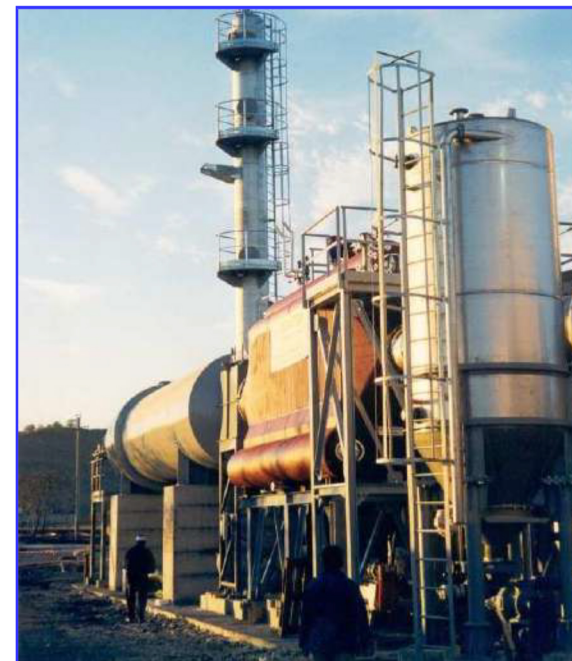
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WASTE GAS AND LIQUID INCINERATOR

Process Data	
Type	Horizontal Static Chamber with Injection nozzles for Waste liquid and toroidal distributor for Vents
Source of wastes	Solvent Stripping from Wastewater
Liquid Capacity	up to 2500 kg/h
Vent Capacity	up to 10000 Nm ³ /h
Oxidation Temperature	950 °C
Residence Time	2 s
Plant sections	Steam Boiler, NO _x thermal reduction with Ammonia injection, Dry Treatment for Flue Gases



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THERMAL OXIDATION

2



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Thermal Oxidizers

Typical Processed Stream

Contaminated Air by Hydrocarbons

Vent stream

Vents containing Chlorinated compounds

Vents containing Nitrogen compounds



Process Solution

Thermal Oxidizer

Recuperative Thermal Oxidizer

Regenerative Thermal Oxidizer

Catalytic Thermal Oxidizer



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TO- THERMAL OXIDIZER

Process Data

Type	Thermal Oxidizer
Source of wastes	Waste gas from copper foundry
Capacity	20000 Nm ³ /h
Pollutants in Air	HCl, SO ₂ , CO, VOC particulate
Oxidation Temperature	850 °C
Residence Time	2 s
Material of Construction	AISI 316 SS
Plant sections	Heat recovery section, quench, Dry abatement with chemical injection



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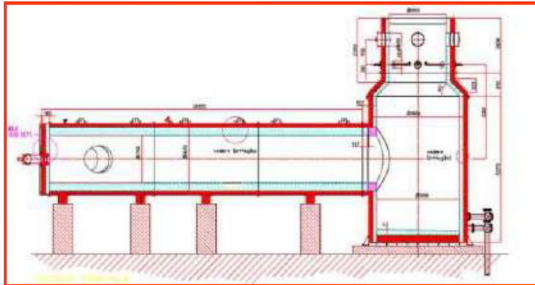
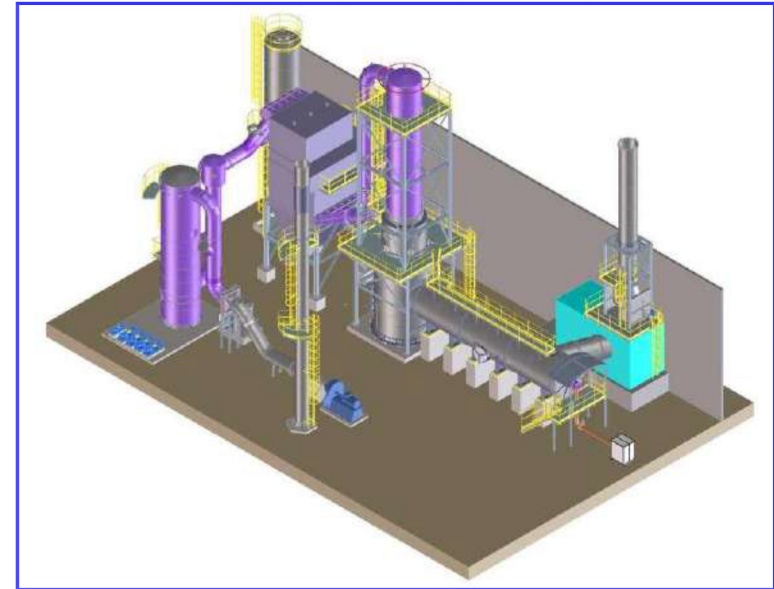
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THERMAL OXIDIZER

Process Data	
Type	Thermal Oxidizer
Source of wastes	Waste gas from copper foundry
Capacity	25000 Nm ³ /h
Pollutants in Air	HCl, HF, SO ₂ , CO, VOC particulate
Oxidation Temperature	850 °C
Residence Time	2 s
Material of Construction	SAF 2507 / AISI 316 SS
Plant sections	Quench, Dry abatement with chemical injection and final scrubber



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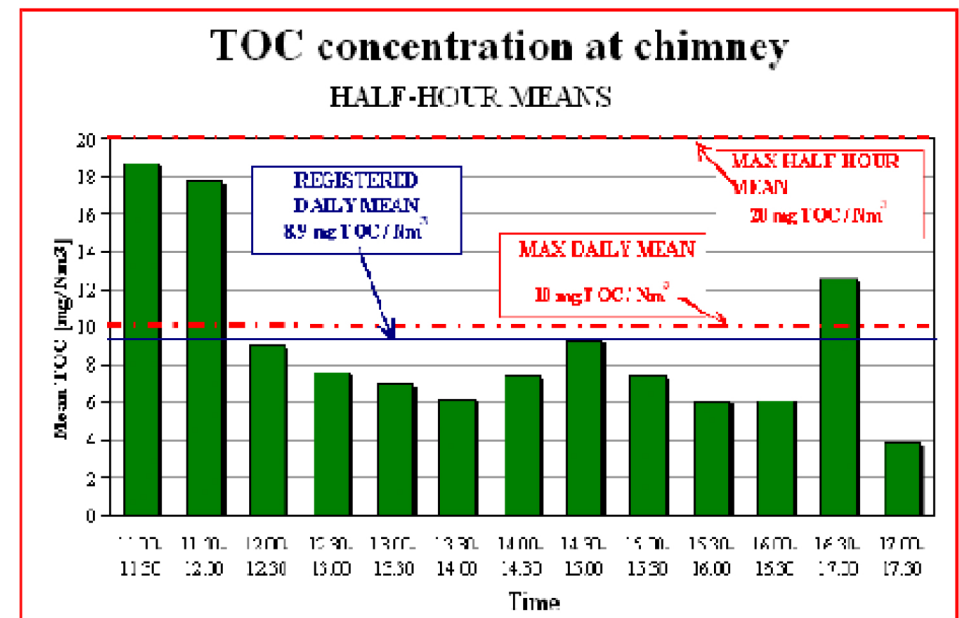
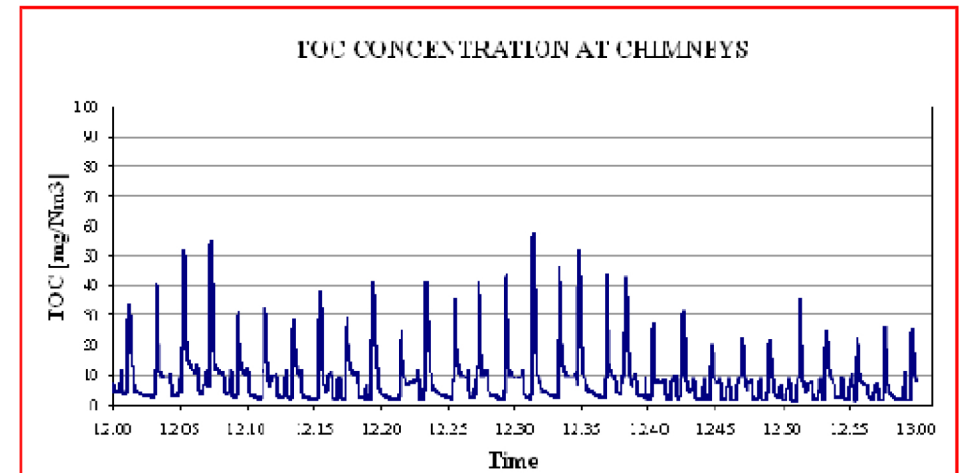
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RTO - REGENERATIVE THERMAL OXIDIZER

Process Data	
Type	Regenerative Thermal Oxidizer
Source of wastes	Air from Film Metalization 5 canister with heat recovery by thermal oil
Capacity	50000 Nm ³ /h
Hydrocarbons in Air	3-8 g/Nm ³
Oxidation Temperature	850 °C
Residence Time	>1.5 s



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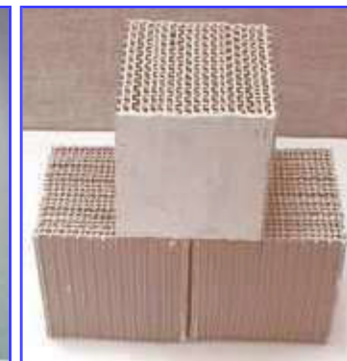
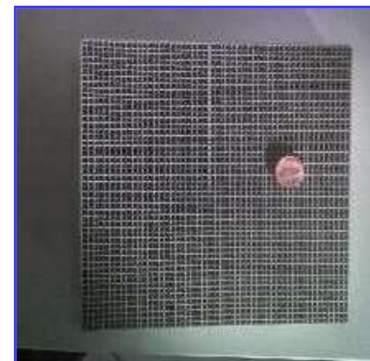
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REGENERATIVE THERMAL OXIDIZER

Process Data

Type	Regenerative Thermal Oxidizer for Air contaminated by Chlorinated Compounds 2 canisters with compensation chamber
Source of wastes	Wastewater treatment plant and Pharmaceutical production plant
Capacity	5000 Nm³/h
Hydrocarbons in Air	2-5 g/Nm³ (Xilene, Toluene, Methylene Chloride, IPA, Acetone, n-Heptane)
Oxidation Temperature	950 °C
Residence Time	2 s
Material of Construction	Hastelloy C22
Plant sections	Final scrubber and Dry abatement

Ceramic Media



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SOLVENT RECOVERY



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Solvent Distillation Plants

Typical Recovered Compounds

Ethanol

Methanol

Acetone

Dymethylformamide (DMF)

N-methyl-2 Pyrrolidone (NMP)

Acetic Acid

Isopropyl Alcohol (IPA)

Ethyl Acetate (EtAc)

Methylene Chloride (MC)

Hexane

TEA

DEA

MDEA

Ammonia

DMAc

DNP

Isobutanol

Acetonitrile

Toluene

NEP

DMSO

and more...

Process Solution

Continuos Distillation

Batch Distillation

Azeotropic Distillation

Extractive Distillation

Vacuum Distillation

High pressure Distillation

With Mechanical Compression

With Thermocompression

Multiple effects



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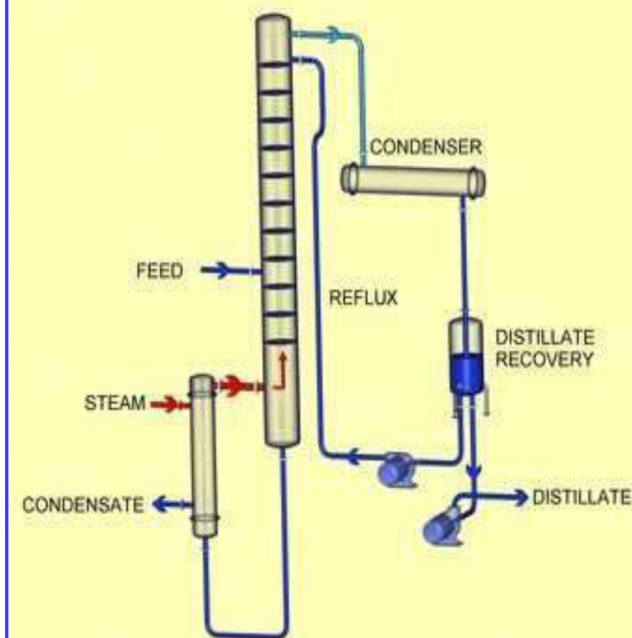
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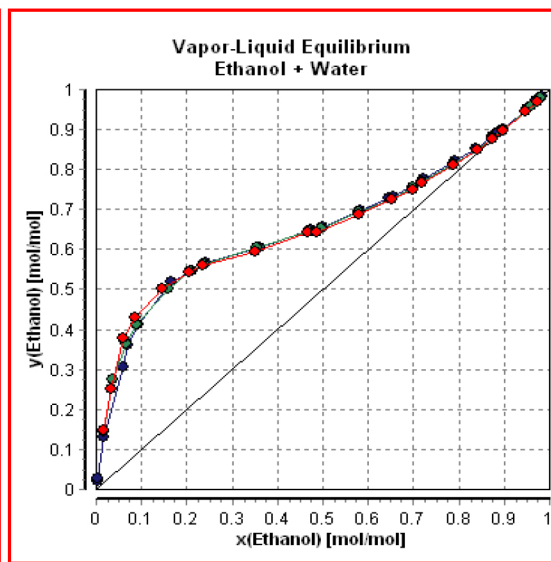
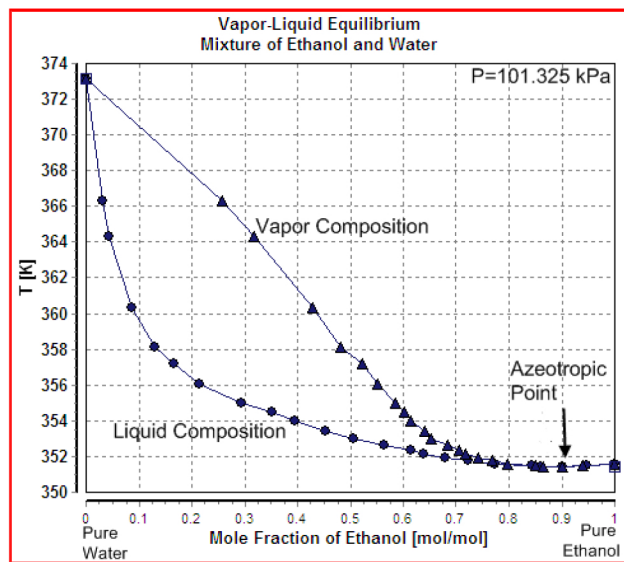
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DISTILLATION PLANT



ETHANOL - WATER DISTILLATION PLANT



Process Data	
Operation	Continuous Double Effects
Type	Sieve Trays
Capacity	3000 kg/h
Operating pressure	Atm.
Top operating Temperature	78 °C
Bottom operating Temperature	100 °C
Recovered Ethanol	>98%
Concentration of Recovered Ethanol	>95% wt.
Material of construction	AISI 304 SS



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DMF / NMP - WATER DISTILLATION PLANT

Process Data

Operation	Continuous
Type	Sieve Trays
Capacity	up to 9000 kg/h
Operating pressure	Vacuum
Top operating Temperature	about 56 °C
Bottom operating Temperature	about 105 °C
Recovered DMF	>99%
Concentration of Recovered DMF	>99% wt.
Material of construction	AISI 316-304 SS



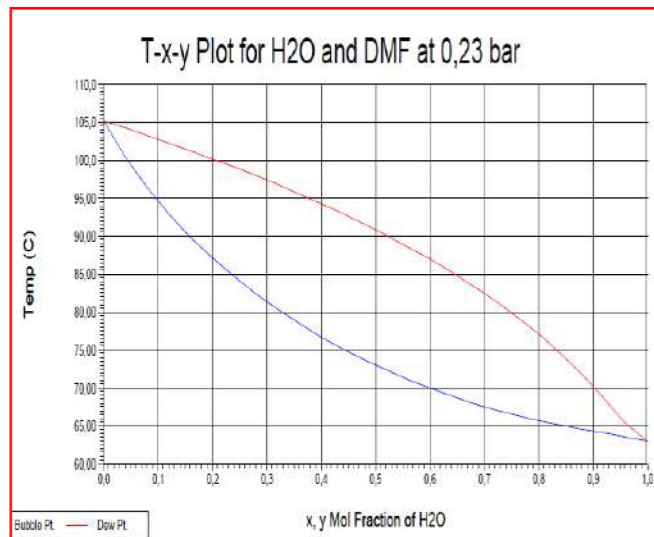
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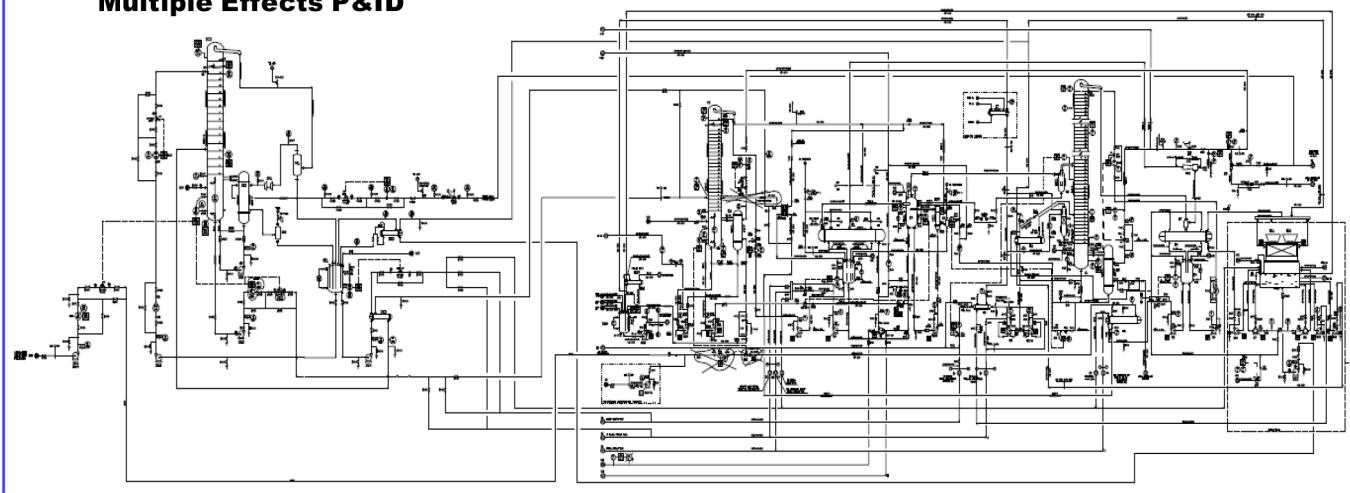
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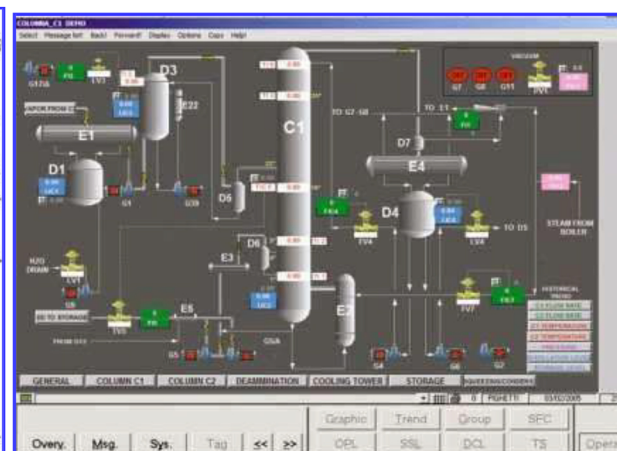
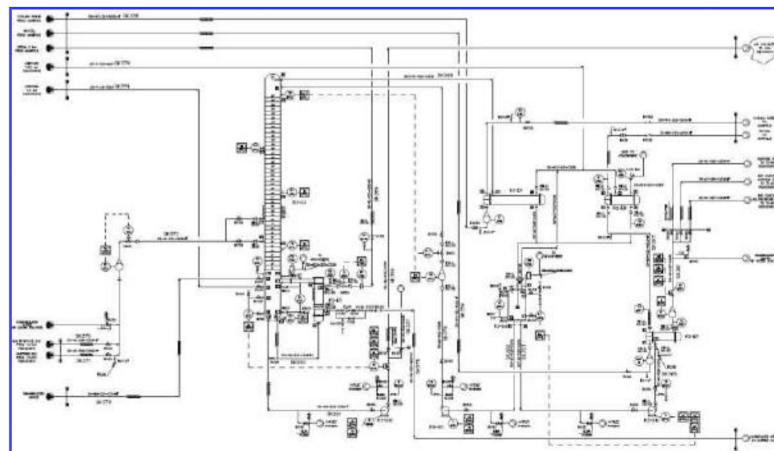


Multiple Effects P&ID



MC, ACETONE, IPA, TEA-DEA , DMAc DISTILLATION PLANT

Process Data				
	MC - water	IPA - water	TEA/DEA – water	ACETONE - water
Operation	Continuous	Continuous	Batch	Continuous/ Batch
Type	Sieve Trays	Sieve Trays	Structured Packing	Structured Packing
Capacity	1500 kg/h	1500 kg/h	800 kg/h	1500 kg/h
Operating pressure	Atm.	Atm.	Atm.	Atm.
Concentration of Recovered Compound	99% wt.	85% wt.	99% wt.	95% wt. 99% wt.
Material of construction	AISI 316 SS	AISI 316 SS	Carbon steel Glass Lined column, Titanium heat exchanger	AISI 316 SS





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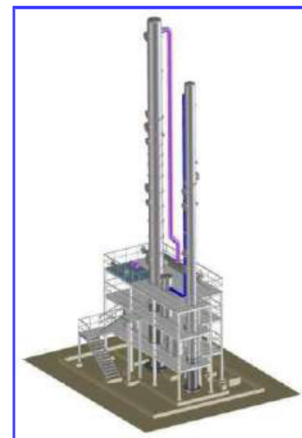
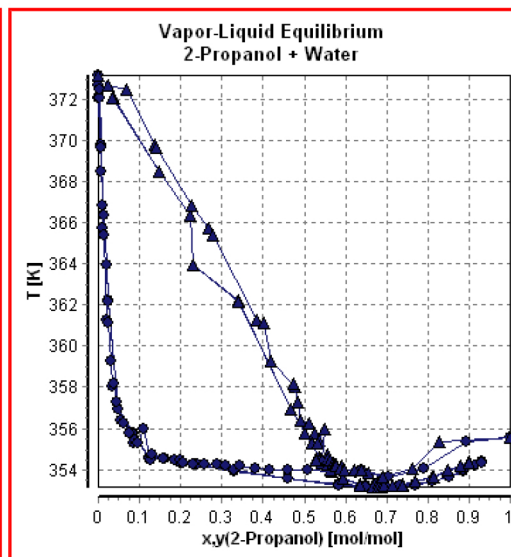
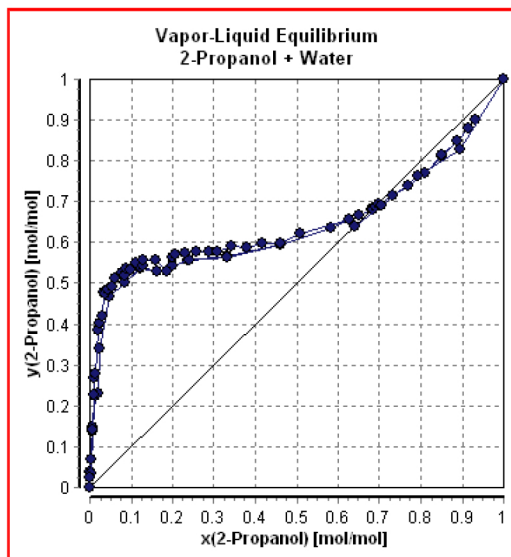
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IPA - WATER DISTILLATION PLANT



Process Data	
Operation	Continuous Double effects
Type	Sieve Trays
Capacity	5000 kg/h
IPA Inlet concentration	50%wt
Operating pressure	Atm.
Top operating Temperature	80 °C
Bottom operating Temperature	100 °C
Recovered IPA	>98%
Concentration of Recovered IPA	>87% wt.
Material of construction	AISI 316 SS / Hastelloy C22



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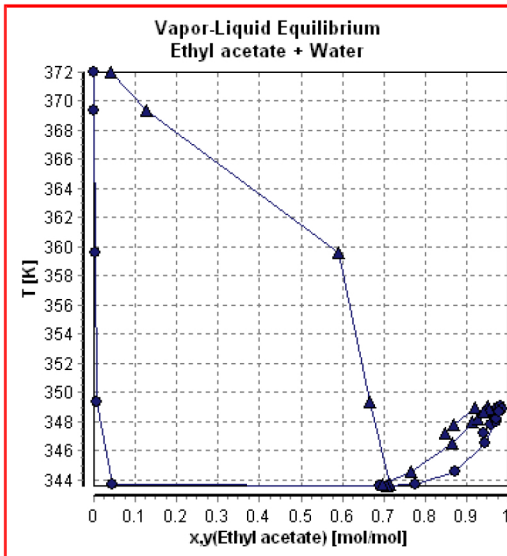
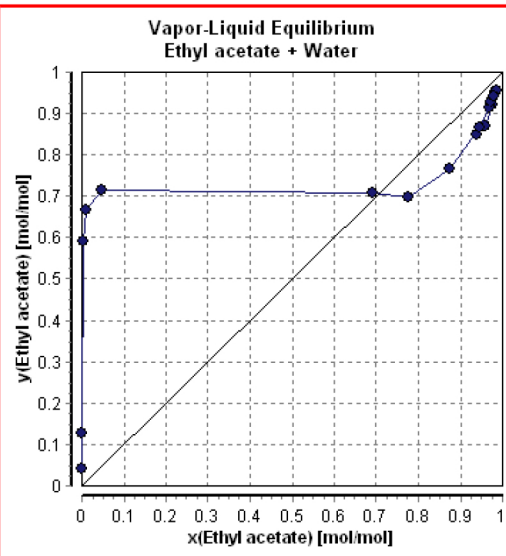
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ETHYL ACETATE - WATER DISTILLATION PLANT



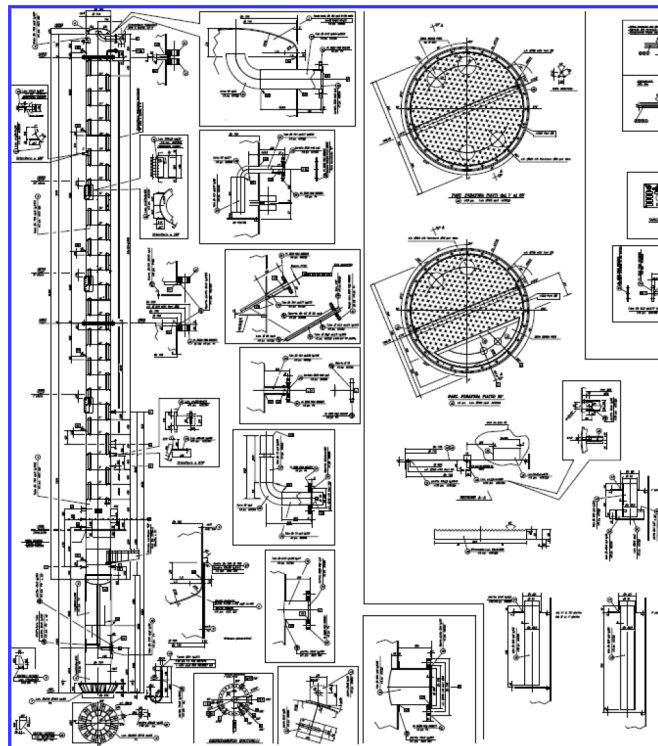
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Process Data

Operation	Continuos
Type	Sieve Trays
Capacity	1000 kg/h
IPA Inlet concentration	50%wt
Operating pressure	Atm.
Top operating Temperature	70 °C
Bottom operating Temperature	100 °C
Concentration of Recovered EtAc	>99% wt.
Material of construction	AISI 304 SS

Adsorption Plants

Typical Recovered Compounds

Toluene

Hexane

Ethyl-acetate

and more...

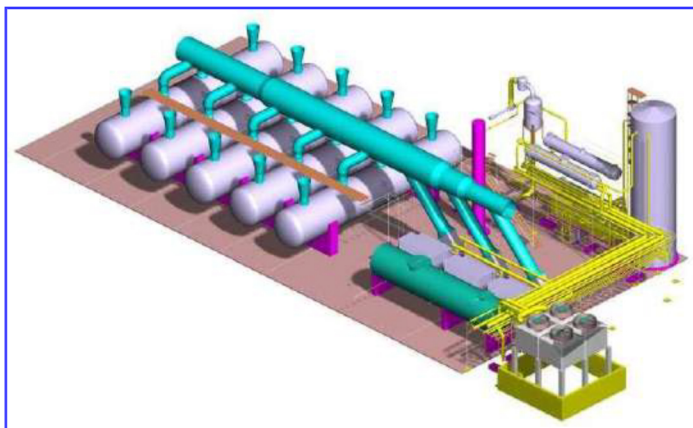
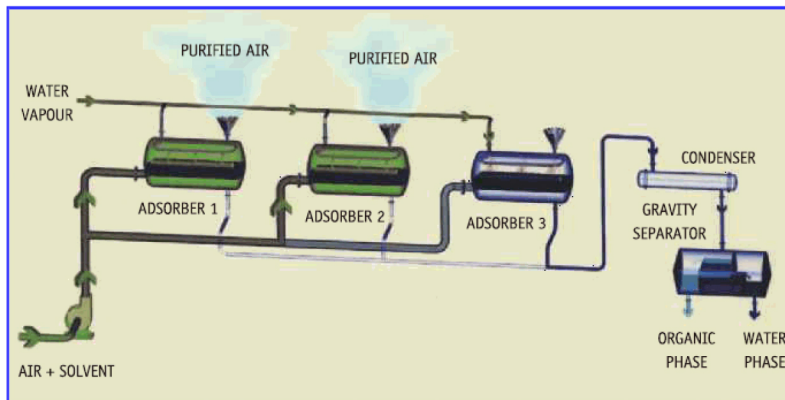
Process Solution

Activated Carbon regeneration by steam

Activated Carbon regeneration by hot nitrogen

with Thermocompression for steam saving

With Distillation Units



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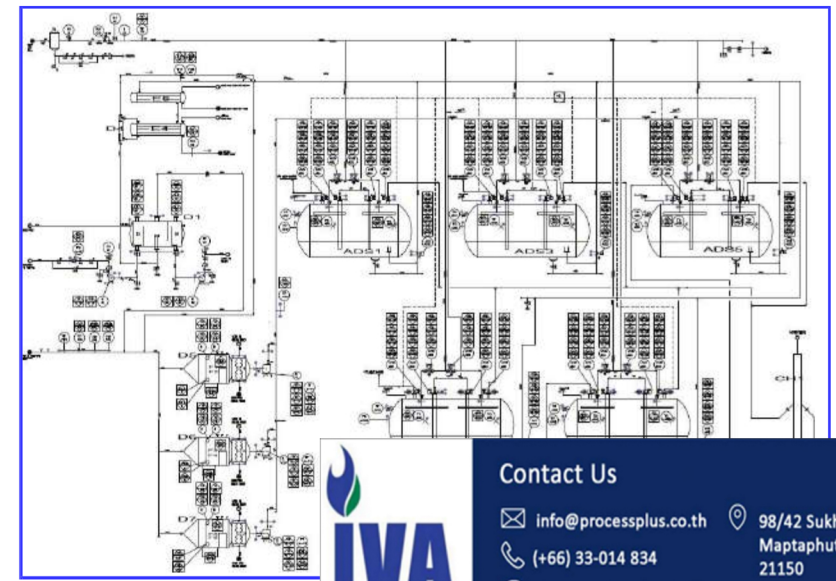
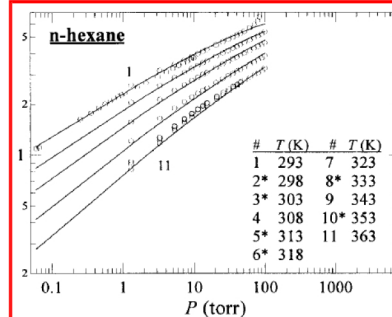
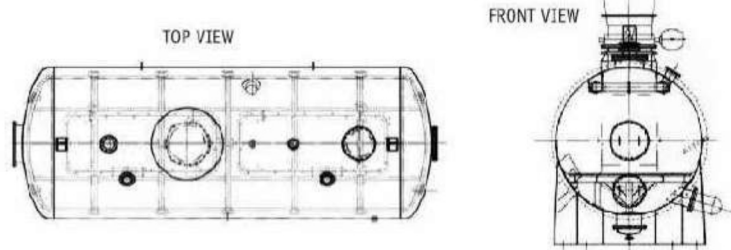
HEXANE RECOVERY PLANT

Process Data

Operation	Continuos
Type	Steam regeneration
Capacity	200000 Nm³/h
Number of adsorbers	5
Solvent Inlet concentration	5 g/Nm³
Recovery percentage	>96%
Steam Specific Consumption	3.5 kgsteam/kgsolvent



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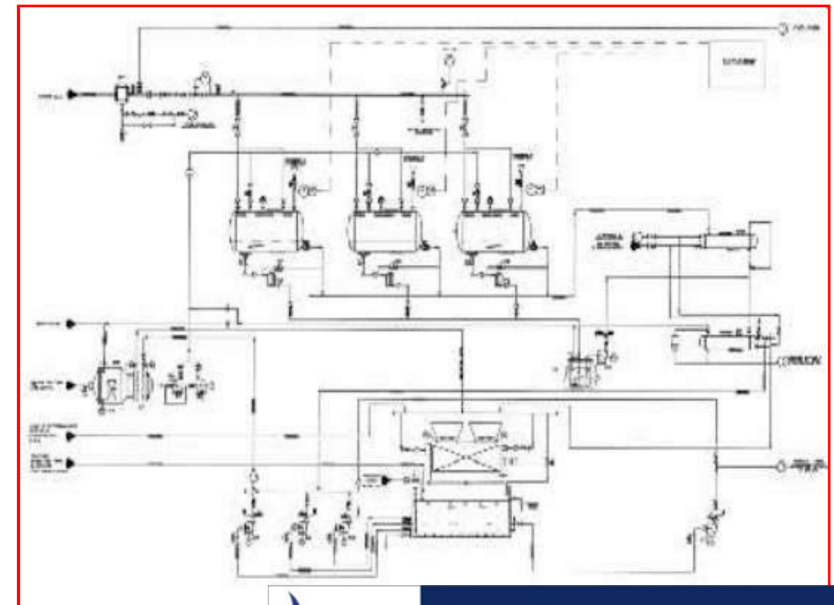
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TOLUENE RECOVERY PLANT

Process Data	
Operation	Continuos
Type	Steam regeneration
Capacity	20000 Nm ³ /h
Number of adsorbers	3
Solvent Inlet concentration	5 g/Nm ³
Recovery percentage	>96%
Steam Specific Consumption	3.5 kgsteam/kgsolvent



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ETHYL ACETATE RECOVERY PLANT

Process Data	
Operation	Continuos
Type	Steam regeneration and Ethyl Acetate Water Mixture Distillation
Capacity	80000 Nm ³ /h
Number of adsorbers	3
Solvent Inlet concentration	8 g/Nm ³
Recovery percentage	>96%
Steam Specific Consumption	3 kgsteam/kgsolvent



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GAS TREATMENT

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Waste Gas Treatment

Typical Processed Stream

Air or Gaseous stream containing solvents

Air or Gaseous stream containing dust

Stream containing HCl, SO₂, HF, Ammonia, NO_x, H₂S ecc.

CO₂ removal



Process Solution

Chemical and Physical Absorption (alkaline or acid scrubber)

Dry Abatement with Chemical Injection

Adsorption on Activated carbon, molecular sieve, iron scavenger

NO_x thermal and catalytic reduction



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FLUE GAS TREATMENT FROM COAL POWER PLANT

Process Data	
Type	Dry Abatement with Chemical Injection
Source of wastes	Fumes from Coal Power Plant
Capacity	26000 Nm ³ /h (n°2 line)
Pollutants in Air	SO ₂ and dust
SO2 inlet concentration	10 g/Nm ³
Dust inlet concentration	5-8 g/Nm ³
SO2 outlet concentration	200 mg/Nm ³
Dust outlet concentration	5 mg/Nm ³
Chemical for Abatement	Sodium Bicarbonate
Material of Construction	AISI 316 SS
Plant sections	Dry abatement with chemical injection, bag filter



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LIQUID TREATMENT

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Waste liquid Treatment



Typical Processed Stream

Water containing solvents, Hydrocarbons, Ammonia, BTEX, CO₂

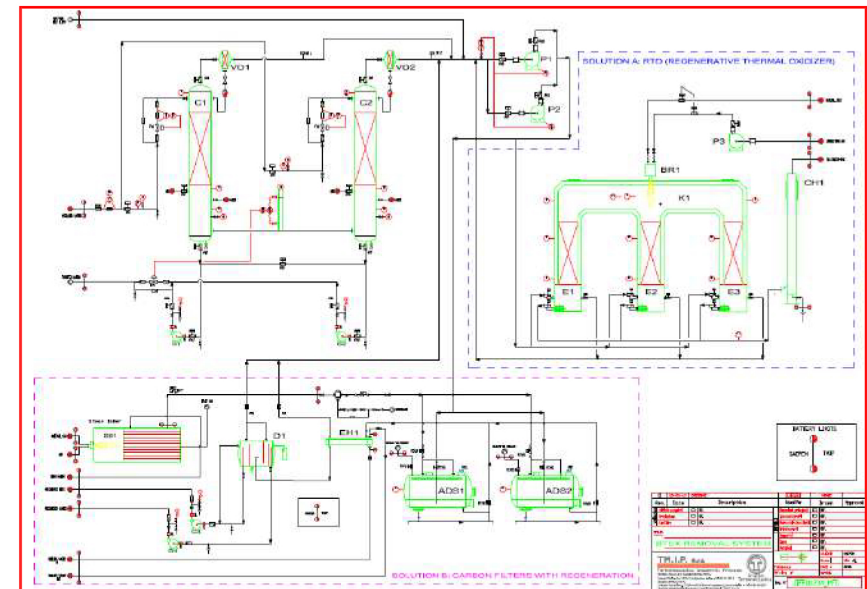
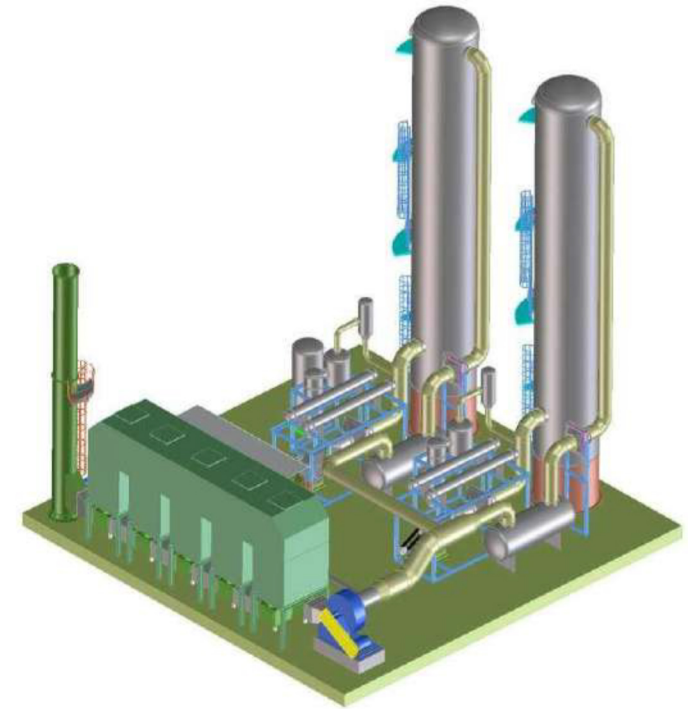
Process Solution

Stripping by Air

Stripping by Fuel Gas

Evaporation

Concentration



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HEAVY CONTAMINATED WATER BY SOLVENTS TREATMENT PLANT

Process Data	
Type	Stripping of light solvent, multiple effect water concentration, solvent recovery from condensate of multiple effect, wet oxidation, concentration and drying of produced sludge.
Source of wastes	Liquid Waste Disposal Industry
Capacity	3000 kg/h
Solvents concentration	20% wt.
Material of Construction	AISI 304 SS
Plant sections	Stripping column, Multiple effects concentrator, Wet Oxidation, Drying of Produced Sludge

