



Termomeccanica Industrial Process

Termomeccanica Group

意大利热工机械集团工业处理公司



意通环境

YITONG COMPANY

**意通环境，源自意大利的环保伙伴**

*Yitong Company, your environmental partner from Italy*



Termomeccanica Industrial Process

Termomeccanica Group

意大利热工机械集团工业处理公司



意通环境

YITONG COMPANY

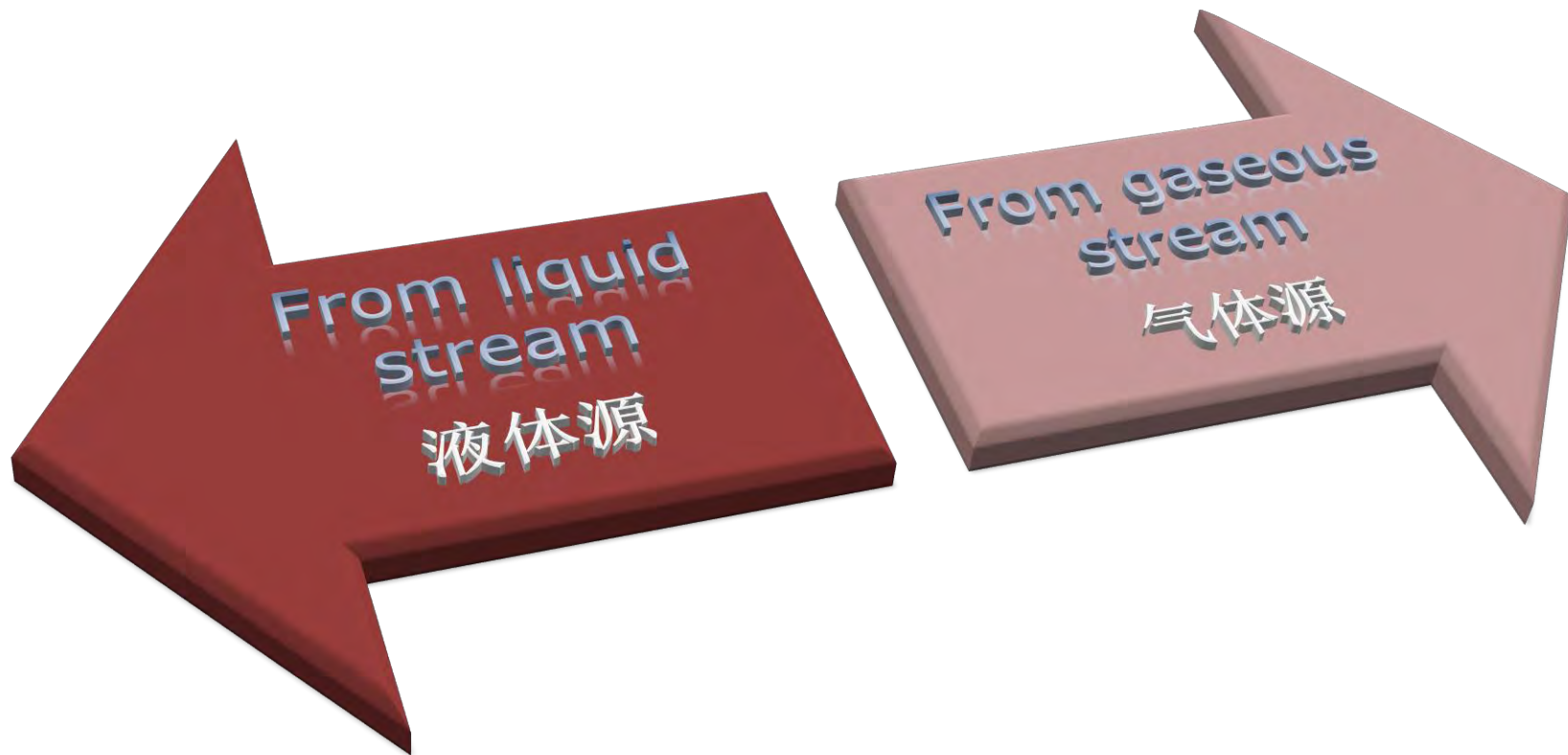


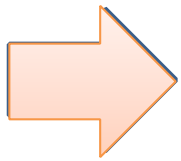
# Solvent recovery

# 溶剂回收

# Solvent recovery

溶剂回收





## from liquid stream: Distillation 液体源: 蒸馏

In many pharmaceutical, chemical and textile processes, solvents are used as solvent mixtures or as water solutions. Solvents can ( “must” ) be recovered.

在许多制药、化学和纺织工艺中，可以回收或者必须回收的溶剂包括混合溶剂和水溶液。

TMIP manufactures both batch and continuous distillation plants suitable for the above mentioned process. Discontinuous (batch) units are normally used for recovering solvents from complex mixtures, usually present in pharmaceutical industry.

TMIP制造的量产设备和连续蒸馏设备可以完美满足回收的需求。量产设备通常用于成分比较复杂的混合溶剂回收，多应用于制药行业。

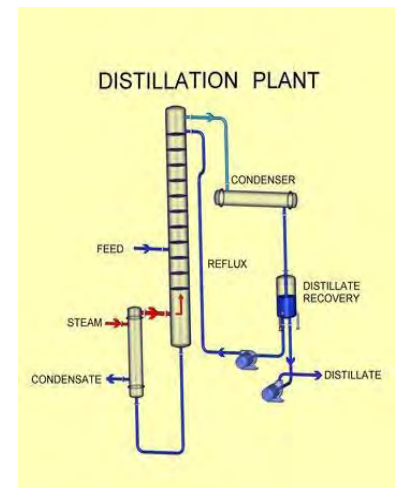
Continuous distillers are aimed at chemical industries.

连续蒸馏设备多应用于化学行业。

TMIP distillation plants include units for operating under pressure or vacuum, double or triple effect, with yields above 95% and controlled by some of the most sophisticated control systems available.

TMIP蒸馏设备包括可在高压或真空条件下运行的装置，具有双重或三重作用，回收有效率超过95%，配备最先进的控制系统。

	Chemical industry in general
	Paints production
	Synthetic leather production
	Resins production
	Pharmaceutical industry and related material (API)

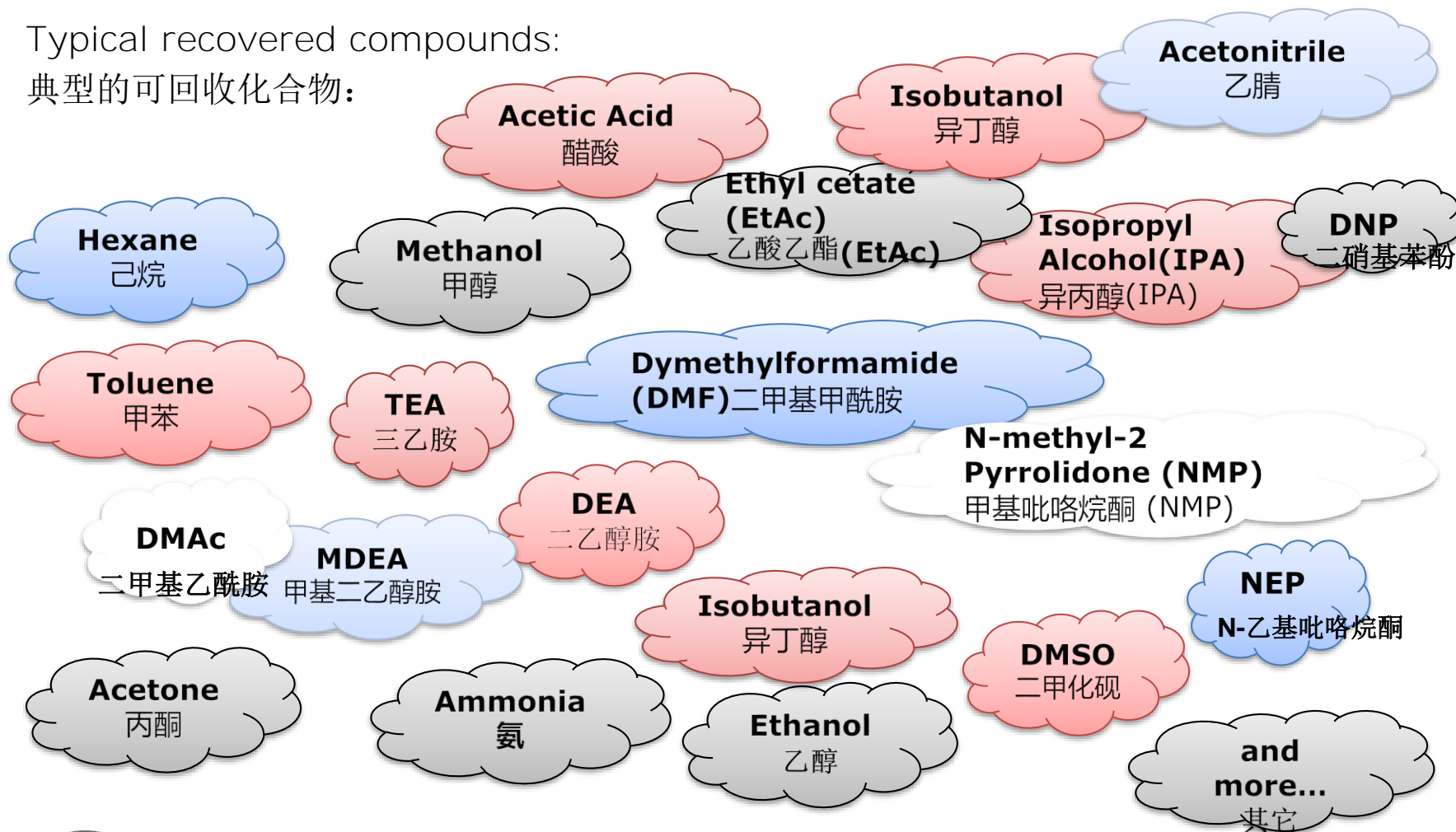


# Distillation

## 蒸馏

Typical recovered compounds:

典型的可回收化合物:





# Distillation

## 蒸馏

The distillation process cannot always be optimized in a theoretical way. In some cases the presence of substances deriving from the proprietary production process that generated the pollutant wastes can hinder and/or limit distillation.

蒸馏过程在纯理论上与实际情况会有些出入。在某些特定情况下，生产过程中产生的污染源会对蒸馏有阻碍

Process Solution 工艺流程设计

- Continuous Distillation 连续蒸馏
- Batch Distillation 分批蒸馏
- Azeotropic Distillation 共沸蒸馏
- Extractive Distillation 萃取蒸馏
- Vacuum Distillation 真空蒸馏
- High pressure Distillation 高压蒸馏
- With Mechanical Compression 机械压缩
- With Thermocompression 热压蒸馏
- Multiple effects 多重工艺并用

TMIP offers its distillation experience in order to recover the solvents into the original process or other process.

TMIP具有丰富的蒸馏经验，可以将溶剂回收到原工艺或其他相关工艺中。



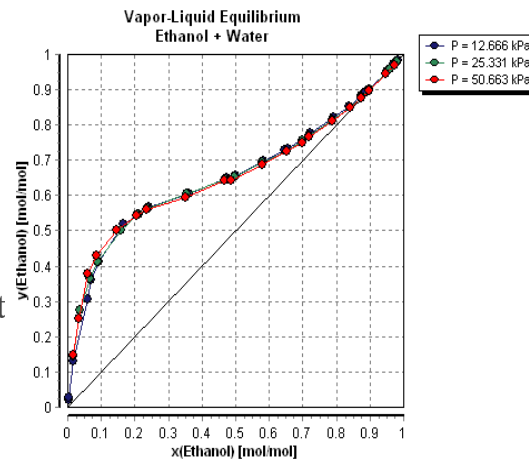
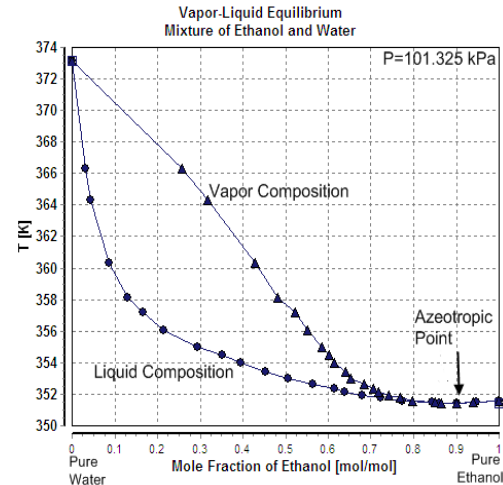
# Ethanol –water

## 乙醇-水

### Process Data

#### 工艺数据

- **Operation:** Continuous Double Effects  
操作: 连续双重效应
- **Type:** Sieve Trays  
类型: 筛板
- **Capacity:** 3000 kg/h  
溶剂量: 3000 千克/小时
- **Operating pressure:** atm  
工作压力: 标准大气压
- **Top operating Temperature:** 78 °C  
顶部运行温度: 78 °C
- **Bottom operating Temperature:** 100 °C  
底部运行温度: 100 °C
- **Recovered Ethanol:** >98%  
乙醇回收率: > 98%
- **Concentration of Recovered Ethanol:** >95% wt  
乙醇回收浓度: > 95%wt
- **Material of construction:** AISI 304 SS  
建筑材料: AISI 304 SS



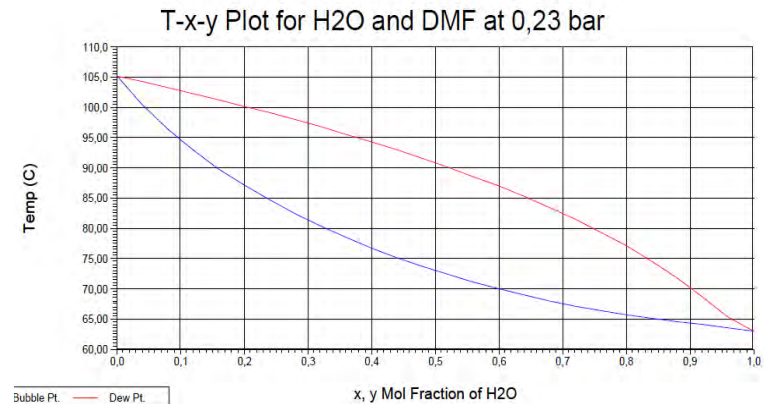
# DMF –water

## 二甲基甲酰胺-水

### Process Data

工艺数据

- **Operation:** Continuous  
操作方式: 连续
- **Type:** Sieve Trays  
类型: 筛板
- **Capacity:** up to 9000 kg/h  
溶剂量: 最高9000千克/小时
- **Material of construction:** AISI 316-304 SS  
建筑材料: AISI 316-304 SS
- **Top operating Temperature:** 56 °C  
顶部运行温度: 56 °C
- **Bottom operating Temperature:** 105 °C  
底部运行温度: 105 °C
- **Recovered DMF:** >99%  
DMF回收率: > 99%
- **Concentration of Recovered DMF:** 99% wt.  
DMF回收浓度: 99% wt
- **Operating pressure:** vacuum  
工作压力: 真空





# MC / ACETONE / IPA / TEA-DEA

二氯甲烷/丙酮/异丙醇/三乙胺-二乙醇胺

	MC –water 二氯甲烷-水	IPA –water 异丙醇 -水	TEA/DEA –water 三乙胺/二乙醇胺-水	ACETONE – water 丙酮水
Operation 操作	Continuous 连续	Continuous 连续	Batch 批量	Conti./Batch 连续/批量
Type 类型	Sieve Trays 筛板	Sieve Trays 筛板	Structured Packing 整装填料	Structured Packing 整装填料
Capacity 容量	1500 kg/h 1500 kg/h	1500 kg/h 1500 kg/h	800 kg/h 800 kg/h	1500 kg/h 1500 kg/h
Operating pressure 工作压力	标准气压.	标准气压.	标准气压.	标准气压.
Concentration of Recovered Compounds 回收化合物浓度	99% wt 99%wt	85% wt 85%wt	99% wt 99%wt	95% wt 95% wt
Material of construction 建筑材料	AISI 316 SS	AISI 316 SS	Carbon steel, Glass lined Column, Titanium heat exchanger 碳钢、玻璃衬里、 立柱，钛热交换器	AISI 316 SS



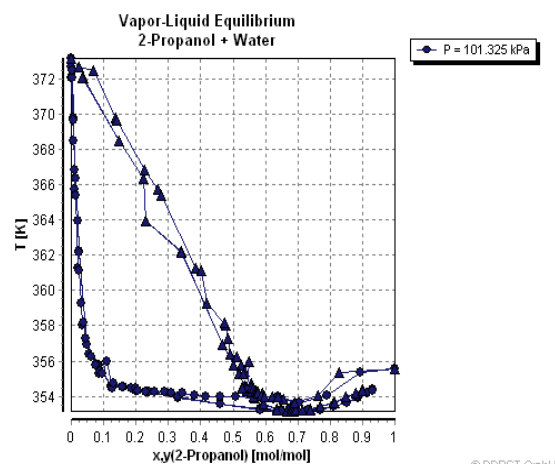
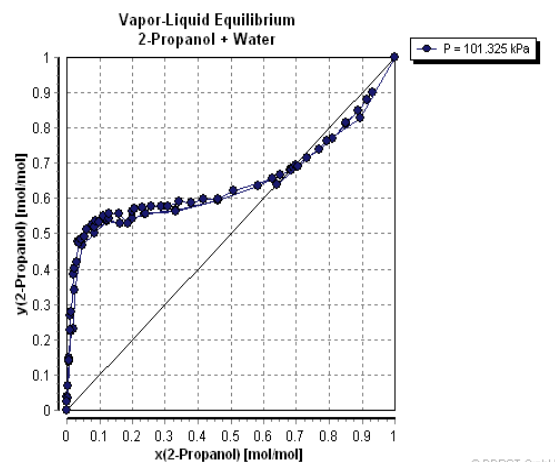
# IPA –water

## 异丙醇-水

### Process Data

#### 工艺数据

- **Operation:** Continuous double effects  
操作: 连续双重效果
- **Type:** Sieve Trays  
类型: 筛板
- **Capacity:** 5000 kg/h  
溶剂量: 5000 kg/h
- **IPA inlet concentration:** 50% wt  
异丙醇入口浓度: 50% wt
- **Top operating Temperature:** 80 °C  
顶部运行温度: 80°C
- **Bottom operating Temperature:** 100 °C  
底部运行温度: 100°C
- **Recovered IPA:** >98%  
异丙醇回收: > 98%
- **Concentration of Recovered IPA:** >87% wt.  
异丙醇回收浓度: > 87% wt
- **Operating pressure:** atm  
工作压力: 标准气压
- **Material of construction:** AISI 316 SS /  
HastelloyC22  
建筑材料: AISI 316 SS /哈氏合金C22



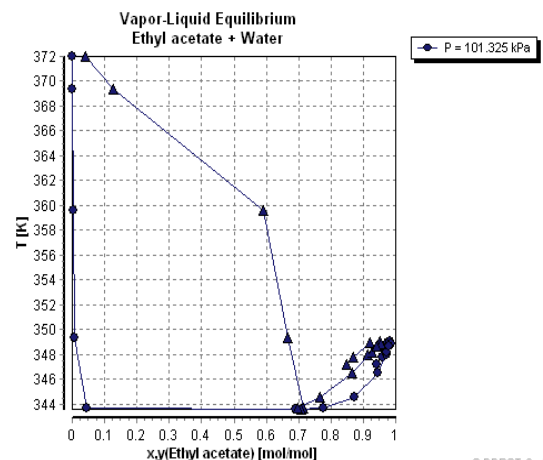
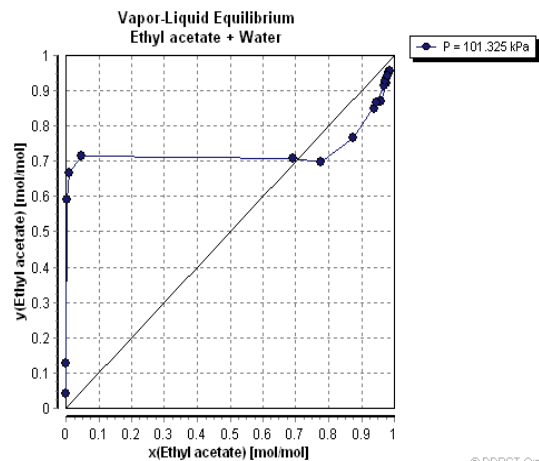
# Ethyl acetate –water

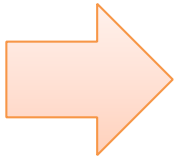
## 乙酸乙酯-水

### Process Data

#### 工艺数据

- **Operation:** Continuous  
操作:连续
- **Type:** Sieve Trays  
类型:筛板
- **Capacity:** 1000 kg/h  
溶剂量:1000 kg/h
- **EtAcinlet concentration:** 50% wt  
醋柳黄酮浓度:50% wt
- **Top operating Temperature:** 70 °C  
顶部运行温度:70°C
- **Bottom operating Temperature:** 100 ° C °C  
底部运行温度:100°C
- **Concentration of Recovered EtAc:** >99% wt.  
乙酸乙酯回收浓度: > 99%wt
- **Operating pressure:** atm  
工作压力: 标准气压
- **Material of construction:** AISI 304 SS  
建筑材料: AISI 304 SS

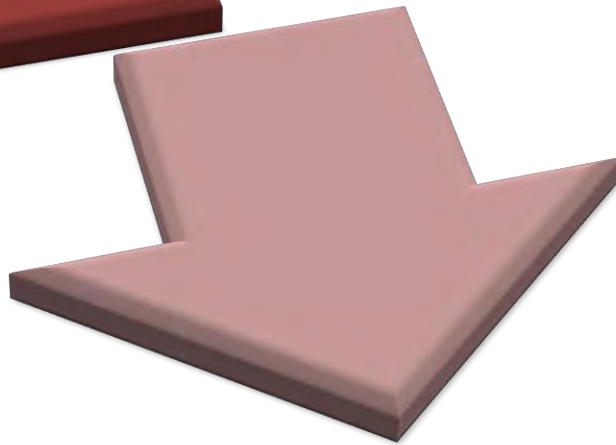




from gaseous stream: Absorption  
气体源: 吸收



Solvent recovery  
**溶剂回收**



Pollutant removal  
**污染物净化**



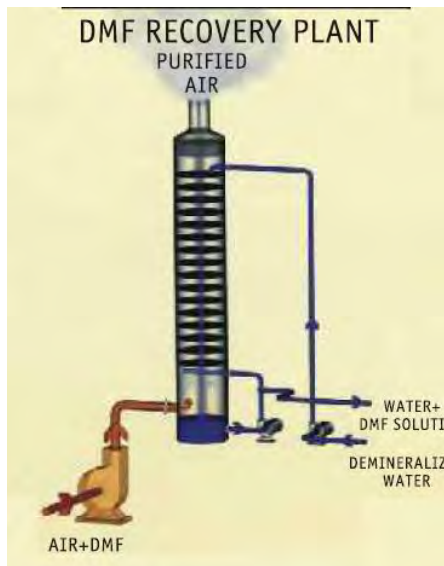


# Absorption: solvent recovery

## 吸附: 溶剂回收

DMF, NMP is highly soluble in water; TM.I.P. exploits this characteristic of the soluble water solvent that can be recovered by washing the air in counter current air stream with water in a plates tower. Solvent is collected on the bottom of the tower in solution with water. The solution will be distilled to recover pure solvent.

NMP 二甲基甲酰胺高度溶于水；该公司利用溶剂可溶于水的特性，在板式塔中用水逆流洗涤空气来回收这种溶剂。用水将溶剂收集在塔底，将溶液蒸馏以回收纯溶剂。





# Absorption: pollutant removal

## 吸附:污染物净化

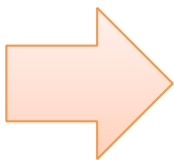
Pollutants removal takes place through a “washing” process by means of liquid. Particles with diameter  $> 1\ \mu\text{m}$  that impact water droplets or wet surface generates the absorption process. A liquid detains small particles by absorption that is the selective passage of one or more gaseous components into liquid phase.

通过液体的“洗涤”过程去除污染物。直径 $>1\mu\text{m}$ 的颗粒会影响水滴或潮湿的表面，从而达到吸附效果。液体通过吸附来保留小颗粒，吸附是一种或多种气体成分选择性进入液相的吸收。

The liquid incorporating the pollutants is then recovered on the bottom of the washing tower and treated.

然后将含有污染物的液体送到洗涤塔的底部并进行处理。





## from gaseous stream: Adsorption 气体源:吸附

It's adopted for treating exhaust gas recovering pollutants with the possibility of recycling them in a new process.

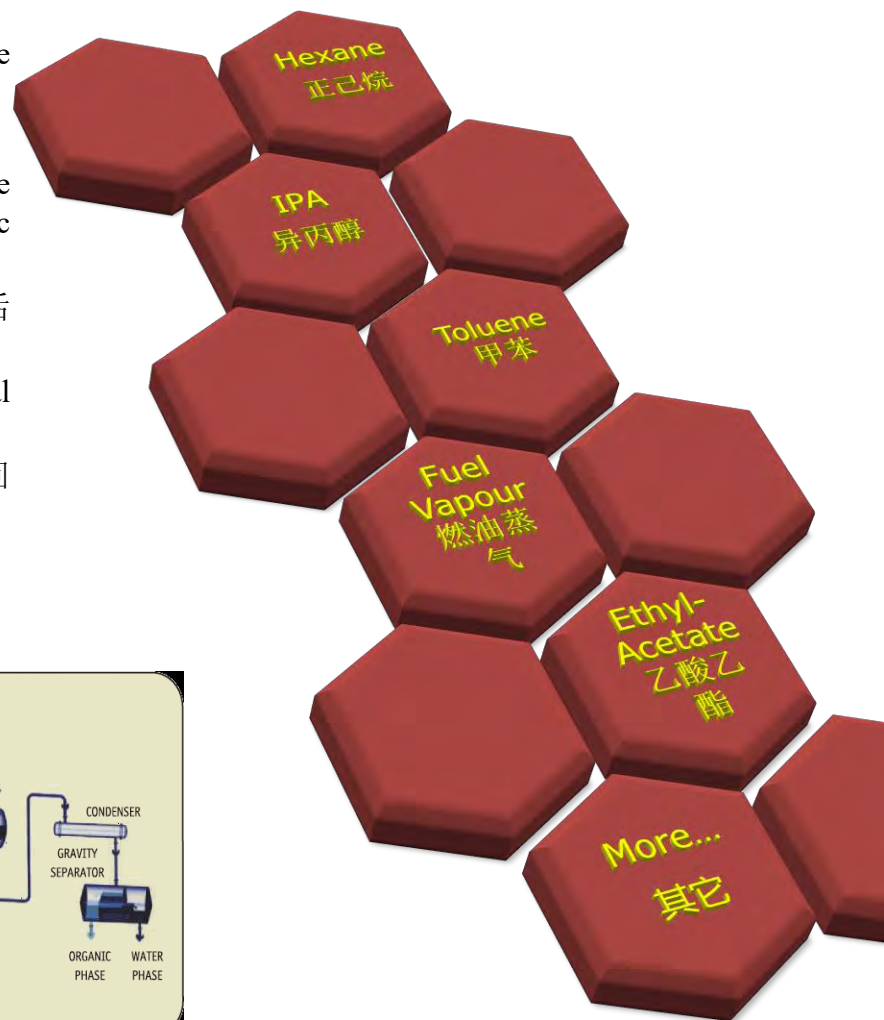
用于处理废气污染物，并在流程工艺中对其进行回收。

Adsorbing materials are micro porous substances with a huge surface/height (up to  $1700 \text{ m}^2/\text{gr}$ ) such as activated carbons, synthetic zeolite, silica gel and activated alumina.

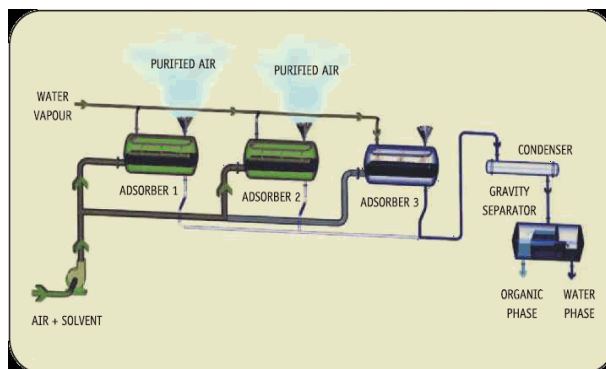
吸附材料是具有巨大表面/高度(高达 $1700\text{m}^2/\text{gr}$ )的微孔物质，如活性炭、合成沸石、硅胶和活性氧化铝。

TMIP designs & manufactures adsorption plants with pollutant removal levels of 97% and with a particularly fast investment payback.

TMIP设计和制造的吸附设备，其污染物去除率达到97%，投资回报周期短。



	胶带生产
	不干胶生产
	油漆生产
	凹版印刷

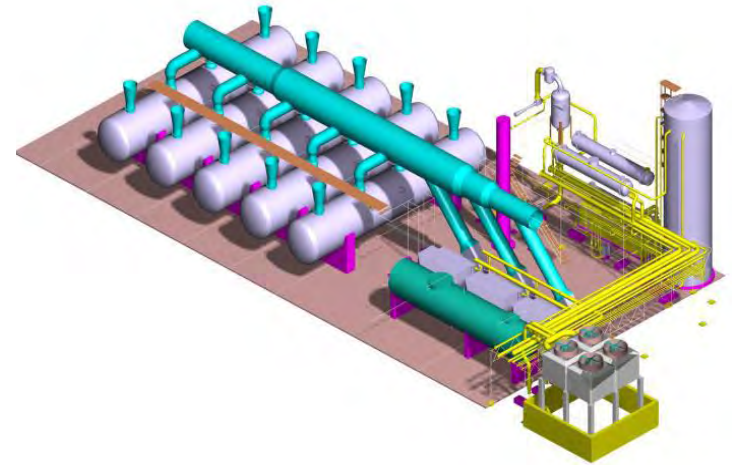


# Adsorption

## 吸附

### Process Solution 工艺流程设计:

- Activated Carbon regeneration by steam  
蒸汽再生活性炭
- Activated Carbon regeneration by hot nitrogen  
热氮再生活性炭
- with Thermocompression for steam saving  
热压节省蒸汽
- With Distillation Units  
蒸馏装置





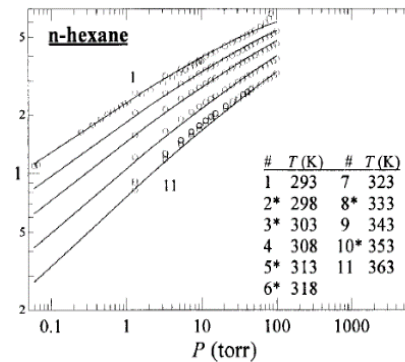
# Hexane recovery

## 己烷回收

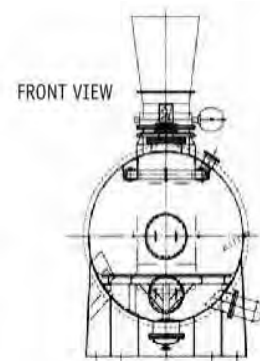
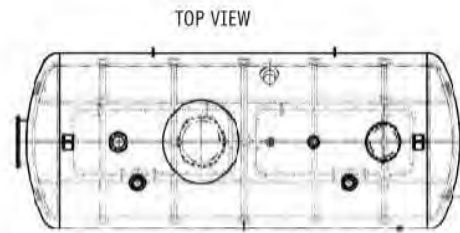
### Process Data

#### 工艺数据

- **Operation:** Continuous  
操作: 连续
- **Type:** Steam regeneration  
类型: 蒸汽再生
- **Capacity:** 200.000 Nm<sup>3</sup>/h  
容量: 200.000 Nm<sup>3</sup>/h
- **Number of adsorbers:** 5  
吸附器数量: 5
- **Solvent inlet concentration:** 5 g/ Nm<sup>3</sup>  
溶剂入口浓度: 5 g/ Nm<sup>3</sup>
- **Recovery percentage:** >96%  
回收率: > 96%
- **Steam specific consumption:** 3.5 kg<sub>steam</sub>/kg<sub>solvent</sub>  
蒸汽消耗: 3.5千克油气/千克溶剂



TIPYCAL ADSORBER



# Toluene recovery

## 甲苯回收

### Process Data

#### 工艺数据

- **Operation:** Continuous  
操作: 连续
- **Type:** Steam regeneration  
类型: 蒸汽再生
- **Capacity:** 200.000 Nm<sup>3</sup>/h  
溶剂量: 200.000 Nm<sup>3</sup>/h
- **Number of adsorbers:** 5  
吸附器数量: 5
- **Solvent inlet concentration:** 5 g/ Nm<sup>3</sup>  
溶剂入口浓度: 5 g/ Nm<sup>3</sup>
- **Recovery percentage:** >96%  
回收率: > 96%
- **Steam specific consumption:** 3.5 kg<sub>steam</sub>/kg<sub>solvent</sub>  
蒸汽消耗: 3.5 千克油气/千克溶剂





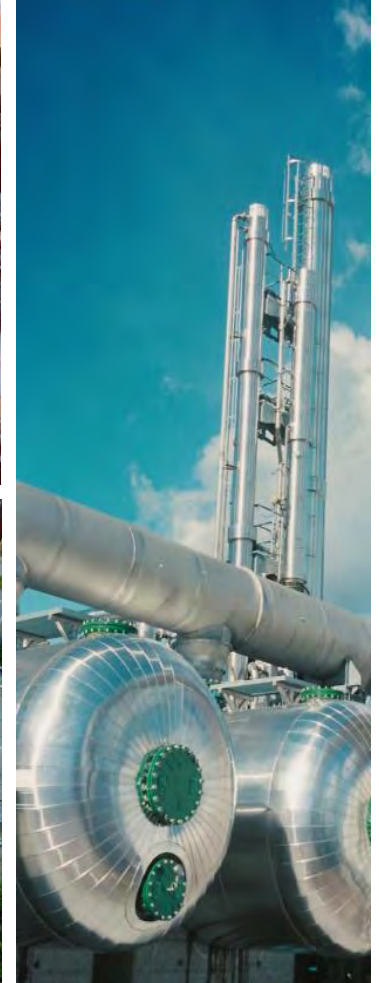
# Ethyl acetate recovery

## 乙酸乙酯回收

### Process Data

#### 工艺数据

- **Operation:** Continuous  
操作: 连续
- **Type:** Steam regeneration and Ethyl acetate water mixer distillation  
类型: 蒸汽再生和乙酸乙酯水混合蒸馏
- **Capacity:** 80.000 Nm<sup>3</sup>/h  
容量: 80.000 Nm<sup>3</sup>/h
- **Number of adsorbers:** 3  
吸附器数量: 3
- **Solvent inlet concentration:** 8 g/Nm<sup>3</sup>  
溶剂入口浓度: 8 g/Nm<sup>3</sup>
- **Recovery percentage:** >96%  
回收率: > 96%
- **Steam specific consumption:** 3 kg<sub>steam</sub>/kg<sub>solvent</sub>  
蒸汽消耗: 3 千克油气/千克 溶剂



# Vapour Recovery Unit

## 蒸汽回收装置

The main advantages for recovering vapours are:

蒸汽回收的主要优点:

- Reduce emission of environmentally hazardous compounds;  
减少对环境有害的化合物排放;
- Increase safety and reduce health risks linked with the distribution net of gasoline or crude oil;  
提高安全性, 降低汽油或原油销售网络的健康风险;
- Recovery of valuable energy resources;  
回收宝贵的能源;
- VRU capacity: from 150 to 3500 m<sup>3</sup>/h of vapours.  
蒸汽回收装置容量: 150至3500 m<sup>3</sup>/h 。

Main application of VRU:

蒸汽回收装置主要应用于:

- Storage terminals;  
存储终端;
- Truck and rail car loading;  
卡车和轨道车装载;
- Marine loading system;  
海运装载系统;
- Vapour balance systems.  
蒸汽平衡系统。



# Vapour Recovery Unit (VCU)

## 油气回收装置

All emission regulations can be achieved:

符合所有相关排放法规的规定:

TA-Luft: 150 mg/m<sup>3</sup>

欧盟环保规定: 150毫克/立方米

EU Directive: 35 g/m<sup>3</sup>

欧盟指令: 35克/立方米

US EPA: 5 mg/l loaded

美国环保局: 5毫克/升

Our VRU may even coupled with a second stage plant, reducing emissions to as low as 50 mg/m<sup>3</sup>.

我们的油气回收装置也可以与二期工艺配合，将排放量降低至50毫克/立方米。

Process consists of three main steps:

流程由三个主要步骤组成:

- ❖ Adsorption of the VOC on activated carbon bed;  
VOC吸附在活性炭床上;
- ❖ Regeneration of the carbon by means of vacuum;  
真空再生碳过程;
- ❖ Re-absorption and recovery of VOC by absorbent liquid.  
吸收剂溶液对VOC的再吸附和回收。



# Vapour Recovery Unit (VCU)

## 油气回收装置

### VRU Safety

#### 油气回收装置的安全性

Safety features of our VRUs include the following:

油气回收装置的安全功能包括:

- Use of activated carbon capable to withstand high degrees of mechanical and thermal stresses;  
使用可以承受高机械应力和热应力的活性炭;
- Higher pressure resistant vessels and piping;  
耐高压容器和管道;
- Control system monitoring all important operating parameters, with ESD;  
控制系统通过ESD实时监控所有重要的操作参数
- Flame arrestors, limit switches , level switches etc.  
阻火器、限位开关、液位开关等。

### VRU Control system

#### 油气回收控制系统

- Our plants are equipped with an advanced Programmable Logic Controller (PLC), a bus communication between I/O station and PLC as well as a PC-based, user-friendly Human Machine Interface (HMI). Control system continuously keeps track of process parameters and the operation of the unit;
- 我们的设备配置了先进的可编程逻辑控制器(PLC), I/O站和PLC之间的总线通信, 以及用户友好的人机界面(HMI)。控制系统持续跟踪工艺参数和设备的运行情况;
- The system enables operational adjustments, accurate diagnostics and remote supervision.
- 该系统支持操作调整、精准诊断和远程监控。

