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SL TEC

Providing engineered solutions in chemical separation

Keeping innovative through R&D

CONTACT US

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Hubei Sanli Fengxiang Technology Co., Ltd. (SL TEC)

COMPANY PROFILE

Hubei Sanli Fengxiang Technology Co., Ltd. (SL Tech) is a young technology company specialized in providing EPC contracting service and the import & export of chemical plants. From its inception, SL TEC has been insisting on the mode of “combining industry, study and research”, and now has built its own R&D center, packing & column manufacture base and independent oil production & test base.

SL Tech provides both proprietary technologies and agent technologies required in coal chemical, petroleum chemical, and natural gas chemical industry. The proprietary technology packages cover the production of chemicals like alkyl-phenol and derivatives, acetates(including methyl acetate, ethyl acetate and iso-butyl acetate), MTBE, MIBK, dihyoxybenzene, trioxane, dioxolane, iso-butene and etc. While the agent technologies mainly lie in the plastics fields, including MMA technology, syngas to MEG technology, CO2-based biodegradable PPC technology, UHMWPE technology and UF/MF/PF glue resin technology.

Based on its R&D strength and its packing/column internals manufacture base, SL TEC also provides tailored chemical separation solutions, including the purification and separation of phenols and derivatives (gasified phenol, coked phenol, methyl phenol); the purification and separation of methanol, ethanol, dimethylcarbonate(DMC), methylal (also called dimethylmethane, DMM); the purification and separation of heavy aromatics; and the non-hydrogenation desulfurization and separation of petroleum and diesel.

We take providing engineered solutions in chemical separation as our mission, and keep innovative through R&D to supply long-term and satisfied technical support for our customers.

PHILOSOPHY

What we provide is not only a chemical plant, but also a package solution from chemical simulation, lab test and modification, pilot plant, to commercialized plant.

SHARE - HOLDING STRUCTURE

HUBEI SANLI FENGXIANG TECHNOLOGY CO., LTD.

JIANGXI WANNIAN ZEJUN ELECTRONIC MATERIAL CO., LTD.

HENAN BOJIE ENERGY TECHNOLOGY CO., LTD.

JINING DEHENG ENERGY CO., LTD.

JIANGSU HUDA CHEMICAL TECHNOLOGY CO., LTD.

ORGANIZATION STRUCTURE

Board of Directors

President

Foreign Business Dept.

Domestic Business Dept.

General Manager

Project Dept

Chief Engineer

Financial Dept

Procurement Dept.

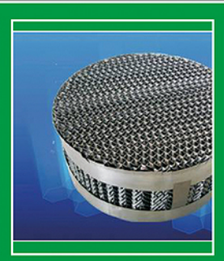
Administration & HR DEpt.

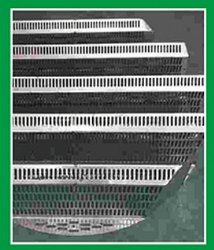
Group of Experts & Consultants

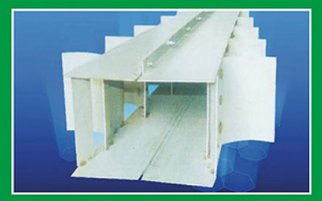
R&D Dept.

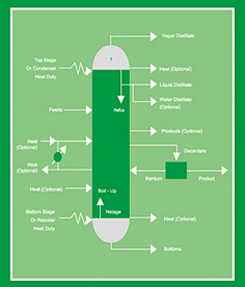
MANUFACTURE BASE OF COLUMN INTERNALS

SL TEC has its column internals manufacture base in Tianjin Hangong Technology Co., Ltd. to support the chemical separation business. It provides various packings, fillings, and column internals required in petroleum, chemical, air separation industries and etc. The products include gas-liquid separator, liquid distributor, metal screen corrugated packings, nested packing, air separation packing, demister, hump support, gas distributor, liquid collector, SS internal floating roof, aluminum alloy fastener ring, latticed shells and etc.









Process Simulation

Lab Test

Column Internal Design

Industrialized Plant

SL TEC R&D

SL TEC's core competency lie in its research center with the technical support from Tianjin University, whose chemical engineering center tops in China. The technology founders of SL TEC are well-known experts in the fields of chemical separation, especially chemical distillation., having provided distillation / absorption / disabsorption /extraction / heat exchange / scrubbing solutions for hundreds of chemical plants. The typical separation technologies SL TEC can provide includes:

Methanol Distillation System
Styrene Distillation System
Ethanol Distillation System
Polyol Separation System
High Purity Organic Silicone Separation System
DMC (dimethyl carbonate) Reaction Distillation System
Crude Benzene Purification System
Crude Phenol Separation System
Aniline Separation System
Phenol-Acetone Separation System
MEK(methyl ethyl ketone) Separation System
Purification System in POM plant
Organic Solvent Separation System
Organic Solvent Dehydration System
Diluted Formalin Recovery System
.....

OUR TEAM

PRESIDENT

ACHIEVEMENTS

- Inventor of over 90 patents;
- The inventor of the first PODEn technology based on formalin-methylal process in China;
- The inventor of the first high concentration methylal plant with proprietary intellectual right in China;
- The inventor of the first paraformaldehyde plant (Spray Dryer Process) with proprietary intellectual right in China;
- The inventor of the first high concentration(55-60%) formalin (Silver Contact Process) with proprietary intellectual right in China;

TECHNICAL TEAM

PM

Mr.Zhang Hongwei

Inventor of PODEn technology based on formalin-methylal process;
Project Manager of over 20 chemical plants;

ED

Dr Zhu Huaigong

PHD in both chemical simulation and equipment design;
Expert in Reaction-Distillation Technology;
Expert in DWC(Dividing Wall Column) Design;
Has successfully commercialized 7 new technologies for the first time in China.

R&D

Mr.Xu Yin

Inventor of PODEn technology based on paraformaldehyde-methylal process;
Inventor of Paraformaldehyde Technology based on Spray Dryer Process;

COMPANY DEVELOPMENT STRATEGY

- Based on proprietary technology license
- Backed by chemical production factories
- Providing tailored chemical separation solutions by the combination of chemical process simulation and lab R&D
- Dedicated to the promotion of China's advanced chemical technologies, especially in the polymer and monomer of new materials

SALES & SERVICE

1 Hubei Wuhan Office

2 Jiangsu Wuxi Office

3 Shanxi Yanan Office

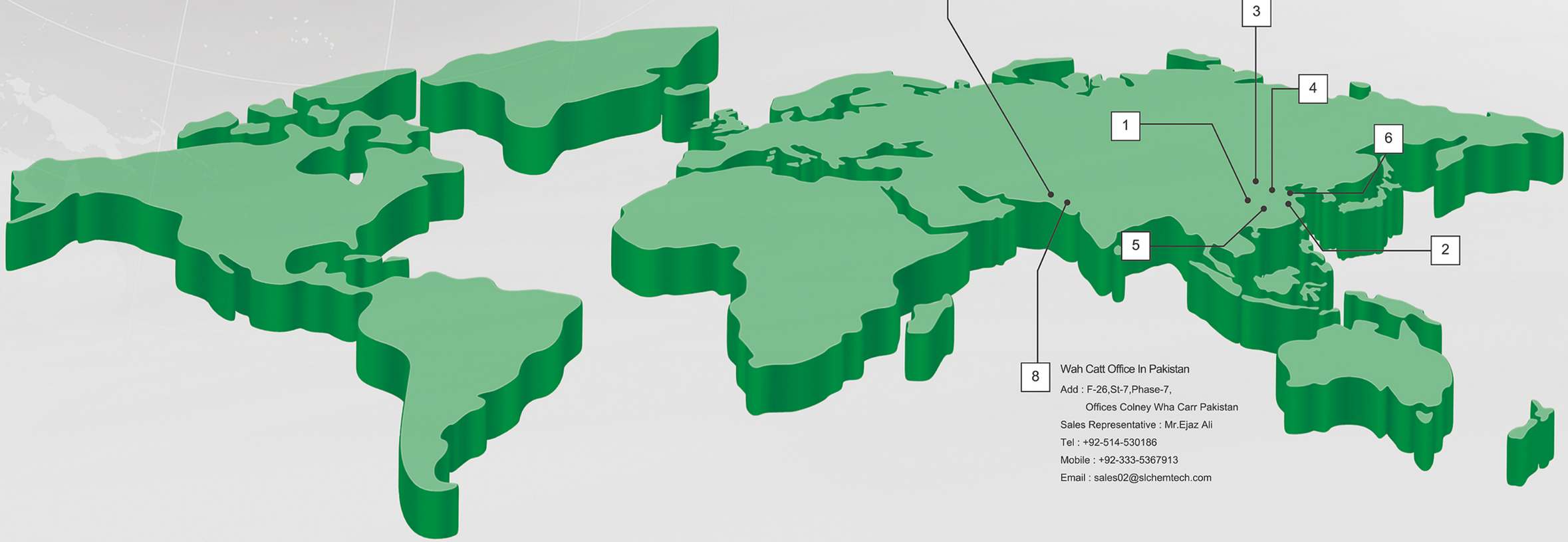
4 Henan Zhenzhou Office

5 Jiangxi Shangrao Office

6 Shandong Jining Office

7 Tehran Office In Iran

8 Wah Catt Office In Pakistan



PROPRIETARY TECHNOLOGY

01 - Phenol Alkylation Technology

Technology Introduction

Alkyl phenol is produced by the alkylation of phenol by reacting with olefin, aliphatic alcohol, or chloro-hydrocarbon. They are important intermediates for fine chemical synthesis, widely applied in the manufacture of surface active agent, anti-oxidation agent, paint and coating. SL TEC offers the technology of phenol's alkylation into o-cresol, and cresol's alkylation into 2-t-butyl-p-cresol, 6-t-butyl-m-cresol, 2,6-di-t-butyl-p-cresol, 2,3,6-trimethylphenol (2,3,6 - TMP) and etc.
Also SL TEC supplies the technology of producing m-cresol / p-cresol by the isomerization of o-cresol.

Technical Features

Hereinafter 2,3,6 -TMP production technology will be introduced as an example. 2,3,6 - TMP is mainly used in pharmaceutical industry to synthesize vitamin E; it is the monomer for the production of thermoresitant PPE engineering plastic and the feedstock for plastic alloy production; also 2,3,6 - TMP is the necessary intermediates for the manufacture of some pesticides, disinfectants and etc.
Compared to the process starting from phenol and methanol, SL Tec offers the one-step process starting from m-cresol and methanol under gas phase catalysis. The catalyst is based on Fe_2O_3, with the conversion of m-cresol reaching 98% and the yield reaching 98%

Performances

Product Specification Of 2,3,6-tmp

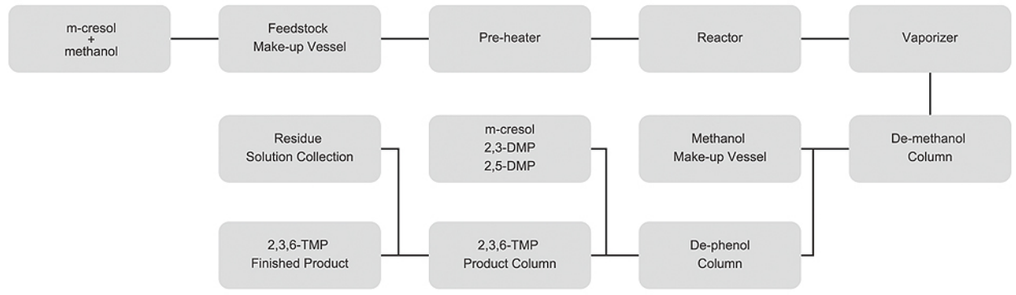
S / N	Item	Index
1	Appearance	Colorless or light yellow solid
2	Purity,% wt	99.5
3	Moisture,≤ % wt	0.3
4	Density(20 / 4℃),kg / L	169
5	Melting Point,℃	62.5~64.0

Performances

Specific Consumption

S / N	Item	Specification	Unit	Consumption Rate
1	RM & Auxiliaries			
1.1	m-cresol	≥ 99.5%	kg / mt of 2,3,6 - TMP	840
1.2	Methanol	First Grade	kg / mt of 2,3,6 - TMP	980
1.3	Catalyst		kg / mt of 2,3,6 - TMP	2.86
2	Fuel and Power			
2.1	Industrial Water		m^3 / mt of 2,3,6 - TMP	3.2
2.2	Circulating Water	Delta t=8oC	mt / mt of 2,3,6 - TMP	400
2.3	Electricity	380 / 220V,50HZ	kwh / mt of 2,3,6 - TMP	720
2.4	Steam	Low pressure, saturated steam	mt / mt of 2,3,6 - TMP	2.88
2.5	Instrumental Air	0.7Mpa, dew point - 25℃	Nm^3 / mt of 2,3,6 - TMP	3
2.6	Nitrogen	0.7MPa	Nm^3 / mt of 2,3,6 - TMP	3

Process Flow Diagram



02 - Methyl Acetate Plant

Technology Introduction

The methyl acetate production process SL TEC propose is based on the condensation of acetic acid and methanol over a solid acid catalyst. This kind of catalyst is the best solution when high yields, low acetic acid and methanol consumption, consistent product and low equipment corrosion are required on reliable basis. Under normal operation, this catalyst has an average service life of three years or longer.

The reaction conditions are moderate, however, as methyl acetate, methanol and water will form binary and tertiary azeotropic mixtures, it is very difficult to prepare high purity product by conventional methods.

In the traditional process, one reactor and nine distillation columns are required to produce high purity methyl acetate. And they have main disadvantages incl.

- The synthesis of methyl acetate is reversible, and due to the limitation of chemical equilibrium, the conversion yield is low.
- Methyl acetate-water binary azeotrope, methyl acetate-methanol binary azeotrope, and methyl acetate-methanol-water ternary azeotrope have boiling points quite close to that of azeotrope, thereby, it is difficult to separate and the product purification is very complicated.
- Large amount of non-reacted methanol and acetic acid are recycled in the system, which complicates the separation process and requires large equipment investment and results in high energy consumption

To solve the aforementioned problems, SL TEC has developed Reaction-Distillation Process. It integrates the reaction and separation, i.e., the reaction takes place at the same time as the non-reacted RM is separated from the product. In this way, the concentration of the product in the reactor is increased, thereby the reaction rate is boosted, moreover the incurrence of side reactions is inhibited due to the isolation of product out of the reactor in time. Thereby the conversion yield is effectively upgraded. Besides, the esterification heat is made use of as the heating source for vaporization to save energy consumption.The reaction conditions are moderate, however, as methyl acetate, methanol and water will form binary and tertiary azeotropic mixtures, it is very difficult to prepare high purity product by conventional methods.

In the traditional process, one reactor and nine distillation columns are required to produce high purity methyl acetate. And they have main disadvantages incl.

PROPRIETARY TECHNOLOGY

Technical Features

Reactive Distillation

Compared to the traditional separate reaction and distillation technology, REACTIONDISTILLATION has advantages as follows:

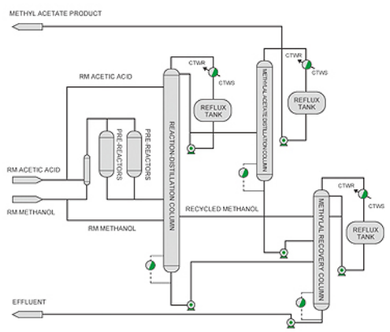
- High Selectivity: inhibiting side reactions
- High Conversion Yield: product continuously removed
- Low Energy Consumption: the reaction heat used as the heating source for vaporization
- Easy Control of Reaction Temperature: reaction heat consumed and temperature limited by vapor-liquid equilibrium
- Acetic acid is not only the RW but also the extraction agent to counter-flow extract water from the water-methyl acetate azeotrope, simplify the purification
- Low Investment: short synthesis and purification route, low equipment cost

Solid Acid Catalyst

Compared to the traditional sulfuric acid catalyst, ACID ION EXCHANGE RESIN has advantages :

- less side reactions higher selectivity
- Low corrosion low requirement for equipment MOC less investment
- simple post-treatment lower production cost
- rare pollution

Process Flow Diagram



Performance

S / N	Item	Consumption Rate
1	99.9% Methanol (mt / mt @ per ton of 99.5% methyl acetate)	0.44
2	99.8% Acetic Acid (mt / mt @ per ton of 99.5% methyl acetate)	0.81
3	Catalyst (m^3 for one load)	Depending upon the plant capacity
4	Steam (mt / mt @ per ton of 99.5% methyl acetate)	0.77
5	Electricity (KWH / mt @ per ton of 99.5% methyl acetate)	50
6	Circulating Water (mt / mt @ per ton of 99.5% methyl acetate)	90

03 - Iso-Butyl Acetate Plant

Technology Introduction

There are two prevailing processes for iso-butyl acetate (IBA) production, i.e. iso-butanol-acetic acid esterification process and n_butene_acetic acid addition process. Due to its much lower production cost, new IBA plants usually use the Addition Process, which is the very technology SL TECH provides. It consists of four units, feedstock purification unit, esterification unit, product separation unit and acetic acid recovery unit.

Compared to the Esterification Process, the Addition Process for IBA production has advantages such as shorter process flow, less equipment and lower production cost (50 - 60% of Esterification Process); lower energy consumption (only 5% of Esterification Process); easy operation, lower maintenance cost and lower operation cost; harmless and poisonless solid acid catalyst, less pollution, less equipment corrosion.

Technical Features

Fixed Bed Tubular Reactor

To ensure the separation effect in the reactor, a disc distributor is arranged at the feedstock inlet; to strengthen the heat exchange effect and better control the temperature in the catalyst bed, baffles are designed in the reactor shell side; to reduce the energy consumption, two pre-heating stages are designed, the first stage is the plate heat exchanger while the second stage is the tubular heat exchanger.

Modified Cation Exchange Resin Catalyst

The catalyst is high temperature resistant strong acid resin modified by metal chloride to prolongitself service life. Also after the modification, the conversion yield as weel as the selectivity will be increased at some extent.

PROPRIETARY TECHNOLOGY

Performance

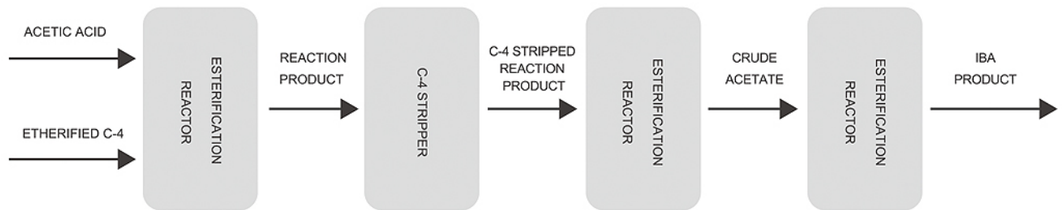
Product Specification

S / N	Item	Specification
1	Appearance (Pt - Co)	≦ 10
2	Density @ 20oC, g / cm3	0.860 - 0.878
3	Product Purity, wt %	≧ 97.5
4	Acidity as acetic acid, wt %	≦ 0.01
5	Water, wt %	≦ 0.1
6	C - 8, wt %	≦ 2.2
7	others	≦ 0.1

Specific Consumption

S / N	Item	Consumption Rate
1	Acetic Acid (mt / mt @ per ton of 97.5% IBA)	0.55
2	C - 4 (mt / mt @ per ton of 97.5% IBA)	0.6
3	Demineralized Water (mt / mt @ per ton of 97.5% IBA)	0.0031
4	Circulating Water (mt / mt @ per ton of 97.5% IBA)	75
5	Fresh Water (mt / mt @ per ton of 97.5% IBA)	0.14
6	Steam (1.5MPaG) (mt / mt @ per ton of 97.5% IBA)	3.7
7	Nitrogen (Nm^3 / mt @ per ton of 97.5% IBA)	0.71
8	Compressed Air & Instrumental Air (Nm^3 / mt @ per ton of 97.5% IBA)	6.6
9	Electricity (KWH / mt @ per ton of 97.5% IBA)	47
10	Esterification Catalyst (kg / mt @ per ton of 97.5% IBA)	0.55 (for one load)

Process Flow Diagram



PROPRIETARY TECHNOLOGY

04 - 1,3-Dioxalane Plant

Technology Introduction

As the second monomer for polyacetal(POM) production,1,3-dioxolane has attracted great attention in recent years due to the expansion of its application, such as the solvent for grease, dyes, cellulose derivatives, polymers and etc, the stabilizer for trichloroethane, components of photosensitiser. There are usually two processes for 1,3-dioxolane production, one uses paraformaldehyde and MEG as the feedstock, while the other starts from concentrated formalin and MEG. SL Tech has been specialized in dioxolane production since 2008 based on concentrated formalin and MEG. In detail, in presence of concentrated acid catalyst, enriched formalin and MEG reacts with each other @ 90-100oC atmospheric pressure, the resulting mixture is charged to Enrichment Unit, Extraction Unit, Heavy Components Distillation Unit and Light Components Distillation Unit in subsequence to get the finished 1,3-dioxolane product.

Technical Features

Compared to the other route beginning from paraformaldehyde and MEG, the process SL TEC provides has advantages as below:

1. It has no formalin polymerization, paraformaldehyde drying and aging units, thereby, the investment and the production cost is much lower.
2. It uses concentrated sulfuric acid as the catalyst, which has a higher conversion yield.

Performance

Product Specification

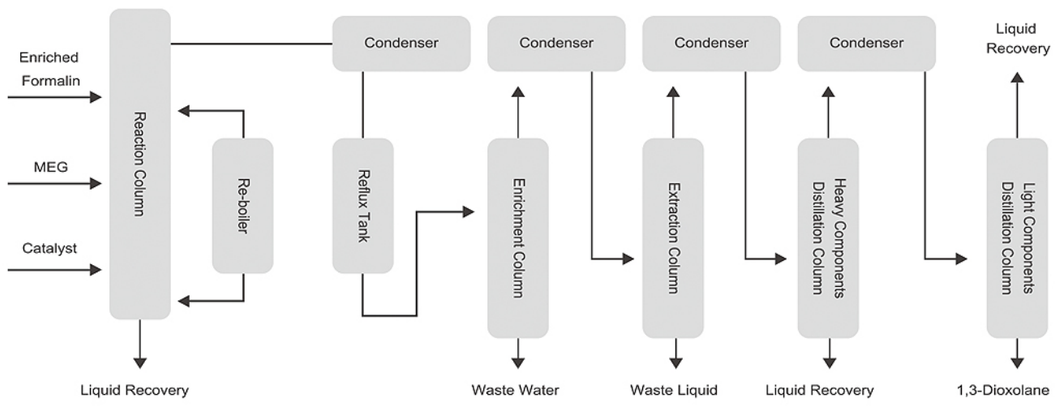
S / N	Item	Index
1	Purity % ≧	99.9
2	Acidity ppm ≦	10
3	Moisture ppm ≦	50
4	Peroxide ppm ≦	30
5	Non-volatile matter mg / 100mL	25
6	Color (Pt - Co) ≦	10

Performance

Specific Consumption

S / N	Item	Consumption Rate
1	37% formalin (mt / mt of 99.9% 1,3 - dioxolane)	1.3
2	99% MEG (mt / mt of 99.9% 1,3 - dioxolane)	0.66
3	Electricity (KWH / mt of 99.9% 1,3 - dioxolane)	20
4	Steam (mt / mt of 99.9% 1,3 - dioxolane)	2
5	Acid Catalyst (mt / mt of 99.9% 1,3 - dioxolane)	/
6	40% Sodium Hydroxide (mt / mt of 99.9% 1,3 - dioxolane)	0.3

Process Flow Diagram



PROPRIETARY TECHNOLOGY

05 - Trioxane Plant

Technology Introduction

Trioxane is the most important monomer for polyacetal(POM) synthesis, POM production technology with trioxane as the copolymerization monomer takes 80% of the total POM capacity in the world. It is usually synthesized by enriching 37% formalin to about 65% and then by oxidation in presence of acid catalyst such as sulfuric acid. The production consists of formalin enrichment, trioxane synthesis, trioxane enrichment, extraction, light components stripping and heavy components stripping.

Technical Features

In trioxane production, one of the biggest problem is that a large amount of steam will be consumed by formalin enrichment and the treatment of diluted formalin generated from formalin enrichment. To solve this problem, SL TECH proposes to oxidize methylal into high concentration formalin(75%) directly instead of synthesis plus enrichment., and meanwhile the formalin generated from trioxane enrichment can be charged back to the methylal synthesis unit. In this way, a closed circuit system is formed.

Also for those manufacturers with formalin as the only feedstock, SL TEC has the propriatary license to provide a special falling film vaporizer to enrich formalin to 78%-80%, and enrich the diluted formalin by-product by customized distillation.

Performance

Product Specification

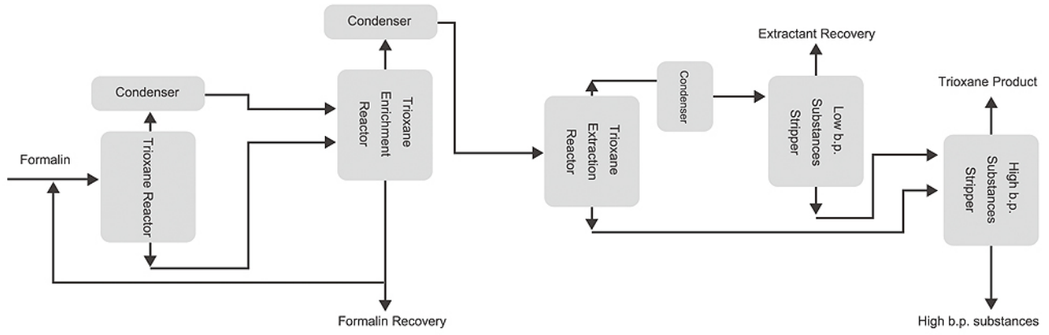
S / N	Item	Index
1	Purity% ≧	99.9
2	Moisture ppm ≦	50
3	Formic Acid ppm ≦	30
4	Methanol ppm ≦	30

Performance

Specific Consumption

S / N	Item	Consumption Rate
I	Raw Material & Auxiliaries	
1	Methanol (mt / mt of 99.9% trioxane)	1.33
2	Benzene (kg / mt of 99.9% trioxane)	4
3	Sodium Hydroxide (25%) (kg / mt of 99.9% trioxane)	0.325
4	Catalyst (kg / mt of 99.9% trioxane)	0.336
II	Utilities	
1	Circulating Water (mt / mt of 99.9% trioxane)	6.1
2	Demineralized Water (mt/hr)	Only used during the plant start-up
3	Circulating Cooling Water (delta t = 10oC)	Covered by electricity consumption
4	Instrumental Air (Nm^3 / mt of 99.9% trioxane)	160
5	Nitrogen (Nm^3 / mt of 99.9% trioxane)	42.6
6	Process Air (Nm^3 / mt of 99.9% trioxane)	73.7
7	Steam (mt / mt of 99.9% trioxane)	5.89
8	Electricity (KWH / mt of 99.9% trioxane)	758

Process Flow Diagram



PROPRIETARY TECHNOLOGY

06 - MTBE Plant

Technology Introduction

MTBE is produced by the etherification of methanol and mixed C - 4 (including iso-butene) in presence of acid catalyst. Depending on the different etherification reactor, there are mainly 6 MTBE production processes, i.e., Fixed Bed Reaction Process, Expansion Bed Reaction Process, Catalysis-Distillation Reaction Process, Expansion Bed-Catalysis Distillation Reaction Process, Mixed Phase Reaction Process and Mixed Phase Reaction Distillation Process.

SL TEC offers Catalysis Distillation Reaction Process for MTBE production. This process combines mixed phase reaction with separation, blends the advantages of mixed phase reaction technology and that of catalysis distillation technology, which ensures in deep conversion (conversion yield reaching about 99%).

Technical Features

Compared to the other MTBE production processes, the Catalysis Distillation Reaction Process has the following features:

1. Separation takes place simultaneously with the reaction, which increases the conversion yield.
2. The energy consumption is greatly reduced.
3. The production cost is also decreased.

Performance

Product Specification

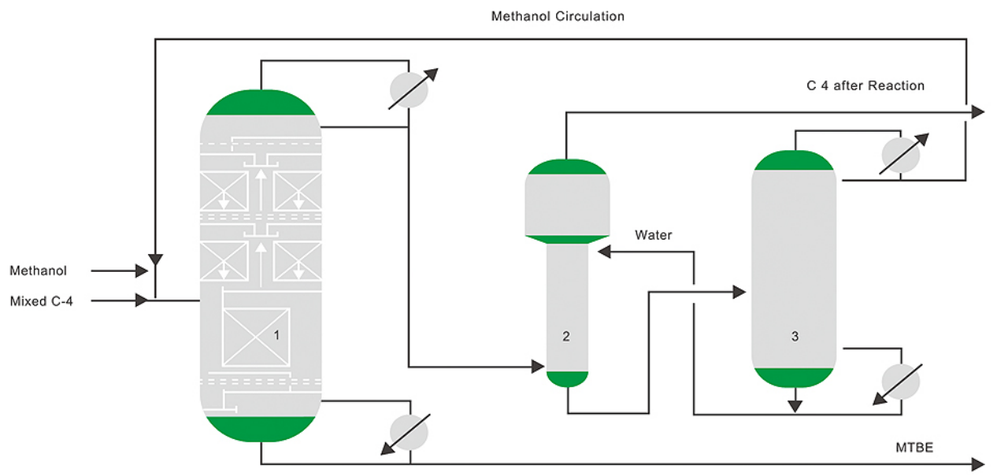
S / N	Item	Index
1	MTBE (deducting C - 5 and over C - 5 components), % wt	≥ 98
2	C - 4, % wt	≤ 0.5
3	Methanol, % wt	≤ 0.5
4	Tert - Butyl Alcohol (TBA)	0.4 - 0.8

Performance

Specific Consumption

S / N	Item	Consumption Rate
1	Mixed C - 4 (incl. 22.74% iso - butene)(mt/mt of 98% MTBE)	4.74
2	Methanol (mt/mt of 98% MTBE)	0.4
3	Catalyst	Depending upon the plant capacity
4	Circulating Water (mt / mt of 98% MTBE)	71.4
5	Electricity (KWH / mt of 98% MTBE)	31.6
6	Steam (mt / mt of 98% MTBE)	1.37

Process Flow Diagram



07 - MIBK Plant

Technology Introduction

MIBK is an excellent solvent with medium boiling point, it can be used as the solvent for paint, nitrocellulose, ethyl cellulose, tape, wax and several resins; a;lso it is widely used as the dewaxing agent, extraction agent, the RM for antiaging agent synthesis and etc.

The MIBK production processes include iso-Propanol Process, Acetone Three-Step Process and Acetone One-Step Process, there advantages and disadvantages are described as below and SL TEC offers the most advanced Acetone One-Step Process.

Production Process	Advantages & Disadvantages	Status
Iso-Propanol Process	It is the earliest process for MIBK production.Its disadvantages include: The availability of the iso-propanol feedstock is limited; The production cost is relatively higher; The by-product amount is large;	It has been phased out
Acetone Three-Step Process	This process has the following advantages: The intermediate/product from every step (methyglyoxal, mesityl oxide, MIBK) can be as the finished product for sales, thereby the production is quite flexible; The catalyst used in every step has good activity and selectivity; The reaction conditions are relatively mild; The operation is easy. However, its disadvantages lie in long process flow, high investment and high production cost.	This process has been successfully industrialized for many years, and up to now it is still one of the main MIBK production processes.
Acetone One-step Process	The advantages of this process include short process flow, less investment, higher conversion yield and low energy consumption,	It is the most competitive and the most prospective process.

Technical Features

Compared to the other two processes, Acetone One-step Process makes use of high performance catalyst to finish acetone condensation, dehydration, hydrogenation and etc. by one step to get MIBK. Also the catalyst has excellent temperature-resistance and can be used in a relatively wide temperature range, thereby the plant normal running period is long.

PROPRIETARY TECHNOLOGY

Performance

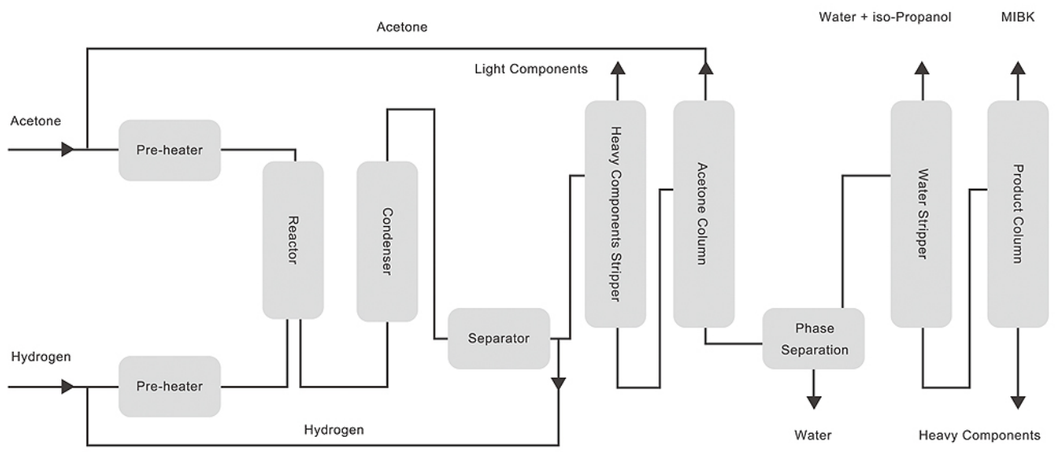
Product Specification

S / N	Item	Index
1	Color, hazen unit (Pt - Co)	10
2	Density (20oC), g / cm^3	0.800 - 0.803
3	Moisture, % wt	0.1
4	Acidity (as per acetic acid), % wt	0.01
5	Boiling range (0oC, 101.3kp), ℃	114 - 117
6	Evaporation Residue, mg / 100mL	5
7	MIBK Content, % wt	99.5

Specific Consumption (Comparison With Other Processes)

S / N	RM Consumption	Acetone Three - Step Process	Veba Acetone One - Step Process	Taxac Acetone One - Step Process	SL TEC Process
1	Acetone (mt / mt of 99.5% MIBK)	1.42	1.33	1.35	1.318
2	Hydrogen (Nm^3 / mt of 99.5% MIBK)	674	590	502	447
3	Cooling Water (mt / mt of 99.5% MIBK)	579	100	100	60
4	Process Water (mt / mt of 99.5% MIBK)	0.417	--	--	--
5	Electricity (KWH / mt of 99.5% MIBK)	309	450	550	340
6	Steam (Nm^3 / mt of 99.5% MIBK)	12.13	4.36	4.9	4.1

Process Flow Diagram



08 - Crude Phenol Purification Technology

Technology Introduction

Phenols have a variety of compounds, with the most important ones incl. phenol(carbonic acid), and cresol(o-cresol, m-cresol and p-cresol); among them, phenol is mainly used as the feedstock for di-phenol A production and phenol formaldehyde production; o-cresol is widely used in the synthesis of resin, pesticide, medicine, perfume, dyes, antioxidant and etc.; m-cresol is an very important feedstock for the production of Vitamin E; p-cresol is widely applied in the synthesis of BHT, the most employed antioxidant in the world.

SL TEC offers the technology of crude phenol purification with the phenol either from coking phenol, or gasified phenol or alkylation liquid.

Technical Features

In the traditional crude phenol purification process, usually water removing, residue removing, phenol purification units in batch are involved to separate and purify phenol, cresol and other products. In this batch production, the intermediate distillate between adjacent components requires repeated rectification to increase the yield, thereby the productivity is low, the energy consumption is low and only suitable for small production capacity; in addition, as the phenol products have certain heat sensitivity, the repeated heating not only decreases the total yield but also results in the unstable product quality. While SL TEC provides a technology based on the achievements by cooperation with Tianjin University. It is based on continuous vacuum distillation, uses DCS control system to optimize operation. Its advantages include the followings:

1. The yield and the product quality is obviously advanced.
2. Thks to the auto-protection and chain shutdown system, the production is very stable, the product quality is also stable and the production flexibility is big.
3. It successfully separates sulfuric acid and heavy components phenol to realize the 100% recovery of sulfuric acid, thereby the consumption is largely reduced; meanwhile graphite reactor and glamel reaction equipment are employed, which avoids the corrosion of sulfuric acid catalyst to the equipment and therefore decreases the equipment investment.

Performances

Product Specification

Phenol Specification

S / N	Item	Index
1	Crystallization point, ℃	40.6
2	Solubility Test [(1 + 2) Absorbance]	0.03
3	Moisture, % wt	0.1

PROPRIETARY TECHNOLOGY

Performances

Cresol Specification

Product Specification

S / N	Item	Index		
		o - Cresol	m - Cresol and p - Cresol	Industrial Cresol
1	Appearance	White to light tawny crystal	Colorless to brown transparent liquid	Colorless to chocolate - brown transparent liquid
2	Density @ 20oC, g / cm^3	-	1.03 - 1.04	1.03 - 1.05
3	Moisture, %wt ≤	0.3	0.3	1
4	Neutral Oil Test (Turbidimetric method), # ≤	2	10	10
5	Phenol content, % wt ≤	-	5	-
6	o - cresol, % wt ≥	99	-	-
7	2,6 - Xylenlo, %wt ≤	-	-	-
8	m - Cresol, % wt ≥	-	50	41
9	Cresol + Xylenlo, % wt ≥	-	-	60
10	Tricresol, % wt ≤	-	-	5

Note 1: in liquid state, o - cresol is colorless or slightly colored transparent liquid

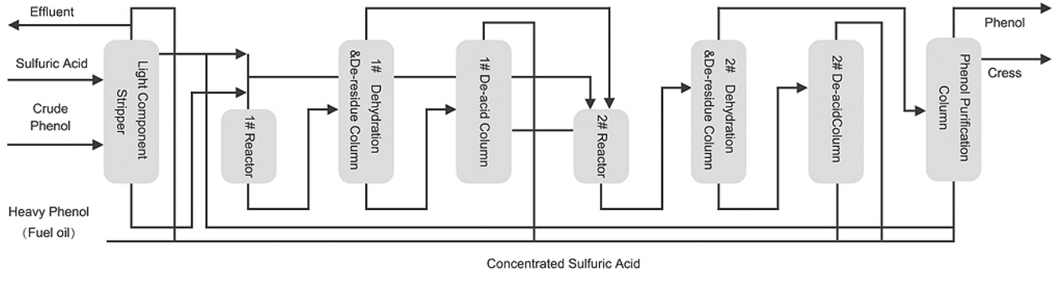
Note 2: cresol includes all isomers of C_7H_8O; xylenlo includes all isomers of $C_8H_{10}O$.

Note 3: tricresol includes all isomers of $C_9H_{12}O$.

Performances Of 40,000TPA Phenol Purification Plant

S / N	Item	Unit	Index	Remark
I	Production Capacity			
	Crude Phenol Purification Plant	kt / a	40	
II	Product Plan			
1	Phenol	t / a	3030.48	
2	Cresol	t / a	19288.8	
3	Fuel Oil	t / a	13564.08	
III	Annual Running Days	days	300	7200 hrs
IV	Consumption of RM and Auxiliaries			
	Crude Phenol	t / a	37677.6	outsourcing
V	Consumption of Utilities			
1	Fresh Water	t / a	82034	Living and others
2	Electricity (10kV / 0.4kV / 220V)	kWh / a	355.68×10^4	
3	Natural gas	Nm^3 / a	622.08×10^4	

Process Flow Diagram



AGENT TECHNOLOGY

01 - Hydrogen Peroxide Plant

Technology Introduction

There are several methods for hydrogen peroxide production, among them the AO (auto-oxidation) process is the most prevailing one. In this process, 2-alkyl anthraquinone is mixed with organic solvent to make up the working solution, which is hydrogenated in presence of catalyst, and the resulting is oxidized by air (or oxygen) in counter-current way before being extracted, regenrated, purified and enriched to get commercial hydrogen peroxideproduct. Depending upon the different reactor type in the hydrogenation unit, AO process is further divided into Fixed Bed Reactor Process and Fluidized Bed Reactor Process. SL Tec provides both processes.

The Fluidized Bed Reactor Process SL TEC offers uses heavy aromatics-TBU binary solvent in the working solution(WS) system, with the WS capacity (H_2O_2 - kg / m3 - WS) reaching 12g / L.

Technical Features

The Fluidized Bed Reactor Process has the following advantages:

1. It enables much larger production capacity, i.e. over 200,000TPA as per 100% hydrogen peroxide for one production line.
2. The WS capacity is as high as 12g / L; 35-40% hydrogen peroxide can be directly collected from the extraction column; the total yield reaches up to 97%.
3. Both material consumption and energy consumption are reduced, thereby the production cost is lower.
4. Due to the absence of potassium carbonate drying column and relating control problems, the process flow is shorted, the product quality is better and more favorable for the production of high purity hydrogen peroxide, like food grade and electronic grade.

Performances

Product Specification

Item	Index		
	Superior Grade	First Grade	Acceptable Grade
Hydrogen Peroxide Content / % ≥	50.0	50.0	50.0
Free Acid (as per sulfuric acid) / % ≤	0.04	0.06	0.12
Non-volatile Matter Content / % ≤	0.08	0.12	0.24
Stability / % ≥	97.0	97.0	97.0
Appearance	Colorless transparent		

Performances

Specific Consumption

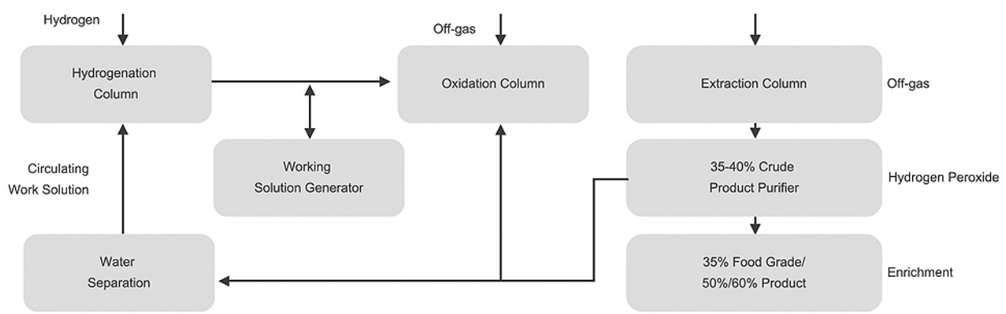
Specific Consumption Based On Per Ton Of 27.5% Hydrogen Peroxide

S / N	Item	Unit	Consumption Rate
1	Anthraquinone	kg	0.195
2	TBU	kg	0.22
3	Heavy Aromatics	kg	0.22
4	Hydrogen	Nm^3	198
5	2% Pd Catalyst	g	5.5
6	Alumina	kg	0.96
7	Steam	kg	138
8	Electricity	kwh	193
9	Water	t	5

Specific Consumption Based On Per Ton Of 50% Hydrogen Peroxide

S / N	Item	Unit	Consumption Rate
1	Anthraquinone	kg	0.35
2	TBU	kg	0.4
3	Heavy Aromatics	kg	0.4
4	Hydrogen	Nm^3	360
5	2% Pd Catalyst	g	10
6	Alumina	kg	1.75
7	Steam	kg	250
8	Electricity	kwh	350
9	Water	t	9

Process flow diagram



AGENT TECHNOLOGY

02 - MMA Plant

Technology Introduction

There are three prevailing processes for MMA, or methyl methacrylate production, C-2 Process starting from ethylene, methanol and formaldehyde, C-3 Process (also called as ACH Process) which uses the byproduct of HCN from acrylonitrile production as the feedstock, and C-4 process which uses isobutene or tertiary butanol as the feedstock. SL TEC provides MMA plant based C-4 Process, consisting of three working units, i.e. oxidation unit, distillation unit and esterification unit.

The comparison of different process is reported as below. Though each process has its own advantages, when the plant capacity is lower than 100,000TPA, C-4 Process is the most economic and therefore more recommended.

MMA Process Comparison

	C2 process	C3 process	C4 process
Feed	The ethylene, methanol, and formaldehyde can be used as the feed	It is required to use the byproduct of the HCN from acrylonitrile unit as the feed	Isobutene or tertiary butynol (TBA) as the feed, which is easy to access
Investment cost	High	High	Comparatively low
Environmental impact & Safety performance	Environmentally-friendly	The treatment cost of the ammonium bisulfate-contained sewage is pretty high and is harmful to the environment	Environmentally-friendly

Technical Features

The MMA plant offered by SL TEC has advantages such as easy availability of feedstock, more environment friendliness, lower investment, lower production cost and etc.

Performances

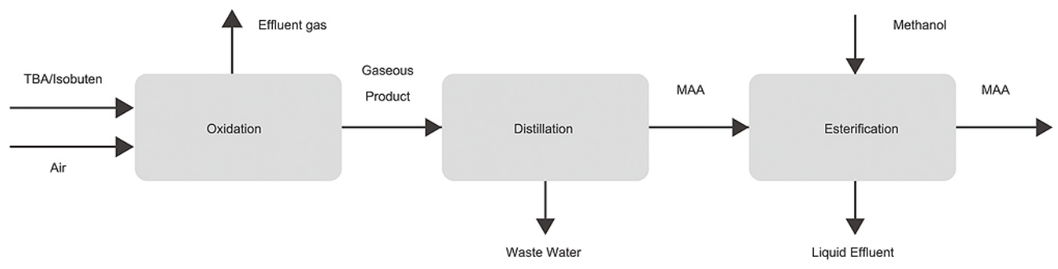
Product Specification

S / N	Item	Index
1	Purity, wt %	≥ 99.9
2	Colour, APHA	≤ 10
3	Water Content, wt %	≤ 0.05
4	Acidity, wt %	≤ 0.005
5	Polymerization Inhibitor, ppm	10

Specific Consumption

S / N	Item	Consumption Rate
1	Tertiary Butanol (TBA), mt / mt of MMA	14.2
2	Methanol, mt / mt of MMA	3.35
3	Polymerization Inhibitor, kg / mt of MMA	30
4	De-foaming Agent, kg / mt of MMA	5
5	Extraction Solvent, kg / mt of MMA	32
6	Steam (3.6MPaG, 350oC) , mt / mt of MMA	19.2
7	Demineralized Water, mt / mt of MMA	2.56
8	Service Water, mt / mt of MMA	1.2
9	Cooling Water, mt / mt of MMA	5522
10	Low Temp. Water (5 - 10oC) , mt / mt of MMA	1869
11	Low Temp. Water (15 - 20oC) , mt / mt of MMA	73.6
12	Electricity, KWH / mt of MMA	3200
13	Instrument Air, Nm^3 / mt of MMA	472
14	Compressed Air, Nm^3 / mt of MMA	160
15	Nitrogen(0.5MPaG), Nm^3/mt of MMA	89.6

Process Flow Diagram



AGENT TECHNOLOGY

03 - MEG Plant

Technology Introduction

There are two main routes for Ethylene Glycol (Monoethyle Glycol / MEG) production: one is the Olefin / EO (Ethylene Oxide) Route starting from either naphtha, ethane or methanol, the licensors include Shell, SD, UCC and etc. And the other is the DMO (dimethyl oxalate) Route newly emerged in China these years, starting from syngas. Depending upon the difference operation pressure, this DMO Route is further divided into Normal Pressure Process and Medium-High Pressure Process.

SL TECH offers the most advanced and the most competitive Medium - High Pressure DMO Process for MEG production. Its production cost is much lower than that of Olefin / EO Process at the current low oil price (i.e., USD 67 / BBT), not to mention the Normal Pressure DMO Route.

Technical Features

The MEG plant provided by SL TEC has advantages as follows:

1.The pressure of the carbonylation unit is increased to 2.0 - 3.0MPa, about 5 - 7 times the conventional process, thereby the diameter of main equipment and pipes are reduced by 2 - 2.5 times.

2.The carbonylation reactor is changed from tubular type to plate type, whose heat transfer effect is increased by one time, the catalyst loading coefficient increased by over 60%, the STY (Space-to-Time Yield) more than doubled, which allows the large scale of each production line.

3.The catalyst has better selectivity, higher conversion yield and longer service time (over 2 years)

4.The CAPEX of the carbonylation unit is reduced by 50%, while the investment of the carbonylation unit takes 40% of the total investment.

Performances

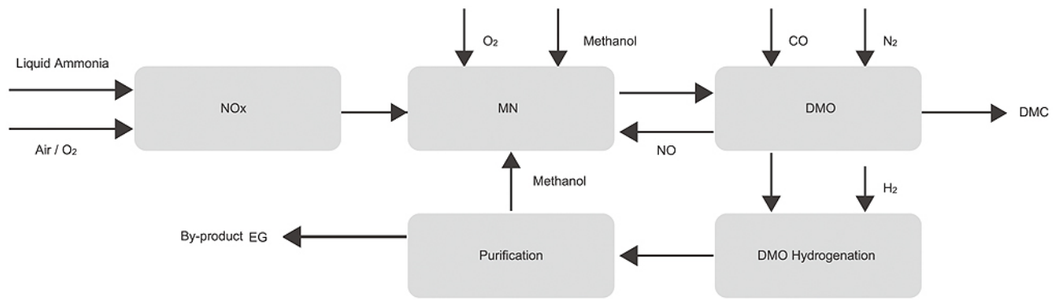
Product Specification

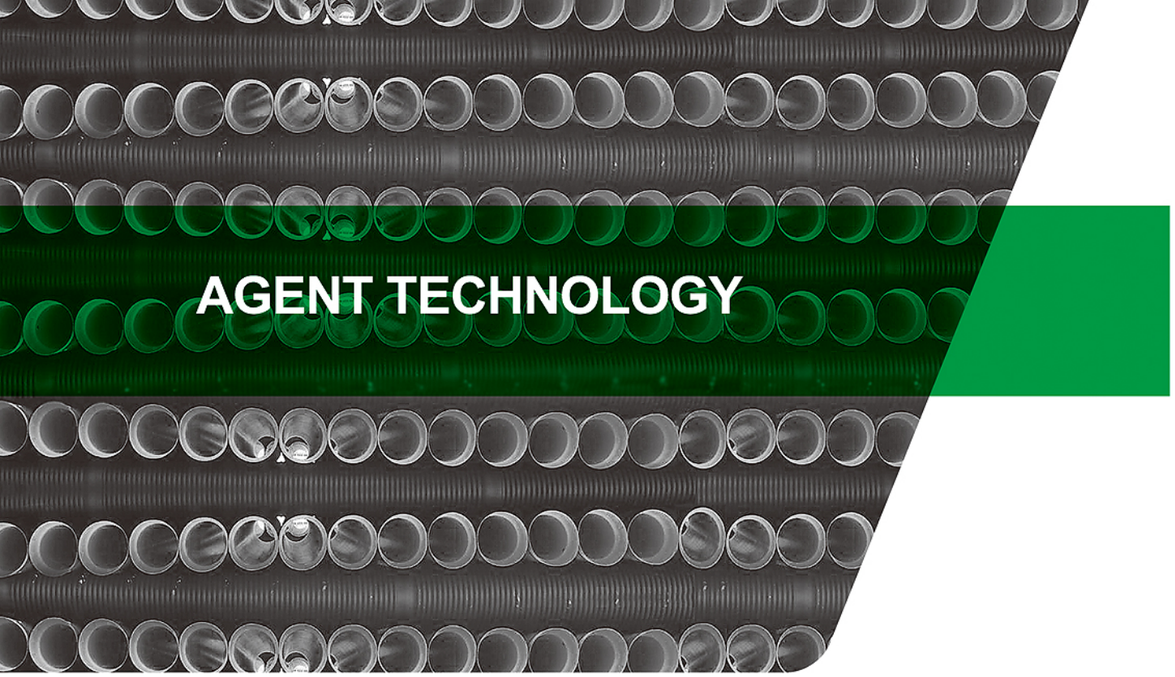
S / N	Item	Quality Specification
1	Visual apprearance	Clear and colorless liquid, mechanical impurities free
2	MEG, wt %	≥ 99.8
3	Color (Pt / Co)	
	Before heating	≤ 5
	After heating with HCl	≤ 20
4	Specific gravity @ 20oC, g / cm^3	1.1128 - 1.1138
5	Water, wt %	≤ 0.1
6	Boiling Range (at 0oC, 0.10133MPa)	
	IBP	≥ 196
	FBP	≤ 199
7	Acidity as Acetic Acid, wt %	≤ 0.001
8	Aldehyde as formaldehyde, wt %	≤ 0.0008
9	Iron as Fe_2+, ppm wt	≤ 0.07
10	Ash, wt %	≤ 0.001
11	UV transmission, %	
	220nm	≥ 75
	275nm	≥ 92
	350nm	≥ 99

Specific Consumption

S / N	Item	Consumption Rate
1	CO, Nm^3 / mt of EG	780
2	H_2, Nm^3 / mt of EG	1580
3	O_2, Nm^3 / mt of EG	186
4	Methanol, kg / mt of EG	20
5	Liquid Ammonia, kg / mt of EG	2
6	Steam, mt / mt of EG	3.6 - 4.3
7	Electricity, KWH / mt of EG	240
8	Circulating water (delta = 10oC), mt / mt of EG	380
9	Water, mt / mt of EG	5

Process Flow Diagram





AGENT TECHNOLOGY

04 - UHMWPE Plant

Technology Introduction

Ultra high molecular weight polyethylene (hereinafter called as UHMWPE) is a linear structural polyethylene (PE) with viscosity-average molecular weight of more than 1,000,000 (ordinary polyethylene molecular weight is only about 200,000-300,000).The high relative molecular weight, which has given its extraordinary performance, and makes it a new type of high performance thermoplastic engineering plastics. Due to its high molecular weight, UHMWPE almost has integrated the advantages of all kinds of plastic, with common polyethylene and other engineering plastics incomparable corrosion resistance, impact resistance, self lubrication, corrosion resistance, low temperature resistance, health non-toxic, no adhesion, non water absorption and other comprehensive performance. Especially in the transmission of solid particles, powder, slurry and gas, UHMWPE has shown a unique superiority，thereby it is called as“amazing plastic”.

SL TEC offers the technology to continuously produce UHMWPE by ethylene polymerization. The UHMWPE plant is composed of catalyst preparation unit ,polymerization unit ,the drying unit and separation unit, product transportation and storage units, product packaging unit, solvent recovery unit, exhaust gas treatment unit, chilled water unit, cooling water unit, the soft water preparation unit, compressed air and instrument air units.

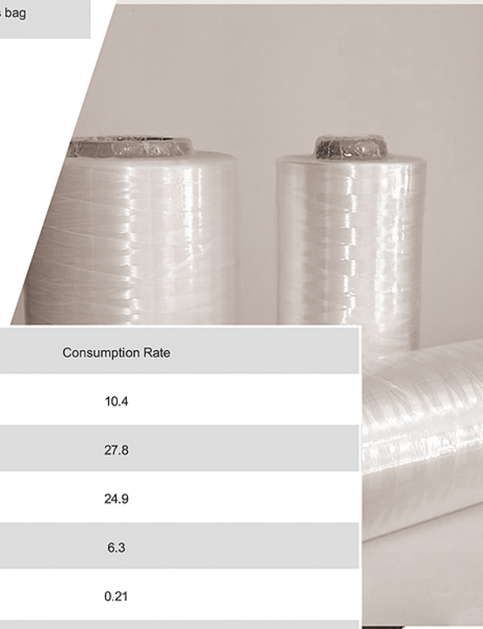
Technical Features

The UHMWPE production process adopts the method of low pressure and low temperature continuous polymerization technology，which is the most advanced in the industry. The advantages of this method include stable product quality, high yield, low energy consumption, low pollution, safe and reliable. All product grades can meet the current market demand for fiber grade, film grade and 9,000,000 molecular weight grade.

Performances

Typical Product Specification

S / N	Item	1 #	2 #	3 #
1	Average Molecular Weight (Million)	900	450	380
2	Bulk Density (g / Ml)	0.38 - 0.55	0.38 - 0.52	0.38 - 0.52
3	Tensile Strength (Mpa)	0.4 ~ 0.62	0.22 - 0.31	0.1 - 0.22
4	Charpy Notched Impact	≥ 150		≥ 160
5	Battery Limit Conditions	25 / 500	25 / 500	25 / 500
		kgs bag	kgs bag	kgs bag



Specific Consumption

S / N	Item	Consumption Rate
1	Ethylene, mt / mt of UHMWPE	10.4
2	Hexane, kg / mt of UHMWPE	27.8
3	Hydrogen, kg / mt of UHMWPE	24.9
4	Water, mt / mt of UHMWPE	6.3
5	Steam (over 1.2MPa) , mt / mt of UHMWPE	0.21
6	Electricity, KWH / mt of UHMWPE	236
7	Nitrogen, Nm^3 / mt of UHMWPE	83

AGENT TECHNOLOGY

05 - PPC Plant

Technology Introduction

PPC (polypropylene carbonate) is a completely biodegradable environment-friendly plastic synthesized from carbon dioxide and propylene oxide. Besides, due to its using the main source of greenhouse gases---CO_2 as the feedstock, PPC not only reduces the emission of greenhouse gases, but also reduces the consumption of fossil fuel. Compared to the degradable PLA (polylactide), it has advantages of high strength, good ductility, lower production cost and etc. PPC polyol with low molecular weight are used to replace conventional petroleum-based polyether, polyester and polycarbonate polyols, while PPC with high molecular weight are employed as film products, oxygen barrier material, injection molding material and etc., especially in package industry and agriculture.

SL TEC offers high molecular weight PPC production technology, with the development history as below:

In 1998, the research of CO_2 based plastic began;

In 2001, the first over 1,000TPA PPC pilot line was built and successfully accepted;

In 2012, 30,000TPA PPC production line was built and successfully put into production;

In 2013, the technology was upgraded to increase the molecular weight to 300,000;

In 2016, a 30,000TPA PPC plant using new technology is under construction

Technical Features

1.The number-average molecular weight of PPC using our technology reaches about 100,000, achieving the most advanced level in the world.

2.The tertiary catalyst ensures shorter polymerization time, i.e., 8 hrs, and within 8 hours the catalyst activity can reach a very high level.

3.For the production of per ton of PPC product, about 0.45-0.5 mt of carbon dioxide will be consumed. It not only makes use of the CO_2, but also the PPC product is completely biodegradable and thereby reduces “white pollution”.

Performances

Product Specification

S / N	Item	Index
1	Appearance	White or colorless transparent granule
2	Density	1.24 - 1.27g / cm^3
3	Number-Average Molecular Weight	200 - 300kg/mol
4	Glass Temperature	35 - 39
5	CO_2 content by weight	40 - 42%（wt）
6	5% decomposition temperature	> 230°C
7	processing temperature	140 - 190°C
8	Moisture Content	< 0.3%（wt）
9	Ash	< 1000ppm
10	Biogradability	Under forced composting, will be decomposed within 3 months

Product Mechanical Properties And Transparency

Density (g / cm^3)	Melting Index (g / 10min)	Tg (°C)	Tensile Strength (MPa)	Tensile Modulus (MPa)	Elongation at break (%)	Impact Strength (g)	Transmittance
1.25 - 1.30	0.2 - 10	35 - 38	40 - 45	1000	15 - 20	<35	94 - 95%
20°C	160 oC,2.16Kg	DSC 100C / min	20oC,50mm / min	20oC,50mm / min	20oC,50mm / min	20oC,falling dart impact	0.2mm film, 400-800nm

Specific Consumption

S / N	Item	Specification	Consumption Rate
1	Catalyst, kg / mt of PPC	99.95%	20
2	Propylene Oxide (PO), mt / mt of PPC	Superior Grade	0.6
3	Carbon Dioxide, mt / mt of PPC	Food Grade	0.48
4	Acid, kg / mt of PPC	Superior Grade	27
5	Dichloromethane, kg / mt of PPC	First Grade	1.6
6	Calcium Hydroxide, kg / mt of PPC	Industry Grade	8
7	Circulating Water, mt / mt of PPC	Delta temp. 8oC	240
8	Chilling Water, mt / mt of PPC	Delta temp. 5oC	80
9	Demineralized Water, mt / mt of PPC	<1000ppm	0.8
10	Electricity, KWH / mt of PPC	380V	3,200
11	Steam, mt / mt of PPC	1.0MPaG	0.8
12	Instrumental Air, Nm^3 / mt of PPC	0.7MPaG	16
13	Nitrogen, Nm^3 / mt of PPC	0.7MPaG	1.6

AGENT TECHNOLOGY

06 - Urea Formaldehyde (UF) Glue Plant

Technology Introduction

The Urea Formaldehyde (UF) technology provided by SL TEC is based on the traditional alkali-acid-alkali process. It consists of three steps: Hydroxymethylation--under neutral or slight alkali conditions, urea and formaldehyde have hydroxymethylation reaction; Polycondensation-- condition the pH of the reaction solution to slight acid, the reaction mixture have polycondensation to reach a certain molecular weight; Temperature Reducing--condition the pH of the reaction solution back to slight alkali, and reduce its temperature to room temp. to get the preliminary condensed solution.

Technical Features

Our UF(MUF) Technology has the following features:

- The Glue Workshop has been designed in a 2-floor steel structure, and installation materials incl. pipe, pipe fittings and etc. will be saved by 20%.
- Urea is directly sent by the Urea Conveyor from the first floor to the reactor, the urea hoisting is saved, thereby the labor strength is largely reduced, i.e. the material feeding time is reduced by about 30 minutes; also the production safety is largely improved.
- Full-auto control has been used to ensure the operation stability and thereby increase the glue product quality.
- We have learned lessons from both the plate reactor and jacket reactor, and designed a reactor with new structure, it has features like higher pressure resistance, less weldings, less glue coating and higher cooling efficiency. In details, SS heat exchange coils are equipped inside the Reactor while CS semi-tube heat exchanger is designed outside the Reactor. In this way, the production volume has been increased, and internal and external heat exchanger can work at the same time to ensure temperature rising/decreasing promptly. Besides, due to the smaller heat transfer area inside the Reactor, the incurrence of glue hanging on the inner face can be reduced.

1.Turbo agitator is selected to hoist the solid particles without settling urea and other particles, which makes the liquid in the reactor rolling and mixed more homogeneously.

2.The tertiary catalyst ensures shorter polymerization time, i.e., 8 hrs, and within 8 hours the catalyst activity can reach a very high level.

3.For the production of per ton of PPC product, about 0.45-0.5 mt of carbon dioxide will be consumed. It not only makes use of the CO2, but also the PPC product is completely biodegradable and thereby reduces “white pollution”.

Performances

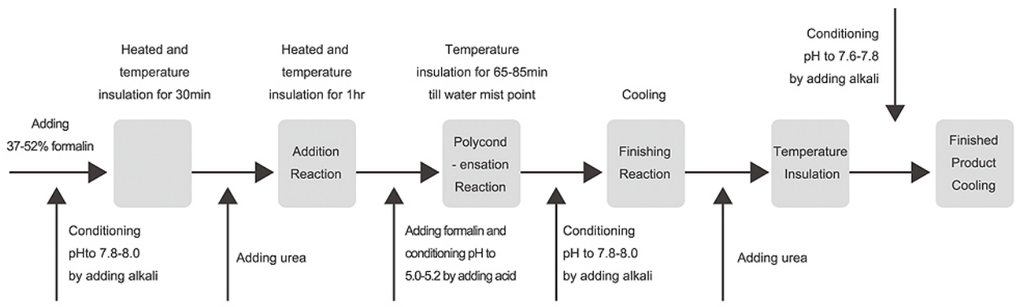
Product Specification: As Per Chinese National Standard GB / T14732-2005

Index	Unit	Resin Purpose				
		For cold lamination	For plywood and block board	For Particleboard	For MDF, HDF	For impregnation
Appearance		Colorless, white or light yellow foreign matters free homogeneous liquid				Transparent foreign matters free liquid
pH		7.0-9.5				
Solid Content	%	≧ 55.0		≧ 46.0		40.0 - 50.0
Free Formaldehyde Content	%	≦ 2		≦ 0.3		≦ 0.8
Viscosity	mPa.s	≧ 300		≧ 60		≧ 20
Curing Time	s	≦ 50.0		≦ 120.0		-
Working Life	min			≧ 120		
Adhesive Strength	MPa	≧ 1.9	As per GB / T98468.2-1988	-	-	-
Internal Bond Strength	MPa	-	-	As per GB / T4897.3-2003	As per GB / T1178-1999	-
Wood Formaldehyde Release Amount	Dryer Method (mg / L)	As per GB / T18580.5-2001				
	Poration method (mg / 100g)					
Remark		The appearance, pH and curing time is not adaptable to modified UF glue				

Specific Consumption

S / N	Item	Consumption		
		E1 Grade Fiberboard Glue	E1 Grade Particleboard Glue	E1 Grade Plywood Glue
1	37 % formaldehyde	0.565t	0.580t	0.565t
2	Urea N46	0.435t	0.407t	0.405t
3	Melamine	-	0.0125t	0.030t
4	Water	2t	2t	2t
5	Electricity	14KWH	14KWH	14KWH
6	Steam	0.06t	0.06t	0.06t

Process Flow Diagram



TYPICAL PROJECT

Crude Cresol Purification Project and Cresol Alkylation Project
Anhui Fulltime Special Solvent Holdings Co., Ltd.

Anhui Fulltime is a company dedicated to the R&D, manufacture and sales of high purity solvent and high purity phenol. Their high purity phenol series products include high purity phenol, o-cresol, m-cresol/p-cresol, dimethylphenol, m-cresol, antioxidant BHT (2,6-di-t-butyl-4-methyl-phenol) and etc.

In 2014, SL TEC has built a crude phenol purification plant for Fulltime depending upon its experienced capability in chemical process simulation and the R&D results obtained in Fulltime's factory. This plant has been using coked crude phenol as the feedstock, which has to be dehydrated and deslagging. In 2016, SL TEC offered to revamp this plant by changing the feedstock from the coked crude phenol to the post-treatment phenol mixture, which not only simplify the phenol purification route, but also reduces the generation of effluent.

Immediately after the finishing of this project, SL TEC has continued to revamp their phenol alkylation plant from the Sulfuric Acid Catalyzed Batch Process to Solid Acid Catalyzed Continuous Process, which not only solved the corrosion problem and the solid acid & effluent treatment problem caused by sulfuric acid, but also improved the alkylation conversion yield as well as the selectivity.

Besides, in 2016, SL TEC has taken to build a new m-cresol and p-cresol separation plant, 2,4-dipentylphenol plant, 4-tert-octylphenol (also called as p-t-octylphenol) plant, 2,4-dicumyl phenol plant and 2-cumy-octylphenol plant.

REFERENCE PLANT

Reference List (2011 - 2016)

S / N	Client	Project	Time
01	Fuhua Tongda Agro-Chemical Technology	Diluted Formalin Recovery Plant	2016
02	Anshan Futang Chemical Co., Ltd.	30,000TPA Crude Phenol Purification Project	2016
03	Anhui Shilian Special Solvent Holdings Co., Ltd.	8,000TPA Alkylated Liquid Separation Project	2016
04	Zhencheng Dingmin Chemical Technology Co., Ltd.	30,000TPA Crude Benzene Hydrogenation Project	2014
05	Shijiazhuang Dingying Chemical Holdings Co., Ltd.	Iso-butyl Acetate Plant Revamping Project	2014
06	Nanjing Refinery Factory	Revamping of Normal Pressure Column and Vacuum Column	2014
07	Chongqing Jingwei Xinneng Biotechnology Co., Ltd.	10,000TPA Bio-diesel Technology and Industrial Application	2014
08	Shanxi Huaxin Fertilizer Holdings Co., Ltd.	Three columns incl. purification column	2014
09	Wannian Jinze Electronic Materials Co., Ltd.	20,000TPA Methyl Acetate Project	2013
10	Tangshan Sanfu Holdings Co., Ltd.	Trichlorosilane Revamping Project	2013
11	Jiangsu Yongpeng Technology Industry Co., Ltd.	20,000TPA Benzene Purification Project	2013
12	Heze Yuandong Qiangya Chemical Technology Co., Ltd.	30,000TPA Crude Benzene Hydrogenation Project	2013
13	Dalian Kaifei Chemical Holdings Co., Ltd.	2,000TPA Agrochemical	2013
14	Tianjin Jitai Technology Co., Ltd.	100,000TPA Hydrogenated Solvent Oil Project	2012
15	Shandong Chenyao Chemical Technology Co., Ltd.	200,000TPA Crude Benzene Hydrogenation-Purification Project	2012
16	Tianjin Jitai Technology Co., Ltd.	100,000TPA Pentane Separation Plant	2012
17	Beijing Hongyueshun Chemical Factory	20,000TPA Crude Benzene Hydrogenation Purification Project	2012
18	Anhui Sinobest Chemical Technology Co., Ltd.	Solvent Recovery Project	2011
19	Zhejiang Huahai Pharmaceutical Co., Ltd.	Ethyl Acetate Plant and Methanol Purification Plant	2011
20	Chifeng Guoneng Chemical Technology Co., Ltd.	60,000TPA Crude Benzene Purification Project	2011
21	Chifeng Guoneng Chemical Technology Co., Ltd.	20,000TPA Crude Phenol Purification Project	2011
22	Yashentech Corporation (Shanghai R&D Center)	De-ammonia Column and DME Purification Column of 10,000TPA DMC Project	2011
23	Tianjin Sipuruifu Technology Co., Ltd.	Acetic Acid Column, Dehydration Column	2011
24	Hunan Xiangwei Co., Ltd.	100,000TPA PVA Solvent Recovery Project	2011
25	China Tianchen Engineering Corporation	55,000TPA BDO Project	2011
26	Zhenjiang Jiangnan Chemical Co., Ltd.	50,000TPA Trichlorosilane Distillation Device	2011
27	Anseteel Group Corporation	Coke Tar Recovery Project	2011
28	Wanhua Chemical Group Co., Ltd.	Reaction Emission Scrubbing Column	2011
29	Shana Synthetic Rubber Co., Ltd.	Acetylene Water-Cooling Column	2011
30	Wanhua Chemical Group Co., Ltd.	Reforming Gas Scrubbing Column and etc.	2011
31	Beijing Huafu Engineering Co.	300,000TPA Methanol Distillation Plant	2011
32	Beijing Huafu Engineering Co.	300,000TPA Methanol Distillation Plant	2011
33	Zhejiang Fushite Special Silicon Material Co., Ltd.	Light/Heavy Components Removing Column	2011
34	Taizhou Jianye Chemical Co., Ltd.	Acetone Column, iso-Propanol Column and etc.	2011