



聚友化工
JOYOU CHEM.

JOYOU Chemical Technology and Engineering Co., Ltd.



May. 2014



Contents



Chapter I Brief Introduction

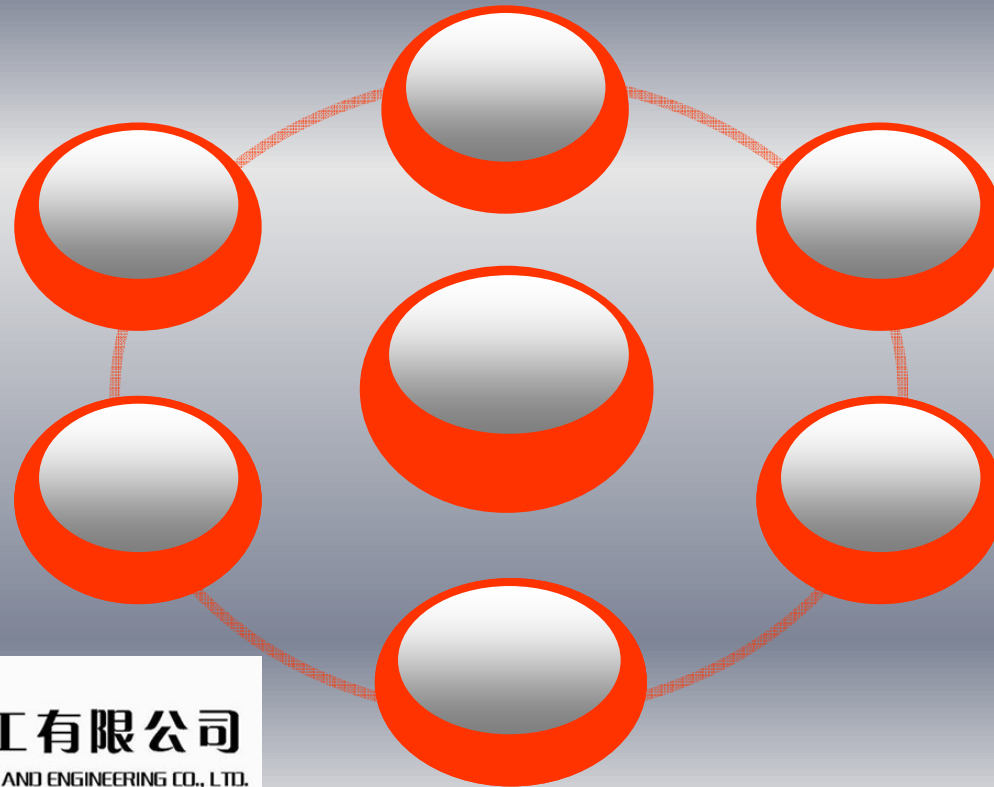
Chapter II Development of Technology

Chapter III Equipment Quality Guarantee System

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Brief Introduction

- ◆ **JOYOU Chemical Technology and Engineering Co., Ltd.** (JOYOU Chem.) is a TECHNOLOGY company with engineering ability, specialized in development and integration of Technology & Engineering in polymerization field of PET, PBT & PBS used for fibers, bottles, sheet & container, packaging films and Nylon engineering plastics.
- ◆ JOYOU Chem. is capable of providing customer with a complete set of services, from process technology, engineering design, equipment procurement, construction supervising, start-up and performance guarantee based on CP of PET, PBT & PBS, including recycle of waste materials emerged from the process.
- ◆ JOYOU Chem. is also a supplier of technological package.



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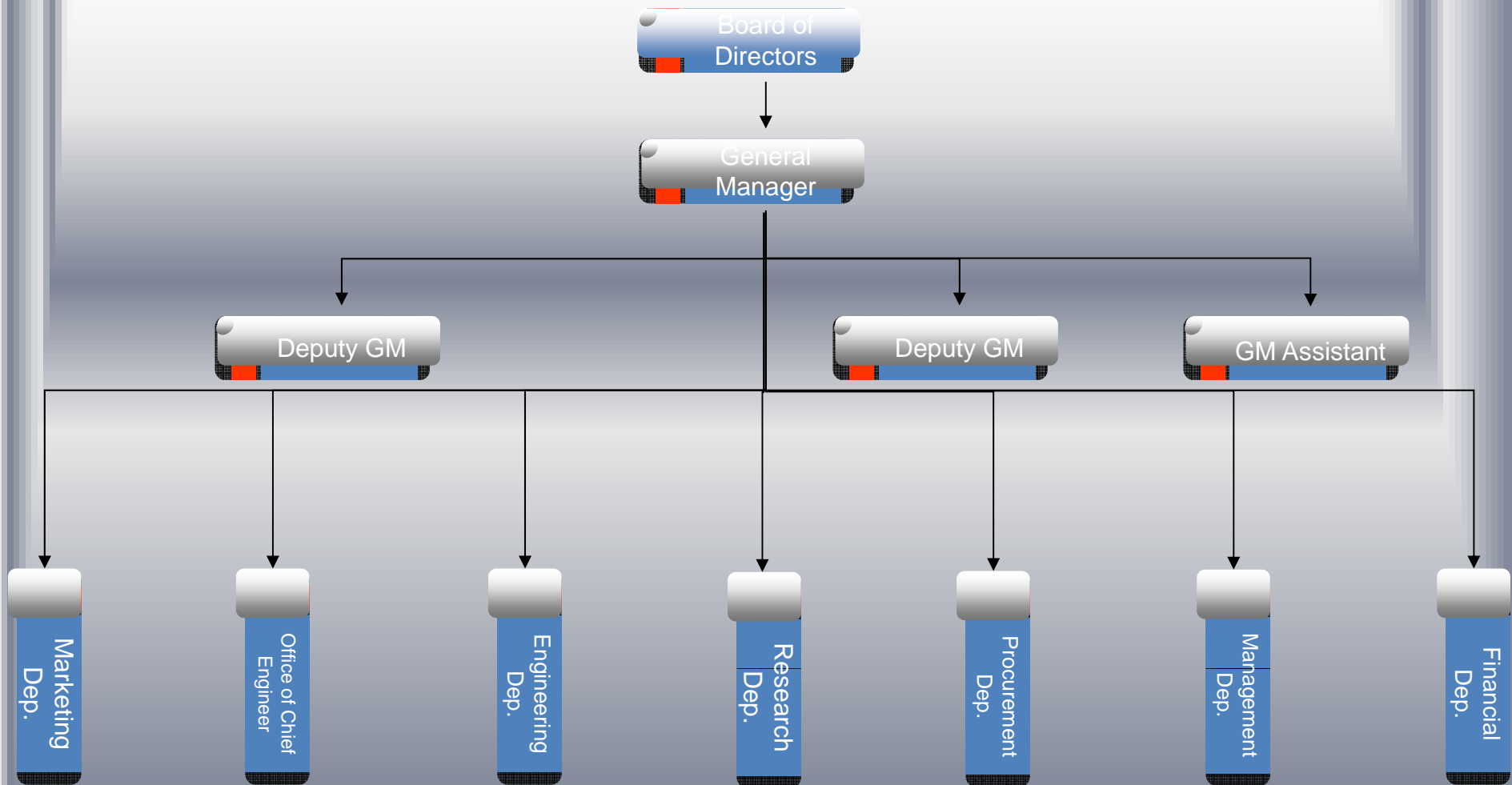
JOYOU CHEMICAL TECHNOLOGY AND ENGINEERING CO., LTD.

Brief Introduction

- ◆ JOYOU Chem. is a subsidiary of China Textile Academy (abbr. CTA) which was founded in 1956 and affiliated to the Ministry of China Textile Industry.
- ◆ CTA is the largest, comprehensive R & D institute in China Textile Industry and the powerful State-owned enterprises group.
- ◆ CTA has been directly under leadership of the China central Government since 1999 and become a partner of China General Technology (Group) Holding, Limited since 2009.



Structure

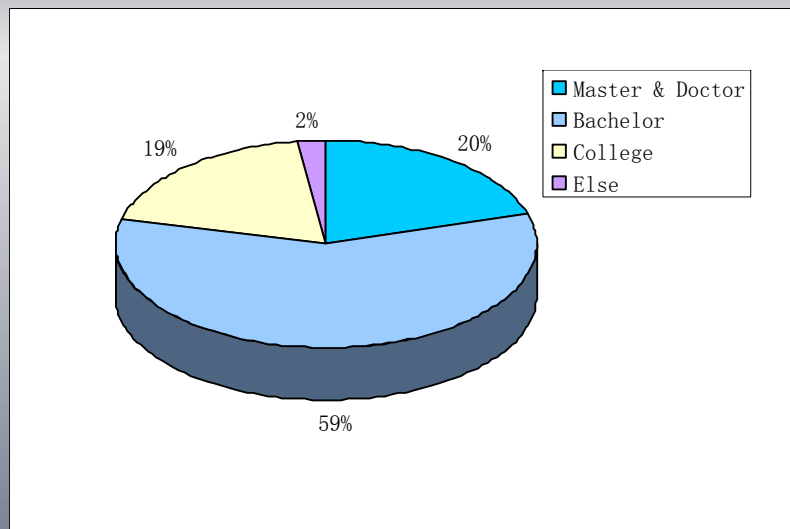


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JOYOU CHEMICAL TECHNOLOGY AND ENGINEERING CO., LTD.

Team work

- ◆ JOYOU's team possesses experts with versatile talents in various fields, including engineering design, process optimization, equipment innovation, system control, R & D of new products, plant start-up and test on chemical and mechanical properties of products.



- ◆ 98% of employees are from university & college of which 20% are with Master & Doctorial degree, 59% are with BS degree.
- ◆ The technical team consists of 80% Engineers and technicians (for process, mechanics and design), and 20% research fellow. Such a composition ensure the company continuous innovation ability.



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SUMEC-CEEC

SUMEC Specialize in Project Contracting

- SUMEC Group Corporation (SUMEC), founded in 1978, the key member company of SINOMACH-China National Machinery Industry Corporation, is working as partner of JOYOU for CP projects overseas, and is mainly dealing with commercial, finance, project management, logistics etc.
- SUMEC is also specialized in contracting for various kinds of projects all over the world, such as power plant, waste water treatment plant, chemical plant, etc.

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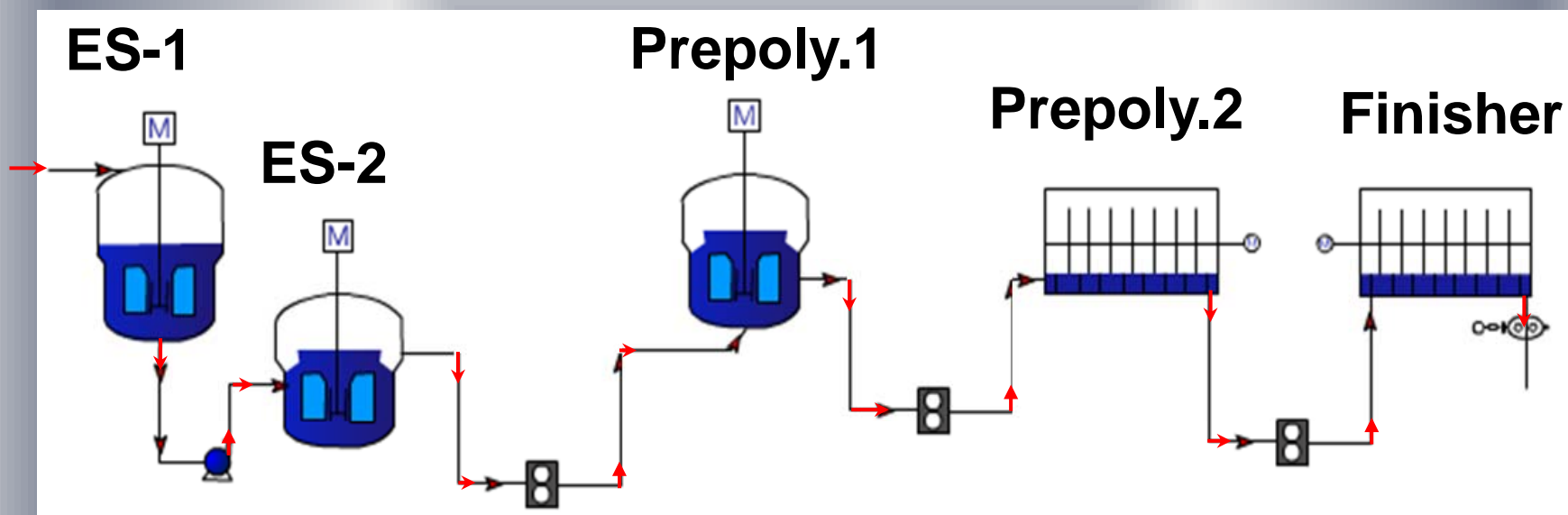


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Comparison between 3-reactor and 4-5 reactor

1. 4 & 5-reactor process: Low temperature, long resident time



Disadvantage: Long process-higher energy consumption
Long resident time-low equipment efficiency
More equipments & moving parts-high running cost

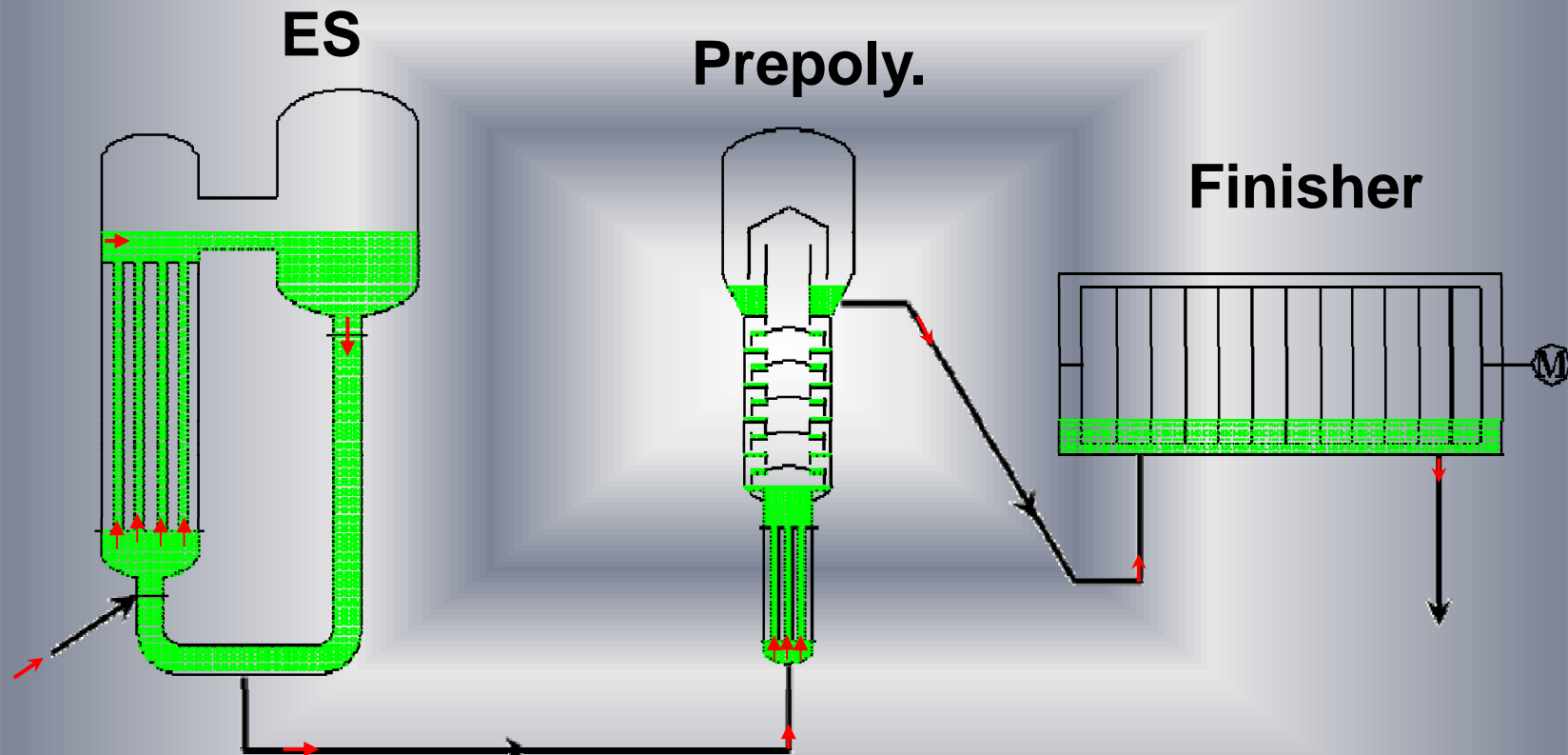


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Comparison between old and new 3-reactor

2. Old 3-reactor process: "High temperature, short process"



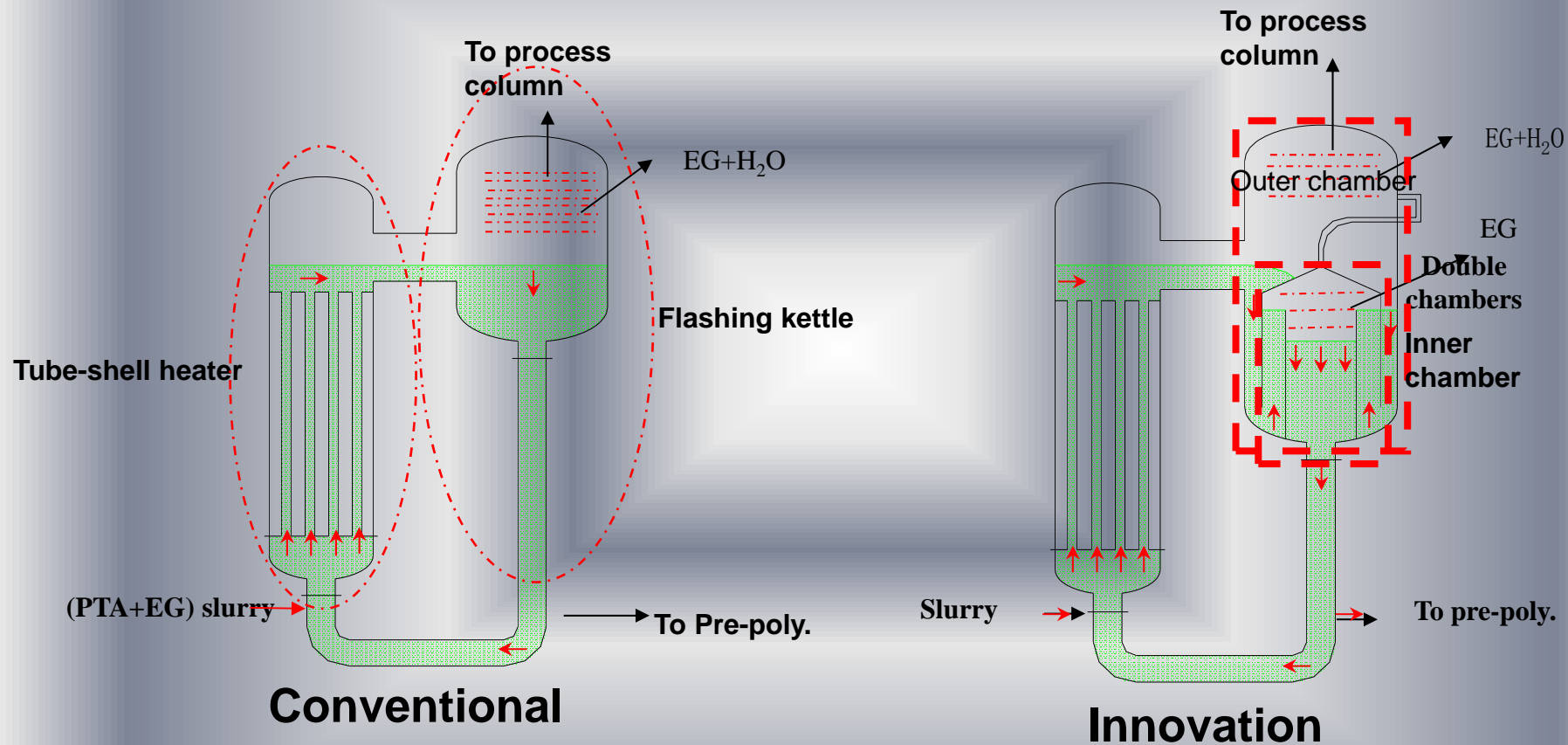
Disadvantage: high reaction temperature, more side reaction & by-products and high consumption of raw materials



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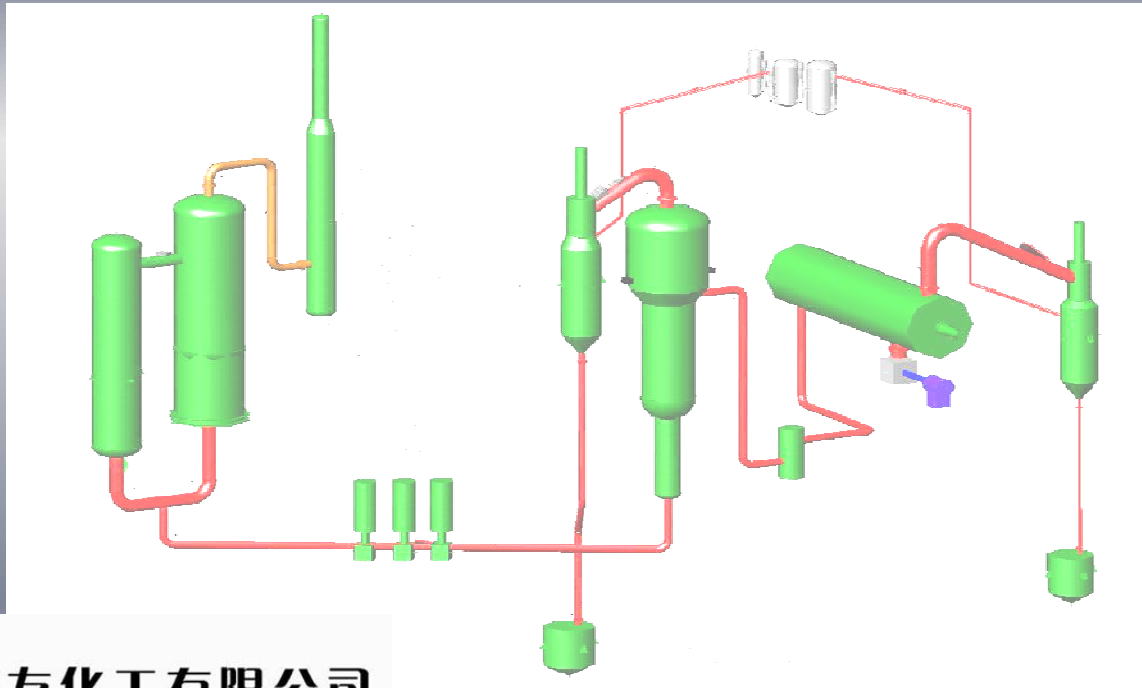
JOYOU CHEMICAL TECHNOLOGY AND ENGINEERING CO., LTD.

JOYOU Esterification reactor working process



JOYOU Chem. CP Technology

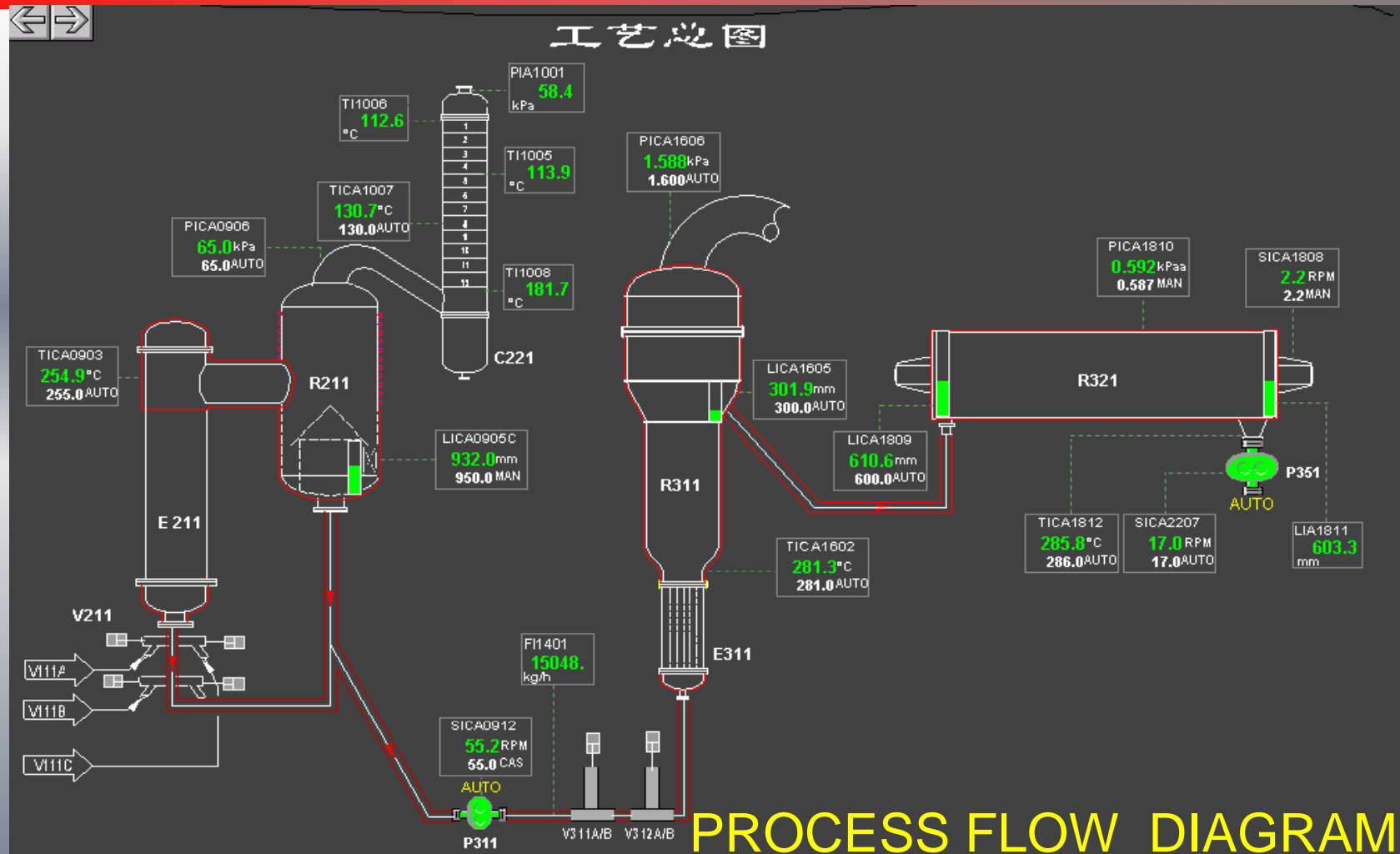
- ◆ International leading CP system with three (3) reactors—low temperature short process, saving energy and reducing emission, compared to old 3-reactor.
- ◆ Additives feeding into oligomer pipeline brings up the minim of waste materials during change of product variety in the production line.
- ◆ All the EG emerged during reaction are recycled.
- ◆ No waste water in vacuum system using EG vapor jet pump, avoiding choking.



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Technology Characteristics



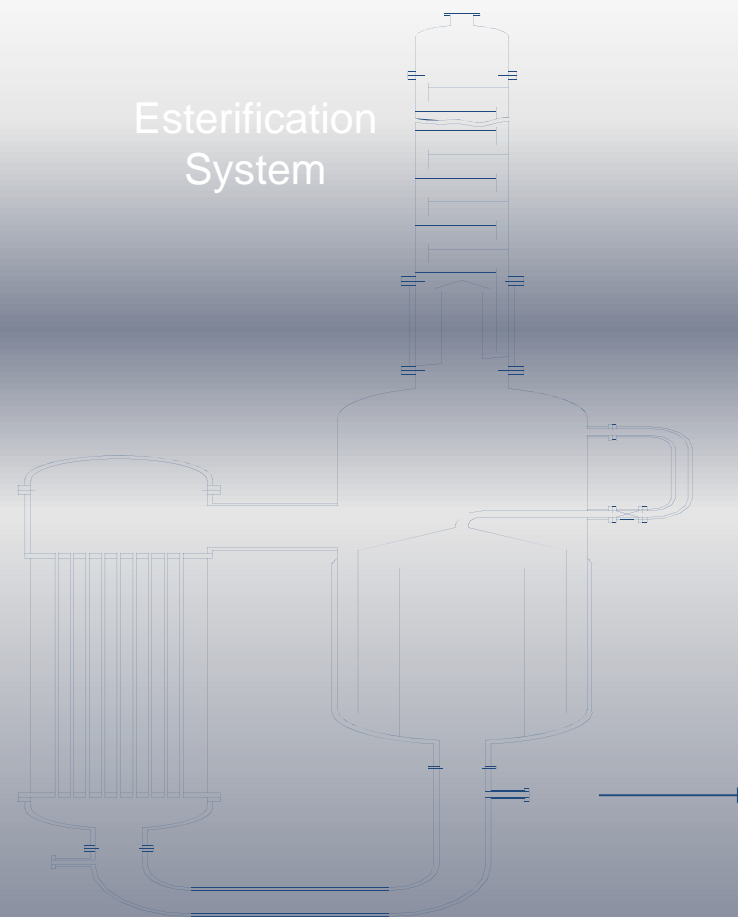
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The esterification reactor with double-chamber and extrinsic circulation is a patented unit developed by JOYOU Chem. of CTA. Esterification temperature is low (260°C-270°C) and there is no any mechanical moving parts inside reactor.

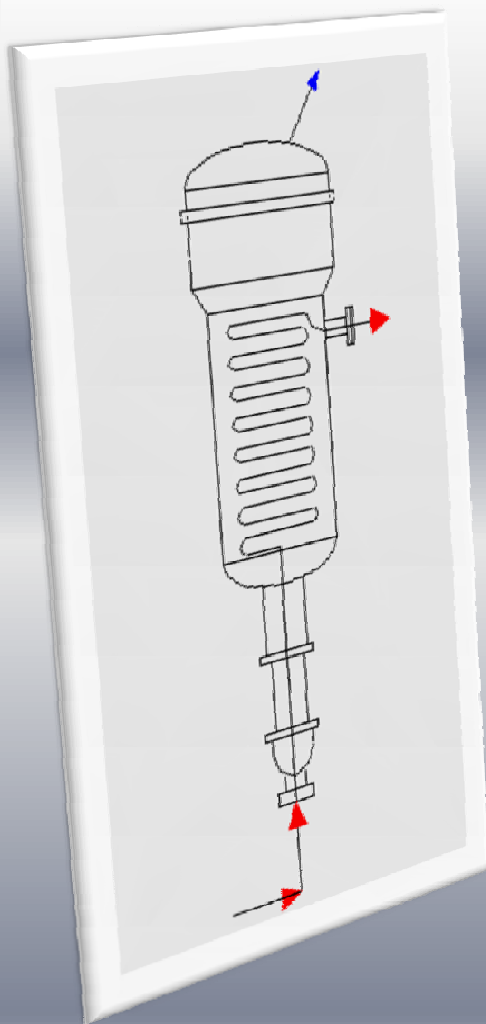
International Patent:
PCT WO2004/098760;
USA Patent:
USP 7708 952 B2



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JOYOU Chem. CP Technology



The pre polycondensation reactor is a tower up-flow unit with plug flow of reaction materials and there is no mechanical moving parts inside the reactor.



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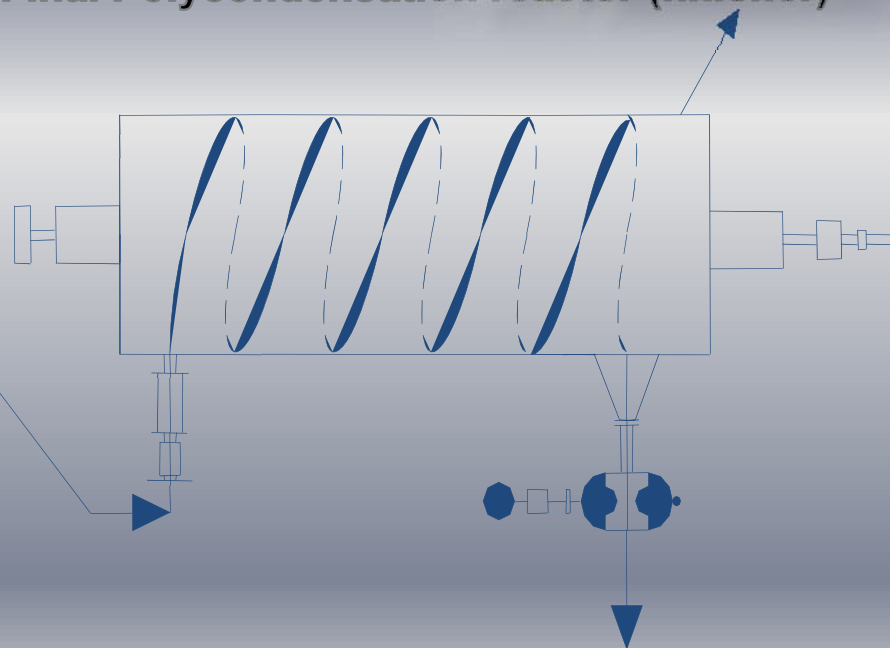
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Final Polycondensation reactor (finisher)

reactor contains a specially designed horizontal cage film-forming aggregate and honeycomb dowel pin jacket.



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Comparison of Different Finisher

	Output (t/d)	Diameter (mm)	Volume(100%)
JOYOU Reactor	450	2920	47
Disc ring Finisher	450	3600	100

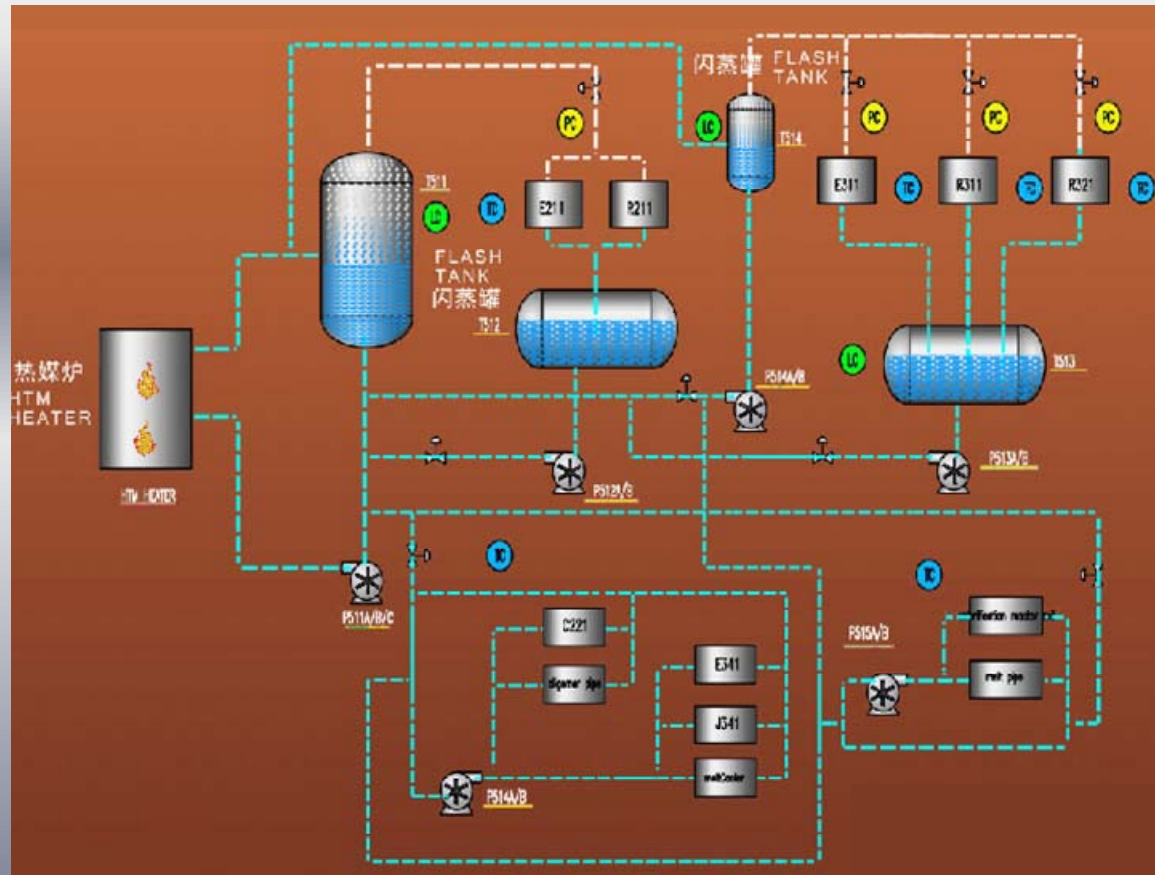


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JOYOU Chem. CP Technology *HTM System*

- ◆ Thermal medium VP-1 is conveying in liquid-phase and flashing in situ. Such technology is with low circulation volume and high efficiency. The HTM system is stable with low running cost and heat loss. The initial investment of thermal medium system is less. (Chinese patent No. ZL200410080335.5)

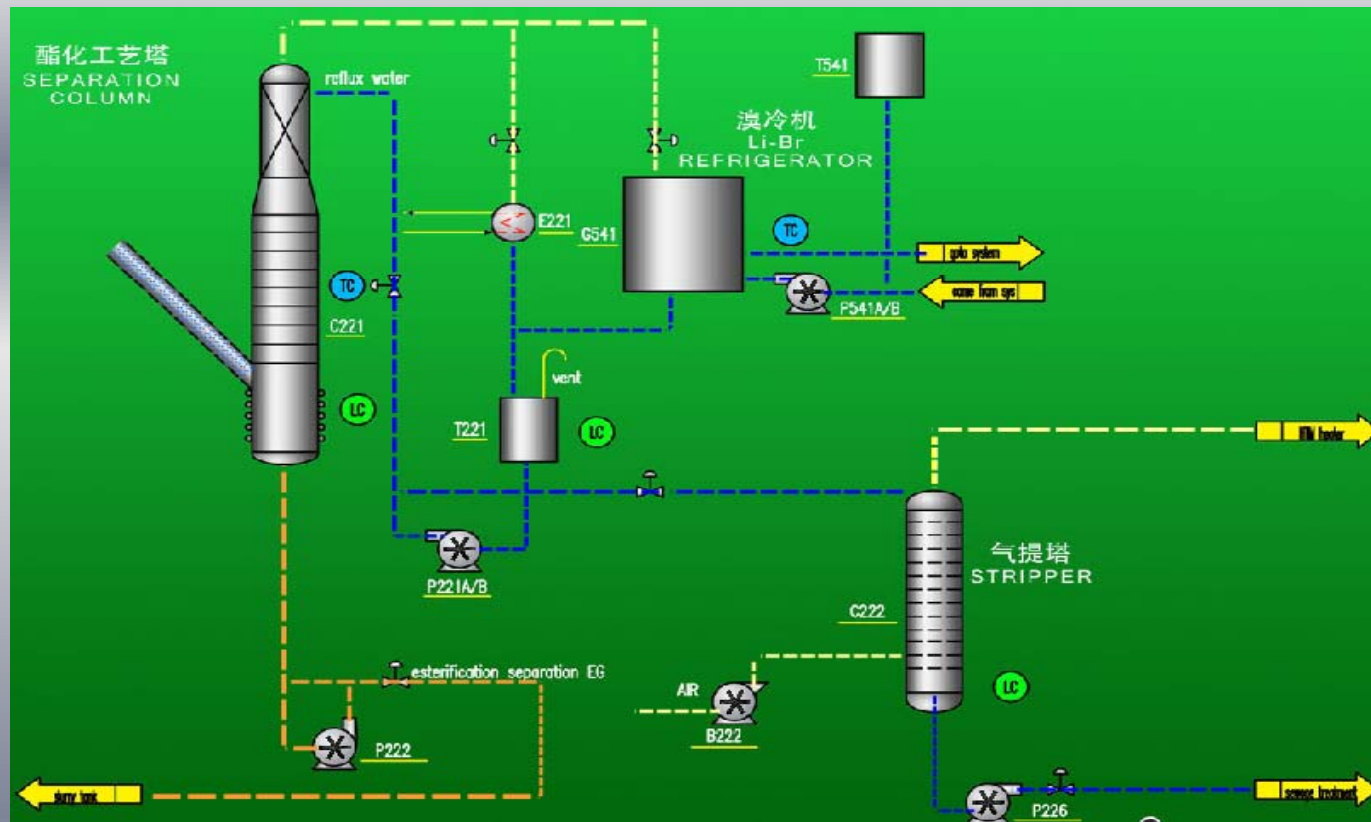


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JOYOU Chem. CP Technology

- ◆ If the esterification vapor is recovered to drive LiBr chiller of 2,500,000kcal/h, the chilled water of 500m³/h can be produced under temp. difference of 5°C for the capacity of 300MTPD CP plant.

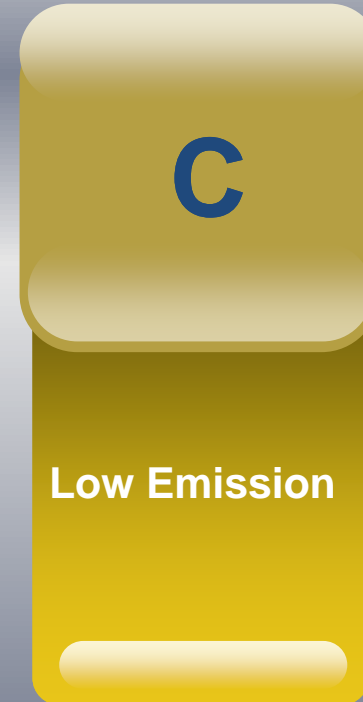
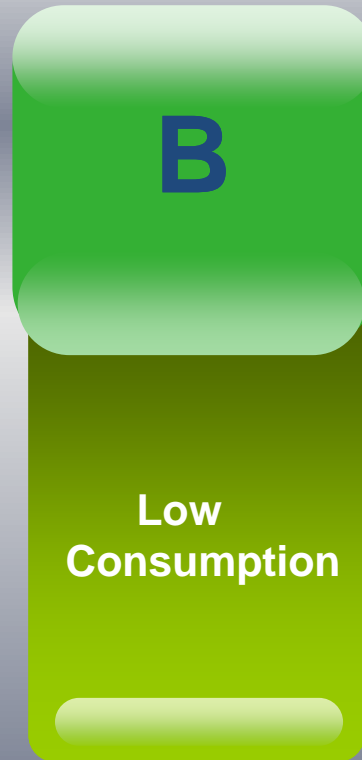
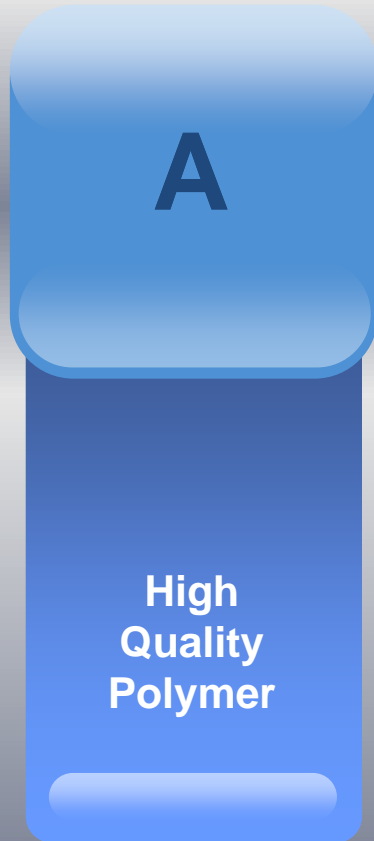


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- ◆ The Low Temperature Short Process Polyester technology has prominent advantages in three aspects:



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Raw Materials Consumption of Different PET Equipment (Semi-dull melt)

Consumption	Five-reactor equipment	Imported three-reactor equipment	JOYOU polyester equipment
PTA (kg/t)	860	858	858
EG (kg/t)	334	332	332



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Overall Energy Consumption (Converting to Standard Oil)

Different Equipment	Capacity (10,000t/y)	Actual standard oil consumption (kg/t)	Comparison	Temperature °C of extrinsic circulation in Esterification
Common level of imported equipment	10	112	1.000	285 ~ 290
Advanced level of imported equipment	15	95	0.8482	272 ~ 275
JOYOU equipment level	15	76	0.6786	260 ~ 265



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PATENTS OF JOYOU

NO.	COUNTRY	PATENT NO.	INVENTION
1	INTERNATIONAL	PCTW02004/098760	A REACTOR OR SEPARATION ESTERIFICATION DEVICE
2	CHINA	ZL03116811.6	AN APPARATUS FOR REACTION & SEPARATION AND CONTINUOUS ESTERIFICATION METHOD USING THE APPARATUS
3	CHINA	Z03123506.9	THE PET PREPARATION METHOD FROM PTA AND EG
4	CHINA	Z1200410080335.5	A CIRCULATING HEATING SYSTEM AND METHOD FOR CHMICAL ENGINEERING PROCESS
5	INDIA	231623	A REACTOR OR SEPARATION ESTERIFICATION DEVICE
6	USA	USP 7708 952 B2	A REACTOR OR SEPARATION ESTERIFICATION DEVICE



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Intellectual Property of JOYOU Chem.

- ◆ Preparation method of polyethylene terephthalate by using terephthalic acid and ethylene glycol (Chinese invention patent , application number: 03123506.9)
- ◆ Continuous esterification device for preparing terephthalate of dihydric alcohol (Chinese invention patent , application number: 03123505.0)
- ◆ Externally circulating heated reaction or separation container (Chinese invention patent , Patent No :ZL 03116811.6)
- ◆ Equipment for reaction or separation in continuous esterification process (PCT invention patent , application number: PCT No. WO2004/098760 ; US invention patent No. 7708 952 B2:)
- ◆ Cyclic heating system and method for chemical process (Chinese invention patent , application number: 200410080335.5)



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JOYOU CHEMICAL TECHNOLOGY AND ENGINEERING CO., LTD.

Differential polyester products and technology

- Typical cases of technology implementation

(Oligomer pipe online adding technology)

The colored products have huge market demand and wide applications. The technology of polyester fiber dope dyeing possesses short process, less expensive equipment, low investment, large single line capacity, high process continuity, good products quality and high degree of environmental protection.



Colored yarn produced by online adding technology

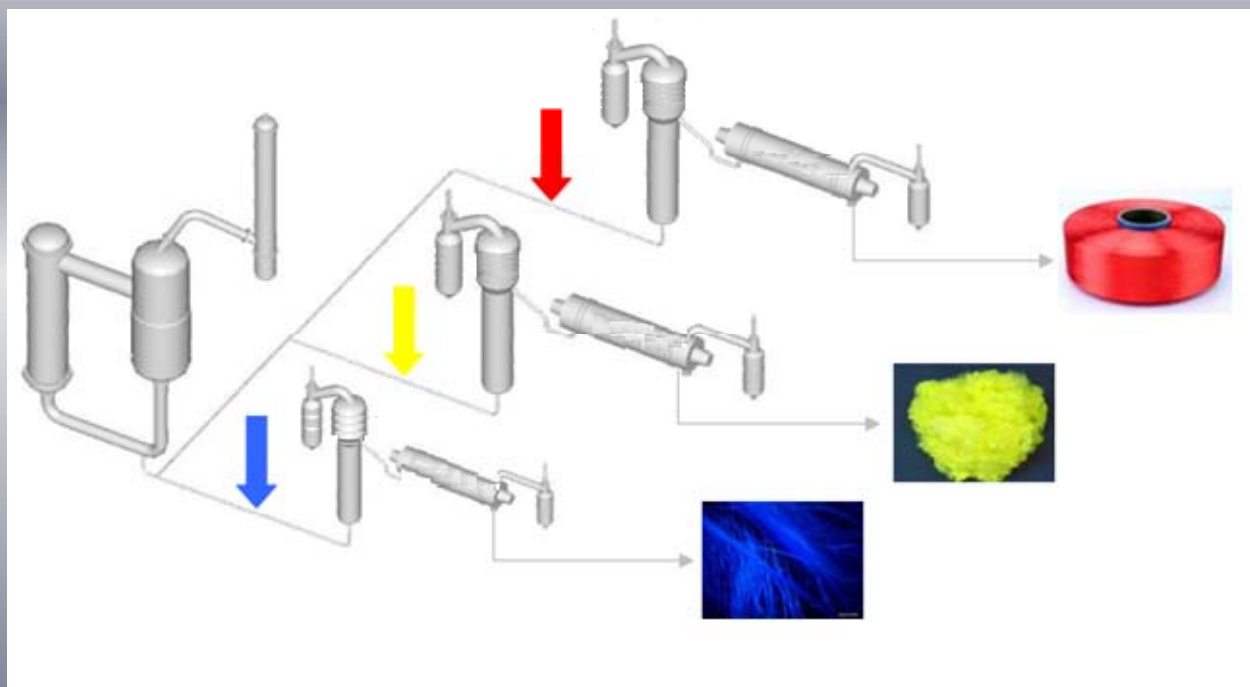


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Differential polyester products and technology

- Producing colored filament by use of on-line adding technology in different locations of the pipeline is the main way to realize large scale preparation of differentiation product in continuous polymerization plant.
 - Technology adding in oligomer pipeline, which is especially intended to produce a single-color yarn in large quantities.**



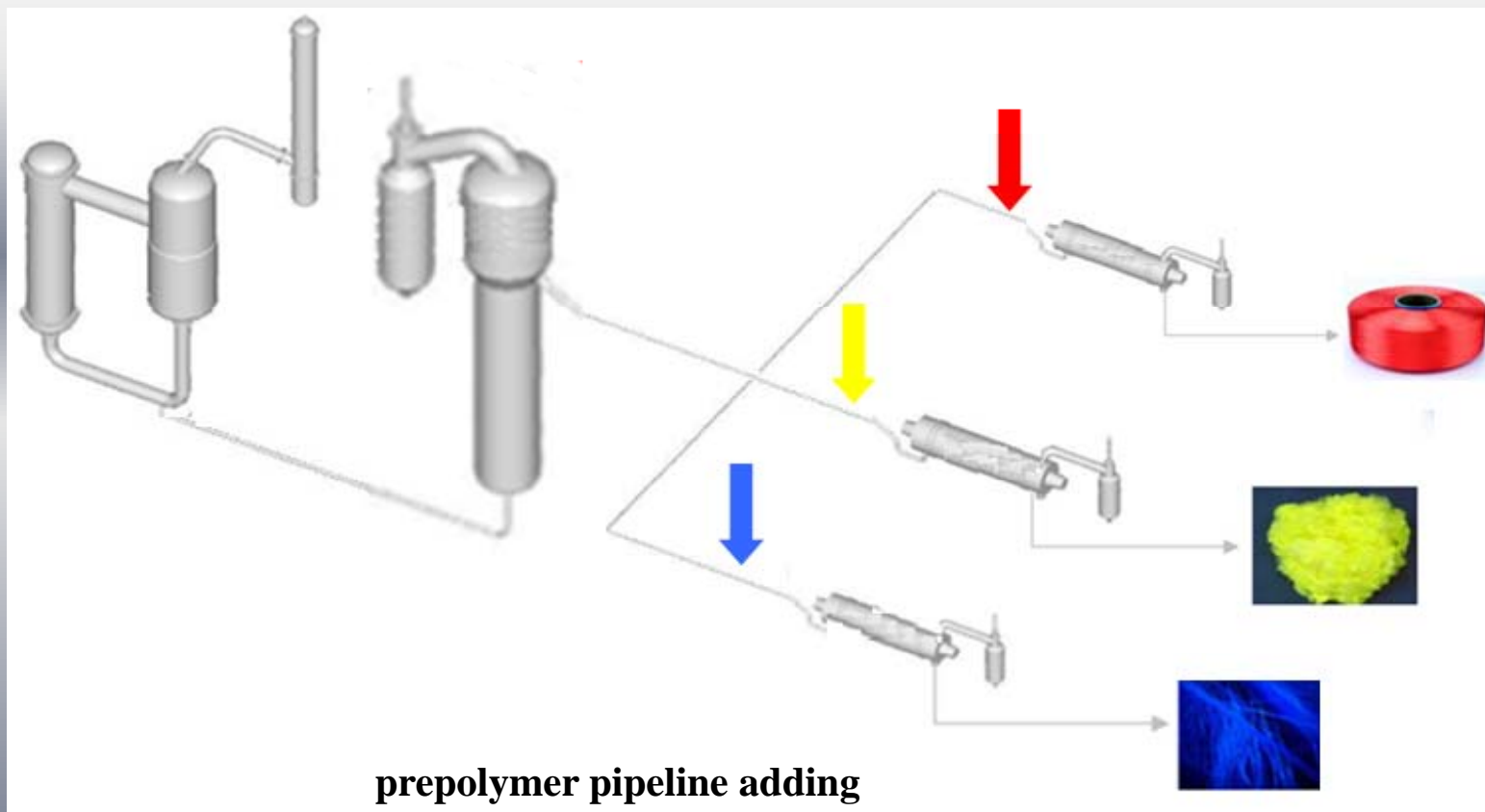
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oligomer pipeline adding

Differential polyester products and technology

(2) Technology adding in prepolymer pipeline, which is especially intended to produce a single-color yarn in large quantities.



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JOYOU CHEMICAL TECHNOLOGY AND ENGINEERING CO., LTD.

Quality guarantee system

In order to guarantee the machinery quality, a specialized chemical equipment company is assigned as JOYOU's proprietary equipment manufacturer .



Quality guarantee system

- A professional foreign company as the inspection party employed by JOYOU himself is introducing the quality management system to the customer.



Quality guarantee system

- The foreign expert leads customer and equipment fabricator to inspect the equipment manufacturing.



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Reference



**PET CP line of 900t/d ES catering two
450t/d polycondensation lines for melt
direct spinning stable fiber in Jiangsu
Xinsu Chemical Fiber Co. Ltd.**



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Reference



PET CP line of 900t/d (300,000t/a) ES catering two polycondensation lines of 450t/d (phase 1) in Shanghai Petrochemical Co. Ltd.



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JOYOU CHEMICAL TECHNOLOGY AND ENGINEERING CO., LTD.

Reference



Three PET CP lines of 240t/d (80,000t/year) CDP
direct spinning POY in Hengsheng Chemical Fiber
Co. Ltd. of TONKUN Group



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JOYOU CHEMICAL TECHNOLOGY AND ENGINEERING CO., LTD.

Reference



The PET CP line of 240t/d (80,000t/year) CDP for direct spinning FDY in Xinsheng spinning branch in Jiangsu Wujiang Silk Co.,Ltd.



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Reference



The PET CP line of 240t/d (80,000t/year) for direct spinning FDY in Zhangjiagang Xinxin Chemical Fiber Co. Ltd.



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Reference



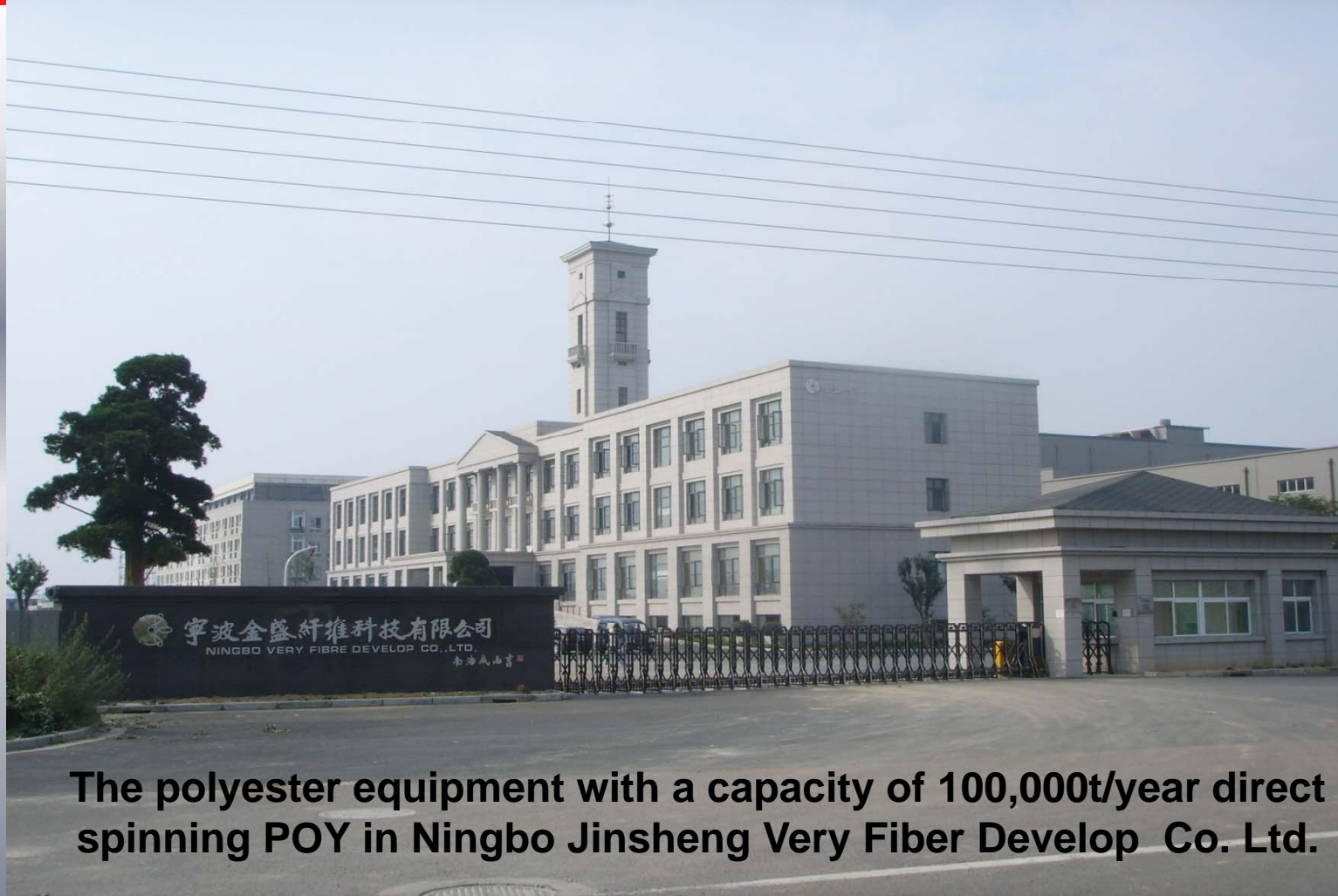
The PET CP Line of 480t/d for direct spinning POY of 240t/d & FDY of 240t/d in Zhejiang HUATSI Polymer Technology Co. Ltd.



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Reference



The polyester equipment with a capacity of 100,000t/year direct spinning POY in Ningbo Jinsheng Very Fiber Develop Co. Ltd.



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Reference



The CP plant with a capacity of 100,000t/year for Xiamen Hongxin special Fiber Co.,Ltd



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Reference

The PET CP line of 600t/d (200,000t/year)
(1 Es catering 2 poly) in Taicang Zhenhui Chemical fiber Co.,Ltd.



Reference



Semi dull Polyester for direct spinning staple fiber with a capacity of 120t/day in Egypt National Cotton & Textile industries Holding Co.



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Reference



The film-grade PET CP plant with a capacity of 180t/day for Ester Industries Ltd. India



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Reference



600t/d PET CP for Far Eastern Industries Ltd. in Taiwan



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PET CP for INDIA SANATHAN TEXTILES PVT. CO.,LTD. 2011



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JOYOU Chem. CP Technology

Project reference of China JOYOU Chemical Technology & Engineering Co., Ltd					
No.	Company	Project	Capacity (t/year)	Built up	Remark
NEW BUILD-UP PROJECTS					
1	Guangzhou Kingfa Sci. & Tech.Co.,Ltd	45t/d PBT project	15,000	2013	
2	Far Eastern Industries (Shanghai) Ltd	Branch PET CP lines	60,000	----	
3	Shandong Fuwin New Material Co.,Ltd	PBS CP line	80,000	----	
4	Zhejiang HuaTex Textiles Co., Ltd	PET CP line	200,000	----	
5	Sanathan Textiles PVT. Co.,Ltd, India	PET CP with 1 ES catering 3 poly. lines	150,000	2013	300t/d+100t/d+50t/d
6	Jiangsu HongTai fiber technology Co., Ltd	PET CP with 1 ES catering 2 poly. lines	210,000	2013	15t/year+6t/year
7	China Textile Academy (Tianjin) Science and Technology Development Co.,Ltd	Demonstration PET CP line	2,000	2013	
8	Fujian Sundfor Industrial Co., Ltd.	PET CP with 1 ES catering 2 poly. lines	160,000	2012	10t/year+6t/year
9	Taicang Zhenhui Chemical Fiber Co., Ltd.	PET CP with 1 ES catering 2 poly. lines	210,000	2012	450t/d+180t/d
10	Shandong Fuwin New Material Co.,Ltd	BDP line	5,000	2012	
11	Shandong Fuwin New Material Co.,Ltd	DOP CP line	20,000	----	
12	Zhejiang Hangzhou Xinfu Pharmaceutical Co.,Ltd	PBS CP line	10,000	2011	
13	Taiwan far Eastern New Century Corporation	PET CP line	200,000	----	
14	Ester Industries Ltd. India	CP for film-grade plant (direct casting film)	60,000	----	
15	Jiangsu Xinsu Chemical Fiber Co.,Ltd	CP for low melting polymer (direct spinning)	30,000	2012	
16	Xiamen Hongxin Special Fiber Co.,Ltd	PET CP with 1 ES catering 2 modified poly. lines	10,000	2010	



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JOYOU Chem. CP Technology

Project reference of China JOYOU Chemical Technology & Engineering Co., Ltd					
No.	Company	Project	Capacity (t/year)	Built up	Remark
17	Egypt National Cotton & Textile Industries Holding Co.,Ltd	CP line	40,000	2009	
18	Anqing Hexing Chemical Co., Ltd	PBS plant	10,000	2009	
19	Zhejiang Hengsheng Chemical Fiber Co.,Ltd, Tongkun Group	CDP CP plant (direct melt spinning)	60,000	2008	Third phase
20	Ningbo Jinsheng Fiber Technology Co.,Ltd	CP plant (direct melt spinning)	100,000	2008	Dope dyed
21	Zhejiang HuaTex Textiles Co., Ltd	PET CP with 1 ES catering 2 poly. lines	160,000	2008	First phase 80,000t/year
22	Zhejiang Hengsheng Chemical Fiber Co.,Ltd Tongkun Group	CDP CP plant (direct melt spinning)	60,000	2006	First phase
23	Jiangsu Xinsu Chemical Fiber Co.,Ltd	PET CP with 1 ES catering 2 poly. lines	300,000	2008	Second phase 150,000t/year
24	Zhejiang hengsheng Chemical Fiber Co.,Ltd Tongkun Group	CP plant (direct melt spinning)	60,000	2007	Second phase
25	Jiangsu Xinsu Chemical Fiber Co., Ltd	PET CP with 1 ES catering 2 poly. lines	300,000	2005	First phase 150,000t/year
26	Shanghai Petrochemical Co., Ltd, Sinopec	PET CP with 1 ES catering 2 poly. lines	300,000	2004	First phase 150,000t/year
27	Zhangjiagang XinXin Chemical Fiber Co.,Ltd	CP line(BRT), direct spinning	80,000	2004	
28	Wujiang Shengze Silk Co.,Ltd Xinsheng Branch	CDP CP line	80,000	2003	
29	Shanghai Petrochemical Co., Ltd, Sinopec	PET CP line	10,000	2002	
RECYCLING PROJECTS OF USED PET					
30	Thai PET Co.,Ltd	Used PET bottle chips recovery	23,300	2013	70t/d
31	Ganesha Ecosphere Ltd, India	Used PET bottle chips recovery	23,300	2012	70t/d
32	Ester Industries Ltd, India	Used PET film recovery BP line	—	—	10L/batch and 80kg/batch



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JOYOU Chem. CP Technology

Project reference of China JOYOU Chemical Technology & Engineering Co., Ltd					
No.	Company	Project	Capacity (t/year)	Built up	Remark
33	Shandong Yangxin Longfu Fiber Technology Co.,Ltd	CP for Liquid State Polycondensation	5,000	2010	
34	Fuyuan Recycling Resources Co., Ltd	Revamping project (used textiles recovery)	3,000	----	
ACETALDEHYDE PROJECTS					
35	Hangzhou Hongjian Chemical Fiber Co.,Ltd	Acetaldehyde recovery system	700,000	2013	
36	Rongsheng Petrochemical Co., Ltd	Acetaldehyde recovery system	1,500,000	2013	
37	Zhangjiagang Xinjinyang Hi-Tech. Fiber Technology Co.,Ltd	Acetaldehyde recovery system	500,000	2013	
38	Zhejiang Xinfengming Group	Acetaldehyde recovery system	2,000,000	2013	
39	Jiangsu Huaya Polyester Co.,Ltd	Acetaldehyde recovery system	400,000	2013	
40	Tongkun Group	Acetaldehyde recovery system	800,000	2013	
41	Jiangsu Sanfangxiang Group Co., Ltd	Acetaldehyde recovery capacity expansion	----	----	Expand to being used for 4000,000t/year PET plant
42	Zhejiang Hengtong Chemical Fiber Co.,Ltd ,Tongkun Group	Acetaldehyde recovery system	----	----	For 970,000t/year PET plant
43	Sinopec Shanghai Petrochemical Co.,Ltd	High COD concentration management	----	2012	For 1# PET plant
44	Wujiang Fudong Textile Group Co., Ltd Chemical Fiber Branch	Es. wastewater stripping treatment system	----	----	For 80,000t/year PET CP plant & 60,000t/year PET BP plant
45	Zhejiang Hengsheng Chemical Fiber Co.,Ltd, Tongkun Group	Acetaldehyde recovery system	----	2011	For 800,000t/year PET plant
46	Jiangsu Sanfangxiang Group Co., Ltd	Acetaldehyde recovery system	----	----	For 1,600,000t/year PET plant
47	Tongkun Group	Acetaldehyde recovery system	----	2009	For 180,000t/year PET plant
48	Xinjiang Lanshan Tunhe PET Co., Ltd	Es. wastewater stripping treatment system	----	2009	For 80,000t/year PET plant



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JOYOU Chem. CP Technology

Project reference of China JOYOU Chemical Technology & Engineering Co., Ltd					
No.	Company	Project	Capacity (t/year)	Built up	Remark
49	Taicang Zhenhui Chemical Fiber Co., Ltd	ES. wastewater stripping treatment system	—	2008	For 200,000t/year PET plant
REVAMPING PROJECTS					
50	ICI Pakistan Limited	Revamping project (HTM boiler & steam boiler)		2013	
51	Ningbo Jinsheng Fiber Co.,Ltd	Technical revamping project	—	----	For 100,000t/year PET plant
52	Zhangjiagang Meijingrong Chemical Co.,Ltd	Revamping project (multi-functional polymer & tetrahydrofuran)	—	----	For 60,000t/year multi-functional polymer & 3,000t/year tetrahydrofuran
53	Xiamen Hongxin Special Fiber Co.,Ltd	36t/d low melting polymer melt conveying project	12,000	2013	
54	Heilongjiang Difeng Polyester Co.,Ltd	Revamping project (melt pipelines)	80,000	----	
55	Sinopec Shanghai Petrochemical Co., Ltd	Revamping project (oligomer pipelines)	—	----	1# PET plant
56	Xinjiang Lanshan Tunhe Polyester Co., Ltd	Revamping project (PBS plant)	5,000	----	
57	Zhejiang HuaTex Textiles Co., Ltd	Revamping project	—	----	
58	Shahid Tondgooyan Petrochemical Company	Revamping & Modifying of PET-2 Plant	160000/480	----	
59	Sinopec Shanghai Petrochemical Co.,Ltd	CP for Liquid State Polycondensation	1,000	----	
60	Ningbo Konced Chemical Fiber Co., Ltd	Revamping project (HTM boiler & spinning HTM Pipelines)	—	----	For 200,000t/year PET plant
61	Sinopec Yizheng Chemical Fiber Co., Ltd	Technical revamping project	—	----	For 30,000t/year PET plant
62	Ningbo SK Zhenbang Chemical Co., Ltd	Technical revamping project	—	2009	
63	Sinopec Hainan ShengZhiYe Hi-Tech. Inc	Es. vapor energy recovery system	—	2009	For 200,000t/year PET plant
64	Sinopec Shanghai Petrochemical Co.,Ltd	Technical revamping project	—	2003	3# PET plant capacity expansion



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JOYOU CHEMICAL TECHNOLOGY AND ENGINEERING CO., LTD.

JOYOU Chem. CP Technology

Project reference of China JOYOU Chemical Technology & Engineering Co., Ltd					
No.	Company	Project	Capacity (t/year)	Built up	Remark
65	Sinopec Shanghai Petrochemical Co.,Ltd	Technical revamping project	—	2003	2# PET plant capacity expansion
TECHNICAL SERVICE PROJECTS					
66	Quanzhou Haitian Material Technology Co.,Ltd	Biological based biodegradable polyester project feasibility study report	200,000	---	
67	Wujiang Fudong Textile Group Co.,Ltd	Add 16 sets direct melt spinning systems	—	---	
68	Ningbo Jinsheng Fiber Technology Co.,Ltd	Spinning capacity expansion	---	---	
OTHER CHEMICAL PROJECTS					
69	Zhejiang Huafeng Group	70,000 t/year TPU plant	70,000	2013	
70	Shanxi Hongyuan Technology Co.,Ltd	Nylon 11 CP line	1,000	---	
71	DongHua University	PLA plant	—	---	



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