

# Uhde Inventa-Fischer

## PET Polycondensation Plants



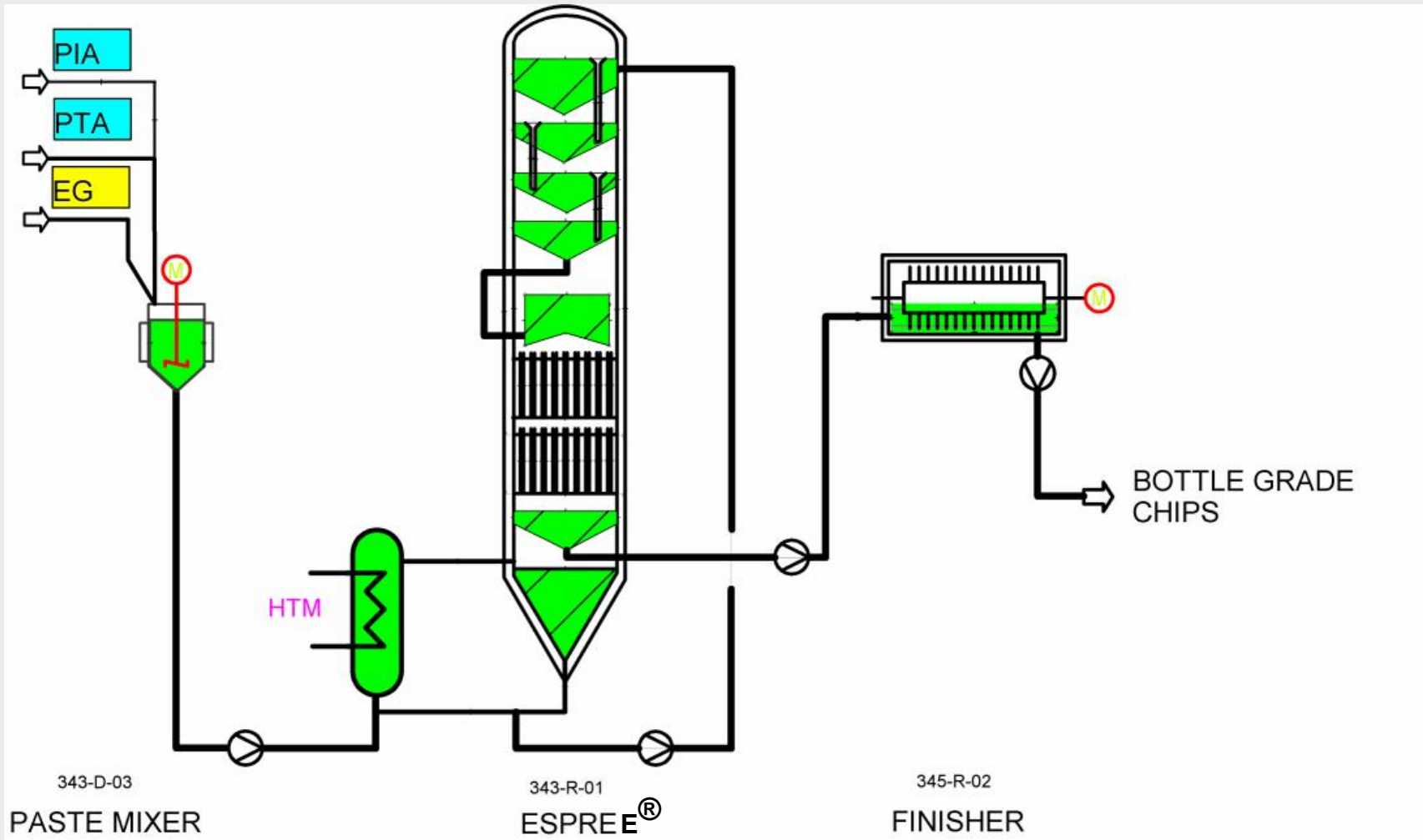
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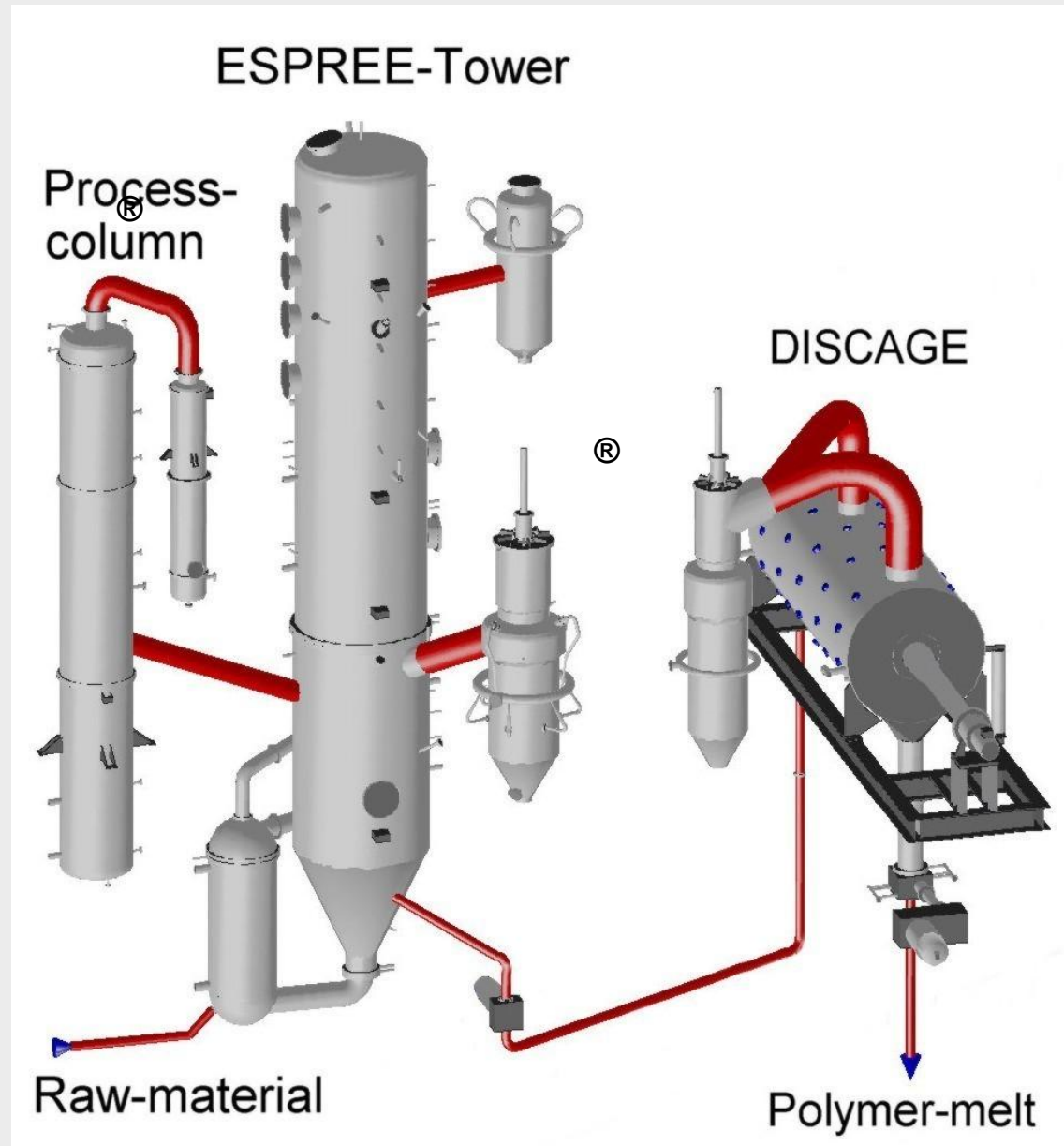


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# 2-Reactor-Technology



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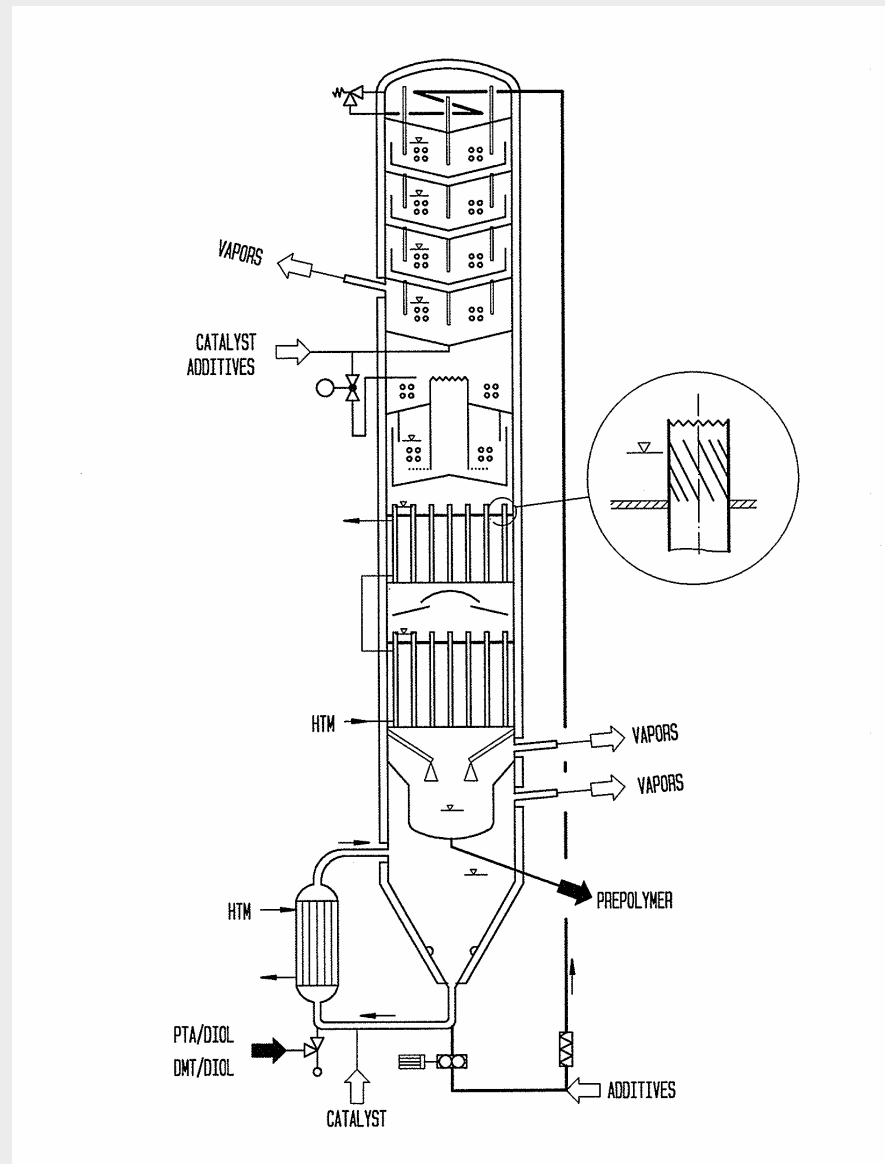
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# ESPREE Reactor

- Minimized hold-up and residence time
- Autogenous stirring / no mechanical agitators
- Prepolymerization: high surface to volume ratio
- Cocurrent flow of vapour and liquid
- Liquid flow from top to bottom



# ESPREE Reactor



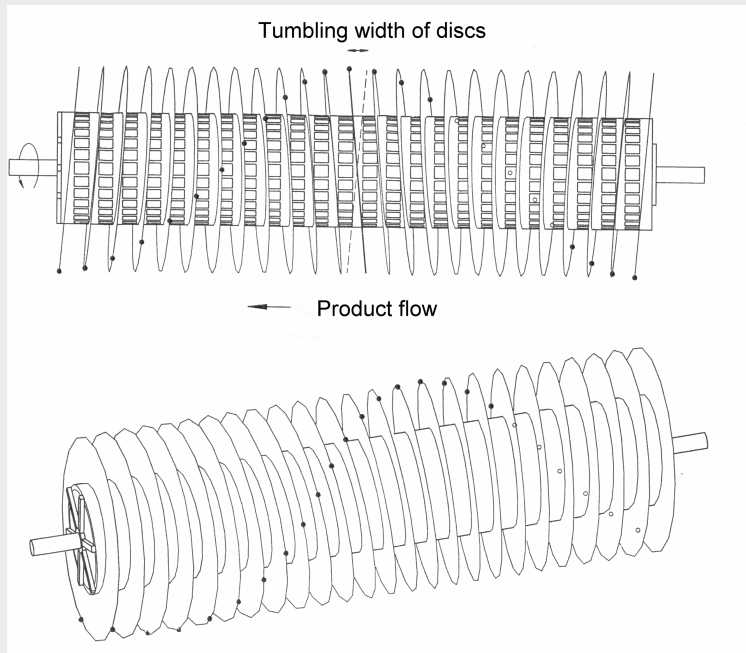
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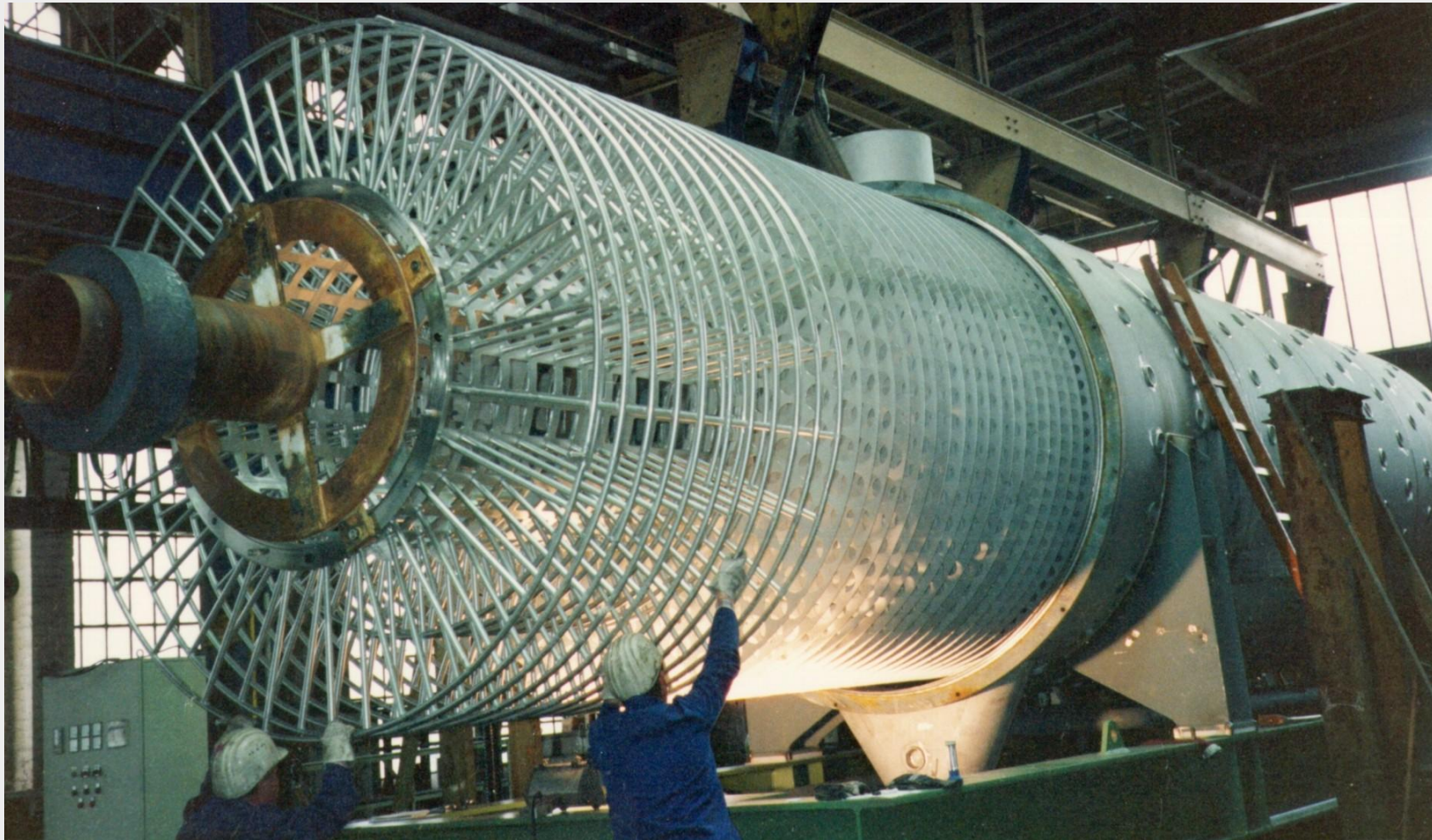
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# DISCAGE Reactor Design based on 40 years of Experience in Polycondensation



- shaftless cage rotor, equipped with discs
- unique seal and bearing modules
  - maintenance free and absolutely leak tight
- rotor simulates the action of a screw
  - special positioning, shape and inclination of the cage ring disc, blades or spoke rings
  - product receives a trend to move from inlet to outlet
- best evaporation conditions for fast diffusion
  - low operation speed = minimized shear (only 0.5 - 2 rpm)
  - generated gases pass through the shell
  - strippers for most effective cascading and plug flow

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# DISCAGE Reactor



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# Cost Comparison 4R vs 2R Process

Cost Type	4 Reactor	2 Reactor	Reduction
Fix	62.6	54.8	
Maintenance	5.7	3.9	
Labour	10.9	9.1	
Energy	31.3	19.8	
Sum = Conversion Cost	110.5	87.6	20.7 %
Raw Material	649.8	644.3	
<b>Manufacturing Cost</b>	<b>760.3</b>	<b>731.9</b>	<b>3.7 %</b>

Base: 400 t/d  
 Cost in €/t of PET Chips

# Earnings from 2R vs. 4R Process

	<b>Chips Sales Price</b>	<b>Manufacturing Cost</b>	<b>Margin</b>
4R Process	900	760.3	139.7 € / t chips
2R Process	900	731.9	168.1 € / t chips
Sales Margin Increase			28.4 € / t chips
Extra Profit at 144.000 t / year:			<b>4.1 Mio. €</b>

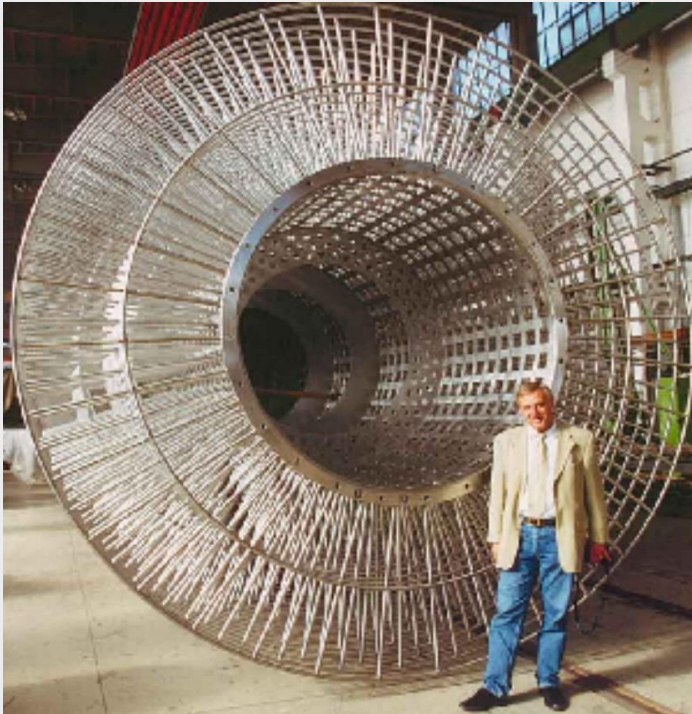
# 2-Reactor-Technology

## References

Company	Capacity	Product	Status
Shinkong, Taiwan	120 mt/d	PBT	In operation since 2002
DuBay, Germany	240 mt/d	PBT	In operation since 2004
DSM / Ticona, Netherlands	180 mt/d	PBT	Engineering
Europlast, Russia	300 mt/d	PET	Engineering
INVENTA-FISCHER, Germany	1 mt/d	PBT / PET	Pilot Plant



# Most Advanced Polycondensation Process for Capacities of more than 600 t/d in one line



600 t/d PET Finisher in Workshop

- Uhde Inventa-Fischer built the first industrial PET plant in the world starting from PTA
- various process features are covered by patents
- dynamic process simulation with **COMPET-DYNA**
- high quality resin CP plants up to 600 t/d one line
- more than 150 plants supplied worldwide

# 600 t/d DISCAGE Reactor



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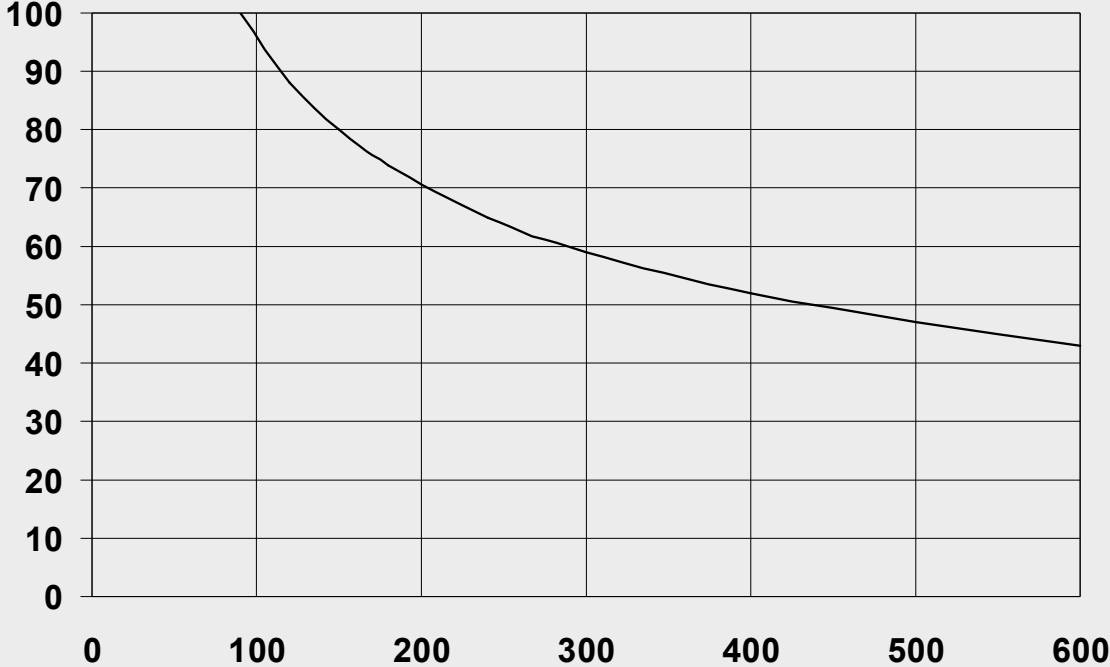
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# Polyester Process Production Costs

DEPRECIATION, SALARY, MANUFACTURING IN %  
OF 90 TONS / DAY PLANT



PLANT CAPACITY IN TONS PER DAY

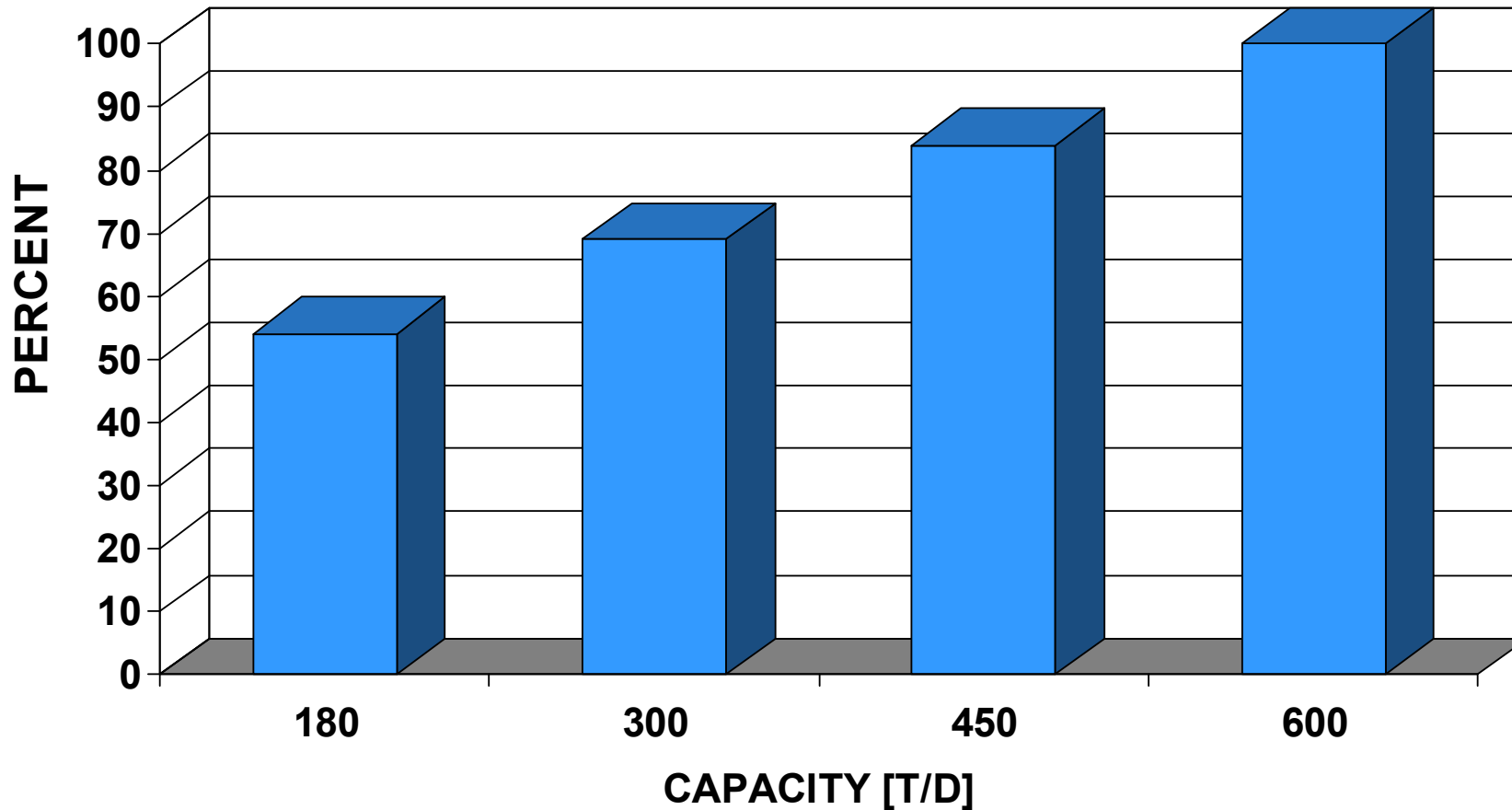
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# Polyester Process Investment Costs of Process Equipment



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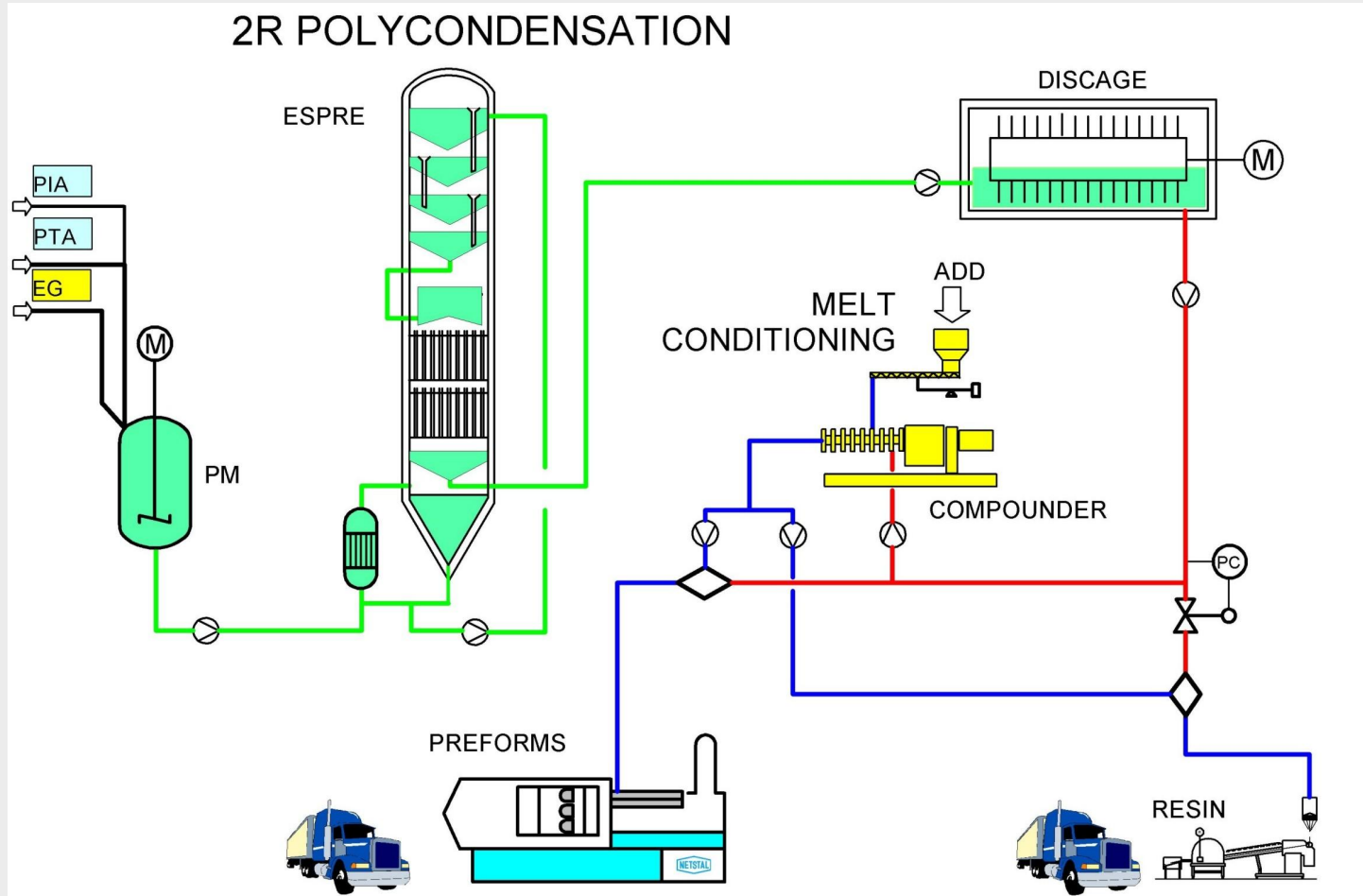
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# High Capacity Plants References

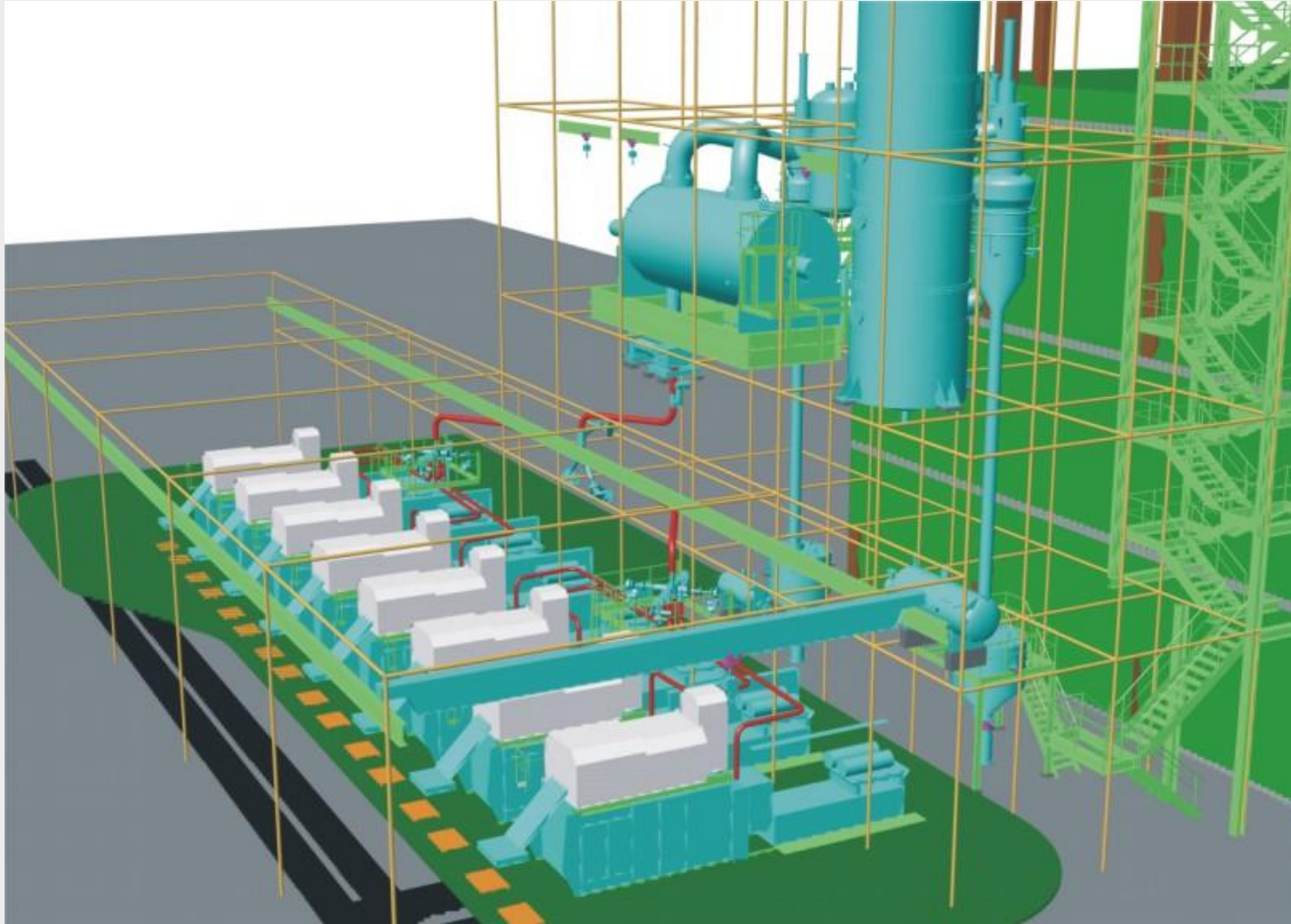
Company	Capacity	Product	Status
Indorama	550 t/d	PET, resin	Engineering
Jian Yin	600 t/d	PET, film	Engineering
Nan Ya	550 t/d	PET, resin	Engineering
Shenjo	2 x 600 t/d	PET, textile	Construction
Cifu	600 t/d	PET, film	Construction
Zibo	600 t/d	PET, textile	Construction
Wuxi	700 t/d	PET, textile	Construction



# From Melt to Preform (MTP) From Melt to Resin (MTR)



# From Melt to Preform



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Polyester 2R Technology  
FROM MELT TO PREFORM "MTP"  
PROCESS STEPS COMPARISON

NOT REQUIRED

OPTION

REQUIRED

PROCESS STEPS	isophthalic acid	polycondensation	high viscosity finisher	chipping	intermediate store	melt transfer line	melt conditioning	additives	<b>solid state postcondensation</b>	storage and marketing of resin	crystallisation	drying	melting	injection moulding
preforms from SSP	OPTION	REQUIRED	NOT REQUIRED	REQUIRED	REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	REQUIRED	OPTION	NOT REQUIRED	REQUIRED	REQUIRED	REQUIRED
preforms from MTR	OPTION	REQUIRED	REQUIRED	REQUIRED	NOT REQUIRED	NOT REQUIRED	REQUIRED	REQUIRED	NOT REQUIRED	OPTION	REQUIRED	REQUIRED	REQUIRED	REQUIRED
preforms from MTP	NOT REQUIRED	REQUIRED	REQUIRED	NOT REQUIRED	NOT REQUIRED	REQUIRED	REQUIRED	REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	NOT REQUIRED	REQUIRED



# Uhde Inventa-Fischer's Polyester Technology Benefits

- **We are the technology leaders**
- **We build 2-Reactor high capacity – most economic plants**
- **We offer Polymer plants up to 1000 t/d**
- **We produce a great variety of products**
- **We guarantee for best product quality**
- **We help customers to find the most economic solution**

