KTS (INVISTA) P8++ Technology for Purified Terephthalic Acid (PTA)

PEP Review 2025-14

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Glossary

¢/lb	cents per pound
$/t	Dollars per metric ton
bara	bar absolute pressure
BFW	Boiler feed water
bhp	Brake horsepower
BLI	Battery limits investment
Btu	British thermal units
CAGR	Compound annual growth rate
capex	Capital expenditure
4-CBA	4-Carboxybanzaldehyde
CNPC	China National Petroleum Corporation
CTA	Crude terephthalic acid
CW	Cooling water
°C	Degree Celsius
°F	Degree Fahrenheit
Dia	diameter
DM	Demineralized water
ETP	Effluent treatment plant
FOB	Free/freight on board
Ft	feet
G	gallons
gpm	Gallons per minute
h	Hours
h^{-1}	per hour
HP	High-pressure
ICI	Imperial Chemical Industries
IPT	INVISTA Performance Technologies
kcal/mol	Kilocalories per mole
kg	Kilograms
kg/h	Kilograms per hour
KTS	Koch Technology Solutions
lb/lb	pound/pound
LP	Low-pressure
LLP	Low low-pressure
Mgal	Thousand gallons
µm	Micrometers
Mlb	Thousand pounds
MMBtu/h	Million British thermal unit per hour
MMlb/y	Million pounds per year
MMt	Million metric tons
MMt/y	Million metric tons per year
mol%	Molar percent
MP	Medium-pressure
MW	Megawatt
opex	Operating expenditure
PBT	Polybutyl terephthalate
PEP	Process Economics Program
PET	Polyethylene terephthalate
PFD	Process flow diagram
ppm	Parts per million
ppmw	Parts per million weight
psi	Pounds per square inch
psia	Pounds per square inch absolute

psig	Pounds per square inch gauge
PTA	Purified terephthalic acid
PTT	Polytrimethylene terephthalate
R2R	residue-to-recovery
RO	Reverse osmosis
ROI	Return on investment
s	Second(s)
sq ft	square feet
SS	Stainless steel
t	Metric ton
t/y	Metric tons per year
TFC	Total fixed capital
ULP	Ultralow-pressure
USGC	United States Gulf Coast
vol%	Volume percent
wt%	Weight percent
WHSV	Weight hourly space velocity

Abstract

Purified terephthalic acid (PTA) is one of the largest-volume commodity chemicals and is predominantly used for producing saturated polyesters, mainly polyethylene terephthalate (PET) and related polymer products, such as fibers, resins, thin films, bottles, etc. A small portion of terephthalic acid is used in the production of semi-aromatic and aromatic polyamides and intermediate chemicals, such as cyclohexanedimethanol, terephthaloyl chloride, liquid crystal polymer, etc.

Terephthalic acid is primarily produced by liquid-phase oxidation of para-xylene (p-xylene) in acetic acid medium in the presence of a cobalt acetate and manganese acetate catalysts with hydrogen bromide as a source of bromine promotor. This step produces crude terephthalic acid (CTA), which contains impurities, mainly 4-carboxybenzaldehyde (4-CBA), p-tolualdehyde, and p-toluic acid. This product (CTA) needs to be further purified before it can be used in the production of PET and other polymers. Thus, CTA produced by the oxidation reaction is then purified through a hydrogenation step, followed by crystallization, filtration, and drying to produce the final PTA product.

The Process Economics Program (PEP) team in previous report RP9H (October 2018) has covered a detailed process analysis and a technoeconomic evaluation for PTA P7 technology licensed by INVISTA Performance Technologies (IPT). INVISTA PTA technology is now licensed by Koch Technology Solutions (KTS) and the latest version of this technology is named as P8++ PTA technology.

This review examines the current P8++ PTA technology licensed by KTS, highlighting the improvements/additions with respect to the previous technology versions. In addition to a detailed process analysis, this review includes a technoeconomic evaluation of the technology along with the process flow diagram (PFD), material balance, major equipment list with specifications, capital and operating expenditure, and the overall production cost. This is PEP's independent assessment based on information presented in open literature, such as patents or technical articles, nonconfidential information obtained from licensor, and may not reflect in whole or in part the actual plant configuration. It is believed that these sources are sufficient to represent the process and process economics within the range of accuracy necessary for the economic evaluation of the conceptual process design of this technology.

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