Production of Maleic Anhydride from benzene

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BACKGROUND

Maleic anhydride is an important raw materials used in the manufacture of phthalic-type alkyd and polyester resins, surface coatings, lubricant additives, plasticizers (qv), copolymers (qv), and agricultural chemicals Asia-Pacific is the largest as well as the fastest-growing market for maleic anhydride, whereas, North America and Europe are the second and third largest markets. The rapid growth in the end use industries, improved standard of living, and strong foothold of the major market players are the key factors driving growth of maleic anhydride market in Asia-Pacific.

PROCESS DESCRIPTION

Main reaction: Benzene + Oxygen —> Maleic Anhydride + carbon dioxide + water

catalyst : vanadium and molybdenum oxide mixture on an inert support

benzene is vaporised in heat exchanger E601 and then mixed with compressed air .the mixture is sent to fired heater to heat the feed to desired temperature inlet conditions.the reaction is highly exothermic and hence ration of air to benzene in the feed mixture is kept high.conversion reactor is used to convert benzene into maleic anhydride and combustion products .the unreacted benzene ,maleic anhydride and combustion products are cooled and sent to absorption tower (compound separator) for separation of combustion gases and product an organic solvent (dibutyl phthalate) is used to absorb maleic anhydride into it .The down product is sent to the separation tower to further separate malice anhydride and dibutyl phthalate.crude malice anhydride is sent further for purification , dibutyl phthalate is recycled back to the absorption tower with makeup stream to balance losses .

Peng-Robinson thermodynamics model is employed in this flowsheet.

the following points where considered while creating the flowsheet :

1. pure air was considered using a mixture of oxygen and nitrogen in stochiometric proportions .
2. all side reactions were ignored .
3. the reactor operation used is based upon conversion of benzene and the outlet temperature of reactor.

4. the liquid outlet stream of conversion reactor is closed as no product is in liquid state at such high temperature only vapour is present .
5. the absorber is simulated using compound separator specifying bottom stream.
6. the fired heater is considered to be 100% efficient to make calculations under tolerance limit.
7. dibutyl phthalate is a user defined compound added from online library to the simulation.
8. the data given in Turton ed al, 2013 was used as a basis to create the flowsheet and confirm the results from DWSIM.

RESULTS OBTAINED:

parameter	unit	input	input	output	output
		benzene	air	maleic anhydride	waste gases
temperature	K	303.15	303.15	468.75	463.745
pressure	KPa	101.325	101.325	80	82
mass flow	kg/s	0.9178	22.358	0.67	22.6139
volumetric flow	metric cube/s	0.0010576	19.2679	0.00056	36.3888
molar flow rates in mixture	mol/s	11.75	775	10.096	774.423
benzene		11.75	0	0	0.705
oxygen		0	162.5	0	112.796
nitrogen		0	612.5	0	612.501
maleic anhydride		0	0	10.096	0.13
carbon dioxide		0	0	0	22.09
dibutyl pthalate		0	0	1.00959E-05	0.0277
water		0	0	0	22.0863

REFERENCES :

Analysis Synthesis and Design of Chemical Processes- third edition Richard Turton. Richard C. Bailie. Wallace B /appendix B-production of maleic anhydride using benzene.