Nature of Invention: Process design

Applicant: PetroProtons Pvt. Ltd.

CEO: Atharva Deshmukh

Inventors: Pradeep Kumar Bagri (210734) , Ritik Ahirwar (210862) , Abhishek Kumar Parte (210041) , Ajitesh Shree (210079)

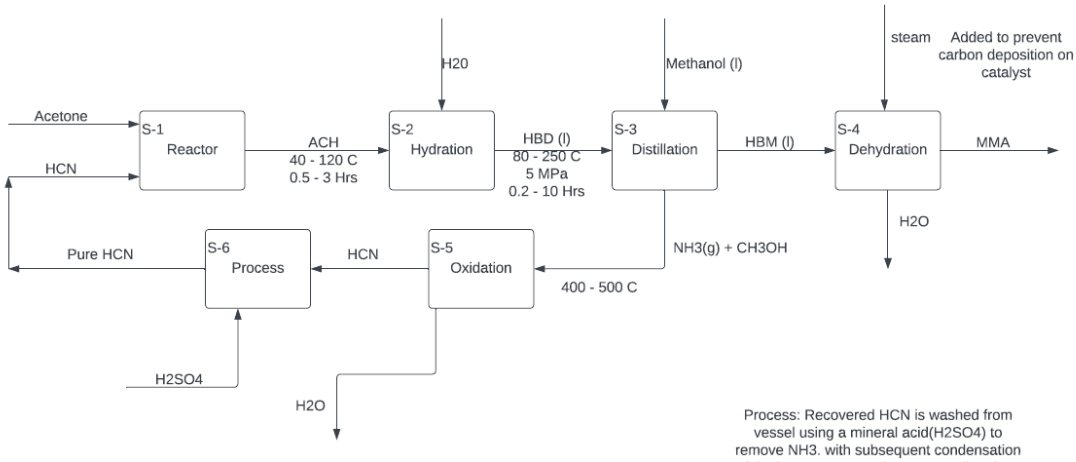
Chemical Formula: $C_5H_8O_2$

Chemical Name: Methyl methacrylate (IUPAC: methyl 2-methylpropenoate)

Process Title: Continuous Synthesis of Methyl Methacrylate (MMA) from Acetone and Hydrogen Cyanide via Cyanohydrin Intermediate

Process Description:

a. **Give the block diagram for the feasible process (as determined in market analysis report). List all unit operations and process conditions.**



Steps	Catalyst
1	Alkali/Amine
2	MgO2, Acetone/Methanol Solvent
3	Titanium Tetraisopropoxide
4	Silica/Silica Alumina/ H3PO4
5	V2O5/MoO3/ Fe2O3/Cu2O/SnO2/CrO3

Notation	Formula	Name
HCN	HCN	Hydrogen Cyanide
ACH	C4H7NO	Acetone Cyanohydrin
HBD	C4H9NO2	Alpha-Hydroxyisobutyramide
HBM	C5H10O3	Methyl Alpha-Hydroxyisobutyrate
MMA	C5H8O2	Methyl Methacrylate

b. Give the material balance for a scaled-up process plant with capacity of 1000 kg/day. (If needed, simplify the calculations by stating assumptions)

Material Balance

https://drive.google.com/file/d/1g2iRvuIDj2zCYw2Rij4xIcjaym5cd2TC/view?usp=drivesdk

Example referred –

https://drive.google.com/file/d/1iRUoORKq-z9pQ4G56ACQ6l2hlRrfdHCf/view?usp=drivesdk

c. List the capacity of reactors needed and evaluate the cost. Use Glass lined Carbon steel (GS lined CS) as the material of construction (MOC). Use the pressure according to reaction conditions. You will use only 70% of the total volume. If you design a 1000 L reactor, you can only fill 700 L reaction mixture.

Capital cost (only for the reactor):

Example:

Equipment	Design Capacity (L)	No. of units	Cost/unit ($ for year 2014)	Total Cost ($ for year 2014)
Reactor 1 (Jacketed reactor, agitated, Carbon steel, atm. pressure)	2730	1	38,100	38,100

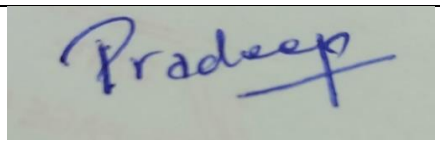
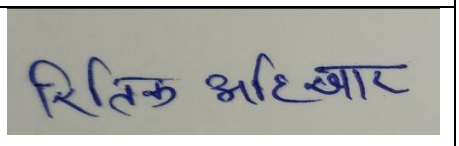
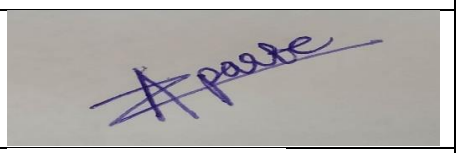
References: Provide reference for a research paper or an actual patent.

1. http://www.matche.com/equipcost/Reactor.html
2. https://patents.google.com/patent/EP0686623A1/en

List the contributions of each author:

- Pradeep Kumar Bagri (Author 1) and Abhishek Kumar Parte (Author 3) carried out the literature search and found the reaction steps.
- Ritik Ahirwar (Author 2) and Ajitesh Shree (Author 4) did the material balance & designed Block diagram.
- Ritik Ahirwar (Author 2) and Abhishek Kumar Parte (Author 3) found necessary separation steps.
- Pradeep Kumar Bagri (Author 1) evaluated the reactor cost.

Sign the pdf and upload.

Name	Roll No	Signature
CEO Name: Atharva Deshmukh	210231	
First author Name: Pradeep Kumar Bagri	210734	
Second author Name: Ritik Ahirwar	210862	
Third author Name : Abhishek Kumar Parte	210041	
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