FORM-I

For

PROPOSED SPECIALITY CHEMICALS, PIGMENTS & AGROCHEMICALS PLANT

of

M/s. HEMANI INTERMEDIATES PVT. LTD. (UNIT-V)

PLOT NO. 73-74, G.I.D.C. SAYKHA,

TAL: VAGRA, DIST: BHARUCH, GUJARAT

APPENDIX I
FORM 1

(I) Basic Information

Sr. No.	Item	Details
1.	Name of the Project/s	Hemani Intermediates Pvt. Ltd. (Unit-V)
2.	S.No. in the Schedule	5 (f) & 5 (b)
3.	Proposed capacity/area/length/tonnage to be handled/command area/lease area/number of wells to be drilled	Proposed chlorination of benzene – 3000 MT/Month Proposed Nitration of Chlorobenzene (ONCB/PNCB) -- 5000 MT/Month Proposed Calcium Chloride – 3000 MT/Month Proposed Di Calcium Phosphate – 1500 MT/Month Proposed 2,4 DNCB – 1500 MT/Month Proposed Fungicides – 500 MT/Month Proposed Herbicides – 500 MT/Month Proposed Insecticides – 500 MT/Month Proposed Pigments-500 MT/Month Proposed Chloro Toluene & Its derivaties -500 MT/Month Proposed PNCB/ONCB & Its derivaties – 1500 MT/Month Proposed PDCB/ODCB & Its derivaties – 1000 MT/Month Proposed Nitrobenzene & derivaties – 500 MT/Month Proposed Sulfuric Acid Plant- 1500 MT/Month Proposed Dimethyl Sulfate-200 MT/Month Proposed 3,3 DCB – 800 MT/Month No bore well to be drilled within the premises.
4.	New/Expansion/Modernization	New
5.	Existing capacity/area etc.	N.A.
6.	Category of project i.e. 'A' or 'B'	'A'
7.	Does it attract the general condition? If yes, please specify.	N.A.
8.	Does it attract the specific condition? If yes, please specify.	N.A.
9.	Location	Plot No.73-74, Saykha Industrial Area, Tal: Vagra, Dist: Bharuch, Gujarat
	Plot/Survey/Khasra No.	Plot. No. 73-74
	Village	GIDC Sayakha
	Tehsil	Vagra
	District	Bharuch
	State	Gujarat

10.	Nearest railway station/airport along with distance in kms.	Nearest Railway Station : Bharuch: 30 km Nearest Airport: Baroda: 90 km
11.	Nearest Town, city, District Headquarters along with distance in km	Nearest town: Bharuch : 30 km, Nearest District Head quarter: Bharuch : 30 km
12.	Village Panchayats, zilla parishad, Municipal corporation, Local body	Village: Saykha, Tal: Vagra, Dist: Bharuch, Gujarat.
13.	Name of the applicant	Hemani Intermediates Pvt. Ltd.(Unit-V)
14.	Registered address	Plot No.73-74, Saykha Industrial Area, Tal: Vagra, Dist: Bharuch, Gujarat.
15.	Address for correspondence:	Plot No CH-5, Dahej Industrial Area, Tal: Vagra, Dist: Bharuch, Gujarat.
	Name	Shri Satish Patel
	Designation (Owner/Partner/CEO)	General Manager
	Address	Plot No CH-5, Dahej Industrial Area, Tal: Vagra, Dist: Bharuch, Gujarat.
	Pin Code	391340
	E-Mail	satishpatel.patel919@gmail.com
	Telephone No.	02641-256042, 291111 / 09824469947
	Fax No.	022-25157491
16.	Details of Alternative Sites examined, if any location of these sites should be shown on a topo sheet.	No
17.	Interlinked Projects	No
18.	Whether separate application of interlinked project has been submitted?	Not applicable
19.	If Yes, date of submission	Not applicable
20.	If no., reason	Not applicable
21.	Whether the proposal involves approval/clearance under: If yes, details of the same and their status to be given. (a) The Forest (Conservation) Act, 1980? (b) The Wildlife (Protection) Act, 1972?	Not applicable
22.	Whether there is any Government order/policy relevant/relating to the site?	No
23.	Forest land involved (hectares)	No
24.	Whether there is any litigation pending against the project and/or land in which the project is propose to be set up? (a) Name of the Court (b) Case No. (c) Orders/directions of the Court, if any and its relevance with the project.	No

(II) Activity

1. Construction, operation or decommissioning of the Project involving actions, which will cause physical changes in the locality (topography, land use, changes in water bodies, etc.)

Sr. No.	Information/Checklist confirmation	Yes /No?	Details thereof (with approximate quantities / rates, wherever possible) with source of information data
1.1	Permanent or temporary change in land use, land cover or topography including increase in intensity of land use (with respect to local land use plan)	No	Proposed Project is within Saykha GIDC Estate
1.2	Clearance of existing land, vegetation and buildings?	Yes	Minor site clearance activities shall be carried out to clear shrubs and weed.
1.3	Creation of new land uses?	No	--
1.4	Pre-construction investigations e.g. bore houses, soil testing?	No	--
1.5	Construction works?	No	Approved plan for construction is attached as **Annexure: 1.**
1.6	Demolition works?	No	--
1.7	Temporary sites used for construction workers or housing of construction workers?	No	--
1.8	Above ground buildings, structures or Earthworks including linear structures, cut and fill or excavations	Yes	Approved plan for construction is attached as **Annexure: 1.**
1.9	Underground works including mining or tunneling?	No	--
1.10	Reclamation works?	No	--
1.11	Dredging?	No	--
1.12	Offshore structures?	No	--
1.13	Production and manufacturing	Yes	List of Products is attached **Annexure: 2** and manufacturing process attached as **Annexure: 3.**
1.14	Facilities for storage of goods or materials?	Yes	Dedicated storage area for storage of Raw Materials and finished products, solvents, etc. shall be provided.
1.15	Facilities for treatment or disposal of solid waste or liquid effluents?	Yes	Effluent Treatment Plant will be installed to treat effluent so as to achieve the GPCB norms. Details of water consumption & effluent generation with segregation of effluent streams are attached as **Annexure: 4.**

			Details of proposed Effluent Treatment Plant are attached as **Annexure: 5.** Details of Hazardous waste generation and disposal is attached as **Annexure: 6.**
1.16	Facilities for long term housing of operational workers?	No	--
1.17	New road, rail or sea traffic during construction or operation?	No	--
1.18	New road, rail, air waterborne or other airports etc?	No	--
1.19	Closure or diversion of existing transport routes or infrastructure leading to changes in traffic movements?	No	--
1.20	New or diverted transmission lines or pipelines?	No	--
1.21	Impoundment, damming, converting, realignment or other changes to the hydrology of watercourses or aquifers?	No	--
1.22	Stream crossings?	No	--
1.23	Abstraction or transfers or the water form ground or surface waters?	Yes	No ground water shall be used. The requirement of raw water shall be met through GIDC Water Supply.
1.24	Changes in water bodies or the land surface affecting drainage or run-off?	No	--
1.25	Transport of personnel or materials for construction, operation or decommissioning?	Yes	Through hired Services
1.26	Long-term dismantling or decommissioning or restoration works?	No	There is no dismantling of any sort. Not applicable.
1.27	Ongoing activity during decommissioning which could have an impact on the environment?	No	No Impact on the Environment
1.28	Influx of people to an area in either temporarily or permanently?	No	This will be a well developed Industrial Area and due to project, 50 people shall be employed for operation.
1.29	Introduction of alien species?	No	
1.30	Loss of native species of genetic diversity?	No	
1.31	Any other actions?	No	

2. Use of Natural resources for construction or operation of the Project (such as land, water,

materials or energy, especially any resources which are non-renewable or in short supply):

Sr. No	Information/checklist confirmation	Yes/ No?	Details there of (with approximate quantities/rates, wherever possible) with source of information data
2.1	Land especially undeveloped or agriculture land (ha)	No	
2.2	Water (expected source & competing users) unit: KLD	Yes	Water requirement will meet through the GIDC Water Supply. For detail water balance is refer as **Annexure – 4**.
2.3	Minerals (MT)	No	Not applicable
2.4	Construction material -stone, aggregates, sand / soil (expected source MT)	Yes	Company shall use Sand, stone, Cement and Structural Steel for Construction as required.
2.5	Forests and timber (source - MT)	No	No wood shall be used as construction material or as a fuel.
2.6	Energy including electricity and fuels source, competing users Unit: fuel (MT), energy (MW)	Yes	Power required from DGVCL is 2500 KVA. Stand by power supply from D.G. set – Proposed: 1000 KVA x 2 Fuel for DG set- HSD: 100 lit/Hour Coal: 125 MT/Day
2.7	Any other natural resources (use appropriates standard units)	No	--

3. Use, storage, transport, handling or production of substances or materials, which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health.

Sr. No.	Information / Checklist confirmation	Yes/ No?	Details thereof (with approximate quantities / rates wherever possible) with source of information data
3.1	Use of substances or materials, which are hazardous (as per MSIHC rules) to human health or the environment (flora, fauna, and water supplies)	Yes	Please refer **Annexure : 8.**
3.2	Changes in occurrence of disease or affect disease vectors (e.g. insect or water borne diseases)	No	Not applicable as site is located in Saykha Industrial Area, Tal: Vagra, Dist: Bharuch.
3.3	Affect the welfare of people e.g. by changing living conditions?	No	Not applicable as site is located in Saykha Industrial Area, Tal: Vagra, Dist: Bharuch.
3.4	Vulnerable groups of people who could be affected by the project e.g. hospital patients, children, the elderly etc.,	No	Not applicable as site is located in Saykha Industrial Area, Tal: Vagra, Dist: Bharuch.

3.5	Any other causes	No	

4. Production of solid wastes during construction or operation or decommissioning MT/month)

Sr. No.	Information/Checklist confirmation	Yes/ No?	Details thereof (with approximate quantities / rates, wherever possible) with source of information data
4.1	Spoil, overburden or mine wastes	No	--
4.2	Municipal waste (domestic and or commercial wastes)	No	--
4.3	Hazardous wastes (as per Hazardous Waste Management Rules)	Yes	Please refer **Annexure: 6**
4.4	Other industrial process wastes	Yes	Please refer **Annexure: 6**
4.5	Surplus product	Yes	As per attached **Annexure: 2**
4.6	Sewage sludge or other sludge from effluent treatment	Yes	Please refer **Annexure: 6**
4.7	Construction or demolition wastes	No	Construction waste shall be utilized for leveling, land filling in the premises.
4.8	Redundant machinery or equipment	No	--
4.9	Contaminated soils or other materials	No	--
4.10	Agricultural wastes	No	--
4.11	Other solid wastes	No	--

5. Release of pollutants or any hazardous, toxic or noxious substances to air (Kg/hr)

Sr. No.	Information/Checklist confirmation	Yes/ No?	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
5.1	Emissions from combustion of fossil fuels From stationary or mobile sources	Yes	Details of flue & process gas emission are attached as **Annexure: 7**
5.2	Emissions from production processes	Yes	Reactors shall be connected to common scrubber system. Details of emission levels from process are attached as **Annexure: 7** Details of Air Pollution Control measures are attached as **Annexure: 7**
5.3	Emissions from materials handling including storage or transport	Yes	All liquid raw materials shall be procured in bulk tankers and shall be transferred through a closed circuit pipe lines by pumps. Solid raw material shall be handled in

			closed charging rooms with proper ventilation and charged through close pipeline into reactors.
5.4	Emissions from construction activities including plant and equipment	No	Utmost care will be taken during construction activity and water sprinklers shall be utilized whenever necessary.
5.5	Dust or odours from handling of materials including construction materials, sewage and waste	No	
5.6	Emissions from incineration of waste	No	
5.7	Emissions from burning of waste in open air (e.g. slash materials, construction debris)	No	
5.8	Emissions from any other sources	No	

6. Generation of Noise and Vibration, and Emissions of Light and Heat:

Sr. No.	Information/Checklist confirmation	Yes/ No?	Details there of (with approximate Quantities /rates, wherever possible) With source of source of information data
6.1	From operation of equipment e.g. engines, ventilation plant, crushers	Yes	Acoustic enclosures shall be provided for DG set.
6.2	From industrial or similar processes	Yes	All machinery / equipment shall be well maintained, shall be proper foundation with anti vibrating pads wherever applicable and noise levels within permissible limits. Acoustic enclosures shall be provided for DG set.
6.3	From construction or demolition	No	
6.4	From blasting or piling	No	
6.5	From construction or operational traffic	No	
6.6	From lighting or cooling systems	No	
6.7	From any other sources	No	Acoustic enclosures shall be provided for DG set.

7. Risks of contamination of land or water from releases of pollutants into the ground or into sewers, surface waters, groundwater, coastal waters or the sea:

Sr. No	Information/Checklist confirmation	Yes/ No?	Details thereof (with approximate quantities / rates, wherever possible) with source of information data
7.1	From handling, storage, use or spillage of hazardous materials	Yes	All the raw material shall be stored separately in designated storage area and safely. Bund walls shall be provided around raw materials storage tanks for containing any liquid spillage. Other materials shall be stored in bags / drums on pallets with concrete flooring and no spillage is likely to occur. Please refer **Annexure : 8.**
7.2	From discharge of sewage or other effluents to water or the land (expected mode and place of discharge)	No	Sewage effluent shall be treated in Septic Tank/Soak Pit and then ETP. The treated effluent shall be drained into underground pipe line of GIDC.
7.3	By deposition of pollutants emitted to air into the land or into water	Yes	The Project site is located in saykha Industrial Area, Tal: Vagra, Dist:Bharuch. The emissions shall conform to the GPCB / CPCB norms of discharge. The treated effluent shall be drained into underground pipe line of GIDC.
7.4	From any other sources	No	Not applicable
7.5	Is there a risk of long term build up of pollution in the environment from these sources?	Yes	Full- fledged Environmental Management System (EMS) will be installed. i.e. ETP, Air Pollution Control systems, Hazardous Waste Handling and Management as per norms, etc. which will eliminates the possibility of building up of pollution.

8. Risks of accident during construction or operation of the Project, which could affect human health or the environment:

Sr. No	Information/Checklist confirmation	Yes/ No?	Details thereof (with approximate quantities / rates, wherever possible) with source of information data
8.1	From explosions, spillages, fires etc from storage, handling, use or production of hazardous substances	Yes	The risk assessment will be carried out and all mitigative measures shall be taken to avoid accidents.
8.2	From any other causes	No	Not applicable
8.3	Could the project be affected by natural disasters causing environmental	No	--

	damage (e.g. floods, earthquakes, landslides, cloudburst etc)?		

9. Factors which should be considered (such as consequential development) which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality

Sr. No.	Information/Checklist confirmation	Yes/ No?	Details thereof (with approximate quantities / rates, wherever possible) with source of information data
9.1	Lead to development of supporting facilities, ancillary development or development stimulated by the project which could have impact on the environment e.g.: * Supporting infrastructure (roads, power supply, waste or waste water treatment, etc.) • housing development • extractive industries • supply industries • other	Yes	Site is located in Saykha Industrial Area, Tal: Vagra, Dist: Bharuch, will be having the entire required infrastructure. This industrial zone is having existing road infrastructure, power supply are to be utilized. Local people will be employed and no housing is required. Please refer **Annexure – 9.**
9.2	Lead to after-use of the site, which could have an impact on the environment	No	--
9.3	Set a precedent for later developments	No	Not applicable
9.4	Have cumulative effects due to proximity to Other existing or planned projects with similar effects	No	The ETP of the company shall be designed such that the treated effluent conforms to the statutory requirement. The treated effluent shall be drained into underground pipe line of GIDC.

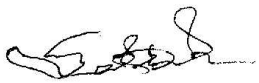
(III) Environmental Sensitivity

Sr. No	Information/Checklist confirmation	Name / Identity	Aerial distance (within 25 km). Proposed Project Location Boundary.
1	Areas protected under international conventions national or local legislation for their ecological, landscape, cultural or other related value	No	Site is located in Saykha Industrial Area, Tal. Vagra, Dist. Bharuch, Gujarat.

2	Areas which are important or sensitive for Ecological reasons - Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests	No	Site is located in Saykha Industrial Area, Dist. Bharuch, Gujarat. Forest area of Rajpipla is 100 km away.
3	Areas used by protected, important or sensitive species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration	Yes	Site is located in Saykha Industrial Area, Dist. Bharuch, Gujarat.
4	Inland, coastal, marine or underground waters	Yes	Arabian Sea- 25 Km River Narmada- 10 Km
5	State, National boundaries	No	--
6	Routes or facilities used by the public for to recreation or other tourist, pilgrim areas.	No	Not applicable
7	Defense installations	No	NIL
8	Densely populated or built-up area	Yes	Bharuch city – 4 lakh population
9	Areas occupied by sensitive man-made land community facilities)	No	
10	Areas containing important, high quality or scarce resources (ground water resources, surface resources, forestry, agriculture, fisheries, tourism, tourism, minerals)	Yes	The project is being in industrial area which does not affect agricultural land.
11	Areas already subjected to pollution or environmental damage. (those where existing legal environmental standards are exceeded)	Yes	Site is located in Saykha Industrial Area, Tal: Vagra, Dist. Bharuch, Gujarat.
12	Are as susceptible to natural hazard which could cause the project to present environmental problems (earthquake s, subsidence ,landslides, flooding erosion, or extreme or adverse climatic conditions)	-	N.A.

IV). Proposed Terms of Reference for EIA studies: For detail please refer **Annexure – 10.**

I hereby given undertaking that, the data and information given in the application and enclosures are true to the best of my knowledge and belief and I am aware that if any part of the data and information submitted is found to be false or misleading at any stage the project will be rejected and clearance give, if any to the project will be revoked at our risk and cost.



Date: 02.12.2015 **Satish Patel (General Manager)**
Place: Bharuch **Hemani Intermediates Pvt Ltd (Unit-V)**

NOTE:

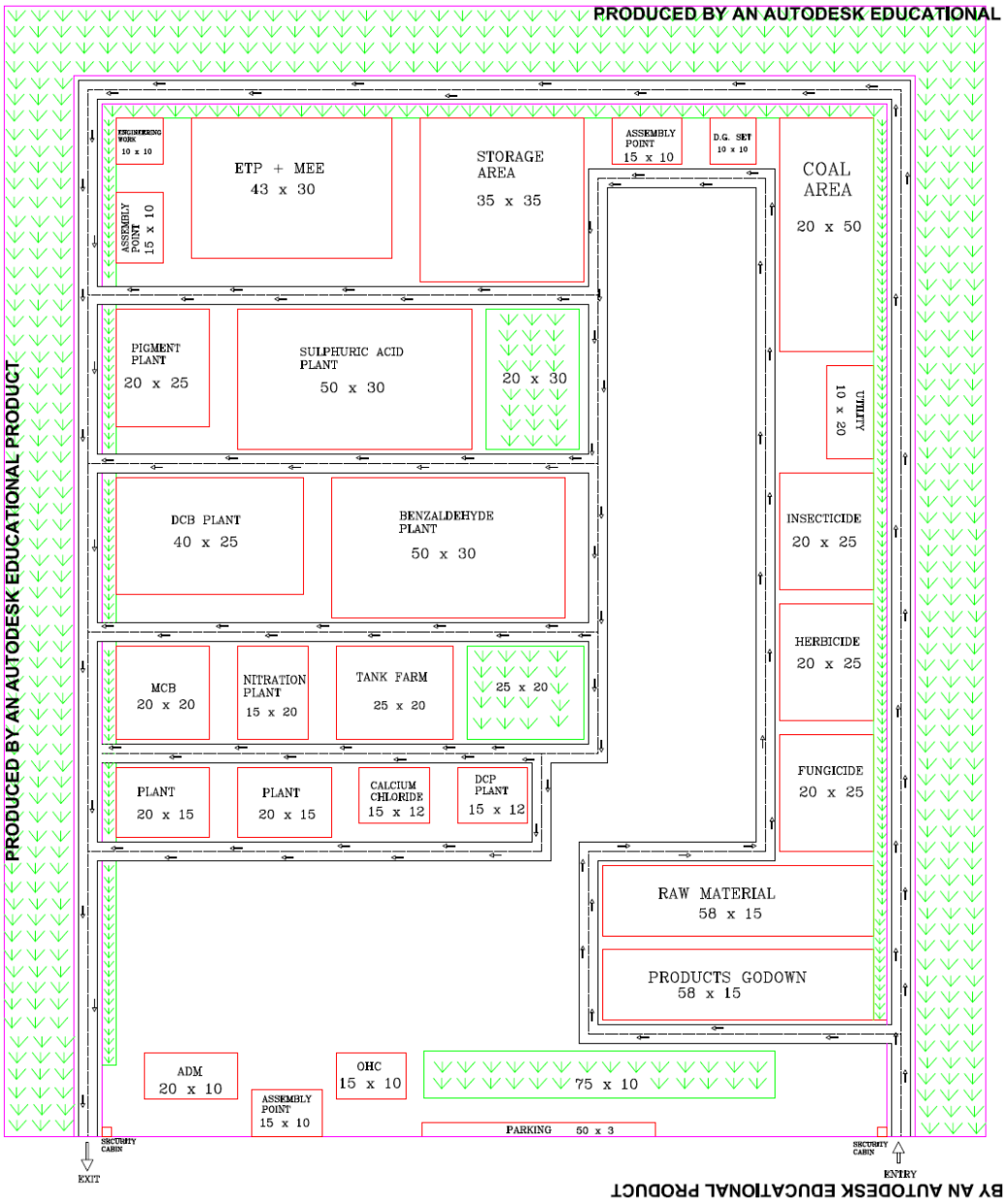
1. The projects involving clearance under Coastal Regulation Zone Notification, 1991 shall submit with the application a C.R.Z. map duly demarcated by one of the authorized agencies, showing the project activities, w.r.t. C.R.Z. (at the stage of TOR) and the recommendations of the State Coastal Zone Management Authority (at the stage of EC). Simultaneous action shall also be taken to obtain the requisite clearance under the provisions of the C.R.Z. Notification, 1991 for the activities to be located in the CRZ.
2. The projects to be located within 10 km of the National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors of Wild Animals, the project proponent shall submit the map duly authenticated by Chief Wildlife Warden showing these features vis-à-vis the project location and the recommendations or comments of the Chief Wildlife Warden thereon (at the stage of EC).
3. All correspondence with the Ministry of Environment & Forests including submission of application for TOR/Environmental Clearance, subsequent clarifications, as may be required from time to time, participation in the EAC Meeting on behalf of the project proponent shall be made by the authorized signatory only. The authorized signatory should also submit a document in support of his claim of being an authorized signatory for the specific project.

ANNEXURES

1	**PLANT LAYOUT**
2	**LIST OF PRODUCTS WITH PRODUCTION CAPACITY AND RAW MATERIALS**
3	**BRIEF MANUFACTRING PROCESS, CHEMICAL REACTION AND MASS BALANCE WITH FLOW DIAGRAM**
4	**WATER CONSUMPTION AND EFFLUENT GENERATION WITH SEGREGATION OF EFFLUENT STREAMS**
5	**DETAILS OF PROPOSED EFFLUENT TREATMENT PLANT**
6	**DETAILS OF HAZARDOUS SOLID WASTE MANAGEMENT AND DISPOSAL**
7	**DETAILS OF HAZARDOUS CHEMICAL STORAGE FACILITY**
8	**DETAILS OF AIR POLLUTION CONTROL MEASURES**
9	**SOCIO - ECONOMIC IMPACTS**
10	**PROPOSED TERMS OF REFERENCES**

ANNEXURE: 1

PLANT LAYOUT



Annexure-2

LIST OF PRODUCTS WITH PRODUCTION CAPACITY

Sr. No.	Name of the Products	Quantity in MT/Month
		Proposed
1.	Chlorination Derivatives (E.g. MCB, DCB, ODCB, PDCB,MDCB & TCB)	3000
2.	Nitration of Chlorobenzene (ONCB, PNCB & MNCB)	5000
3.	Calcium Chloride	3000
4.	Di Calcium Phosphate	1500
5.	2,4 Dinitro Chloro Benzene(DNCB) & Derivatives	1500
6. Fungicides		
a)	Hexaconzole (T)	500
b)	Tebuconzole (T)	
c)	Propioconzole (T)	
d)	Fenbuconzole (T)	
7. Herbicides		
a)	Dicamba (T)	500
b)	Metribuzine (T)	
c)	Metsulfuron Methyl (T)	
d)	Pendimethalin (T)	
e)	Sulfentrazone (T)	
f)	Ethofumesate (T)	
8. Insecticides		
a)	Transfluthrin (T)	
b)	Cyfluthrin & Beta Isomers (T)	
c)	Bifenthrin (T)	
d)	Cypermethrin (T) & Beta Isomers (T)	

e)	Chloropyriphos (T)	500
f)	Imidacloprid (T)	
g)	Clodinafop Prpargyl (T)	
h)	Cloquintocet mexyl (T)	
i)	Thiamethoxam	
9	Para Nitro Chloro Benzene & Derivatives	1000
10	Ortho Nitro Chloro Benzene & Derivatives	500
11	Para Dichloro Benzene & Derivatives	500
12	Ortho Dichloro Benzene & Derivatives	500
13	Pigments (AZO)	500
14	3,3 DCB	800
15	Dimethyl Sulphate	200
16	Sulfuric Acid & Allied Products	1500
17	Nitro Benzene & Derivatives	500
18	Chloro Toulene & Derivatives (Benzyl Chloride & Benzaldehyde)	500
TOTAL		**22000**

LIST OF BY PRODUCTS

Sr. No.	Name of the Products	Quantity in MT/Month Proposed	Remark
1.	Potassium Carbonate	175	Reuse in plant premises or sell to end user
2.	Potassium Chloride Solution	186	Sell to end user
3.	Potassium Bromide	123	Reuse in bromine recovery unit
4.	Sodium Sulfite Solution	900	Sell to end user
5.	HBr (38%)	301	Reuse in bromine recovery unit
6.	Liqour Ammonia (36%)	1484	Sell to end user
7.	Aluminium Chloride	836	Sell to end user
8.	Sodium Bromide Salt	150	Reuse in bromine recovery unit

LIST OF RAW MATERIALS

Sr. No.	Name of Raw Materials	Quantity (MT/Month)
1) Chlorination Derivatives (e.g MCB,DCB,ODCB,PDCB,MDCB & TCB)		
1.	Benzene	2130
2.	Chlorine	1920
2) Nitration of Chlorobenzene (ONCB, PNCB & MNCB)		
1.	H_2SO_4	1680
2.	HNO_3	2100
3.	MCB	3650
3) Calcium Chloride		
1.	Lime	3000
2.	HCl (32%)	2400
4) Di Calcium Phosphate		
1.	Rock Phosphate	900
2.	HCl (32%)	1800
3.	Lime	100
4.	Sodium Silicate	10
5) 2,4 DNCB		
1.	H_2SO_4	270
2.	HNO_3	510
3.	DCB	1185
6) Fungicide		**Quantity (MT/MT)**
a) Hexaconzole (T)		
1.	Valeryl Chloride	0.539
2.	MDCB	0.027
3.	Alumimun Chloride	0.927

4.	Methanol	0.072
5.	KOH	0.60
6.	DMS	0.64
7.	1,2,4 – Triazole	0.270
8.	Solvent – Dimethyl Formamide	0.190
b) Tebuconzole (T)		
1.	1-(4 – Chlorophenyl) 4-4- Dimethyl -3- Pentanoate	0.675
2.	Sodium Methoxide	0.162
3.	Di Methyl Sulfide	0.186
4.	Solvent – Toluene	1.4
5.	1,2,4 – Triazole	0.206
6.	Solvent – DMF	1.1
c) Propioconzole (T)		
1.	1,3 Di Chloro Benzene	0.452
2.	Acetyl Chloride	0.238
3.	Alumimun Chloride	0.558
4.	Solvent – EDC	1.6
5.	Bromine	0.553
6.	Catalyst	0.010
7.	1,2 – Butanediol	0.32
8.	Solvent – Toluene	1.0
9.	Potassium Hydroxide	0.166
10.	1,2,4 – Triazole	0.21
11.	Solvent – Dimethyl Formamide	1.0
d) Fenbuconazole (T)		
1.	Benzyl Cyanamide	0.376
2.	1, Chloro-2-(4-Chlorophenyl) Ethane	0.564
3.	Methylene Bromide	0.544

4.	Sodium Hydroxide	0.198
5.	1,2,4 - Triazole	0.128
6.	Solvent - Xylene	2.475
7.	Catalyst	0.011
7) Herbicide		
a) Dicamba (T)		
1.	2,4-dichloro phenol	0.820
2.	Carbon dioxide	0.260
3.	Dimehtyl sulfate	0.320
4.	Sodium hydroxide	0.205
5.	Solvent –Methenol	1.4
6.	Solvent –Toluene	1.6
b) Metribuzine (T)		
1.	ATMT	1.0
2.	Di Methyl Sulphate	0.652
3.	Sulfuric Acid	1.274
4.	Soda Ash	1.6
5.	Caustic Soda Flakes	0.03
c) Metsulfuron Methyl (T)		
1.	2-Sulfomoyl Methyl Benzoate	0.827
2.	Ethyl chloroformate	0.461
3.	Potassium Carbonate	1.115
4.	Acetone	0.03
5.	Carbamate of 2-Sulfomoyl Methyl Benzoate	1.104
6.	2-amino-4-methoxy-6-methyl-1,3,5-Triazine	0.565
7.	Mono Chloro Benzene	0.02
8.	Methylene dichloride	0.04
9.	n-Hexane	0.03

d) Pendimethalin (T)		
1.	Hydrogen	0.032
2.	Diethylketone	0.692
3.	EDC	1.000
4.	Sulfuric acid 98 %	0.263
5.	Nitric acid 60 %	0.826
e) Sulfentrazone		
	Phenyl hydrazine	0.765
	Acetaldehyde	0.376
	Sodium cyanate	0.530
	Chlorine	2.308
	Acetic acid	0.500
	Methanol	0.212
	10% Sodium Hydroxide	1.500
	Potassium Carbonate	0.900
	Dimethyl formamide	0.972
	Dichlorofluoromethane	0.650
	Oleum	4.450
	Nitric acid	0.386
	Dichloroethane	0.073
	Catalyst Pd/C	0.063
	Methane Sulfonyl chloride	0.689
	Pyridine	0.049
	Toluene	0.384
	Dichloromethane	0.319
	IPA	3.848
f)	**Ethofumesate**	
	Isobutyraldehyde	0.500

	Morpholine	0.604
	Quinone	0.600
	Toluene	0.482
	Water	6.000
	Methyl Sulfonyl chloride	0.650
	Triethylamine	0.058
	48% sodium hydroxide	0.500
	Ethanol	1.000
	35% HCl	0.250
	sodium bi carbonate	0.100
8) Insecticide		
a) Transfluthrin (T)		
1.	2,3,5,6 Tetra Fluoro Benzyl Alcohol	0. 5
2.	R- Trans Cypermethric Acid Chloride	0.62
3.	Catalyst	0.012
4.	Solvent- Hexane	2.0
5.	5 % Soda Ash Solution	0.25
b) Cyfluthrin & Beta Isomers (T)		
1.	3- Phenoxy -4- Fluoro Benzaldehyde	0.51
2.	CMAC- Cypermethric Avid Chloride	0.56
3.	Sodium Cyanide	0.132
4.	Solvent –n- Hexane	2.9
5.	Catalyst	0.01
6.	5 % Soda Ash Solution	0.49
7.	5 % Acetic Acid Solution	0.49
8.	8-10 % Sodium Hypochorite Solution	0.78
c) Bifenthrin (T)		
1.	Lambda Acid	0.57

2.	3-Phenyl -2-Methyl Benzyl Chloride	0.54
3.	Catalyst	0.024
4.	Solvent- Hexane	0.58
d) Cypermethrin (T) & Beta Isomers (T)		
1.	Meta Phenoxy Benzaldehyde	0.463
2.	CMAC- Cypermethric Acid Chloride	0.542
3.	Sodium Cyanide	0.463
4.	Solvent –n- Hexane	0.126
5.	Catalyst	2.78
6.	4 % Soda Ash Solution	0.009
7.	5 % Acetic Acid Solution	0.463
8.	8-10 % Sodium Hypochorite Solution	0.74
e) Chloropyriphos (T)		
1.	Monochloro Acetic Acid	0.67
2.	Chlorine	1.3
3.	DCAC	0.815
4.	Pyridine	0.005
5.	Trichloro Acetyl Chloride	0.98
6.	Acrylonitrile	0.355
7.	3-Chloro Propionitrile	1.300
8.	EDC	0.2
f) Imidacloprid (T)		
1.	2- Chloro -5- Chloromethyl Pyridine	0.88
2.	N- Nitro N- Methyl Imidazolidine	0.83
3.	Sodium Carbonate	0.68
4.	Catalyst -1	0.01
5.	Solvent - DMF	2.14
6.	Caustic Lye 47 %	0.05

7.	Solvent – Methanol	0.39
g) Clodinafop Propargyl		
1.	2,4,5 Trichloro Pyridine	0.513
2.	2-(4-Hydroxy Phenoxy) Propionic Acid	0.513
3.	Sodium Hydroxide	0.223
4.	DMF	0.100
5.	Propargyl Chloride	0.206
6.	Toluene	0.08
h) Cloquintocet Mexyl (T)		
1.	Mono Chloro Acetic Acid	0.377
2.	1-Methyl Hexalol	0.440
3.	Toluene	0.047
4.	5-Chloro-8-Hydroxy Quinoline	0.616
5.	MIBK	0.260
6.	Potassium Carbonate	0.500
7.	Hexane	0.047
i)	**Thiamethoxam**	
	Allyl chloride	0.670
	Chlorine	1.330
	47% caustic lye	0.900
	Ammonium thio cyanate	0.780
	EDC	0.150
	So2	0.120
	4N Sodium Hydroxide	3.000
	Guanidine nitrate	1.255
	Sulfuric acid	3.365
	40% Methyl amine	0.890
	Para formaldehyde	0.742

	Formic acid	0.345
	DMC	0.210
	Potassium carbonate	0.900
9. PNCB & Derivatives		
1	PNCB/ONCB	1.16
2	NH3	1.113
10. PDCB/ODCB & Derivatives		
1) 2,5-DICHLORO ANILINE		
1.	2,5-Dichloro Nitro Benzene	1.225
2.	Catalyst (Raney Nickel)	0.002
3.	Solvent (Methanol)	0.025
4.	Hydrogenation	0.02
2) 2, 3-DICHLORO ANILINE		
1.	2,3-Dichloro Nitro Benzene	1.245
2.	Catalyst (Raney Nickel)	0.002
3.	Solvent (Methanol)	0.03
4.	Hydrogenation	0.025
3) 3,4-DICHLORO ANILINE		
1	3,4-Dichloro Nitro Benzene	1.260
2	Catalyst	0.002
3	Solvent (Methanol)	0.025
4	Hydrogenation	0.038
4) 3 - CHLORO ANILINE		
1	3 - Chloro Nitro Benzene	1.273
2	Catalyst	0.002
3	Solvent (Methanol)	0.025
4	Hydrogen	0.015
5) 4 - CHLORO ANILINE		
1	4 - Chloro Nitro Benzene	1.273

2	Catalyst	0.002
3	Solvent (Methanol)	0.025
4	Hydrogen	0.015
6) 2 - CHLORO ANILINE		
1	2 - Chloro Nitro Benzene	1.273
2	Catalyst (Raney Nickel)	0.002
3	Solvent (Methanol)	0.025
4	Hydrogen	0.015
7) 3, 5-DICHLORO ANILINE		
1	3,5-Dichloro Nitro Benzene	1.225
2	Catalyst	0.002
3	Solvent (Methanol)	0.050
4	Hydrogen Gas	0.040
11. Pigment		
1) Pigment Red 122		
1	Crude pigment Red 122	1.02
2	DMF	0.06
2) Pigment Red 168		
1	Crude pigment Red 168	1.01
2	Nitrobenzene	0.03
3) Pigment Red 170		
1.	p-Amino Benzamide	0.313
2.	Hydrochloric acid	0.425
3.	Sodium nitrite	0.163
4.	Sulfamic acid	0.0080
5.	Naphthol ASPH	0.716
6.	Caustic soda	0.291
4) Pigment Red 176		

1.	3-AMINO, 4-METHOXY BENZANILIDE	0.471
2.	HCl	0.5
3.	SODIUM NITRITE	0.142
4.	CAUSTIC SODA	0.857
5.	BON ACID AMIDE OF 5-AMINO BENZIMIDAZOLONE	0.585
5) Pigment Yellow 147		
1.	ODCB	0.185
2.	1-CHLORO ANTHRAQUINONE	0.884
3.	PHENYL GUANAMINE	0.389
4.	METHANOL	0.530
6) Pigment Yellow 155		
1.	5-AMINO DIMETHYL TEREPHTHALATE	0.316
2.	HCL	0.441
3.	SODIUM NITRITE	0.110
4.	CAUSTIC SODA	0.073
5.	1:4 BIS (ACETO ACETYLAMINO)BENZENE	0.424
6.	SODIUM ACETATE	0.294
7) Pigment Yellow 180		
1.	m-AMINO PHENOL	0.313
2.	1;2 DI BROMO PROPANE	0.288
3.	CAUSTIC SODA	0.244
4.	HYDROCHLORIC ACID	0.666
5.	SODIUM NITRITE	0.211
6.	5-ACETYL AMINO BENZOXAZOLONE	0.688
7.	SODIUM ACETATE	0.388
8) Pigment Yellow 188		
1.	3,3’ DICHLORO BENZIDINE DIHYDROCHLORIDE	0.425
2.	HYDROCHLORIC ACID	0.550

3.	SODIUM NITRITE	0.241
4.	ACETOACETANILIDE	0.316
5.	CAUSTIC SODA	0.300
6.	SODIUM ACETATE	0.333
13. Dimethyl Sulphate		
1.	Methanol	0.508
14. Sulphuric Acid & Allied Products		
1.	Sulfur	0.3265
15. Nitro Benzene & Derivatives		
1	Nitro Benzene	1.380
2	Catalyst	0.001
3	Solvent	0.03
4	Hydrogenation	0.022
16. Chloro Toulene & Derivatives		
1) BENZALDEHYDE		
1	Caustic Flake	1.325
2	Benzal Chloride	0.015
2) CHLORO TOLUENE		
1	Toluene	0.612
2	Chlorine	1.232

ANNEXURE: 3

BRIEF MANUFACTRING PROCESS, CHEMICAL REACTION AND MASS BALANCE WITH FLOW DIAGRAM

1. Chlorination Derivatives (E.g. MCB, DCB, ODCB, PDCB,MDCB & TCB)

MCB

Manufacturing Process:

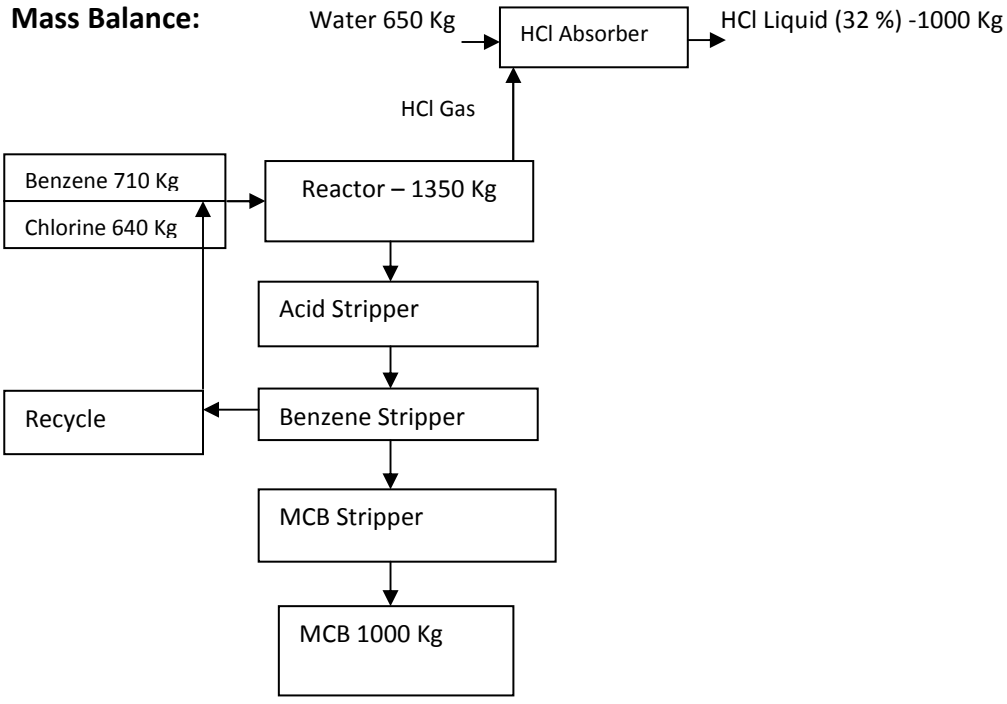
Mono Chlorobenzene plant is continuous plant. Benzene and Chlorine continuously feed in reactor from bottom. From overflow we are getting product Mono Chlorobenzene. The reaction is exothermic so cooling water circulation controls temperature of the reactor. During the reaction we are getting Hydrochloric Acid vapor. This vapor is passed through the water to produce 30% Hydrochloric Acid. Material getting from reactor is feed into acid stripper to remove the acidity. Material from the stripper is sent to remove any unreacted benzene. The benzene free material is feed into the MCB stripper; from MCB stripper we are getting pure mono chloro benzene from the top and dichlorobenzene from the bottom.

Chemical Reaction:

$C_6H_6 + Cl_2 \rightarrow C_6H_5Cl + HCl$

78 71 112.5 36.5

Mass Balance:



Process Description (ODCB & PDCB):

The raw material Benzene is fed into continuous chlorinator (Packed Column) via Benzene dryer to remove the moisture from Benzene. Chlorine is fed through vaporizer and reacts with Benzene in manner to produce DCB isomer and lower high boiler by controlling the process parameter, where HCl gas coming out from top of reactor is scrubbed with water in absorber to produce 30% HCl as byproduct.

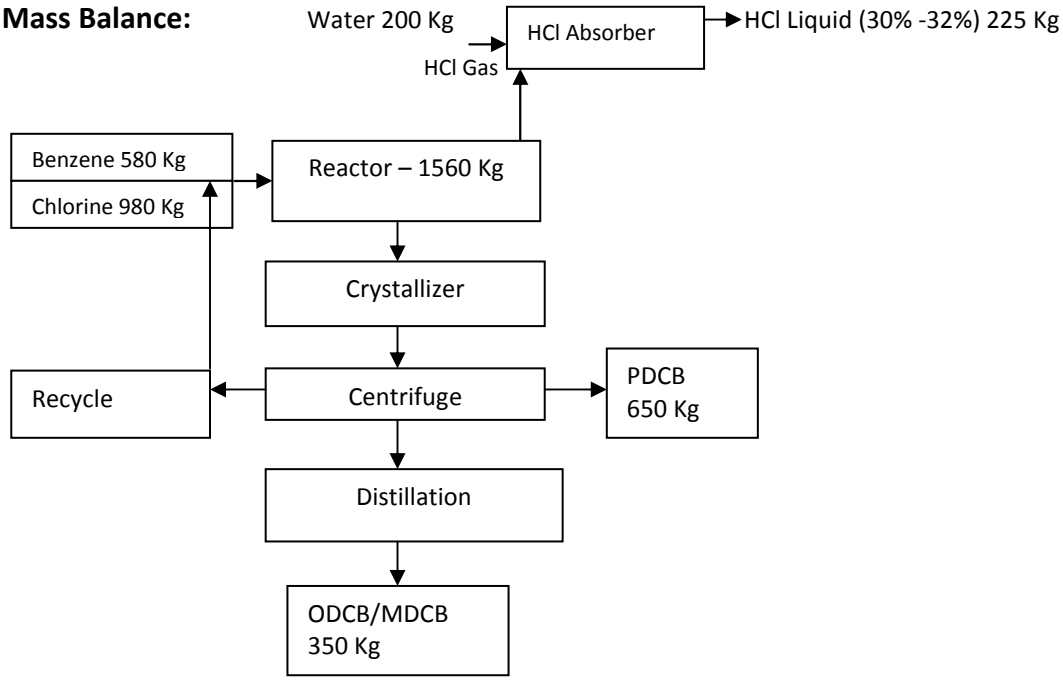
The reactor mass is washed with water to remove the impurity and then it is delivered to the crystallizer to crystallize para isomer of DCB. After crystallizing the PDCB, it is centrifuged and mother liquor is taken into distillation section. In distillation section, from the bottom of the first column ODCB is obtained and top contains high concentrate PDCB which is recycled in crystallization section. And from the top of the second column in distillation section, pure ODCB will be separated as a product.

Chemical Reaction:

$C_6H_6 + 1.5\ Cl_2 \rightarrow C_6H_5Cl_2 + HCl$

78 106.5 147 36.5

Mass Balance:



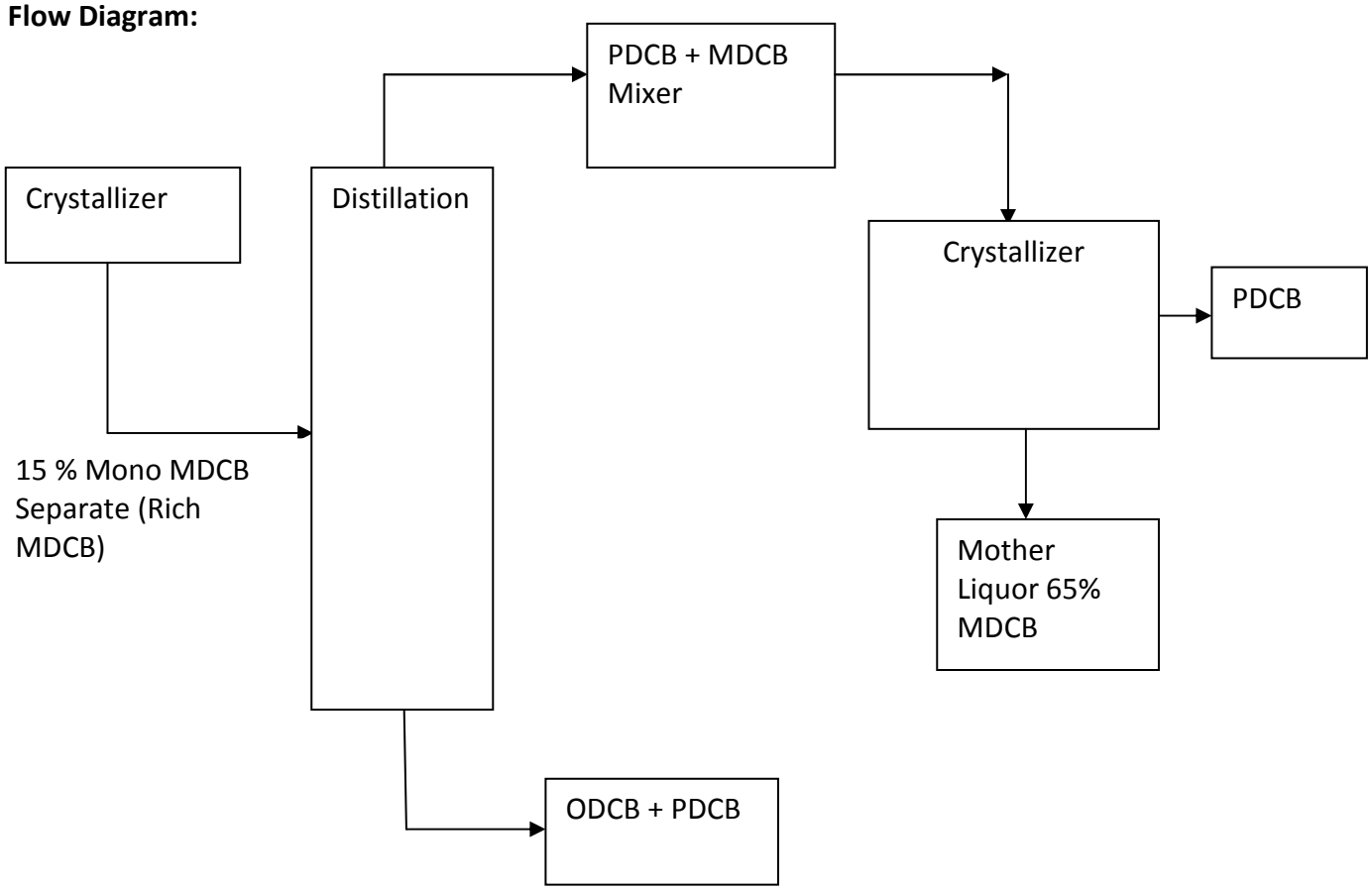
MDCB

Process Description

During chlorination of Benzene, a small quantity of MDCB is also produced. In the process, slowly it gets accumulated and when it reaches to more than 15% at the end of crystallization the stream is taken out and store separately.

This mixture is separated by distillation where rich MDCB is produced from top of the column and bottom product – a mixture of ODCB/PDCB - is recycled in the process. The top product – rich MDCB – is crystallized to get pure PDCB and MDCB.

Flow Diagram:

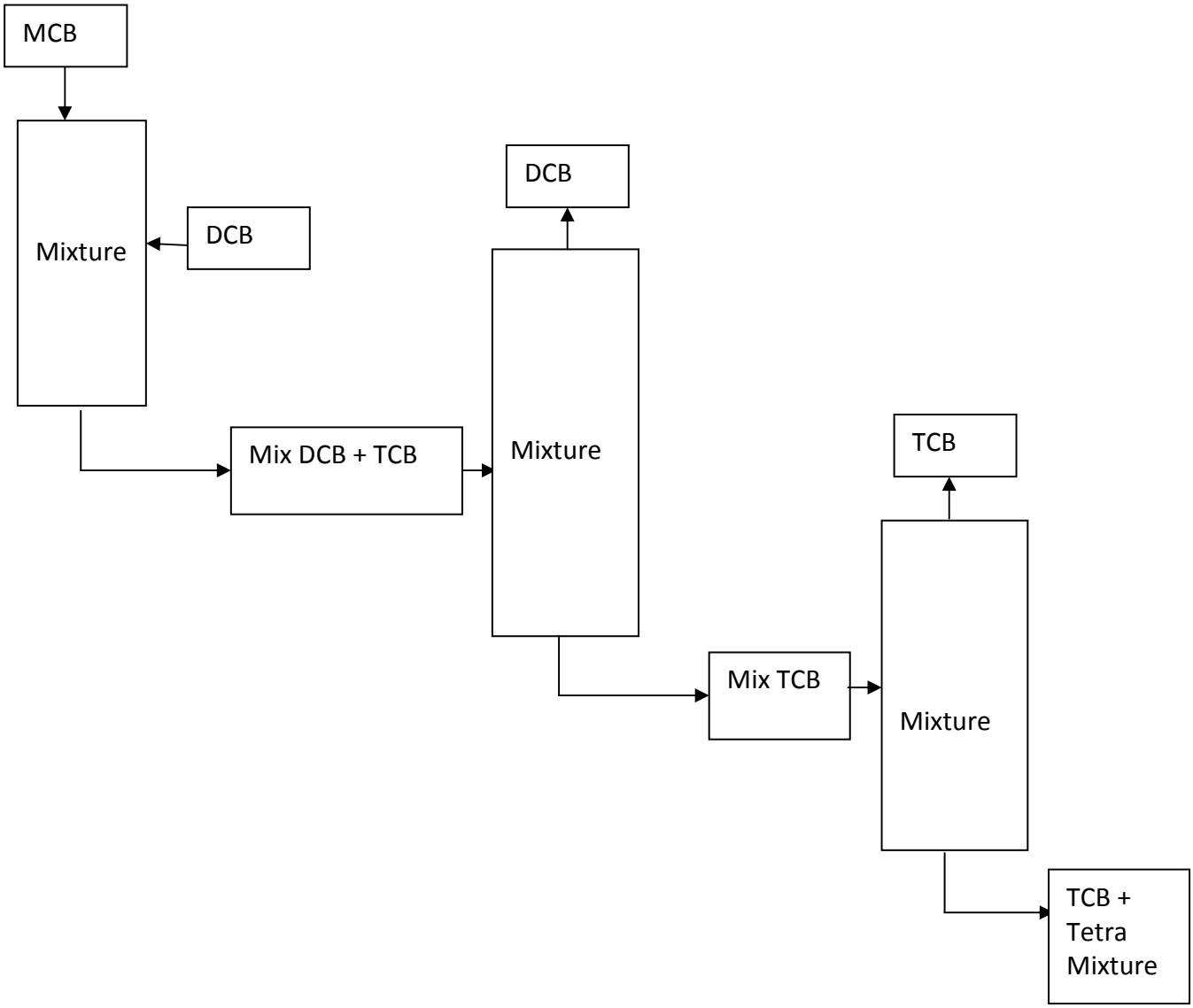


TCB

Process Description

During the separation of Di-Chloro Benzene, a mixture of Di-Chloro Benzene and Tri-Chloro Benzene is obtained. This mixture is taken for distillation where DCB is recovered and bottom product is collected as TCB and High Boiler. This mixture is further taken for distillation where pure Tri-Chloro Benzene (TCB) is collected where the bottom product rich in Tetra Chloro Benzene and Tri-Chloro Benzene - a small quantity is collected and recycle for next batch.

Flow Diagram:



2. Nitration (ONCB, PNCB & MNCB)

Manufacturing Process:

a. Mono Chlorobenzene containing recycled stream. Nitric acid and Sulphuric acid are introduced into the first nitrator. The rates of flow of each component are manually adjusted.

The nitration vessels are stainless steel reactors equipped with cooling coils and a powerful stirring system. The nitrator is cooled by water circulation through the coils. The reaction temperature is maintained constant by a thermostatic control system which adjusts the water flow to maintain the operating temperature. The nitration vessels are also provided with heating jackets that are kept under a very light vacuum by a suction system. The amount of nitrogen admitted is measured by online flow meters.

The reaction mixture flows from the overflow of the first nitrator of the second reactor and from this to the last. The emulsion reflowing from the last nitrator enters a separator. The speed separation is increased by admitting the inlet stream tangentially or the interface.

MCB and the Sulphuric acid (70-72%) are continuously separated into phases. The interface, i.e. the narrow emulsion layer, where separation has not yet taken place, is maintained at constant by means of an automatic 2 controller operating on the sulphuric acid outlet valve of the separator. The heavier Sulphuric acid layer on off via this valve flows by gravity to the stirred vessel. In the stirred vessel having cooling coils, the sulphuric acid (70-72%) is mixed. The cooled mixture flows to a continuous decanter, where the stripped acid is separated and sent to its storage tank.

The organic layer, consisting of MCB flows to a tank from which it is pumped to the first nitrator.

The acidic and crude MCB are purified in a series of washing and separation stages.

The moist MCB containing some un reacted staring product is preheated by passage through two successive heat exchangers. The first one is fed counter-currently by MCB leaving the distillation column; the second one is heated by means of steam. The distillation is carried out in a packed column operated under vacuum.

The bottom product is MCB containing less than 10% moisture and aromatic. The condensate is a mixture of water and aromatic that is separated. Water is discarded, while part of the aromatic returns to the column (reflux) and the balance is recycled to the nitration section.

b. Separation of Isomers

The crude NCB isomer mixture from the nitration plant is collected in an intermediate tank in which it is blended with fractions coming either from the crystallization section or from the distillation section. This blend rich in PNCB is sent to a batch crystallizer provided with a cooling / heating system.

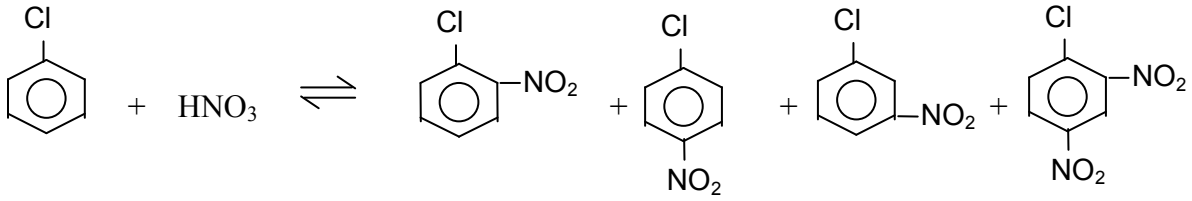
The first crystallization fraction is rich in ONCB that is sent to the distillation column K-101. The second crystallization fraction is a mixture of NCB having the same composition of crude NCB, which is recycled back in to the above mentioned intermediate tank. The third crystallization fraction is the pure NCB in melted form. The packed distillation column K-101 ensures a high efficiency of separation combined with a very low pressure drop. The bottom product consists of pure ONCB containing some DNCB. This fraction is sent to the distillation column K-301 for the removal of the DNCB and the isolation of pure ONCB and the top product is fed to the distillation column K-201 consisting of a mixture of rich in PNCB containing ONCB and MNCB.

The bottom product from distillation column K-201 is rich in PNCB with the remaining ONCB, sent back to the crystallization section. The head product is PNCB containing MNCB.

The purpose of the packed distillation unit K-301 is the separation of pure ONCB from the tails consisting of some Di-NCB.

Chemical Reaction:

Nitro chloro Benzene (NCB)

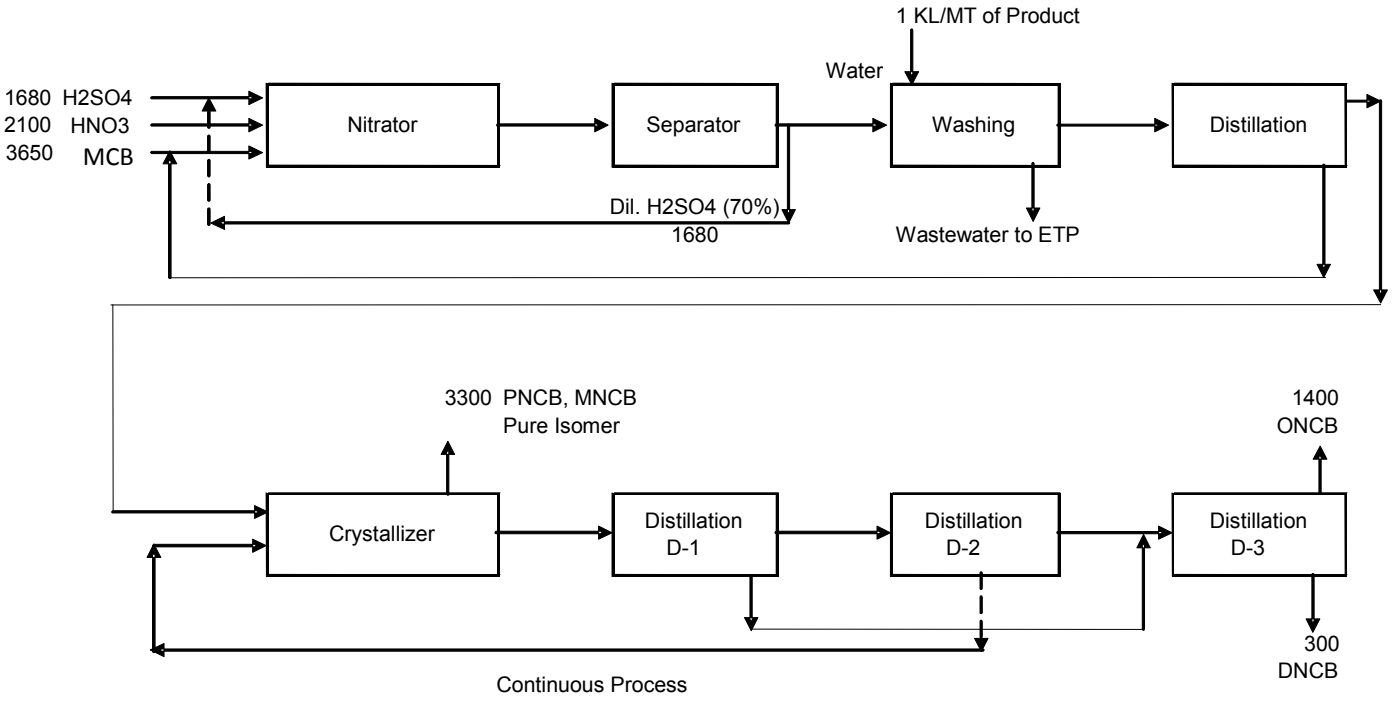


Chloro Benzene (112.5)	Nitric Acid (63)	o-Nitro Chloro Benzene (157.5)	p-Nitro Chloro Benzene (157.5)	m-Nitro Chloro Benzene (157.5)	Dinitro Chloro Benzene (202.5)

c. Separation of Isomers

The crude N isomer mixture is firstly separated in the vacuum distillation column K-101 Head product is pure ONCB, PNCB, DNCB & MNCB.

Mass Balance:



MASS BALANCE OF NITROCHLOROBENZENE

1. Calcium Chloride

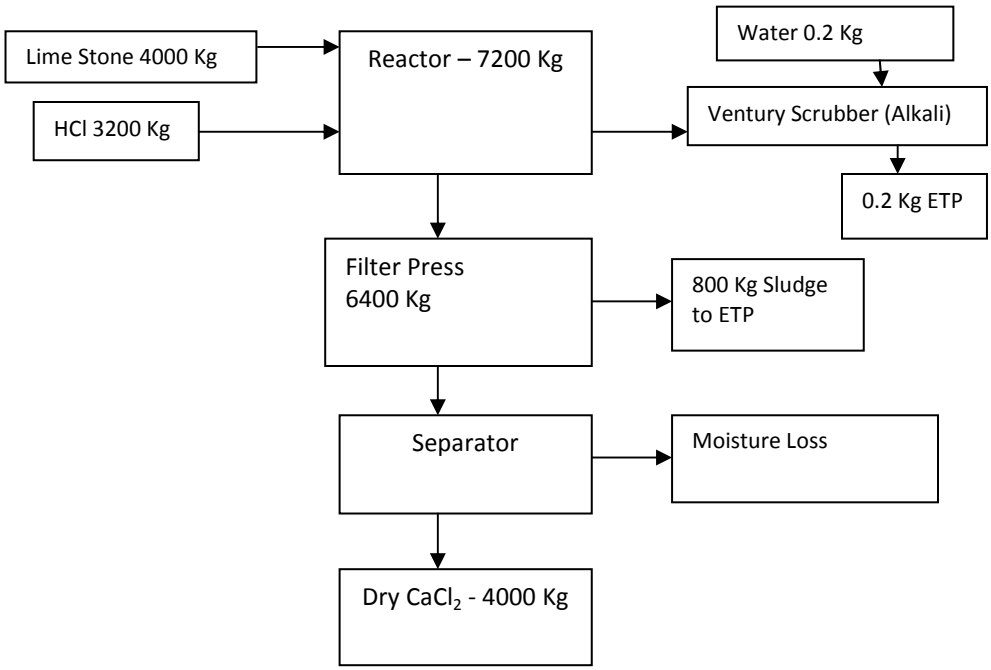
Manufacturing Process:

Calcium Carbonate is reacted with Hydrochloric Acid to get Calcium Chloride.

Chemical Reaction:

$$2CaCO_3 + 4\,HCl \longrightarrow 2CaCl_2 + 2\,HCO_3$$

Mass Balance:



Process Flow Chart of Calcium Chloride

4. Di Calcium Phosphate

Manufacturing Process:

Rock Phosphate is reacted with Hydrochloric Acid / Sulphuric acid to generated Phosphoric Acid, which is further reacted with Lime stone to get DCP which separated and crystallized.

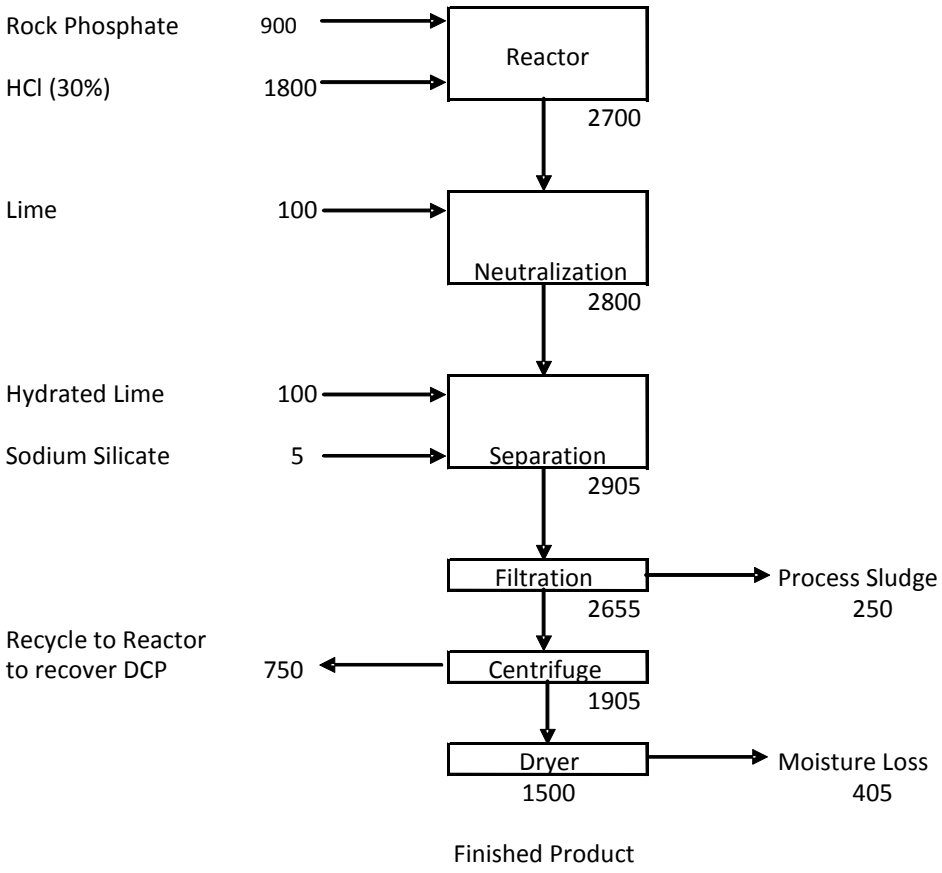
Chemical Reaction:

$$CaF_2\ \ 3(Ca_3(PO_4)_2) + 14\ HCl \longrightarrow 7\ CaCl_2 + 3\ CaH(PO_4)_2 + 2HF$$

$$3\ Ca(OH)_2 \longrightarrow 6CaHPO_4$$

DCP

Mass Balance:



MASS BALANCE OF DI CALCIUM PHOSPHATE

5) 2,4-Dichloro Nitrobenzene & Derivatives (Dichloro Aniline)

2,4-DichloroNitrobenzene

Brief Manufacturing Process

ODCB/PDCB containing recycled stream, nitric acid and sulphuric acid are introduces into the first nitrator. The rates of flow of each component are manually adjusted.

The nitration vessels are stainless steel reactors equipped with cooling coil and powerful stirring system. The nitrator is cooled by water circulation through the coils. The reaction vaccum by stemperature is maintained constant by a thermostatic control system, which adjusts the water flow to maintain the operating temperature. The nitration vessels are kept under a minor vaccum by a suction system. Inter gas is admitted to the top of the first nitrator while the process is on line. The amount of nitrogen admitted is measured by in line flow meters.

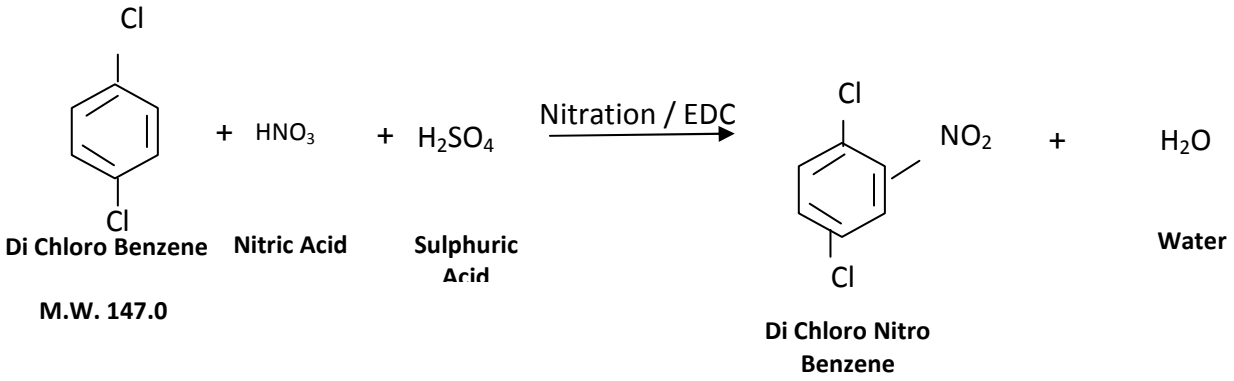
The reaction mixture flows from the overflow of the first nitrator of the second reactor and from this to the last. The emulsion is flowing from the last nitration enters a separator. The speed of separation admitting the inlet stream tangentially at the interface increases the speed separation. DCB and the sulphuric acid (70-72%) are continuously separated into phases. The interface, i.e. the narrow emulsion layer, where separation has not yet taken place, is maintained at constant by means of an automatic controller operating on the sulphuric acid outlet valve of the separator. The heavier H2SO4 layer on off via this valve and flows by gravity in hydrocarbon that not only extracts the notrobodies contained in it, but also uses up the excess nitric acid. The cooled mixture flows to a continuous decanter, where the stripped acid is separated and sent to its storage tank.

The organic layer consisting of Di Chloro Benzene and a small amount of DCNB flows to a small surge tank from which it is pumped to the first nitrator. The acidic and crude DCNB are puried in a series of washing and separation stages.

The most DCNB containing some unreacted starting product is preheated by passing through two successive heat exchangers. The first one is fed counter-currently by the DCNB leaving the distillation column, the second one is heated by means of steam. The distillation is carried out in packed operated under vaccum.

The bottom product is DCNB containing less tha 10% moisture and staring automatic, the condensate is a mixture of water and aromatic that is separated. Water is discarded, while part of the aromatic returns to the column (reflux) and the balance is recycled to the nitration section.

Chemical Reactions:



Di Chloro Benzene **Nitric Acid** **Sulphuric Acid** **Water**

M.W. 147.0

Di Chloro Nitro Benzene

Mass Balance

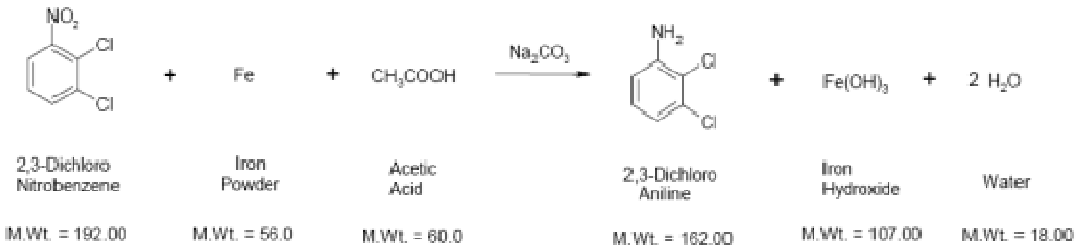
Di Chloro Nitro Benzene					
IN- PUT				**OUT- PUT**	
Sr No	**Raw Materials / Items**	**Kg/Batch**		**Product / Bi Product**	**Qty/Batch**
1	Di Chloro Benzene	790		Di Chloro Nitro Benzene	1000
2	Nitric Acid	340		Dilute Sulphuric Acid	280
3	Sulphuric Acid	180		Distillation Residue	14
4	Water for Washing	400		Aqueous Effluent to ETP	416
	Total	**1710**		**Total**	**1710**

Dichloro Aniline

Manufacturing Process:

2,3-Dichloro Nitrobenzene undergoes reduction by Iron Powder as well as Hydrochloric Acid to give Crude product 2,3-Dichloro Aniline. After the reaction add Solvent & Iron Hydroxide is isolated by filtration. Finally, solvent is recovered by distillation to get the final product.

Chemical Reaction:



Mass Balance

	IN – PUT		**OUT – PUT**	
Sr. No.	**Raw Materials / Items**	**Kg / Batch**	**Product / Byproduct**	**Qty. / Batch**
1	Di chloro Nitro Benzene	1540	Dichloro Aniline	1000
2	Solvent	1480	Recovered Solvent	1435
3	Iron	870	Solvent Loss	45
4	Hydrochloric Acid	20	Iron Hydroxide (Sludge)	1700
5	Soda Ash	15	Distillate Water	527
6	Water	800	Distillate Residue	18
	Total	**4725**	**Total**	**4725**

5) Fungicide

a. Hexaconzole (T)

Process Description:

I_VC - VP

S.No.	Raw Material	Qty.		Ratio	MW	Mole	M/R	spgr
1	Valeryl Chloride	1000	kgs.	1.0000	120.6	8.29	1.00	0.995
2	MDCB	1250	kgs.	1.2500	147	8.50	1.03	1.3
3	Aluminium chloride	1719	kgs.	1.7188	133.34	12.89	1.55	2.44
4	Water	5138	lits.	5.1375	18	285.42	34.42	1.0

6856

IInd Wash 3000

Process

1. charge MDCB M/C less than 0.1 %., start stirring.
2. Then charge $AlCl_3$ U/S
3. Heat to 50 ° C
4. Start addition of VC at 50° C
5. After addition maintain for 3.0 hr.on 75-80°C.
6. Check sample for conversion of VC to VP thro' Ester.
7. After completion quinch the RM in water(4) up to 80°C
8. Stirr for 1 hr.Separate Aquious , wash organic layer with water.
9. Take organic layer for distillation.

Out Put

S.No.	Finished Product	Qty.		Ratio	MW	Mole	M/R	spgr	B.P.°C	Y %
VP	Valerophenone Dist.	1800	kgs.	1.8000	231.12	7.79	0.94	1.2	96 (2 mm Hg)	

Residue 70Kg

II_VP TO OXIRANE

S.No.	Raw Material	Qty.		Ratio	MW	Mole	M/R	Sp.Gr.
1	Valero Phenone (VP)	**1800**	kg.		1.0000	231.12	7.79	1.00
2	Dimethyl sulfide (DMS)	2115	kg.		1.1750	62.13	34.04	4.37
3	Dimethyl Sulfate (DMSO4)	1170	kg.		0.6500	126.13	9.28	1.19

4	Potassium Hydroxide(KOH)	900	kg.	0.5000	56.1	16.04	8.02
5	PTC	18	kg.	0.0100			
6	Water	36	kg.	0.0200	18	2.00	0.26

K- SALT- Potassium Methyl Sulphate 150.2

Process

1. Charge VP,DMS,CAT PTC & Water at room temperature.
2. Add DMSO4 at R.T.
3. Slowly heat up to 40°c & Maintain for 1hr.
4. Add KOH at 40°c. in 2.0 hr.
5. Maintain for 1 hr. at 40°c.
6. Send the sample to q.c.lab for VP to Oxirane conversion.
7. VP should be < 2.0% & Oxirane should be >97.0%.
8. If results are not as per point no. 7 , maintain 1 hr. more to achieve desire results.
9. Start collection of DMS & apply heating up to 50°c.(Finally under vacuum upto 90°C.)
10. After recovery of DMS ,Send the sample to q.c.lab for vp to oxirane conversion.
11. VP should be < 2.0% & Oxirane should be >97.0%.
12. Add 1800.0 ml water filter the mass
13. Wash filtrate cake with 1800.0
14. Give 1800.0 ml X 2.0 water wash to organic layer (pH 6.8 to 7.0)
15. Recover EDC at normal & finally under Vacuum with max temp 75°c.
16. Send sample to q.c. lab for % age of VP & Oxirane & check the qty of Oxirane.
17. Take this Oxirane to Hexa preparation.

Intermediate Product	Qty.	Ratio	MW	Mole
2-(2,4-Dichlorophenyl)-2-butyl-oxirane	1800	kgs.	1.0000	

III _Oxirane to Hexaconazole

S.No.	Raw Material	Qty.	Ratio	MW	Mole
1	Oxirane	1800	kg.	1	
2	1,2,4 - triazole	504	kg.	0.2800	
3	DMF	6300	lit.	3.5000	
4	NaOH	54.0	kg.	0.0300	
5	Water	2700	lit.	1.5000	
6	Methanol 90%	1800	lit.	1.0000	

Process :-

Charge 1+2+3+4 starrt agitation.
Heat to 115-120°C & maintain for 3 hrs.
Check sample for Oxirane content.if less than 0.5%
Distill off DMF under vacuum to max. temp. 98°C.

Add	900.0	lit. water, stirr, settle , separate aq.layer.
Add	900.0	lit. water, adjust pH 6 by 20% HCl, stirr, settle , separate aq.layer.
Add	900.0	lit. water, stirr, settle , separate aq.layer.

Hexa crude dehydrated under vacuum.

Add	1800.0	lit. 90% MeOH at 60°C, or drawing Hexa crude in 90% MeOH.

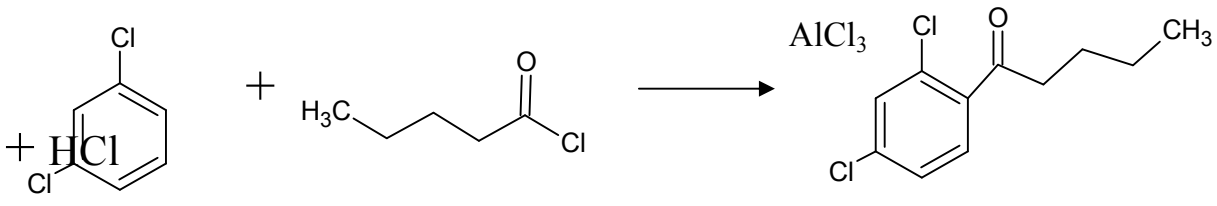
Cool, chill to 20°C , maintain for 1.0 hr. on 20°C
,filter, dry.

Finished Product	Qty.	Ratio	MW	Mole
Hexaconazole1st crop	1854	kgs.	1.0300	
Hexaconazole 2nd crop	54	kgs.	0.0300	

Chemical Reaction

HEXACONZOLE REACTION SCHEME

Step I: VC to VP

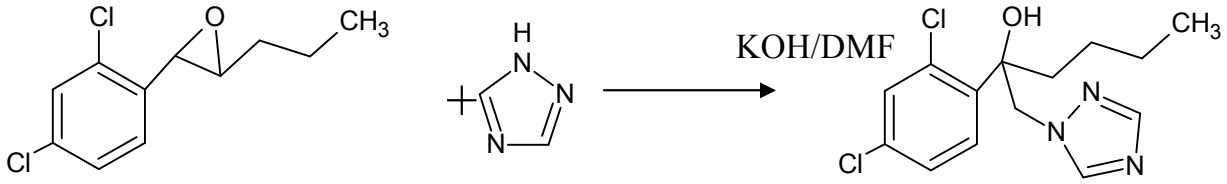


2,4 Dichloro benzene (MDCB)	Valeroyl chloride (VC)	Valerophenone (VP)	HCl
M.W. = 147.00	M.W.= 120.57	M.W.= 231.11	M.W.= 36.5

Step II: VP to Oxirane

Valerophenone (VP)	Oxirane	Potassium methyl sulfate
M.W.= 231.11	M.W.= 231.11	M.W.= 150.20

Step III: Oxirane to Hexaconazole



Oxirane	1,2,4-Triazole	Hexaconazole
M.W.= 231.11	M.W.= 69.06	M.W.= 314.21

b) Tebuconzole (T)

Process Description:

Step -1

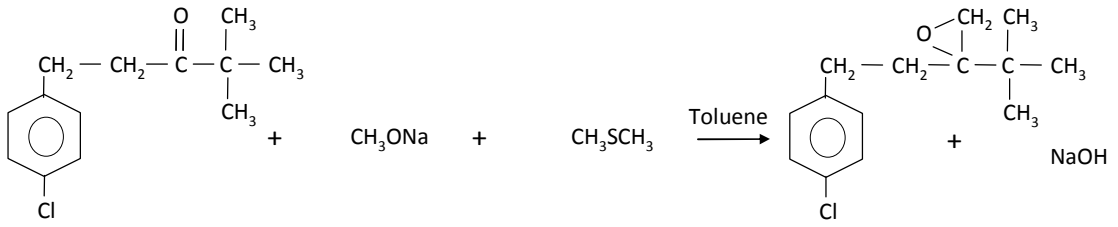
1-(4-Chlorophenyl)-4,4-Dimethyl-3-Pentanone reacted with Sodium Methoxide & Dimethyl Sulfide in presence of Toluene to get 2- [2-(4- Chlorophenyl)ethyl]-2-(1,1 – Di methyl ethyl) Oxirane.

Step -2

2- [2-(4- Chlorophenyl)ethyl]-2-(1,1 – Di methyl ethyl) Oxirane. is reacted with 1,2,4-Triazole in presence of DMF to give final product TEBUCONAZOLE

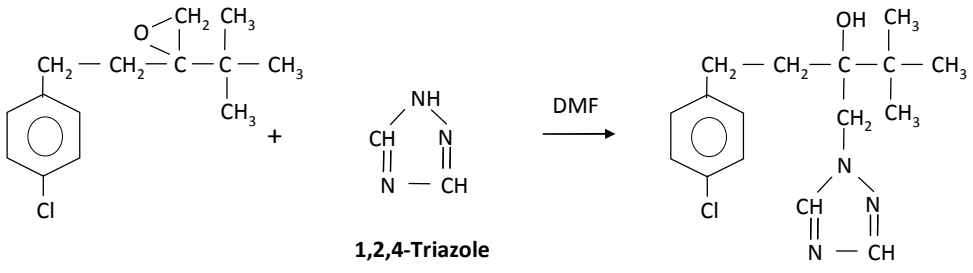
Chemical Reaction

STEP:1



1-(4-Chlorophenyl)-4,4-Dimethyl-3-Pentanone **224.5** | **Sodium Methoxide** **54** | **Dimethyl Sulfide** **62** | **Intermediate-I** **238.5** | **40.0**

STEP:2



238.5 | **1,2,4-Triazole** **69** | **TEBUCONAZOLE** **307.5**

M-aterial Balance / Mass Balance (All Quantities are in Kg)

IN- PUT				**OUT- PUT**	
Sr No	**Raw Materials / Items**	**Kg/Batch**		**Product / Bi Product**	**Qty/Batch**
1	1-(4 – Chlorophenyl) 4-4-Dimethyl -3- Pentanoate	675		Tebuconazole	1000
2	Sodium Methoxide	162		Recovered Solvent - Toluene	1360
3	Di Methyl Sulfide	186		Solvent Loss - Toluene	40
4	Solvent - Toluene	1400		Methanol	95
5	1,2,4 - Triazole	206		20 % Sodium Methyl Sulfide	1048
6	Solvent - DMF	1100		Recovered Solvent - DMF	1070
7	Water	1690		Solvent loss - DMF	30
				Aqueous Layer to ETP	768
				Distillation Residue	14
	Total	**5419**			**5419**

c) Propioconzole (T)

Process Description

Step -1

1,3-Dichloro benzene is reacted with Acetyl chloride in presence of Aluminum Chloride and Solvent - Ethylene Di Chloride to get 2,4-Dichloro Acetophenone.

Step -2

2,4-Dichloro Acetophenone further reacted with bromine in presence of Solvent - Ethylene Di Chloride to get 2,4-Dichloro Phenacyl Bromide.

Step -3

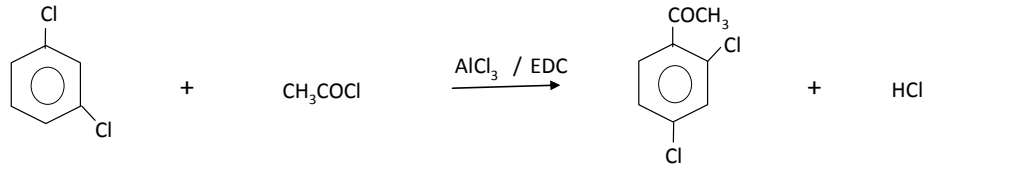
2,4-Dichloro Phenacyl bromide reacted with 1,2-Pentanediol in presence of Toluene to get 4-(2-Bromomethyl-4-Propyl-1,3-Dioxolane-2-yl)-1,3-Dichlorobenzene.

Step - 4

4-(2-Bromomethyl-4-Propyl-1,3-Dioxolane-2-yl)-1,3-Dichlorobenzene further reacted with 1,2,4-Triazole in presence of Potassium hydroxide and Solvent DMF to get final product PROPICONAZOLE.

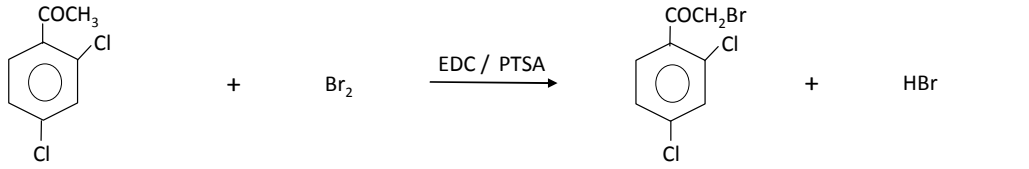
Chemical Reaction

STEP:1



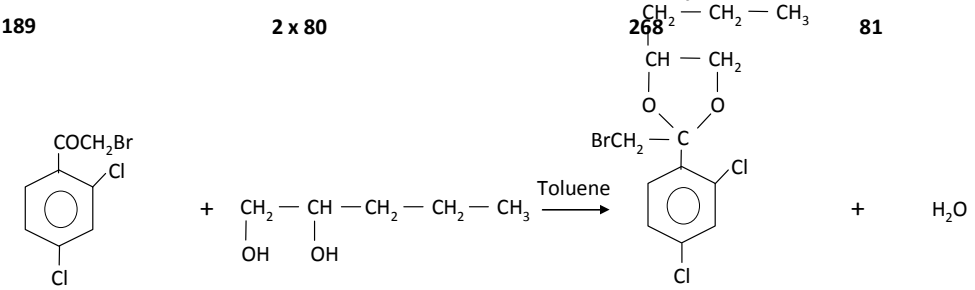
1,3 – Dichloro Benzene	Acetyl chloride	2,4 – Dichloro Acetophenone	Hydrochloric Acid
147	78.5	189	36.5

STEP:2



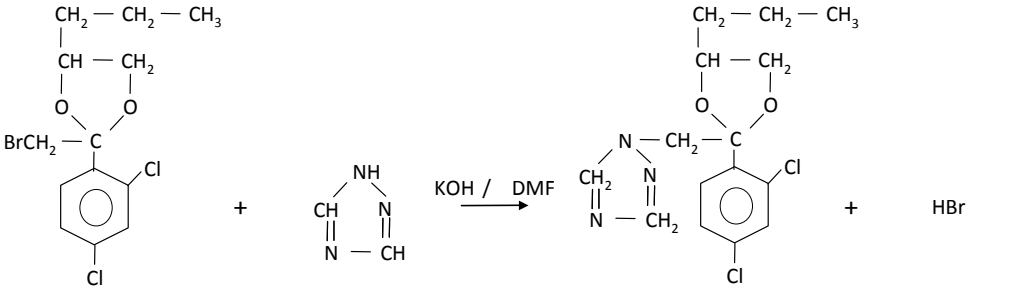
2,4 – Dichloro Acetophenone	Bromine	2,4 – Dichloro Phenacyl bromide	Hydrobromic Acid
189	2 x 80	268	81

STEP:3



2,4 – Dichloro Phenacyl bromide	1,2-Pentanediol	4-(2-Bromomethyl-4-Propyl-1,3-dioxolane-2-yl)-1,3-Dichlorobenzene	
268	104	354	18

STEP:4



4-(2-Bromomethyl-4-Propyl-1,3-dioxolane-2-yl)-1,3-Dichlorobenzene	1,2,4-Triazole	PROPICONAZOLE	Hydrobromic Acid
354	69	342	81

Material Balance / Mass Balance (All Quantities are in Kg)

IN- PUT				**OUT- PUT**	
Sr No	**Raw Materials / Items**	**Kg/Batch**		**Product / Bi Product**	**Qty/Batch**
1	1,3 Di Chloro Benzene	452		Propiconazole	1000
2	Acetyl Chloride	238		Recovered Solvent - EDC	1570
3	Alumimun Chloride	558		Solvent Loss EDC	30
4	Solvent - EDC	1600		20 % Aluminium Chloride	2786
5	Bromine	553		30 % Hydrochloride Solution	375
6	Catalyst	10		Recovered Solvent - DMF	970
7	1,2 - Butanediol	320		Solvent loss - DMF	30
8	Solvent - Toluene	1000		Potassium Bromide	390
9	Potassium Hydroxide	166		Recovered Catalyst	12
10	1,2,4 - Triazole	210		Recovered Solvent - Toluene	975
11	Solvent – Dimethyl Formamide	1000		Solvent Loss - Toluene	25
12	Water	3672		28 % Hydrobromic Acid	890
13				Aqueous Layer to ETP	712
14				Distillation Residue	14
	Total	**9779**			**9779**

d) Fenbuconazole (T)

Process Description :

Step-1

Benzyl Nitrile is reacted with p-Chloro Ethyl Chlorobenzene in presence of solvent & Catalyst to form 1-(4-Chlorophenyl)Ethyl Benzyl Nitrile.

Step-2

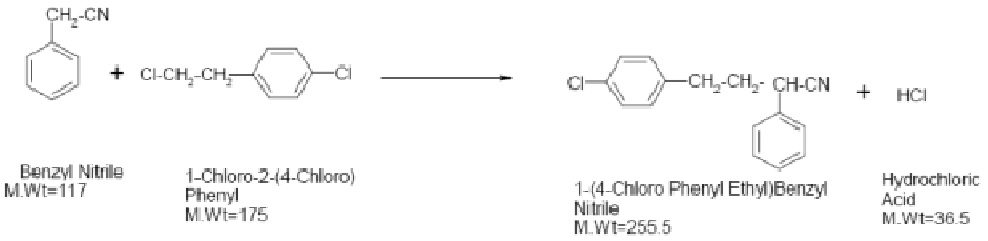
1-(4-Chlorophenyl)Ethyl Benzyl Nitrile reacts with Methyl Bromide to give 1-(4-Chlorophenyl)Ethyl Benzyl Nitrile.

Step-3

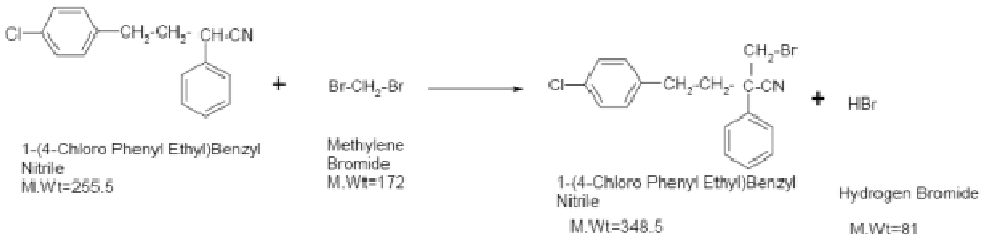
1-(4-Chlorophenyl)Ethyl Benzyl Nitrile reacts with 1,2,4-Triazole in presence of solvent and Catalyst to form the final product Fenbuconazole.

Chemical Reaction :

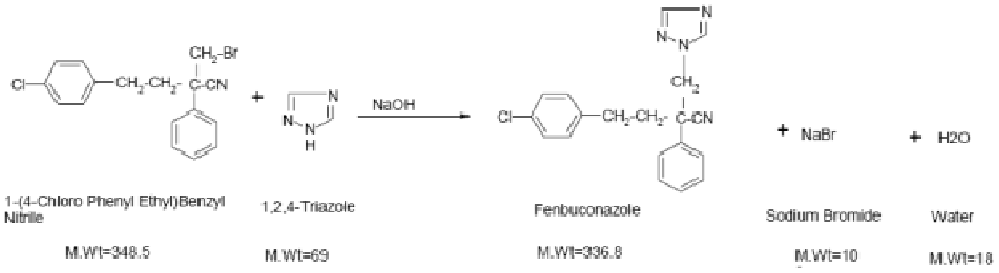
Step-1



Step-2



Step-3



Material Balance / Mass Balance of Fenbuconazole (T) (All Quantities are in kg)

	IN – PUT			OUT – PUT	
Sr. No.	**Raw Materials / Items**	**Kg / Batch**		**Product / Byproduct**	**Kg / Batch**
1)	Benzyl Cynamide	380		Fenbuconazole	1010
2)	1 – Chloro -2- (4-Chlorophenyl) Ethane	570		HBr Solution	870
3)	Methylene Bromide	550		NaBr Salt	300
4)	Sodium Hydroxide	200		Recovered Solvent – Xylene	2430
5)	1,2,4 Triazole	130		Solvent Loss (Xylene)	70
6)	Solvent - Xylene	2500		Aqueous to ETP	365
7)	Catalyst	12		30% HCl Solution	647
8)	Water	1350			
	Total	**5692**		**Total**	**5692**

6) Herbicide
a) Dicamba (T)

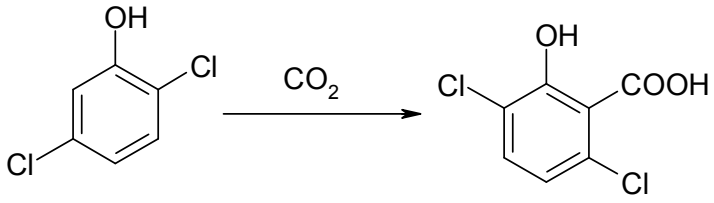
Process Description:

Step-1
2,5-Dichloro Phenol reacts with carbon Dioxide under pressure to get 3,6-Dichloro-2-Hydroxy Benzoic Acid

Step-2
3,6- Dichloro-2-Hydroxy Benzoic Acid reacts with Dimethyl Sulphate in presence of Sodium Hydroxide to get 3,6-Diclhloro-2-Methoxy Benzoic Acid (Dicamba)

Chemical Reaction:

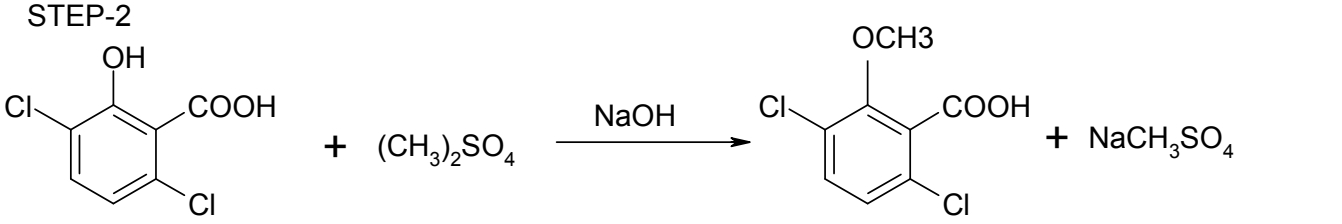
STEP-1



2,5-Dichloro Phenol
M.Wt=163

3,6-Dichloro,2-Hydroxy Benzoic Acid
M.Wt=207

STEP-2



3,6-Dichloro,2-Hydroxy Benzoic Acid
M.Wt=207

Methyl Sulfate
M.Wt=126

3,6-Dichloro,2-Hydroxy Benzoic Acid
M.Wt=233

Sodium Methyl Sulfate
M.Wt=134

Material Balance/Mass Balance (All Quantities are in Kg)

Dicamba (3,6 Dichloro-2-methoxy benzoic acid)					
IN- PUT				**OUT- PUT**	
Sr No	**Raw Materials / Items**	**Kg/Batch**		**Product / Bi Product**	**Qty/Batch**
1	2,4-dichloro phenol	820		Dicamba	1000
2	carbon dioxide	260		Recovered Solvent- Methenol	1345
3	dimehtyl sulfate	320		Solvent Loss -methenol	55
4	sodium hydroxide	205		Recovered Solvent- Toluene	1540
5	Solvent -Methenol	1400		Solvent loss - toluene	60
6	Solvent -Toluene	1600		distilalte water	110
7	Water	1100		Unreacted CO2	40
				Sodium Sulfate	740
				Aqueous Layer To E.T.P.	793
				Distillation Residue	22
	Total	**5705**		**Total**	**5705**

b) Metribuzine (T)

Process Description:

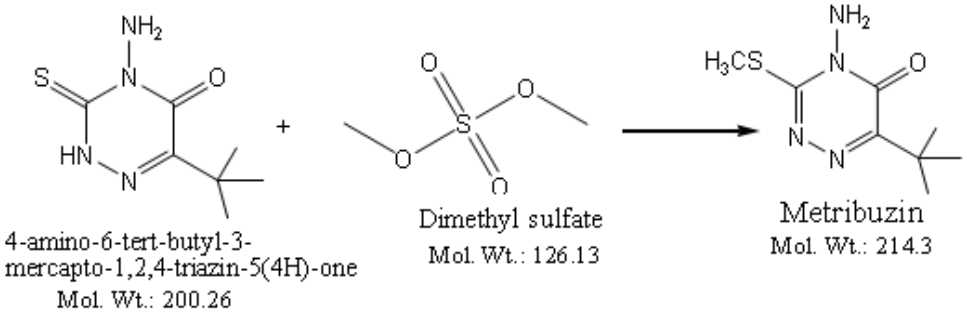
Step -1

Metribuzin is a 1,2,4-Triazinone class of herbicide. It is manufactured by the reaction of 4-Amino-6-Tert-Butyl-3-Mercapto-1,2,4-Triazin-5(4H)-one (ATMT) with Dimethyl Sulphate

<u>Step – 2</u>

Reaction of 4-Amino-6-Tert-Butyl-3-Mercapto-1,2,4-Triazin-5(4H)-one (ATMT) with Dimethyl Sulphate (DMS) in presence of Sulphuric Acid to give Metribuzine.

Chemical Reaction



Material Balance/Mass Balance (All Quantities are in Kg)

Metribuzine					
IN- PUT				OUT- PUT	
Sr No	**Raw Materials / Items**	**Kg/Batch**		**Product / Bi Product**	**Qty/Batch**
1	ATMT	1000		Metribuzine	1000
2	Di Methyl Sulphate	652		Sodium Sulphate	2130
3	Sulfuric Acid	1274		Organic Impuroties	512
4	Soda Ash	1600		Carbon Dioxide gas	664
5	Caustic Soda Flakes	30		Aqueous Layer to ETP	4750
6	Water	4500		Distillation Residue	0
	Total	**9056**		**Total**	**9056**

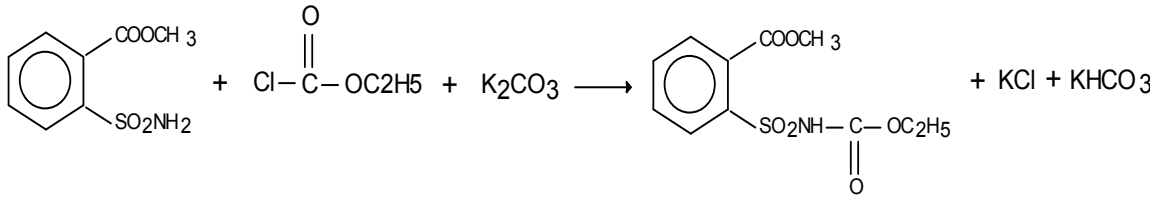
c) Metsulfuron Methyl (T)

Process Description

Potassium carbonate, acetone and sulfamoyl methyl benzoate are charged in reactor. Ethyl chloroformate is added in reaction mix maintaining temp. 60-65^{0}C. Acetone is recovered at 60-65 ^{0}C after filtration of inorganic matter. Ethyl carbamate of 2-sulfamoyl methyl benzoate as obtained as residue is reacted with 2-amino-4-methoxy-6-methyl-1, 3, 5-triazine to form crude Metasulfuron methyl which is further purified with methylene dichloride and n-hexane mix to get pure metsulfuron methyl.

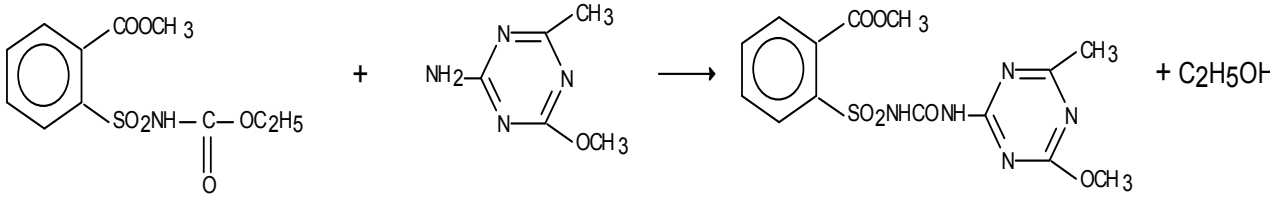
Chemical Reaction

Stage I: Preparation of ethyl Carbamate of 2-Sulfomoyl Methyl Benzoate



2-Sulfamoyl Methyl Benzoate (SMB) | Ethylchloroformate | Ethylcabamate of 2-Sulfamyol methyl benzoate

StageII: Preparation of Metasulfuron Methyl



Ethylcabamate of 2-Sulfamyol methyl benzoate | 2-Amino-4-methoxy-6-methyl-1,3,5-triazine | Metsulfuron Methyl | Ethanol

Material Balance

Stage - 1

Input	Qty. (Kg)		Output	Qty. (Kg)
2-Sulfomoyl Methyl Benzoate	827		Carbamate of 2-Sulfomoyl Methyl Benzoate	1104
Ethyl chloroformate	461		Potassium Carbonate	584
Potassium Carbonate	1115		Potassium Chloride	286
Acetone	3088		Potassium hydrogen carbonate	385
Water	7693		Acetone	3088
			Unreacted Ethyl chloroformate	44
			Water	7693
Total	**13184**		**Total**	**13184**

Stage - 2

Input	Qty. (Kg)		Output	Qty. (Kg)
Carbamate of 2-Sulfomoyl Methyl Benzoate	1104		Crude Metasulfuron Methyl	1465
2-amino-4-methoxy-6-methyl-1,3,5-Triazine	565		Ethanol	176
Mono Chloro Benzene	5961		Mono Chloro Benzene	5961
			Unreacted Triazine	28
Total	**7630**		**Total**	**7630**

Stage 3: Purification of Metasulfuron Methyl

Input	Qty. (Kg)		Output	Qty. (Kg)
Crude Metasulfuron Methyl	1465		Metasulfuron Methyl	1000
Methylene dichloride	1730		Methylene dichloride	1400
n-Hexane	1540		Methylene dichloride + n-Hexane	1450

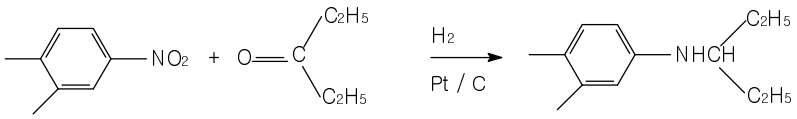
			Mixture	
			Residue	465
			Uncondensed Vapour	420
Total	**4735**		**Total**	**4735**

d) Pendimethalin (T)

Step I: Reductive alkylation of 4 NOX

4-Nitro-1, 2-xylene (4 –NOX) is reacted with hydrogen with Pt / C as a catalyst in presence of diethylketone when N-alkyl xylidine is formed.

Chemical Reaction

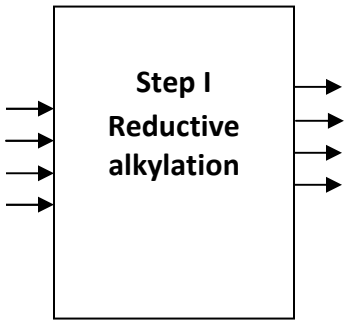


4-Nitro-1,2-xylene
M.W. 151

Di ethyl ketone
M.W.86

NAX M.W. 191

Material Balance :



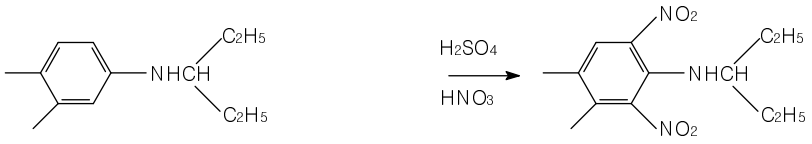
4-NOX	0577 gm
Hydrogen	0031 gm
Diethylketone	0658 gm
Pt / C catalyst	0005 gm
INPUT	**1271 gm**

NAX	0716 gm
DEK	0329 gm
Catalyst	0005 gm
Water	0221 gm
OUTPUT	**1271 gm**

Step II: Nitration of NAX

NAX is nitrated using sulfuric acid and nitric acid to PENDIMETHALINE.

Chemical Reaction

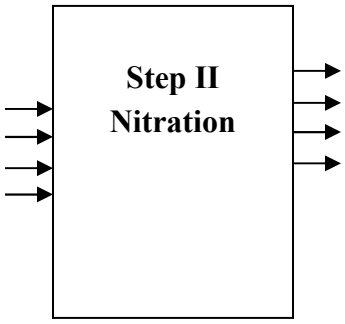


NAX M.W. 201

Pendimethalin
M.W. 281

Material Balance :

NAX	0715 gm
EDC	1000 gm
Sulfuric acid 98 %	0250 gm
Nitric acid 060 %	0786 gm
INPUT	**2751 gm**



Pendimethaline	0950 gm
Nitroso pendi	0060 gm
EDC	1000 gm
Spent acid 35 %	0741 gm
OUTPUT	**2751 gm**

f) Sulfentrazone

Manufacturing Process:

Step-1:

A mixture of phenyl hydrazine, acetaldehyde, sodium cyanate and acetic acid in solvent methanol was chlorinated using chlorine gas over a period of 6 – 8 hours at 50 – 55°C. Product of this step (Intermediate I) was filtered after recovery of methanol under reduced pressure.

Step 2:

A mixture of intermediate - II in solvent dimethyl formamide and potassium carbonate was heated to 175 – 180°C. Freon 22 gas was purged for 3 – 4 hours. The mass was cooled to 50 – 60°C and the resultant solid was filtered. Chlorine gas was purged to the filtrate over a period of 4 – 5 hours maintaining the temperature of the mass at 65 – 75°C. Solvent dimethyl formamide was distilled off under reduced pressure, residue quenched in water and filtered to give Intermediate – II.

Step 3:

Nitric acid was charged to a mixture containing Intermediate – II in solvent Dichloroethane and Oleum at ambient temperature. The mass was quenched in water & the resultant product (Intermediate – III) was obtained by filtration. Solvent Dichloroethane recovered during the process was recycled.

Step 4:

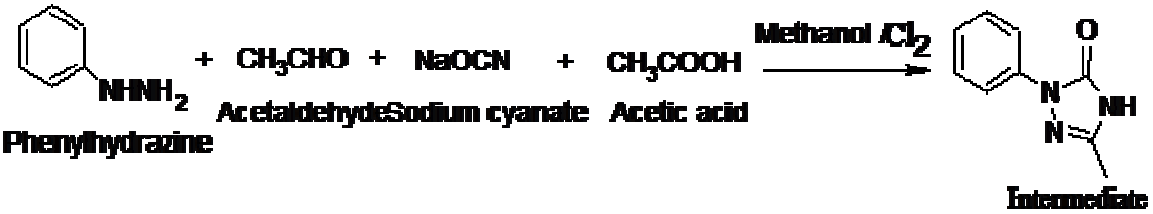
A solution containing intermediate – III in solvent isopropyl alcohol (IPA) and Pd/C catalyst was pressurized using hydrogen at 70 – 80°C for a period of 10 – 11 hours. The mass was cooled to 50 – 60°C & Pd/C Catalyst was filtered off and recycled. Solvent IPA was distilled, residue was quenched in water and the product (Intermediate-IV) was obtained by filtration.

Step 5:

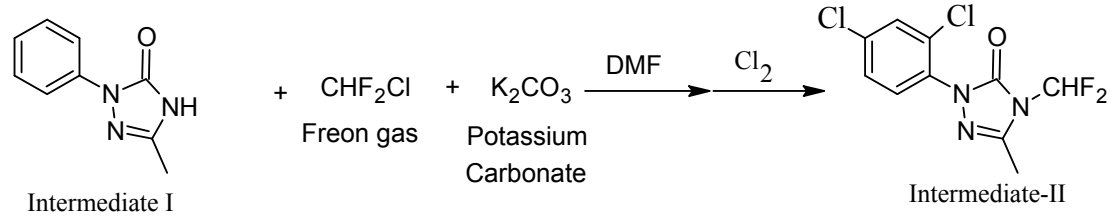
A mixture of Intermediate – IV, toluene and pyridine was charged to the reactor. Mixture was heated to 50 - 60°C and methane Sulfonyl chloride was charged. Reaction was subjected to a series of extractions. Pyridine was recovered by extraction with dichloromethane. Toluene was distilled and the residue was quenched in water and filtered to yield Sulfentrazone technical. Recovered toluene was recycled in subsequent batches.

Chemical Reaction:

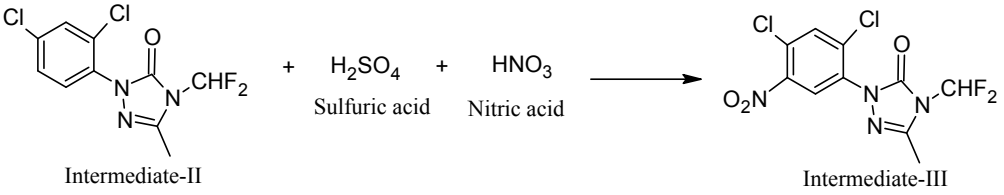
Step-I



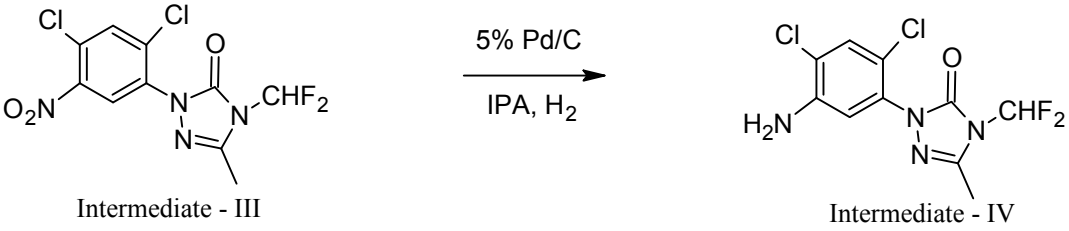
Step-II



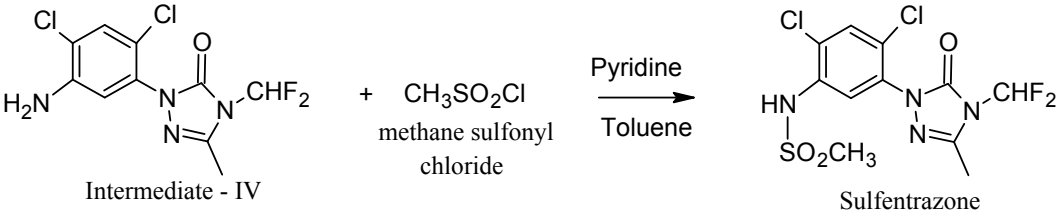
Step-III



Step-IV



Step-V



Mass Balance:

Sr. No.	Input (Raw Material)	Quantity (Kg)	Output	Quantity (Kg)
1.	Acetaldehyde	376.0	Sulfentrazone	1000.0
2.	Acetic Acid	500.0	Recovered Methanol	3888.0
3.	Chlorine	530.0	Methanol Loss	112.0
4.	Phenyl Hydrazine	765.0	DMF Recovered	7248.0
5.	Sodium Cyanate	530.0	DMF Loss	302.0
6.	Methanol	4000.0	MDC Recovered	2502.0
7.	Caustic Lye	500.0	MDC Loss	118.0
8.	Potassium Carbonate	900.0	IPA Recovered	6286.0
9.	Dimethyl Formamide	7550.0	IPA Loss	129.0
10.	Dichlorodifluoromethane	650.0	Toluene Recovered	4834.3
11.	Oleum	4450.0	Toluene Loss	149.5
12.	MDC	2620.0	Pyridine Recovered	466.0
13.	Nitric Acid	385.5	Pyridine Loss	24.6
14.	Iso Propyl alcohol	6415.0	Effluent	7527
15.	Methane Sulfonyl Chloride	689.0	Drying Loss	80.5
16.	Pyridine	490.6	Scrubbed NaOH Solution → Reuse	1472
17.	Toluene	4983.8	Spent Acid	3865
18.	Water	3669.0		
Total		**40003.9**	**Total**	**40003.9**

f). ETHOFUMESATE

MANUFACTURING PROCESS

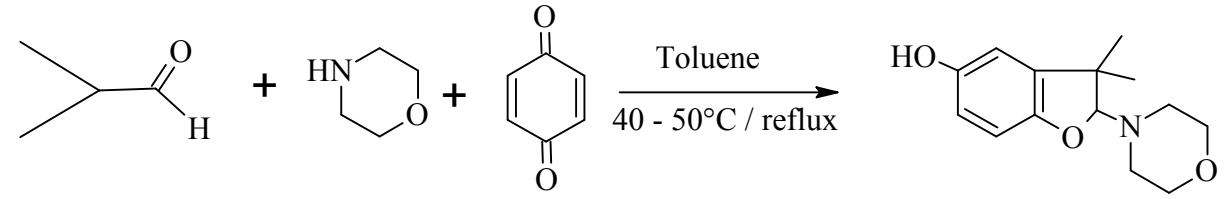
Step-1:
Morpholine was charged slowly to Isobutyraldehyde in toluene over a period of 1 – 2 hours maintaining the temperature of the mass at 40 – 50°C. Quinone in toluene was charged to the above mixture and the mass was cooked at reflux temperature for a period of 5 – 6 hours. Solvent toluene was recovered from the reaction mass at 80 – 90°C and 700 – 720mmHg vacuum and was recycled in subsequent batches. The residue was quenched in ice cold water and the mass was filtered. The product of this step, Intermediate - I was dried and taken for subsequent step.

Step-2:
A mixture of intermediate - I in solvent toluene and Triethylamine was cooled to 5 - 10°C. Methyl Sulfonyl chloride was charged to the above mixture over a period of 2 – 3 hours. After completion of reaction, the mass was filtered off to remove triethyl amine hydrochloride, which was basified with caustic lye solution and recycled in subsequent batches. The filtrate was washed with water and the product, Intermediate – II in solvent toluene was taken as such for next step reaction.

Step-3:
A mixture of Intermediate – II in toluene, ethanol and 35% hydrochloric acid was heated to reflux for a period of 8 – 10 hours. After completion of reaction, the reaction mass was washed to neutral pH using water and sodium bicarbonate solution. Solvent toluene was recovered from the reaction mass at 80 – 90°C at 700 – 720mmHg vacuum and was recycled in subsequent batches. The residue was quenched in ice cold water, filtered, washed with water, sucked well and dried to yield Ethofumesate technical with 96%+ purity.

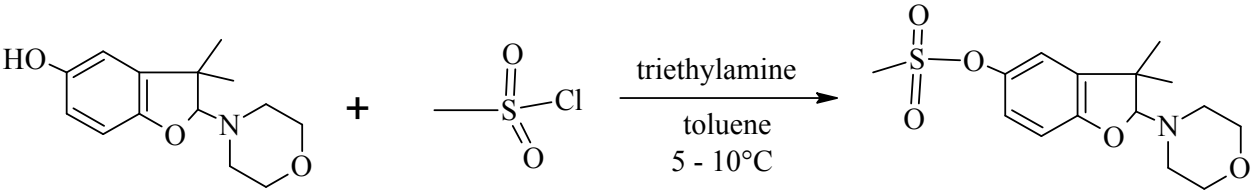
Chemical Reaction

Step-I



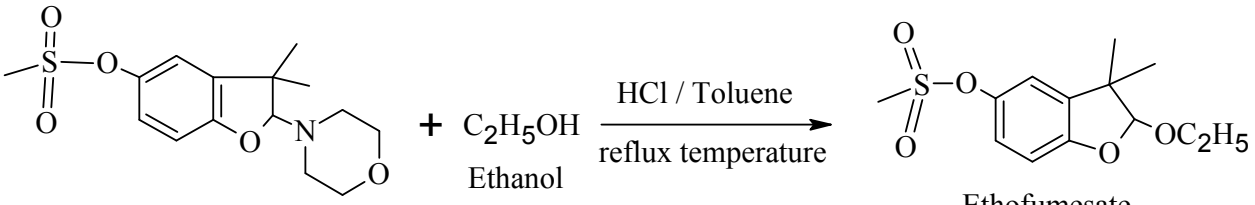
Isobutyraldehyde Morpholine Quinone Intermediate - I

Step-II



Intermediate - I methanesulfonylchloride Intermediate - II

Step-III



Intermediate - II Ethofumesate

Material Balance

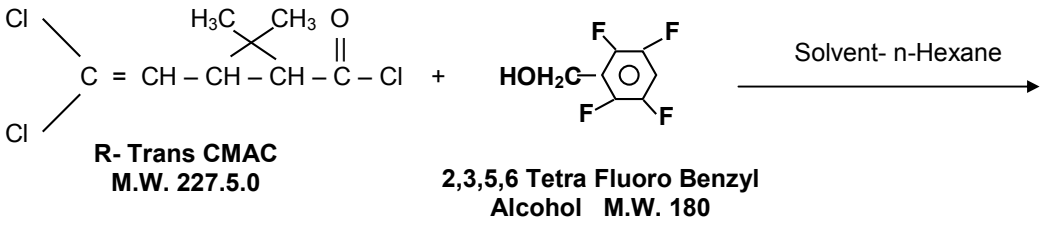
Sr. No.	Input (Raw Material)	Quantity (Kg)	Output	Quantity (Kg)
1.	Isobutyraldehyde	500.0	Ethofumesate	1000.0
2.	Morpholine	604.0	TEA Recovered	563.5
3.	Quinone	600.0	TEA Loss	11.5
4.	Toluene	4300.0	Toluene Recovered	4192.5
5.	Triethyl amine	575.0	Toluene Loss	107.5
6.	Methyl Sulfonyl Chloride	650.0	Drying Loass	60.0
7.	Caustic Lye	500.0	Distillation Residue	15.0
8.	Water	6000.0	Effluent	8229.0
9.	Ethanol	100.0		
10.	35% HCL	250.0		
11.	Sodium Bicarbonate	100.0		
Total		**14179.0**	**Total**	**14179.0**

7) Insecticide (T)
a) Transfluthrin (T)

Manufacturing Process:
2,3,5,6 - Tetra Fluoro Benzyl Alcohol is reacted with R –Trans Cypermethric Acid Chloride (R-Trans CMAC) in presence of Solvent n-Hexane to give the Tefluthrin mass. Hydrochloric acid gas is generated during the reaction which is scrubbed in water to get 30% solution of hydrochloric acid.

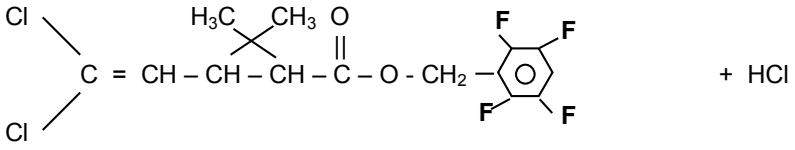
The resulting mass is then washed by Soda Ash solutions as well as water. Finally solvent is stripped off to recover it & to get the pure Transfluthrin Tech.

B) CHEMICAL REACTIONS:



R- Trans CMAC
M.W. 227.5.0

2,3,5,6 Tetra Fluoro Benzyl Alcohol M.W. 180



TRANSFLUTHRIN
M.W. 371.3

HYDROCHLORIC ACID
M.W. 36.5

Material Balance / Mass Balance (All Quantities are in Kg)

TRANSFLUTHRIN (TECH)					
IN- PUT				**OUT- PUT**	
Sr No	**Raw Materials / Items**	**Kg/Batch**		**Product / Bi Product**	**Qty/Batch**
1	2,3,5,6 Tetra Fluoro Benzyl Alcohol	500		Transfluthrin	1010
2	R- Trans Cypermethric Acid Chloride	631		Recovered Solvent - n Hexane	1950
3	Catalyst	12		Solvent Loss n - Hexane	50
4	Solvent- Hexane	2000		30 % HCl Solution	337
5	Water for HCl Solution	237		Aqueous Layer to ETP	533
6	5 % Soda Ash Solution	250			
7	Water for Washing	250			
	Total	**3880**			**3880**

b) Cyfluthrin & Beta Isomers (T)

Brief Manufacturing Process :-

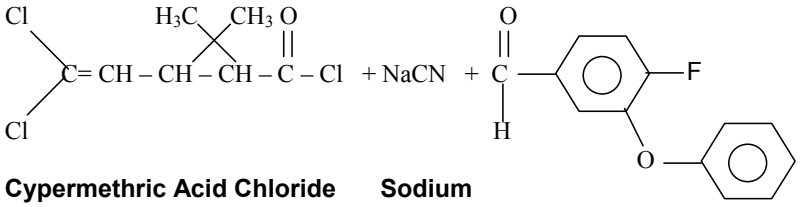
3- Phenoxy 4- Fluoro Benzaldehyde is reacted with Sodium Cyanide to form 3-Phenoxy 4-Fluoro Benzaldehyde Cyanohydrin as an intermediate. This on reaction with Cypermethric Acid Chloride (CMAC) forms the final Product Cyfluthrin. In this process n.- Hexane is used as solvent along with phase transfer Catalyst.

The reaction mass of Cyfluthrin is washed by Soda Ash solution & Water.

Finally n-Hexane is stripped off to get pure Cyfluthrin.

Aqueous layers which content traces of Sodium Cyanide is detoxified by the treatment of Sodium Hypochlorite 8 - 10% Solution to < 0.2 ppm Level.

B) CHEMICAL REACTIONS :-

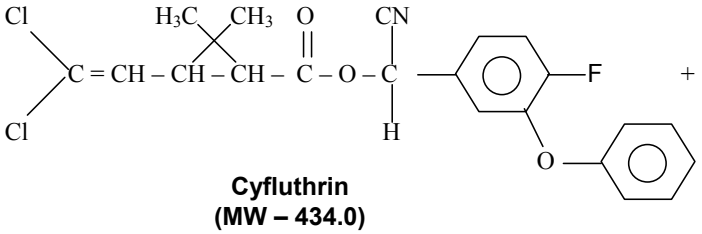


Cypermethric Acid Chloride (MW 227.5)

Sodium Cyanide

3- Phenoxy 4- Fluoro Benzaldehyde M.W.- 216.0

N. Hexane
Catalyst



Cyfluthrin (MW – 434.0)

Sodium Chloride M.W. -58.5

Material Balance / Mass Balance (All Quantities are in Kg)

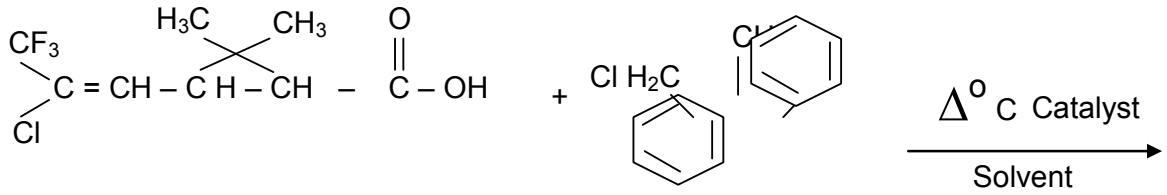
CYFLUTHRIN (TECH)					
IN- PUT				**OUT- PUT**	
Sr No	**Raw Materials / Items**	**Kg/Batch**		**Product / Bi Product**	**Qty/Batch**
1	3- Phenoxy -4- Fluoro Benzaldehyde	523		Cyfluthrin	1030
2	CMAC- Cypermethric Avid Chloride	578		Recovered Solvent – n - Hexane	2850
3	Water for Reaction	500		Solvent Loss n - Hexane	150
4	Sodium Cyanide	136		Detoxified Aqueous to ETP	3017
5	Solvent –n- Hexane	3000			
6	Catalyst	10			
7	5 % Soda Ash Solution	500			
8	5 % Acetic Acid Solution	500			
9	Water for washing	500			
10	8-10 % Sodium Hypochorite Solution	800			
	Total	**7047**			**7047**

c) Bifenthrin (T)

Brief Manufacturing Process :-

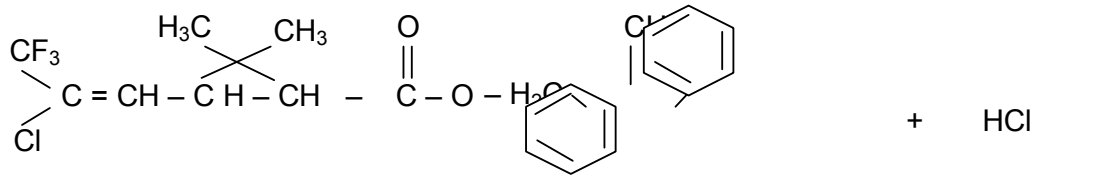
TFP Acid (Lambda Acid) is reacted with 3-Phenyl 2-Methyl Benzyl Chloride (PMBC) in presence of Solvent & catalyst to give the product Bifenthrin.

B) CHEMICAL REACTIONS :-



$C_8H_9O_2F_3Cl$
M.W. 229.5

$C_{14}H_{13}Cl$
M.W. 216.5



M.W. 36.5

$C_{22}H_{21}ClF_3O_2$
Bifenthrin
M.W. 409.5

Material Balance / Mass Balance (All Quantities are in Kg)

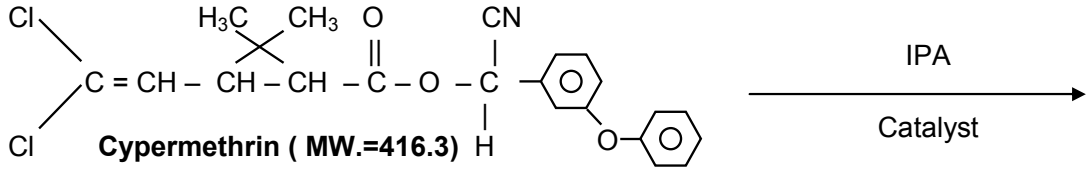
BIFENTHRIN (TECH)					
IN- PUT				**OUT- PUT**	
Sr No	**Raw Materials / Items**	**Kg/Batch**		**Product / Bi Product**	**Qty/Batch**
1	Lambda Acid	585		Bifenthrin	1030
2	3-Phenyl -2-Methyl Benzyl Chloride	558		Recovered Solvent - n Hexane	560
3	Catalyst	25		Solvent Loss n - Hexane	40
4	Solvent- Hexane	600		30 % HCl Solution	315
5	Water for HCl Solution	220		Distillation Residue	20
6	Water for Washing	500		Aqueous to ETP	523
	Total	**2488**		**Total**	**2488**

d) Cypermethrin (T) & Beta, Zeta, Theta etc Isomers (T)

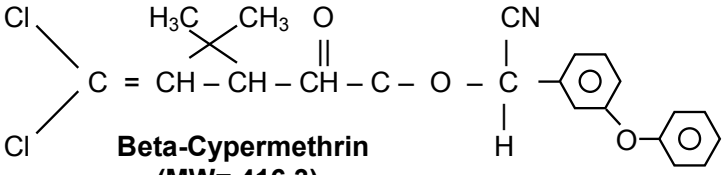
Brief manufacturing process:

Cypermethrin (Tech) of 50:50 Cis:Trans ratio of the purity >92% is treated with Epimerising Catalyst in pressure of Iso Propyl Alcohol – solvent to give Beta – Cypermethrin crude material which on recrystallisation from Iso Propyl Alcohol gives the pure product Beta – Cypermethrin

B) CHEMICAL REACTIONS:



Cypermethrin (MW.=416.3)



Beta-Cypermethrin
(MW= 416.3)

Material Balance / Mass Balance (All Quantities are in Kg)

BETA – CYPERMETHRIN (TECH)					
INPUT				**OUTPUT**	
Sr No	**Raw Materials / Items**	**Kg/Batch**		**Product / Bi Product**	**Qty/Batch**
1	Cypermethrin Tech	1430		Beta Cypermethrin	1010
2	Solvent –IPA for Reaction	1430		Recovered Solvent – IPA + Catalyst	2436
3	Catalyst - 1	143		Solvent + Catalyst Loss	252
4	Solvent –IPA for washings	1100		Cypermethrin Isomer	405
	Total	**4103**		**Total**	**4103**

e) Chloropyriphos technical 94%

Process Description

Stage: 1
Mono Chloro Acetic Acid is chlorinated over a moderated temperature by using suitable catalyst to give Di Chloro Acetyl chloride.

Stage: 2
Di Chloro Acetyl Chloride again chlorinated to give Tri Chloro Acetyl Chloride. Crude Tri Chloro Acetyl chloride will be distilled to get Pure Tri Chloro Acetyl Chloride.

Stage: 3
Trichloro Acetyl Chloride and Acrylo nitrile is reacted in the presence of suitable catalyst at 110°C to form hydroxy trichloro Pyridinol.

Stage: 4
2, 3, 5-Trichloropyridinol is reacted with sodium hydroxide lye to form sodium salt of 2, 3, 5-Trichloropyridinol.

Stage: 5
2, 3, 5-Trichloropyridinol is further reacted with sodium hydroxide under pressure at 125^{0}C to get pure sodium salt of 2, 3, 5-Trichloropyridinol.

Stage: 6
Sodium salt of 2,3,5-Trichloropyridinol is reacted with O, O-Di ethyl thio phosporyl chloride in the presence of suitable solvent and catalyst at 40°C to form Chlorpyriphos Technical.

Chemical Reaction

Stage -I

$ClH_2COOH + 3Cl_2 + \frac{1}{2}\,S + \frac{1}{2}\,Na_2CO_3$

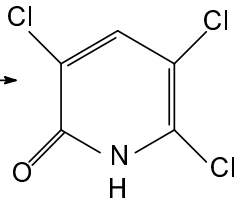
Monochloro Acetic Acid — Chlorine — Sulfur — Sodium Carbonate

↓

$Cl_3CCOCl + 3HCl + \frac{1}{2}\,Na_2SO_3 + \frac{1}{2}\,CO_2$

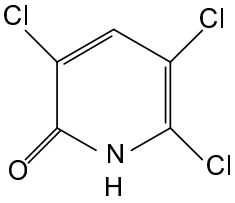
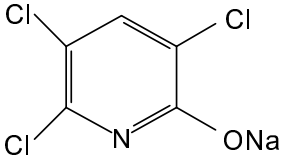
Trichloro Acetylchloride — Hydrochloric Acid — Sodium Sulfite — Carbon Dioxide

Stage -II

$Cl_3CCOCl + CH_2CHCN \rightarrow$  $+ HCl$

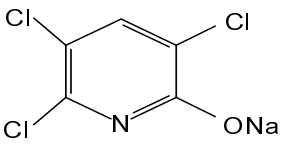
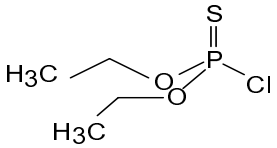
Trichloro Acetylchloride — Acrylonitrile — Trichloro Pyridone — Hydrogen Chloride

Stage -III

 $+ NaOH \rightarrow$  $+ H_2O$

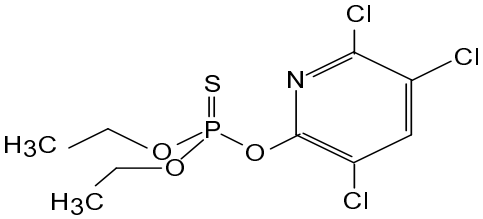
Trichloro Pyridone — Sodium Hydroxide — Sodium Salt Trichloro Pyridone — Water

Stage -IV

 $+$ 

Sodium Salt Trichloro Pyridone — Diethyl Thio Phosporyl Chloric

↓

 $+ NaCl$

Chlorpyrifos — Sodium Chloride

Material Balance:

Stage 1:

Input	Qty. (Kg)		Output	Qty. (Kg)
Monochloro Acetic Acid Ml'S	670		DCAC	815
Sulphur	140		Residue	214.3
Ferric Chloride	3.3		Hydrochloric Acid (28%)	2137
Chlorine	960		Sodium Sulfite Solution	2027
Water	1620			
NaOH (16% Solution)	1800			
Total	**5193.3**		**Total**	**5193.3**

Stage 2:

Input	Qty. (Kg)		Output	Qty. (Kg)
DCAC	815		TCAC	1000
Pyridine	5.5		Residue	10.5
Chlorine	392		Hydrochloric Acid (28%)	722
Water	520			
Total	**1732.5**		**Total**	**1732.5**

Stage 3:

Input	Qty. (Kg)		Output	Qty. (Kg)
Trichloro Acetyl Chloride	980		Stage – III	1020
Acrylonitrile	355		3-Chloro Propino Nitrile (Recovery for Re-Use)	1470
Cuprous Chloride	4.7		3-Chloro Propino Nitrile loss	89.7
3-Chloro Propionitrile	1300		Hydrogen Chloride	60
Total	**2639.7**		**Total**	**2639.7**

Stage 4:

Input	Qty. (Kg)		Output	Qty. (Kg)
Stage – III	1020		NaTCP Wet Cake (NaTCP 715 kg, Water 948 kg)	1663
Caustic Lye (48%)	1036		Effluent	3678
Water	2285			
Water (Washings)	1000			
Total	**5341**		**Total**	**5341**

Stage 5:

Input	Qty. (Kg)		Output	Qty. (Kg)
NATCP Wet Cake	1663		NaTCP Solution	7054
Caustic Lye (48%)	385			
Water	5000			
Carbon	6			
Total	**7054**		**Total**	**7054**

Stage: 6

Input	Qty. (Kg)		Output	Qty. (Kg)
EDC	5000		Chlorpyriphos Technical (95%)	1000
NaTCP Solution	7054		EDC Recovery	4820
DETCl	585		EDC Loss	180
TEBA	6		Carbon Recovery	10
4 DMAP	0.5		Effluent	7841.5
Water (Washings)	1200			
Phosphoric Acid	1			
Carbon	5			
Total	**13851.5**		**Total**	**13851.5**

f) Imidacloprid (T)

Brief manufacturing process:

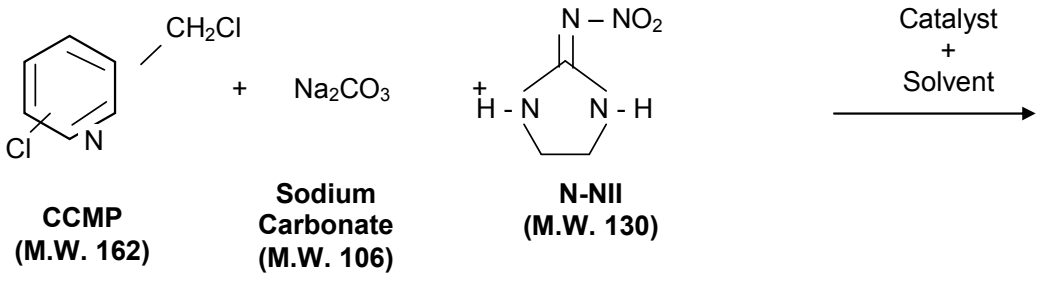
2 – Chloro, 5 – Chloromethyl Pyridine (CCMP) is reacted with N – Nitro Imino Imidazolidine (N-NII) in present of catalyst and solvent.

The Hydrochloric acid, which is formed during the reaction, is scavenged by putting Sodium carbonate as acid scavenger. The resulting mass is diluted by water & filtered to remove the salts of Sodium Chloride (NaCl) & Sodium bicarbonate.

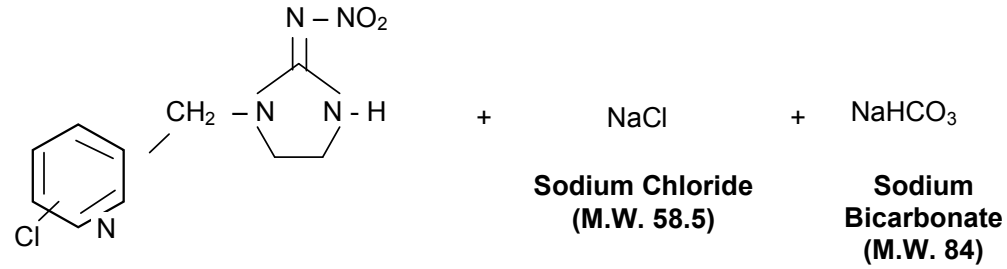
The organic mass is then treated with water and finally solvent is removed by distillation. The concentrated mass is then crystallized to get pure product – Imidacloprid (Tech)

Finally Toxic Effluent which contains traces of Pesticides is taken to Hydrolysis stage for detoxification. Where Aq. Mass is treated at high temp. by Alkali for the rapid hydrolysis of pesticides to simpler non-toxic compounds.

B) CHEMICAL REACTIONS:



CCMP (M.W. 162) | **Sodium Carbonate (M.W. 106)** | **N-NII (M.W. 130)**



Imidacloprid (M.W. 255.7) | **Sodium Chloride (M.W. 58.5)** | **Sodium Bicarbonate (M.W. 84)**

Material Balance / Mass Balance (All Quantities are in Kg)

IMIDACLOPRID (TECH)					
IN- PUT				OUT- PUT	
Sr No	**Raw Materials / Items**	**Kg/Batch**		**Product / Bi Product**	**Qty/Batch**
1	2- Chloro -5- Chloromethyl Pyridine	900		Imidacloprid	1030
2	N- Nitro N- Methyl Imidazolidine	850		Recovered Solvent DMF	2110
3	Sodium Carbonate	705		Solvent Loss DMF	90
4	Catalyst -1	10		Recovered Solvent Methanol	370
5	Solvent - DMF	2200		Solvent Loss Methanol	30
6	Water for Washings	1000		Aqueous Layer to ETP	2360
7	Caustic Lye 47 %	50		Distillation Residue	125
8	Solvent - Methanol	400			
	Total	**6115**		**Total**	**6115**

i) Clodinafop Propargyl (T)

Manufacturing Process:

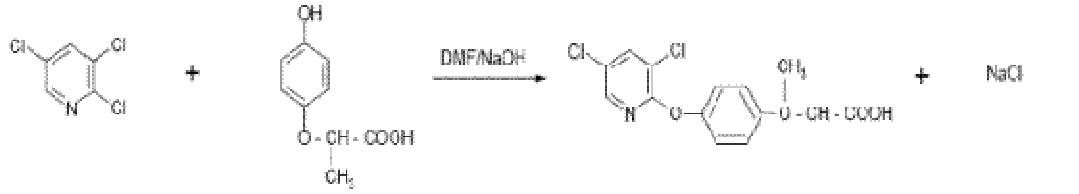
Process Description :

Step -1:
2,3,5 Tri Chloro Pyridine is reacted with 2 - (4- Hydroxy Phenoxy) Propionic Acid in presence of Solvent - Di Methyl Formamide (DMF) and Sodium Hydroxide to form 2- [-4 – {(3,5 Di Chloro -2- Pyridinyl) Oxy} Phenoxy] Propionic Acid.

Step -2 :
2- [-4 – {(3,5 Di Chloro -2- Pyridinyl) Oxy} Phenoxy] Propionic Acid reacted with Propargyl Chloride in Presence of Sodium Hydroxide as well as Solvent -Toluene to form final product as CHLORAZIFOP PROPARGYL

Chemical Reaction:

STEP-1



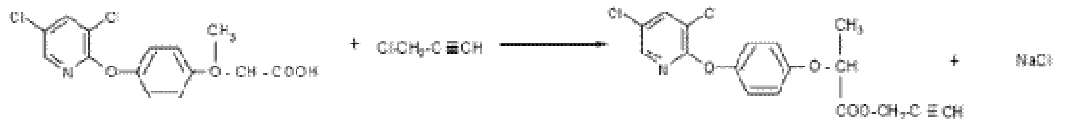
2,3,5-Trichloro Pyridine — M.Wt=182.50

2-(4-Hydroxy Phenoxy) Propionic Acid — M.Wt=182.03

2-[4-{(3,5-Dichloro-2-Pyridinyl)oxy] Phenoxy}Propionic Acid — M.Wt=324.00

Sodium Chloride — M.Wt=58.

STEP-2



2-[4-{(3,5-Dichloro-2-Pyridinyl)oxy] Phenoxy}Propionic Acid — M.Wt=324.00

Propargyl Chloride — M.Wt=74.5

Chlorazifop Propagyl — M.Wt=398.80

Sodium Chloride — M.Wt=58.5

Material Balance / Mass Balance of Chlorazifop Propargyl (All Quantities are in kg)

	IN – PUT			OUT – PUT	
Sr. No.	**Raw Materials / Items**	**Kg / Batch**		**Product / Byproduct**	**Qty. / Batch**
1)	2, 4, 5 Tri Chloro Pyridine	514		Chlorazifop Propargyl	1000
2)	2 – (4 – Hydroxy Phenoxy) Propionic Acid	512		Recovered Solvent - DMF	1170
3)	Sodium Hydroxide	224		Solvent Loss (DMF)	30
4)	Solvent – Di Methyl Formamide (DMF)	1200		Sodium Chloride	340
5)	Propargyl Chloride	208		Recovered Solvent - Toluene	975
6)	Solvent - Toluene	1000		Solvent Loss (Toluene)	25
7)	Water	492		Aqueous Layer to ETP	586
8)				Distillation Residue	24
	Total	**4150**		**Total**	**4150**

j) Cloquintocet mexyl (T)

Manufcturing Process:

Step – 1

Methyl Hexanol (Mexylol) is reacted with mono Chloro Acetate Acid (MCA) in presence of Solvent – Solvent and catalyst to give Mono Chloro Acetic Acid 1-Mexyl Ester.

Step – 2

5-Chloro 8-Hydroxy Quinoline is reacted with potassium carbonate in presence of MIBK – solvent and catalyst to give the potassium salt of 5-Chloro 8-Hydroxy Quinoline.

Step – 3

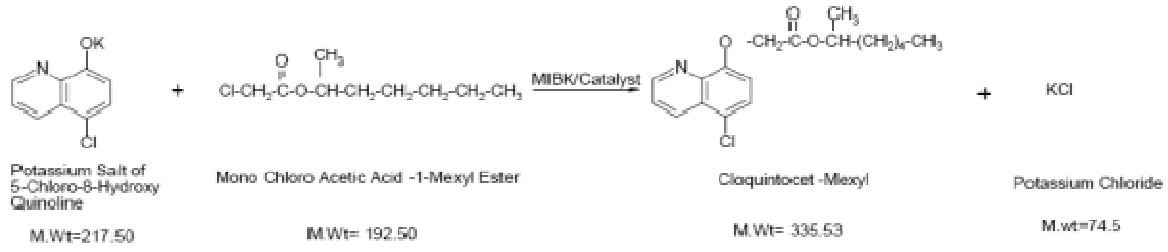
Mono Chloro Acetic Acid 1-Mexyl Ester and potassium salt of 5-Chloro 8-hydroxy Quinoline is finally reacted in presence of catalyst and solvent to give the final product Cloquintocet Mexyl – Safener.

Chemical Reaction :

STEP-1

STEP-2

STEP-3



Material Balance / Mass Balance of Cloquintocet Mexyl (All Quantities are in kg)

	IN – PUT			OUT – PUT	
Sr. No.	**Raw Materials / Items**	**Kg / Batch**		**Product / Byproduct**	**Qty. / Batch**
1)	Mono Chloro Acetic Acid (MCA)	405		Cloquintocet Mexyl (93%)	1075
2)	1-Methyl Hexalol (HOL)	472		Water (Distilled out Azeotropically)	80
3)	Solvent - Toluene	1200		Aqueous Washing to ETP	1760
4)	Catalyst -1	13		Recovered Solvent - Toluene	1150
5)	5-Chloro 8-Hydroxy Quinoline	663		Solvent Loss (Toluene)	50
6)	Solvent - MIBK	3000		Potassium Chloride + Potassium Bi Carbonate Salt	802
7)	Potassium Carbonate	538		Recovered Solvent – MIBK	6200
8)	Catalyst-2	37		Solvent Loss (MIBK)	300
9)	Water for washing	1150		Aqueous Layer to ETP	1110
10)	2% Sodium Bi Carbonte Solution	540		Recovered Solvent - Hexane	3950
11)	Solvent - MIBK	3500		Solvent Loss (Hexane)	50
12)	Catalyst-3	37		Solvent Loss During Drying	50
13)	SHS	37		Organic Residue to Incinerator	15
14)	Solvent – Hexane	4000			
15)	Water – for Washing	1000			
	Total	**16592**		**Total**	**16592**

k) Thiamethoxam

Manufacturing Process:

STAGE-1:
Reaction of Allyl chloride with Chlorine gas at 20-25°C and then treated with dilute sodium hydroxide solution at 70-75°C to get Intermediate-1. Separated the bottom organic and washed with water to get pure Intermediate-1. Excess chlorine gas scrubbed in 4N sodium hydroxide solution in Ventury scrubber. Purity of Allyl chloride used for the reaction is always above 99%, RM Chlorine gas is 98% and that of caustic lye is above 47%. The purity of Intermediate-1 obtained will be min.98%.

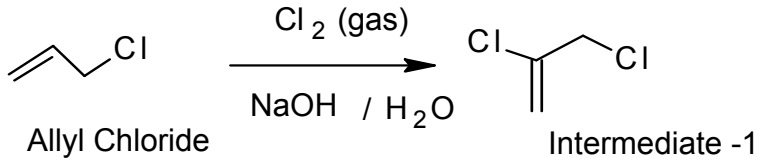
STAGE-2:
The Intermediate-1 obtained above is heated at 80-85°C with ammonium Thiocyanate solution and the product obtained is separated. Mixed with Ethylene dichloride solvent and then purged Chlorine and Sulphur dioxide at 60-65°C to get Intermediate-2. The product is washed with water and recovered the EDC solvent and distilled to get pure Intermediate-2. Excess chlorine and Sulphur dioxide gas was scrubbed in dilute sodium hydroxide solution in Ventury scrubber. Purities of reactants to be used viz. Intermediate-1 is above 98% and Ammonium Thiocyanate, EDC, Chlorine and Sulphur dioxide is above 99%. The purity of Intermediate-2 obtained will be min.97%.

STAGE-3:
Guanidine nitrate reacted with sulphuric acid at 15-20°C and the resultant product filtered and washed with water to get Nitro guanidine with 98% purity. 40% methylamine solution reacted with 50% sulfuric acid at 10-15°C and the above nitro guanidine added and cooked at 50-55°C for 3hr.Cooled to 20°C and filtered and washed with cold water. This product reacted with formic acid and formaldehyde at 45-50°C. Filtered and washed with water and dried to get Intermediate-3 with 98% min purity. Purity of reactants Guanidine nitrate will be min 98%.

STAGE-4:
Intermediate-3 reacted with Intermediate-2 in presence potassium carbonate and DMC solvent at 50-55°C to get Thiamethoxam. Cooled and water added to remove potassium carbonate. Then cooled to 10°C and filtered to get Thiamethoxam Technical with 97% purity. DMC was recovered and recycled. The purity of DMC solvent and potassium carbonate will be above 99%.

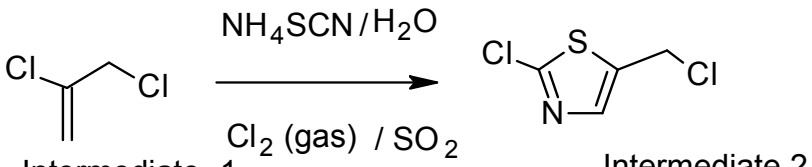
Chemical Reaction:

Step-I:



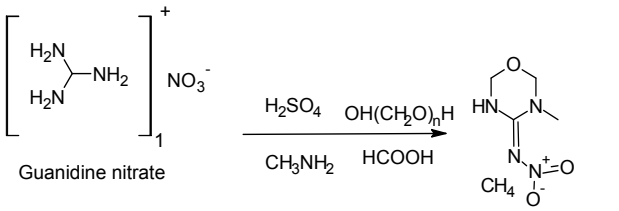
Allyl Chloride Intermediate -1

Step-2:



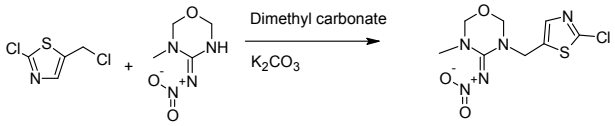
Intermediate -1 Intermediate.2

Step-3:



Guanidine nitrate Intermediate -:

Step-4:



Thiamethoxam

Mass Balance:

	IN – PUT			OUT – PUT	
Sr. No.	**Raw Materials / Items**	**Kg / Batch**		**Product / Byproduct**	**Kg / Batch**
1)	Allyl Chloride	670		Thiamethoxam Technical	1000
2)	Chlorine Gas	1330		Recovered EDC	2280
3)	Caustic Lye	900		EDC Loss	120
4)	Ammonium Thiocynate	780		Recovered MDC	2940
5)	EDC	2400		MDC Loss	60
6)	Sulphur Dioxide	110		Spent Acid	6280
7)	Water	6600		Effluent	5877
8)	Guanidine Nitrate	1255		Caustic Solution	3920
9)	Sulfuric Acid	3365			
10)	40% METHYL Amine	890			
11)	Para Formaldehyde	742			
12)	Formic Acid	345			
13)	MDC	3000			
14)	Potassium Carbonate	90			
	Total	**22477**		**Total**	**22477**

9. PNCB/ONCB & Derivatives (Para Nitro Aniline/ Ortho Nitro Aniline)

Ortho Nitro Aniline/Para Nitro Aniline

Manufacturing Process:

p-Nitro Chloro Benzene is reacted with NH3 in autoclave at 178°C. The mass is then filtered in Nutch filter to get p- Nitro Aniline. The pressurized gas from auto clave is then taken in to depressurize, here NH3 liberated is taken in to make –up tank. The NH4Cl is taken is taken in to other vessel, where is liberated ammonia taken to the makeup tank. The NH4CL is reacted with Ca(OH)2. The mass in then filtered in Nutch filter.

Chemical Reaction:

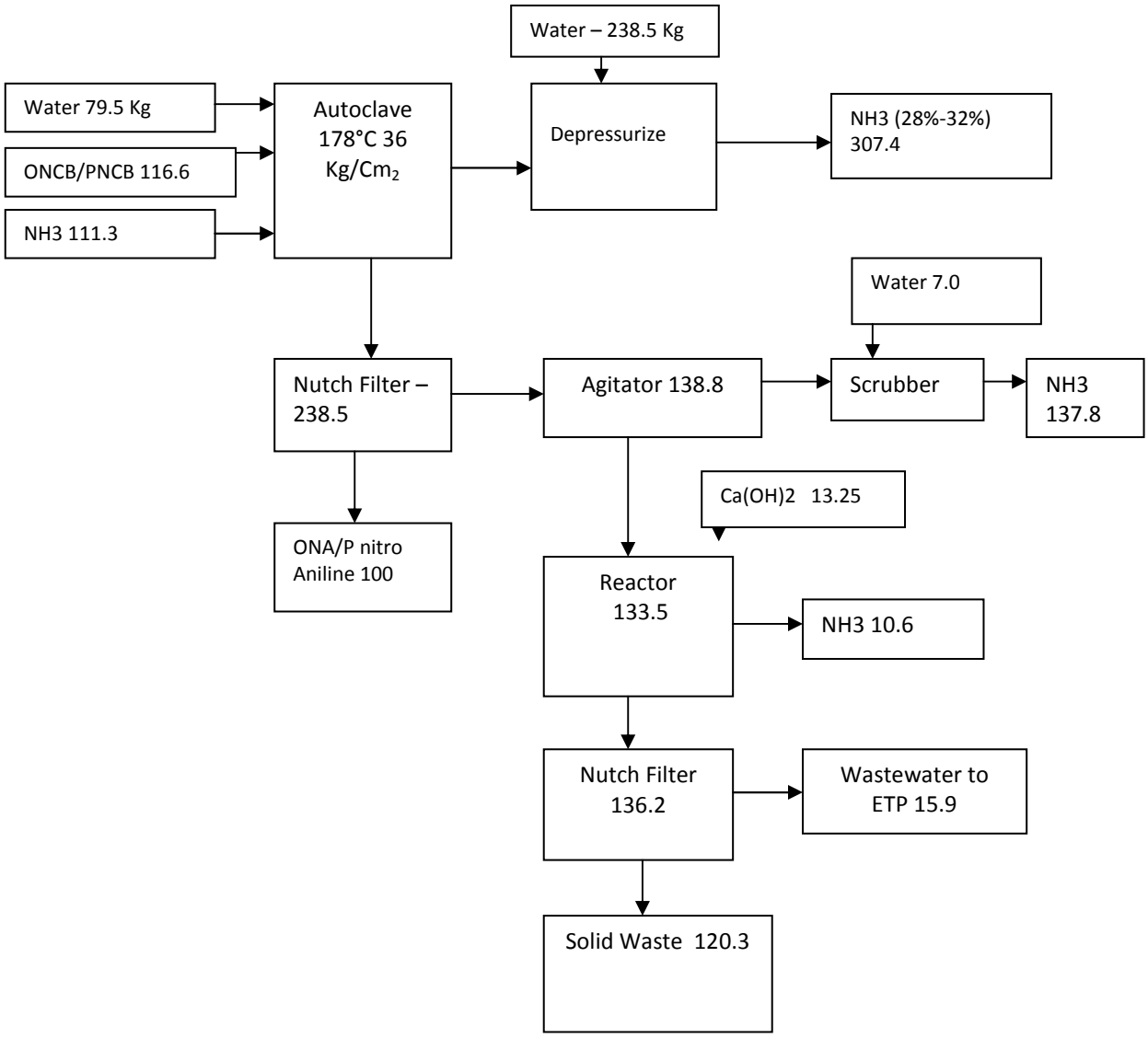
$C_6H_4.Cl.NO_2 + 2\ NH_3 \xrightarrow{36\ Kg/Cm^2} C_6H_4.NH_2.NO_2 + NH_4Cl$

p-Nitro Chloro Benzene — Ammonia — 178°C — p- Nitro Aniline — Ammonium Chloride

$C_6H_4.Cl.NO_2 + 2\ NH_3 \xrightarrow[178°C]{36\ Kg/Cm^2} C_6H_4.NH_2.NO_2 + NH_4Cl$

o-Nitro Chloro Benzene — Ammonia — o-Nitro Aniline — Ammonium Chloride

Process Flow Chart of P Nitro Aniline



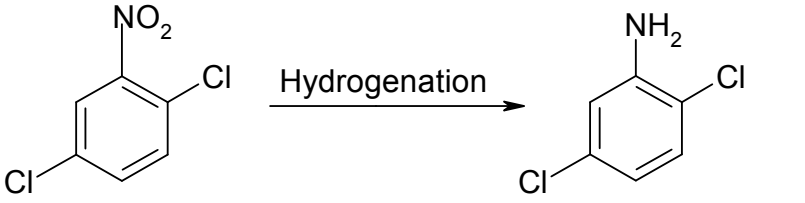
10. PDCB/ODCB & Derivatives (Di Chloro Aniline)
Manufacturing Process:

1) 2,5-DICHLORO ANILINE

Brief Manufacturing Process

2, 5 - Dichloro Nitro Benzene reduced by hydrogenation to get 2,5-Dichloro Aniline

Chemical Reaction



2,5 Dicholro Nitro Benzene
M.W- 192

2,5- Dichloro Aniline
M.W- 162

Material Balance / Mass Balance (All Quantities are in Kg)

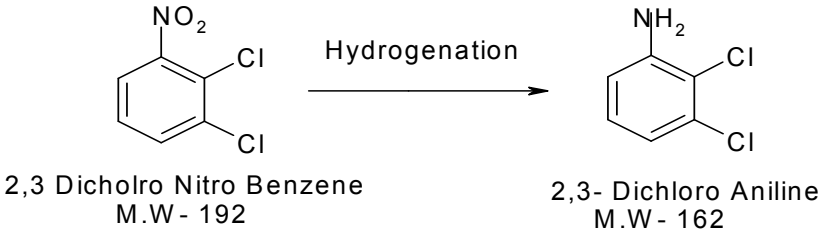
2,5-Dichloro Aniline					
IN- PUT				OUT- PUT	
Sr No	Raw Materials / Items	Kg/Batch		Product / Bi Product	Qty/Batch
1	2,5-Dichloro Nitro Benzene	1225		2,5-Dichloro Aniline	1000
2	Catalyst (Raney Nickel)	10		Recovered Catalyst	8
3	Solvent (Methanol)	1250		Catalyst Loss	2
4	Hydrogenation	30		Recovered Solvent	1225
5				Solvent Loss	25
6				Distilled Water	235
7				Distillation Residue	10
8				Unreacted Hydrogen	10
	Total	**2515**		**Total**	**2515**

2) 2, 3-DICHLORO ANILINE

Brief Manufacturing Process

2,3- Dichloro Nitro Benzene reduced by hydrogenation to get 2,3-Dichloro Aniline

Chemical Reaction



2,3 Dicholro Nitro Benzene
M.W - 192

2,3- Dichloro Aniline
M.W - 162

Material Balance / Mass Balance (All Quantities are in Kg)

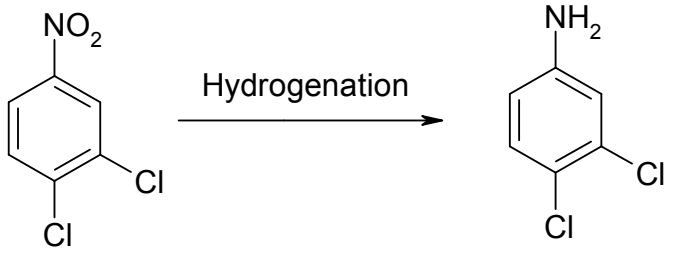
2,3-Dichloro Aniline					
IN- PUT				**OUT- PUT**	
Sr No	**Raw Materials / Items**	**Kg/Batch**		**Product / Bi Product**	**Qty/Batch**
1	2,3-Dichloro Nitro Benzene	1245		2,3-Dichloro Aniline	1000
2	Catalyst (Raney Nickel)	10		Recovered Catalyst	8
3	Solvent (Methanol)	1300		Catalyst Loss	2
4	Hydrogenation	40		Recovered Solvent	1270
5				Solvent Loss	30
6				Distilled Water	258
7				Distillation Residue	12
8				Unreacted Hydrogen	15
	Total	**2595**		**Total**	**2595**

3) 3,4-DICHLORO ANILINE

Brief Manufacturing Process

3,4-Dichloro Nitro Benzene reduced by hydrogenation to get 3,4-Dichloro Aniline

Chemical Reaction



3,4 Dicholro Nitro Benzene
M.W- 192

3,4- Dichloro Aniline
M.W- 162

Material Balance / Mass Balance (All Quantities are in Kg)

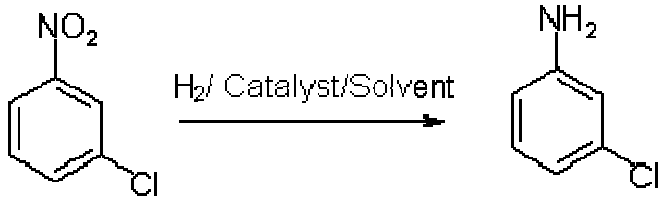
3,4-Dichloro Aniline					
IN- PUT				**OUT- PUT**	
Sr No	**Raw Materials / Items**	**Kg/Batch**		**Product / Bi Product**	**Qty/Batch**
1	3,4-Dichloro Nitro Benzene	1260		3,4-Dichloro Aniline	1000
2	Catalyst	10		Recovered Catalyst	8
3	Solvent (Methanol)	1200		Catalyst lost	2
4	Hydrogenation	50		Recovered Solvent	1175
5				Solvent lost	25
6				Distilled Water	256
7				Distilled Residue	42
8				Unreacted Hydrogen	12
	Total	**2520**		**Total**	**2520**

4) 3 - CHLORO ANILINE

Brief Manufacturing Process

3 - Chloro Nitro Benzene undergoes reduction by hydrogen gas in presence of solvent as well as catalyst to give 3 - Chloro Aniline

Chemical Reaction



3 – Chloro Nitro Benzene
M.W- 157.5

3 - Chloro Aniline
M.W- 127.5

Material Balance / Mass Balance (All Quantities are in Kg)

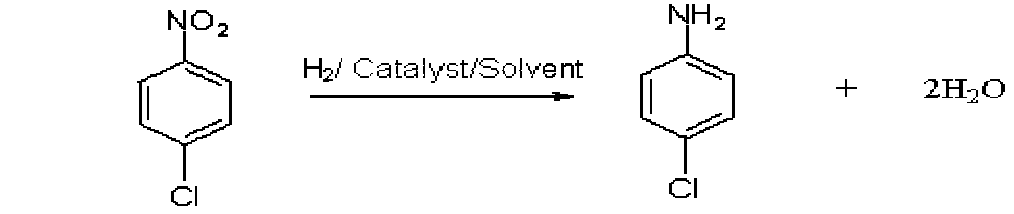
3 - Chloro Aniline					
IN- PUT				**OUT- PUT**	
Sr No	**Raw Materials / Items**	**Kg/Batch**		**Product / Bi Product**	**Qty/Batch**
1	3 - Chloro Nitro Benzene	1273		3 - Chloro Aniline	1000
2	Catalyst	8.0		Recovered Catalyst	6.0
3	Solvent (Methanol)	1200		Recovered Solvent	1175
4	Hydrogen	25		Solvent lost	25
5				Distilled Water	282
6				Distilled Residue	8.0
7				Unreacted Hydrogen	10.0
	Total	**2506**		**Total**	**2506**

5) 4 - CHLORO ANILINE

Brief Manufacturing Process

4 - Chloro Nitro Benzene undergoes reduction by hydrogen gas in presence of solvent as well as catalyst to give 4 - Chloro Aniline

Chemical Reaction



4 – Chloro Nitro Benzene
M.W- 157.5

4 - Chloro Aniline
M.W- 127.5

Water
M.W - 36

Material Balance / Mass Balance (All Quantities are in Kg)

4 - Chloro Aniline					
IN- PUT				**OUT- PUT**	
Sr No	**Raw Materials / Items**	**Kg/Batch**		**Product / Bi Product**	**Qty/Batch**
1	4 - Chloro Nitro Benzene	1273		4 - Chloro Aniline	1000
2	Catalyst	8.0		Recovered Catalyst	6.0
3	Solvent (Methanol)	1200		Recovered Solvent	1175
4	Hydrogen	25		Solvent lost	25
5				Distilled Water	282
6				Distilled Residue	8.0
7				Unreacted Hydrogen	10.0
	Total	**2506**		**Total**	**2506**

6) 2 - CHLORO ANILINE

Brief Manufacturing Process

2 - Chloro Nitro Benzene undergoes reduction by hydrogen gas in presence of solvent as well as catalyst to give 2 - Chloro Aniline

Chemical Reaction

2 – Chloro Nitro Benzene
M.W- 157.5

2 - Chloro Aniline
M.W- 127.5

Material Balance / Mass Balance (All Quantities are in Kg)

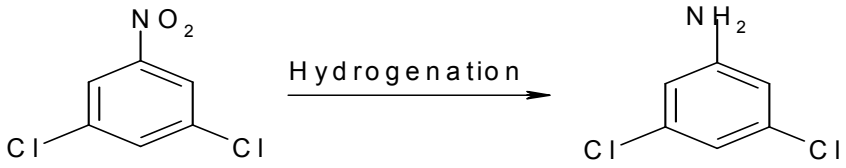
2 - Chloro Aniline					
IN- PUT				**OUT- PUT**	
Sr No	**Raw Materials / Items**	**Kg/Batch**		**Product / Bi Product**	**Qty/Batch**
1	2 - Chloro Nitro Benzene	1273		2 - Chloro Aniline	1000
2	Catalyst (Raney Nickel)	8.0		Recovered Catalyst	6.0
3	Solvent (Methanol)	1200		Recovered Solvent	1175
4	Hydrogen	25		Solvent lost	25
5				Distilled Water	282
6				Distilled Residue	8.0
7				Unreacted Hydrogen	10.0
	Total	**2506**		**Total**	**2506**

7) 3, 5-DICHLORO ANILINE

Brief Manufacturing Process

3,5- Dichloro Nitro Benzene reduced by hydrogenation to get 3,5-Dichloro Aniline

Chemical Reaction



3,5 Dicholro Nitro Benzene
M.W - 192

3,5- Dichloro Aniline
M.W - 162

Material Balance / Mass Balance (All Quantities are in Kg)

3,5-Dichloro Aniline					
IN- PUT				OUT- PUT	
Sr No	Raw Materials / Items	Kg/Batch		Product / Bi Product	Qty/Batch
1	3,5-Dichloro Nitro Benzene	1225		3,5-Dichloro Aniline	1000
2	Catalyst	10		Recovered Catalyst	8
3	Solvent (Methanol)	1200		Catalyst Lost	2
4	Hydrogen Gas	48		Recovered Solvent	1150
5				Solvent lost	50
6				Distillate Water	255
7				Distillation Residue	10
8				Unreacted Hydrogen	8
	Total	**2483**		**Total**	**2483**

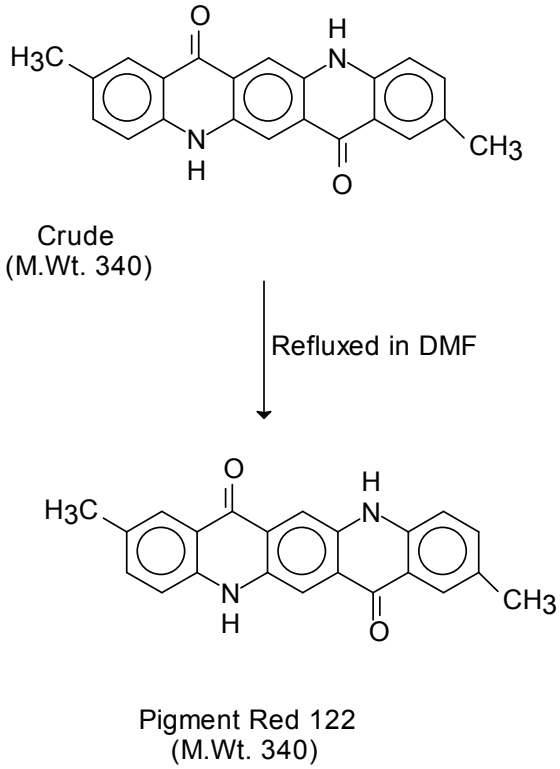
11. Pigment

11.1 Pigment Red 122

Manufacturing Process:

The crude pigment is charged into Di methyl formamide and refluxed for 10 hrs. The mass is then cooled and filtered. It is then washed with water. The wet cake is then dried, pulverized and sieved to get the finished product.

Chemical Reaction:



Mass Balance:

INPUT:

NO.	RAW MATERIALS	Kg/Batch
1.	Crude pigment Red 122	510
2.	DMF	1000
3.	WATER	3000
	TOTAL	**4510**

OUT PUT:

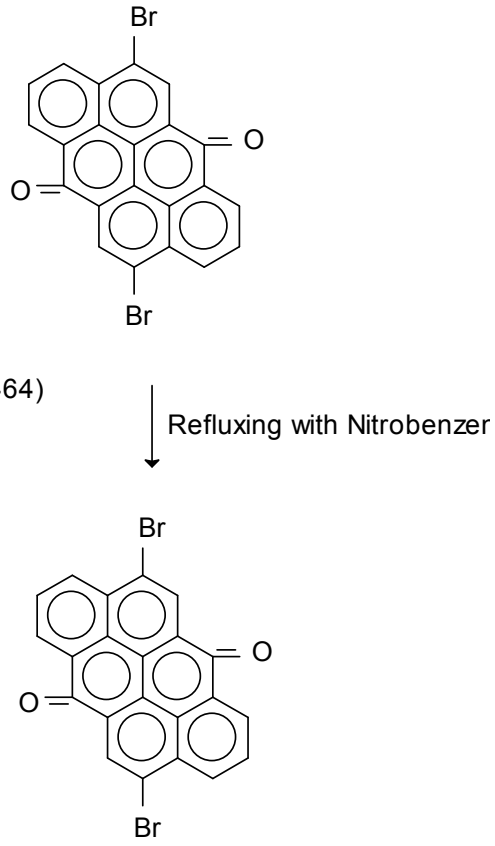
No.	MATERIAL	Kg/Batch
1.	Pigment Red 122	500
2	DMF (Recovered)	970
3.	Aqueous ML	2290
4.	Loss on drying	750
	TOTAL	**4510**

11.2 Pigment Red 168

Manufacturing Process:

The crude pigment is charged into Nitrobenzene and refluxed for 8 hrs. The Nitrobenzene is distilled off azeotropically. The mass is then filtered. The product is washed with water. The wet cake is then dried, pulverized and sieved to get the finished product.

Chemical Reaction:



Mass Balance:

INPUT:

NO.	RAW MATERIALS	Kg/Batch	Specific consumption Kg/Kg
1.	Crude pigment Red 168	610	1.017
2.	Nitrobenzene	610	0.03
3.	WATER	6000	10.00
	TOTAL	**7220**	

OUT PUT:

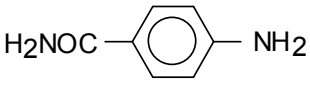
No.	MATERIAL	Kg/Batch
1.	Pigment Red 168	600
2	Nitrobenzene (Recovered)	592
3.	Aqueous ML	5128
4.	Loss on drying	900
	TOTAL	**7220**

11.3 Pigment Red 170

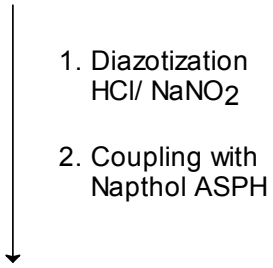
Manufacturing Process:

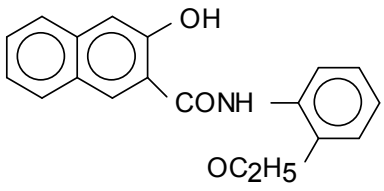
P-Amino Benzamide is diazotized using HCl and sodium nitrite. The diazo is then coupled with Naphthol ASPH in alkaline medium. The resulting product is filtered ad washed with water. The wet cake is dried and pulverized to get the finished product.

Chemical Reaction:

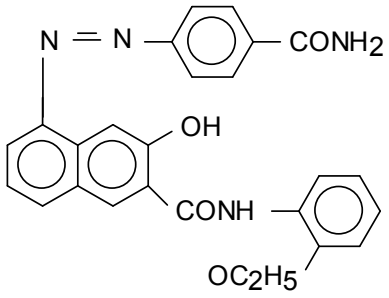


P-Amino Benzamide
(M.Wt. 136)





(M.Wt. 307)



Pigment Red 170
M.Wt. 454

MATERIAL BALANCE:

INPUT:

NO.	RAW MATERIALS	Kg/Batch	Specific consumption Kg/Kg
1.	Water + ice	23,000	38.333
2.	p-Amino Benzamide	188	0.313
3.	Hydrochloric acid	255	0.425
4.	Sodium nitrite	98	0.163
5.	Sulfamic acid	5	0.008
6.	Naphthol ASPH	430	0.717
7.	Caustic soda	175	0.292
	TOTAL	**24,151**	

OUT PUT:

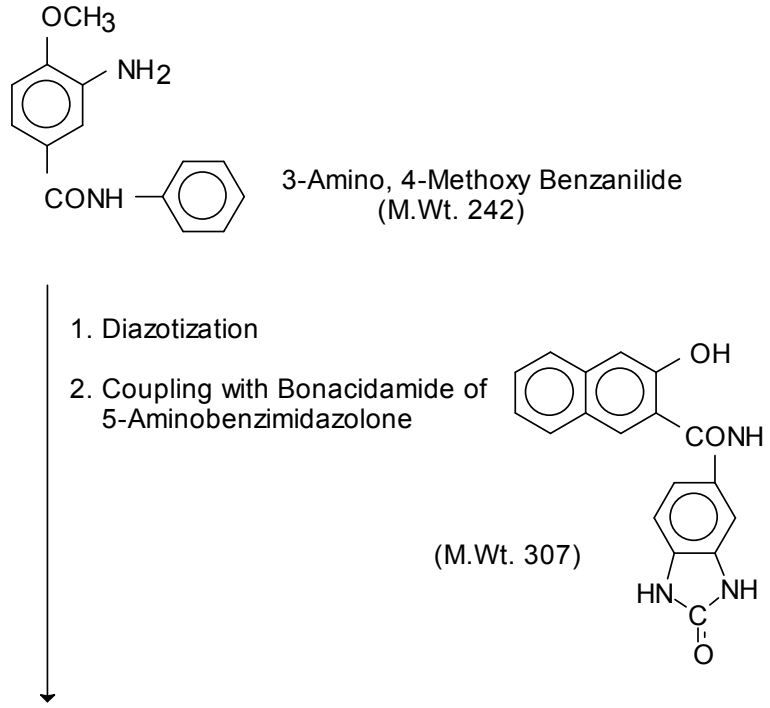
No.	MATERIAL	Kg/Batch
1.	Pigment Red 170	600
2.	Aqueous ML	22151
4.	Loss on drying	1400
	TOTAL	**24,151**

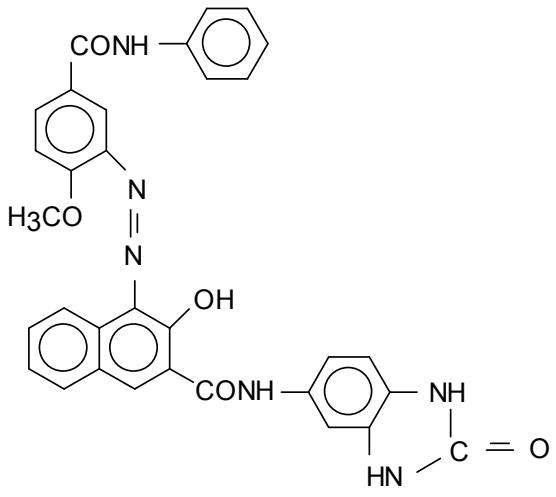
11.4 Pigment Red 176

Manufacturing Process:

3-Amino 4-methoxy benzanilide is diazotized and then coupled with BON acid amide of 5-Amino benzimidazolone.The. The product thus obtained is then filtered and washed with water. The wet cake is dried and pulverized to get the finished product.

Chemical Reaction:





Pigment Red 176
(M.Wt. 560)

MATERIAL BALANCE:

INPUT:

NO.	RAW MATERIALS	Kg/Batch	Specific consumption Kg/Kg
1.	3-AMINO, 4-METHOXY BENZANILIDE	330	0.417
2.	HCl	350	0.500
3.	SODIUM NITRITE	100	0.143
4.	CAUSTIC SODA	60	0.086
5.	BON ACID AMIDE OF 5-AMINO BENZIMIDAZOLONE	410	0.585
6.	ICE/WATER	18000	25.714
	TOTAL	**19250**	

OUT PUT:

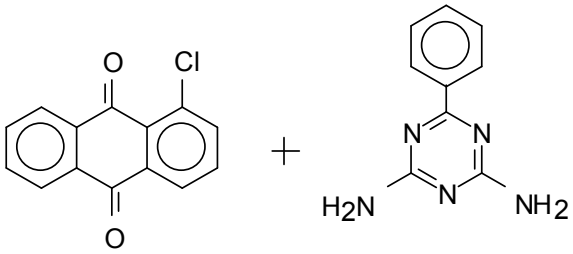
No.	MATERIAL	Kg/Batch
1.	PIGMENT RED 176	700
2.	LOSS ON DRYING	1280
3.	EFFLUENT	17270
	TOTAL	**19250**

11.5 Pigment Yellow 147

Manufacturing Process:

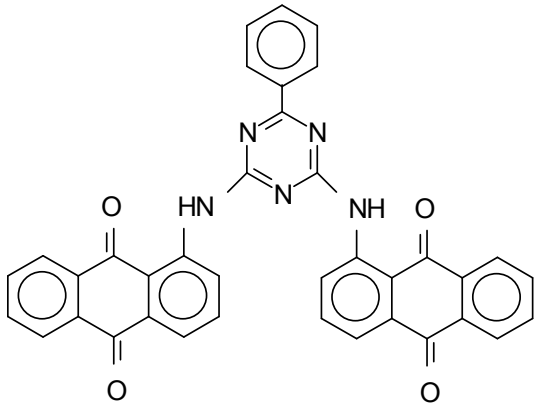
1-Chloro anthraquinone is condensed with phenyl guanamine using ODCB as a solvent. The product is isolated by adding methanol. The resulting product is then filtered and washed with methanol followed by hot water wash.. The wet cake is dried and pulverized to get the finished product.

Chemical Reaction:



1-Chloro Anthraquinone
(M.Wt. 242.5)

Phenyl Guanamin
(M.Wt. 187)



Pigment Yellow 147
(M.Wt. 599)

MATERIAL BALANCE:

INPUT:

NO.	RAW MATERIALS	Kg/Batch	Specific consumption Kg/Kg
1.	ODCB	1500	0.203
2.	1-CHLORO ANTHRAQUINONE	500	0.885
3.	PHENYL GUANAMINE	220	0.389
4.	METHANOL	2000	0.531
5.	WATER	4000	7.079
	TOTAL	**8220**	

OUT PUT:

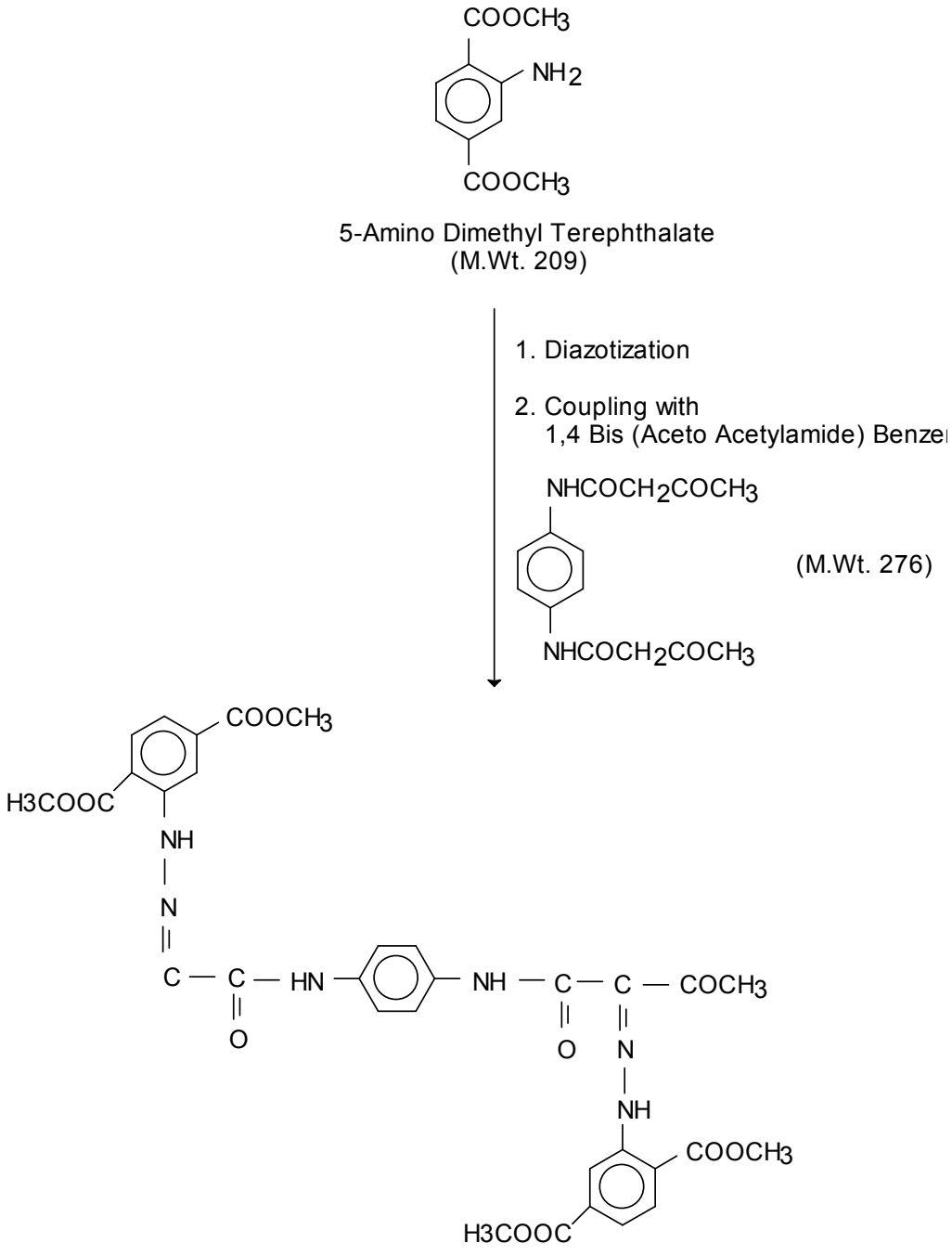
No.	MATERIAL	Kg/Batch
1.	PIGMENT YELLOW 147	565
2.	ODCB (RECOVERED)	1395
3.	METHANOL (RECOVERED)	1700
4.	EFFLUENT	4300
5.	LOSS ON DRYING	170
6.	RESIDUE	90
	TOTAL	**8220**

11.6 Pigment Yellow 155

Manufacturing Process:

5- Amino Dimethyl Terephthalate is diazotized and coupled with 1; 4 Bis (Aceto acetylamino) Benzene. The product thus obtained is then filtered and washed with water. The wet cake is dried and pulverized to get the finished product.

Chemical Reaction:



Pigment Yellow 155
(M.Wt. 716)

MATERIAL BALANCE:

INPUT:

NO.	RAW MATERIALS	Kg/Batch	Specific consumption Kg/Kg
1.	5-AMINO DIMETHYL TEREPHTHALATE	215	0.316
2.	HCL	300	0.441
3.	SODIUM NITRITE	75	0.11
4.	CAUSTIC SODA	50	0.073
5.	1:4 BIS (ACETO ACETYLAMINO)BENZENE	290	0.426
6.	SODIUM ACETATE	200	
7.	ICE + WATER	18000	26.47
	TOTAL	**19130**	

OUT PUT:

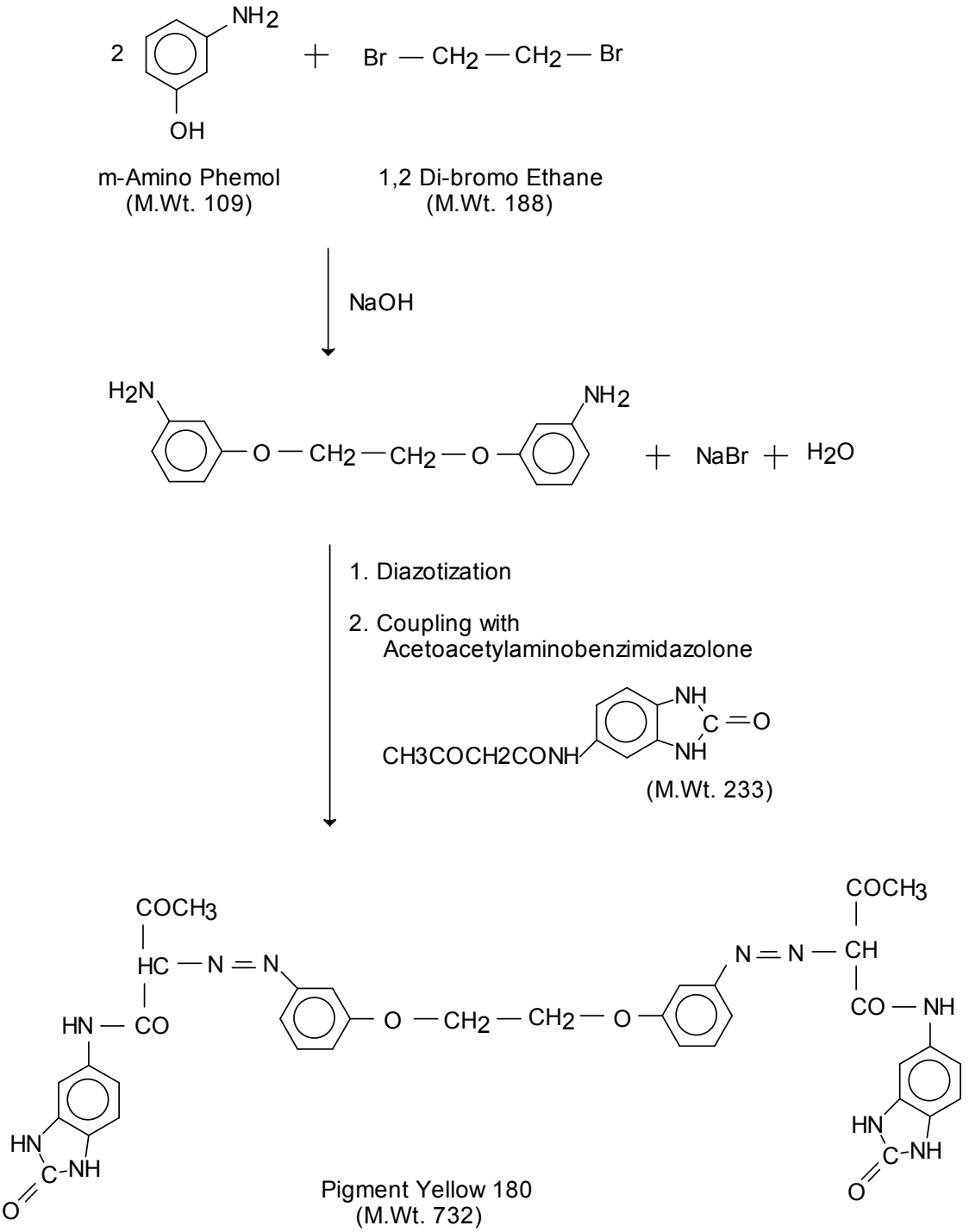
No.	MATERIAL	Kg/Batch
1.	PIGMENT YELLOW 155	680
2.	LOSS ON DRYING	1400
3.	EFFLUENT	17050
	TOTAL	**19130**

11.7 Pigment Yellow 180

Manufacturing Process:

Meta Amino Phenol is condensed with 1:2 Di Bromo Propane using caustic soda. The resulting product is diazotized and then coupled with 5-Acetylamino Benzimidazolone. The product is then filtered and washed with water. The wet cake is dried and pulverized to get the finished product.

Chemical Reaction:



Pigment Yellow 180
(M.Wt. 732)

MATERIAL BALANCE:

INPUT:

NO.	RAW MATERIALS	Kg/Batch	Specific consumption Kg/Kg
1.	m-AMINO PHENOL	141	0.313
2.	1;2 DI BROMO PROPANE	130	0.288
3.	CAUSTIC SODA	110	0.244
4.	HYDROCHLORIC ACID	300	0,666
5.	SODIUM NITRITE	95	0.211
6.	5-ACETYL AMINO BENZOXAZOLONE	310	0.688
7.	ICE + WATER	21,000	46.66
8.	SODIUM ACETATE	175	0.388
	TOTAL	**22,261**	

OUT PUT:

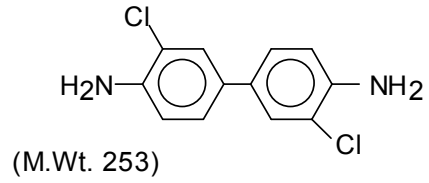
No.	MATERIAL	Kg/Batch
1.	PIGMENT YELLOW 180	450
2.	LOSS ON DRYING	835
3.	EFFLUENT	20,976
	TOTAL	**22.261**

11.8 Pigment Yellow 188

Manufacturing Process:

3, 3' DICHLORO BENZIDINE DI HYDROCHLORIDE is tetradiazotized and coupled with acetoacetanilide**.** The resulting product is then filtered and washed with water. The wet cake is dried and pulverized to get the finished product.

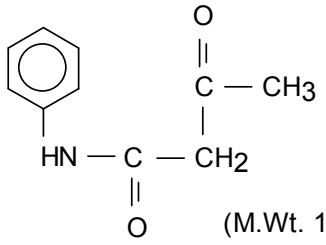
Chemical Reaction:



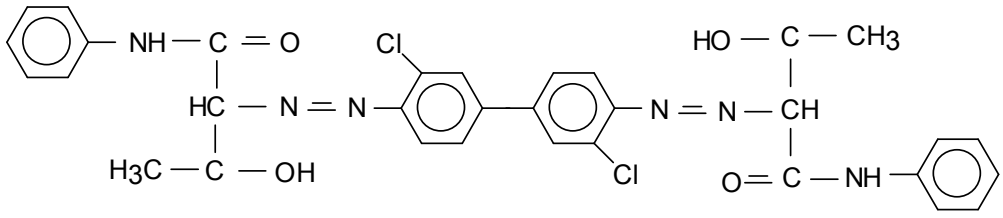
(M.Wt. 253)

1. Diazotization

2. Coupling with Acetoacetanilide



(M.Wt. 177)



Pigment Yellow 188
(M.Wt. 631)

MATERIAL BALANCE:

INPUT:

NO.	RAW MATERIALS	Kg/Batch	Specific consumption Kg/Kg
1.	3,3' DICHLORO BENZIDINE DIHYDROCHLORIDE	255	0.425
2.	HYDROCHLORIC ACID	330	0.550
3.	SODIUM NITRITE	145	0.241
4.	ACETOACETANILIDE	190	0.316
5.	CAUSTIC SODA	180	0.300
6.	SODIUM ACETATE	200	0.333
7.	ICE+ WATER	18,000	30.000
	TOTAL	**19,300**	

OUT PUT:

No.	MATERIAL	Kg/Batch
1.	PIGMENT YELLOW 188	600
2.	LOSS ON DRYING	1200
3.	EFFLUENT	17,500
	TOTAL	**19,300**

12. 3,3 DCB

Process Description

Ortho Nitro Chloro Benzene (ONCB) is taken in the reactor along with solvent toluene and caustic soda solution. Than reduction is carried out by purging Hydrogen gas into it. Then laver are separated and aqueous layer is discarded to ETP. The solvent layer is again mixed with caustic soda solution and the mass is reduced by Hydrogen gas. The layer separation is carried out to remove aqueous layer which is discarded to ETP. The solvent layer is acidified with dilute Sulphuric Acid.

The layer separation results in two layers where solvent is removed and distilled for reuse.

The product isolated from aqueous layer by salting and dried. Then it is discarded to ETP.

Mass Balance:

Sr No	**Input**	**Qty (Kg)**	**Sr. No**	**Output**	**Qty (Kg)**
1	Orthonitrochloro benzene	4536	1	3-3 DCB 2 HCL (Product)	4400
2	Caustic Soda	212	2	Toluene Recovered	2350
3	Toluene	2500	3	Toluene Loss	150
4	Water	42000	4	Effluent	41134
5	Hydrogen	54	5	Drying Loss	4100
6	Sulphuric Acid	1322			
7	NaCL	1510			
Total		**52134**		**Total**	**52134**

13. Dimethyl Sulphate

Manufacturing Process:

Methanol from day tank in the plant is taken through metering pump passed through heat exchanger and condenser in gas cycle. The methanol gas is passed through the aluminum catalyst, further it is reacted with liquid SO3. The ration of consumption of methanol + SO3 for DMS produced is as follows:

SO3 = 0.70 MT and Methanol = 0.55 MT.

The moisture shall be collected out of Methanol and sent to ETP. After reaction of SO3 + Methanol gas in a closed reaction, which will have chilled water circulation in jacket. The crude DMS formed is having a high acidity. The distilled acid thus produced is 98% Sulphuric Acid. This is a byproduct and will be sold or use in plant.

Chemical Reaction

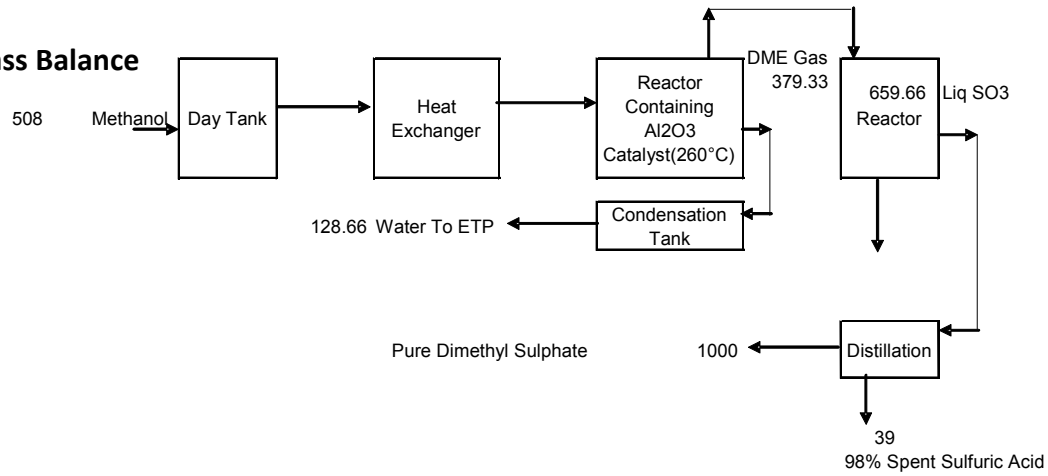
$$2\ CH_3OH \xrightarrow[\text{Catalyst}(Al_2O_3)]{260^\circ C} CH_3\text{-}O\text{-}CH_3 + H_2O$$

Methanol 2 x 32 — Dimethyl Ether 46 — 18

$$CH_3\text{-}O\text{-}CH_3 + SO_3 \longrightarrow (CH_3)_2SO_4$$

46 — 80 — Dimethyl Sulphate 126

Mass Balance



MASS BALANCE OF DIMETHYL SULPHATE

14.0 Sulphuric Acid, Oleum (23% & 65%) and Liquid SO_3

Manufacturing Process

The process for the manufacture of sulphuric acid comprises the following steps:

Solid Sulphur after weighment is fed to sulphur melter which is provided with steam coils. The ash content of the molten sulphur settles in the melter cum settler and molten sulphur free of impurities is pumped to the sulphur burner where it is burnt with air. Sulphur is converted in to SO2 in the sulphur burner as per the following reaction

S + O2 → SO2

SO2 is further converted to SO3 in presence of Vanadium Pentoxide catalyst in the converter as per the following reaction:

SO2 + ½ O2 → SO3

The conversion of SO2 to SO3 is carried out in stages in all the five pass of the converter. The conversion is optimized by intermediate cooling of gases between the different stages and also by interpass absorption of SO3 after 3rd pass of the converter.

The gas from the 3rd & 5th pass of the converter containing SO3 is cooled & then fed to the interpass & final absorption tower where SO3 is removed by circulating Sulphuric Acid in the absorption towers. The concentration of sulphuric acid is controlled by addition of water in the pump tank.

Air for sulphur burner is routed through Air Filter to drying tower and further to suction side of Centrifugal Air Blower. 98.5% acid is circulated through drying tower at 70°C, thus heating to 125°C before entering sulfur burner.

SO_2 emission during start up of the plant is controlled by a Venturi Scrubber using alkali as scrubbing medium. The plant therefore does not cause any pollution either during start up or during normal operation.

The process as described above has been divided into five main sections described as follows:

Sulphur Circuit

The weighed quantity of sulphur of about 99.5% purity is fed to the first compartment of sulphur melter. The heat for melting sulphur is provided through steam coils. The optimum pressure to be maintained for melting sulphur in the first compartment is upto 7 kg/cm2 G.

The molten sulphur flows from compartment no. 1 to pumping compartment through underflows/overflows. The sulphur pumps for feeding sulphur are fitted in pumping compartment. The total time of retention in the compartments corresponds to more than 72 hrs at normal rated production capacity of the plant. In order to achieve optimum results, it is necessary that the feeding of sulphur to the melter should be maintained at specified temperature of 135 °C. All compartments are fitted with steam coil to provide the necessary heat for maintaining the temperature of molten sulphur at the desired level. Molten sulphur from the pumping compartment is pumped to the sulphur burner through one of the submersible type sulphur pumps through specially designed sulphur feeding gun. The rate of feed of sulphur to the sulphur burner is controlled by operation of sulphur feed control valve. Drain lines have been provided in the molten sulphur discharge line at two different points.

The optimum steam pressure for coils located in 2^{nd}, 3^{rd} , 4^{th} through pumping compartments of the sulphur melter is around 4 kg/cm2 G. This regulated steam pressure is achieved through pressure reducing valve. Molten sulphur line starting from the discharge flange of the sulphur pump to the inlet of the sulphur burner is suitably steam jacketed to maintain correct temperature of molten sulphur fed to the sulphur burner.

SO2 Scrubber

It is very important that SO2 emission during plant startup is controlled within permissible limits. This is achieved by use of a alkali scrubber located after the final absorption tower where gas is scrubbed with circulating alkali solution.

DM and Water Softening Plants

For generation of steam of high quality DM water is required for this purpose RO plant and DM plant will be installed.

Chemical Reaction

$$S + O_2 \longrightarrow SO_2$$

$$SO_2 + 1/2O_2 \longrightarrow SO_3$$

$$SO_3 + H_2O \longrightarrow H_2SO_4$$

Overall

$$S + 3/2O_2 + H_2O \longrightarrow H_2SO_4$$

M.W	32	48	18	98

Oleum & Liquid SO_3

Oleum (23%)

Oleum 23% is manufactured by absorbing SO_3 gas with Sulphuric Acid.

$H2SO4 + SO3 \longrightarrow H_2S_2O_7$

Oleum 23% means free SO_3 in the product is 23%, which is equivalent to 105.17% Sulphuric Acid. This way 23% Oleum is equivalent to 1.07 of 98% Sulphuric Acid. The sulphur required for 1 ton of 23% Oleum is 0.326 x 1.07 = 0.349 ton.

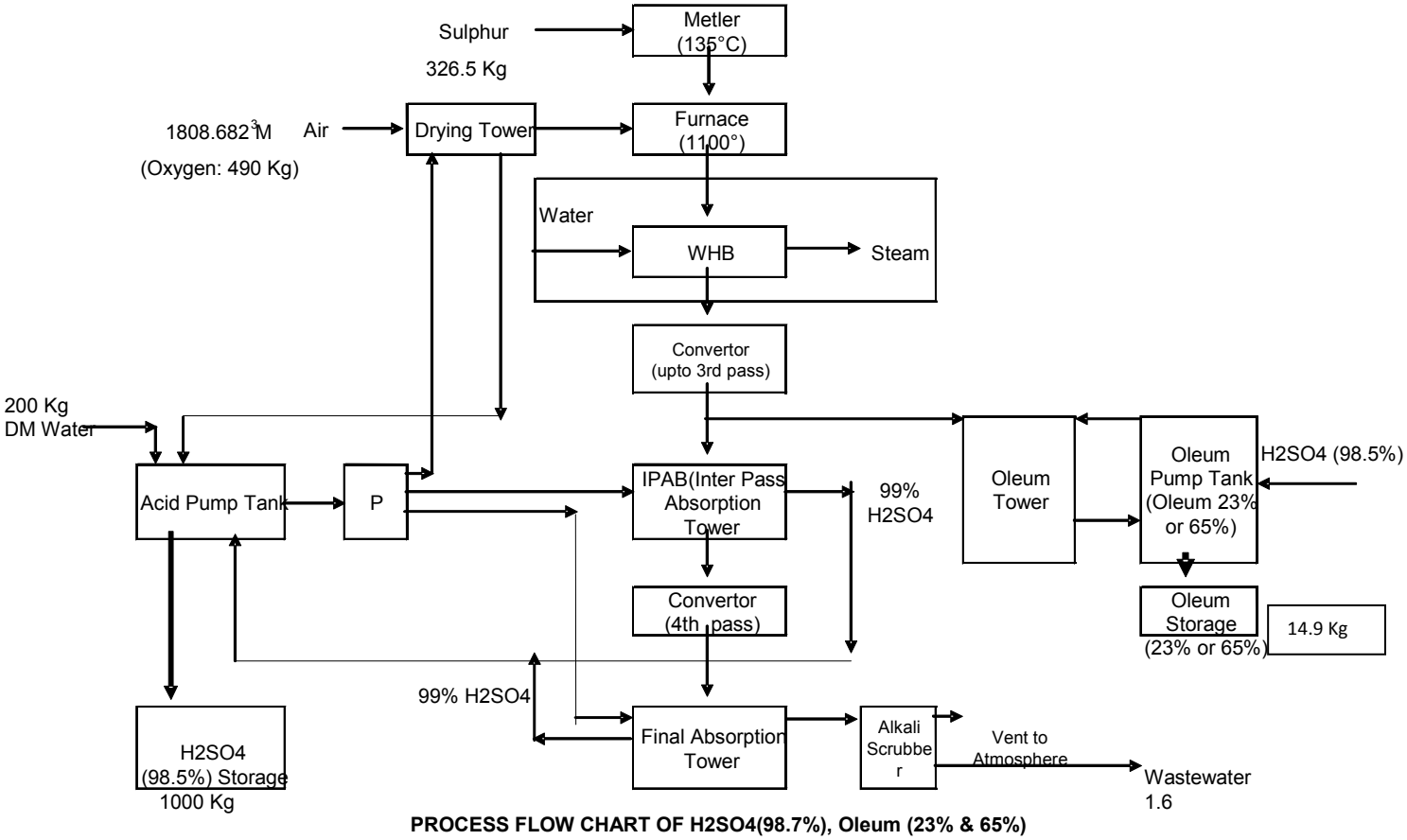
Oleum (65%)

Oleum 65% means, the free SO3 in this product is 65% which is equivalent to 114.626% sulphuric acid. This way the Oleum 65% is equivalent to 1.17 times of 98% sulphuric acid. The sulphur required for 1 ton of 65% Oleum 0.326 x 1.17 = 0.381 ton

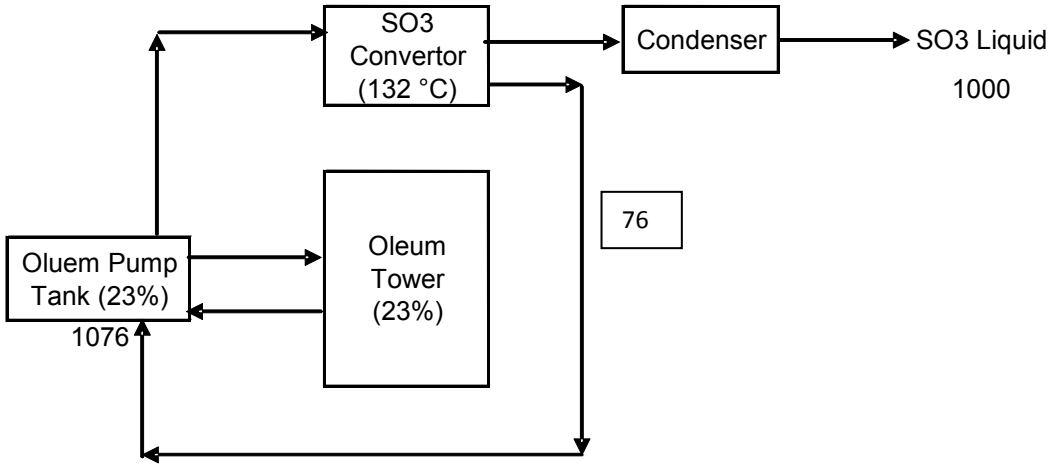
Liquid SO_3

Liquid SO_3 is = 1.25 times of 98% Sulphuric Acid. The Sulfur required for 1 ton of liquid SO_3 = 0.326 x 1.25 = 0.41 ton.

Mass Balance



PROCESS FLOW CHART OF H2SO4(98.7%), Oleum (23% & 65%)



PROCESS FLOW CHART OF SO3 LIQUID

15. Nitro Benzene & Derivatives (Aniline/Amino Benzene)

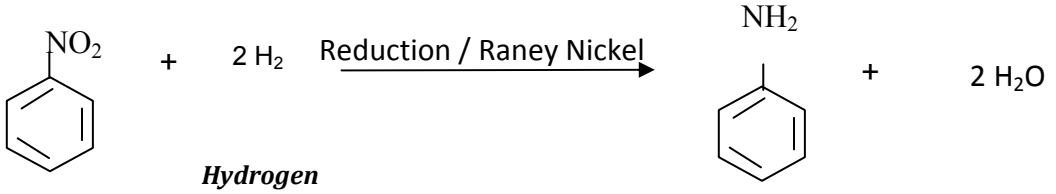
Brief Manufacturing Process

Nitro Benzene reduced by hydrogenation to get Aniline / Amino Benzene.

After the reaction is completed the mass is filtered to recover the catalyst. This catalyst is recycled to Fresh Batch.

Solvent is recovered & concentrated reaction mass is washed with water. The organic mass is finally distilled out to get the Pure Product.

Chemical Reactions:



Hydrogen Gas

Aniline

Material Balance / Mass Balance (All Quantities are in Kg)

M.W. 2.0

Aniline / Amino Benzene					
IN- PUT				**OUT- PUT**	
Sr No	**Raw Materials / Items**	**Kg/Batch**		**Product / Bi Product**	**Qty/Batch**
1	Nitro Benzene	1380		Aniline	1000
2	Catalyst	10		Recovered Catalyst	9.0
3	Solvent	1200		Catalyst lost	1.0
4	Hydrogenation	50		Recovered Solvent	1170
5	Water for Washing	250		Solvent lost	30
6				Distilled Water	380
7				Distillation Residue	12
8				Unreacted Hydrogen	28
9				Aqueous Effluent to ETP	260
	Total	**2890**		**Total**	**2880**

16. Chloro Toulene & Derivatives (Benzyl Chloride & Benzaldehyde)

16.1 BENZALDEHYDE

Process Description

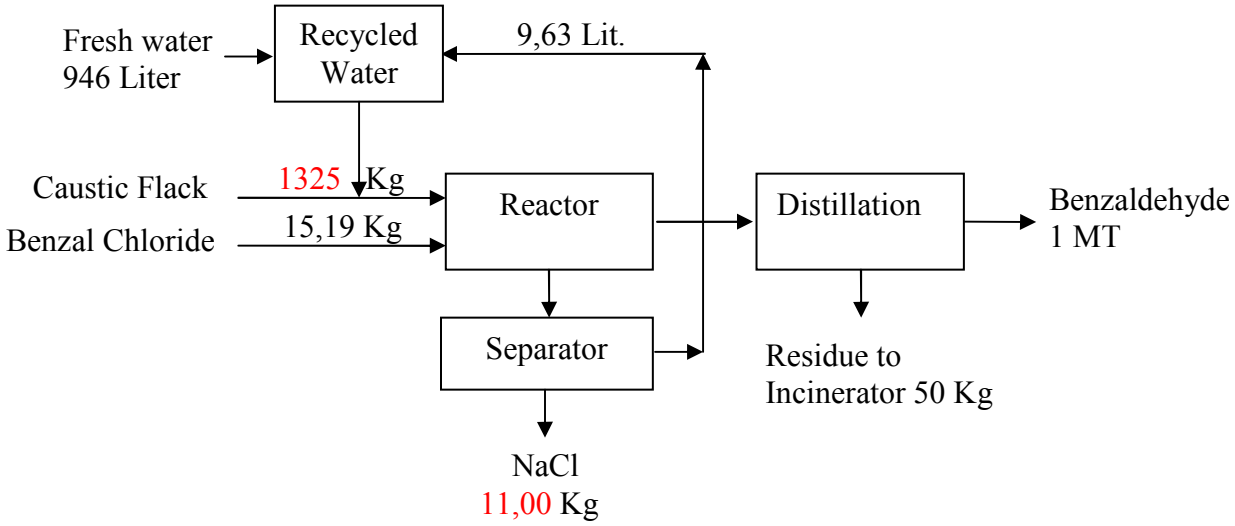
Benzaldehyde is produced by the hydrolysis of Benzal chloride with caustic solution. Caustic solution is prepared in reactor than Benzal chloride is added in the caustic solution. After completion of reaction the reaction mass is allow to settle for separation. Aqueous layer goes to the separator where common salt gets settled. The common salt separated is a byproduct. The clear liquid recovered from the Aqueous Solution is reused for next batch. The Organic mass goes to the Distillation unit to recover distilled Benzaldehyde as a product.

Chemical Reaction

$$C_6H_3CHCl_2 + NaOH + H_2O \longrightarrow C_6H_5CHO + NaCl + H_2O$$

Benzal Chloride — Sodium Hydroxide — Benzaldehyde — Sodium Chloride

Material Balance

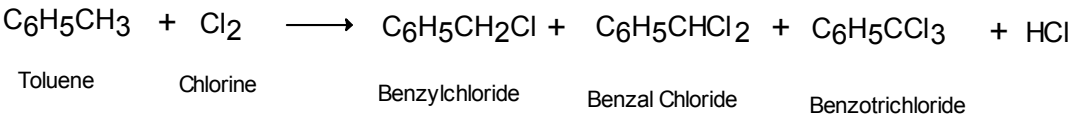


16.2 CHLORO TOLUENE

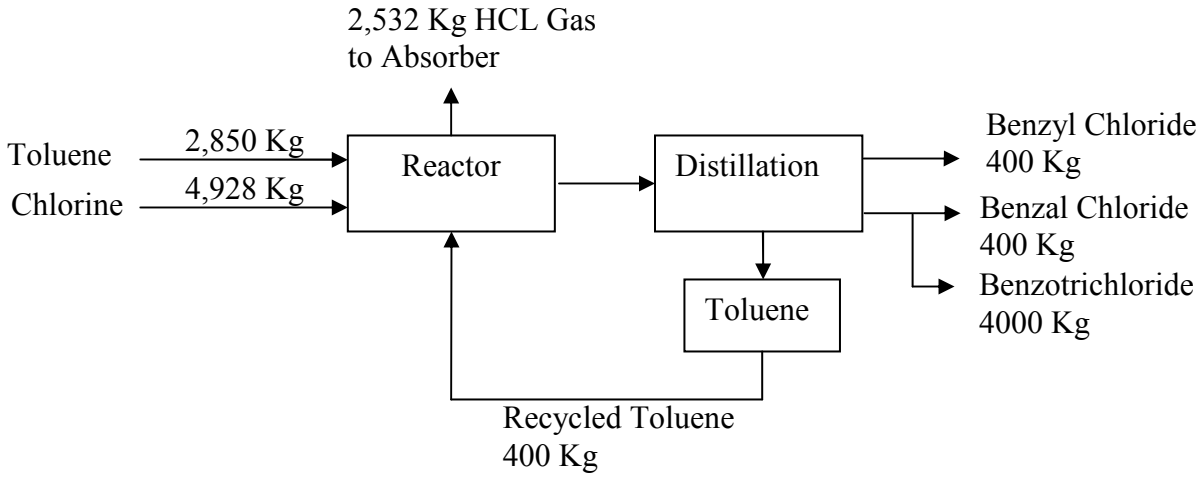
Process Description

Benzotrichloride is manufactured by the liquid phase chlorination of toluene. Toluene is heated up to its temperature and chlorine gas pass through it till reaction is complete. After completion of reaction organic mass transferred to distillation unit where distilled product obtain. A small quantity of Benzyl chloride and Benzochloride also form in the reaction. Toluene is distilled and recycled to chlorination reactor and Benzyl chloride and Benzalchloride and Benzotrichloride goes for packing.

Chemical Reaction



Material Balance

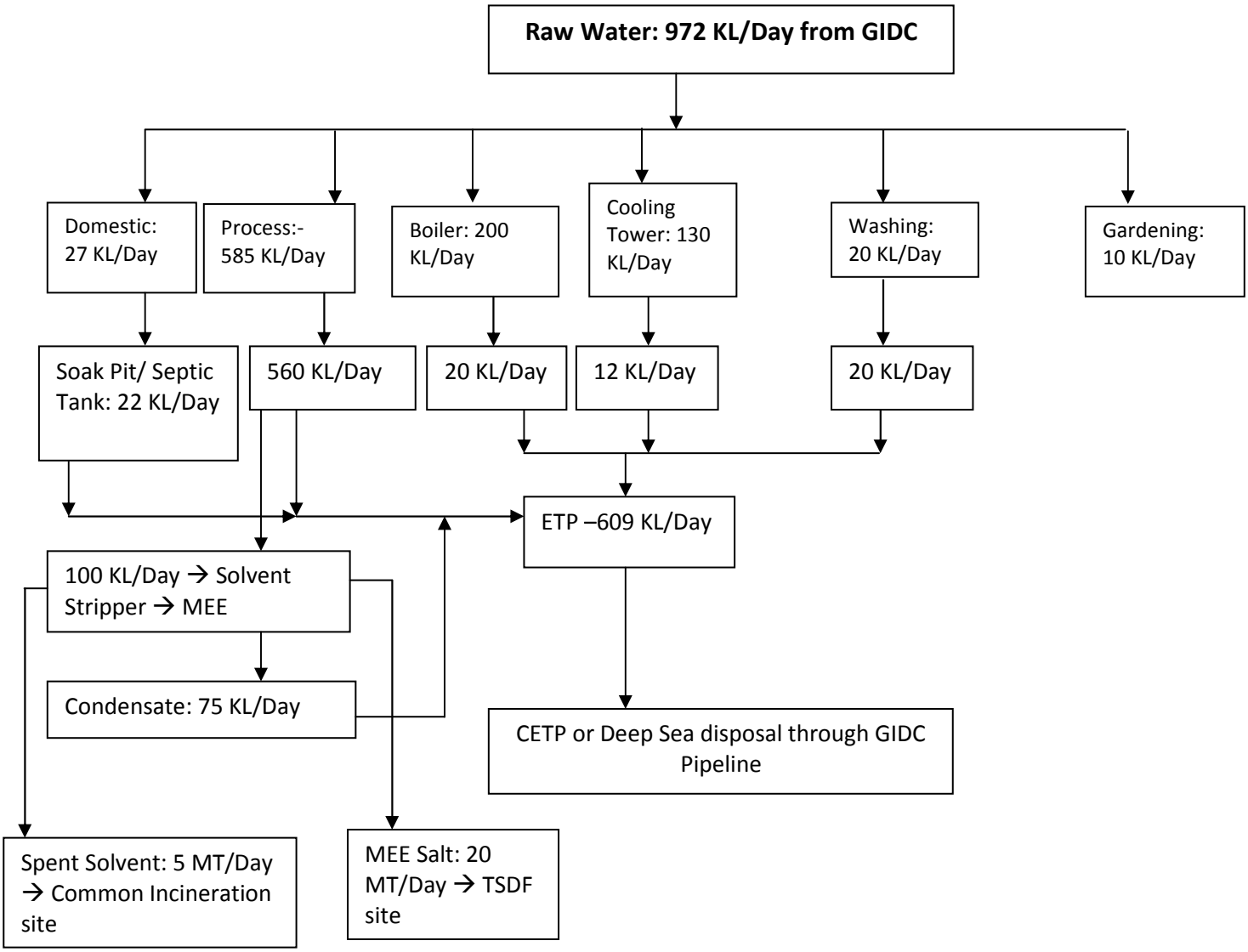


ANNEXURE: 4
WATER CONSUMPTION AND EFFLUENT GENERATION

Proposed

Sr. No.	Category	Proposed Scenario (m^3/day)	
		Water Consumption	**Waste Water Generation**
1. Industrial			
	Process	585	560
	Boiler	200	20
	Cooling	130	12
	Washing	20	20
2.	Gardening	10	-
3.	Domestic	27	22
Total (Industrial)		**935**	**612**
Total		**972**	**634**

WATER BALANCE DIAGRAM



ANNEXURE: 5
ETP DETAILS

M/s. Hemani Intermediates Pvt. Ltd. (Unit-V) shall have an Effluent treatment plant consisting of primary, secondary and tertiary treatment units. The effluent confirming the GPCB standards shall be disposed into deep sea through GIDC pipeline. The details of ETP are as follows.

PROCESS DESCRIPTION: ETP (EFFLUENT TREATMENT PLANT)

1) First all non-toxic, biodegradable streams of wastewater shall be collected in Collection cum Equalization Tank (CET). Pipe grid is provided at bottom of the CET to keep all suspended solids in suspension and to provide proper mixing. 2 nos. of Air Blowers (B-01) shall supply air through diffusers to pipe grid.
2) Then after, equalized wastewater shall be pumped to Neutralization Tank (NT) where the continuous addition and stirring of lime solution is done to maintain the pH of wastewater from Lime Dosing Tanks (LDT) as per requirement by gravity. Then after, neutralized wastewater shall go to Flash Mixer (FM). Alum shall be dosed from Alum Dosing Tank by gravity into FM to carry out coagulation by using a Flash Mixer. Then effluent shall be collected in Flocculator (FL) where Polyelectrolyte shall be dosed from Polyelectrolyte Dosing Tank (PEDT).Then after, coagulated wastewater shall be settled in Primary Clarifier (PCL).Clear supernatant from Primary Clarifier shall be passed in Aeration Tank (AT).
3) Domestic wastewater shall be added to AT, if required. Here, biodegradation of organic matter of the wastewater shall be carried out by bacteria (suspended growth) in the AT. The aeration tank provides proper mixing and supplies oxygen to the microorganisms in the dissolved form through the fine bubble diffusers. A constant feed rate shall be maintained in the aeration tank. A sludge percentage of around 25 to 30 % by volume shall be maintained in the aeration tank. Also MLSS and MLVSS ratio shall be maintained to ensure active microorganisms growth. Various nutrients like UREA and DAP shall be added from Nutrient Dosing Tanks regularly so as to ensure proper growth

of the microorganisms. Oxygen shall be supplied by 2 nos. of air blowers (B-02) through diffusers. Air blowers also keep MLSS in suspension.

4) Then the overflow of the aeration tank shall be diverted into the Secondary Clarifier(SCL) for biomass separation. An appropriate retention time is given to the effluent to ensure proper settling. The sludge settles down into the bottom of the SCL and required amount of settled sludge shall be recycled back into the aeration tank to maintain desired concentration of biomass. Excess biomass shall be pumped to sludge sump.
5) Then after, overflow (clear supernatant) of SCL shall collected in Intermediate Sump(IS).Then effluent from the IS shall be pumped to the Pressure Sand Filter (PSF) and Activated Carbon Filter (ACF) for tertiary treatment. The effluent shall enter into the sand filter from the top and the filtered effluent shall be further passed to the Activated Carbon Filter for color removal. A back wash facility shall be provided to the sand filter and carbon filter to wash out the suspended solid whenever required. For backwash, the effluent from the Intermediate Sump shall be pumped at the bottom of the sand filter (and / or carbon filter) and the discharge of the sand filter (and / or carbon filter) shall be diverted into the Collection cum Equalization Tank.
6) The outlet of the carbon filter shall be collected into the Treated Effluent Sump (TES). The treated effluent from the treated water tank shall be finally pumped to CETP/GIDC underground drainage through magnetic flow meter and recorder system. We will meet all the norms laid by Gujarat Pollution Control Board.
7) The primary and secondary sludge from the sludge sump shall be pumped to the filter press (FP) for sludge dewatering. The sludge cake shall be collected and packed into the plastic bags and stored in the HWSA and ultimate disposal to TSDF. The leachate from the filter press shall be diverted to the collection cum equalization tank for further treatment.

EXPECTED CHARACTERISTICS OF WASTEWATER BEFORE & AFTER TREATEMENT

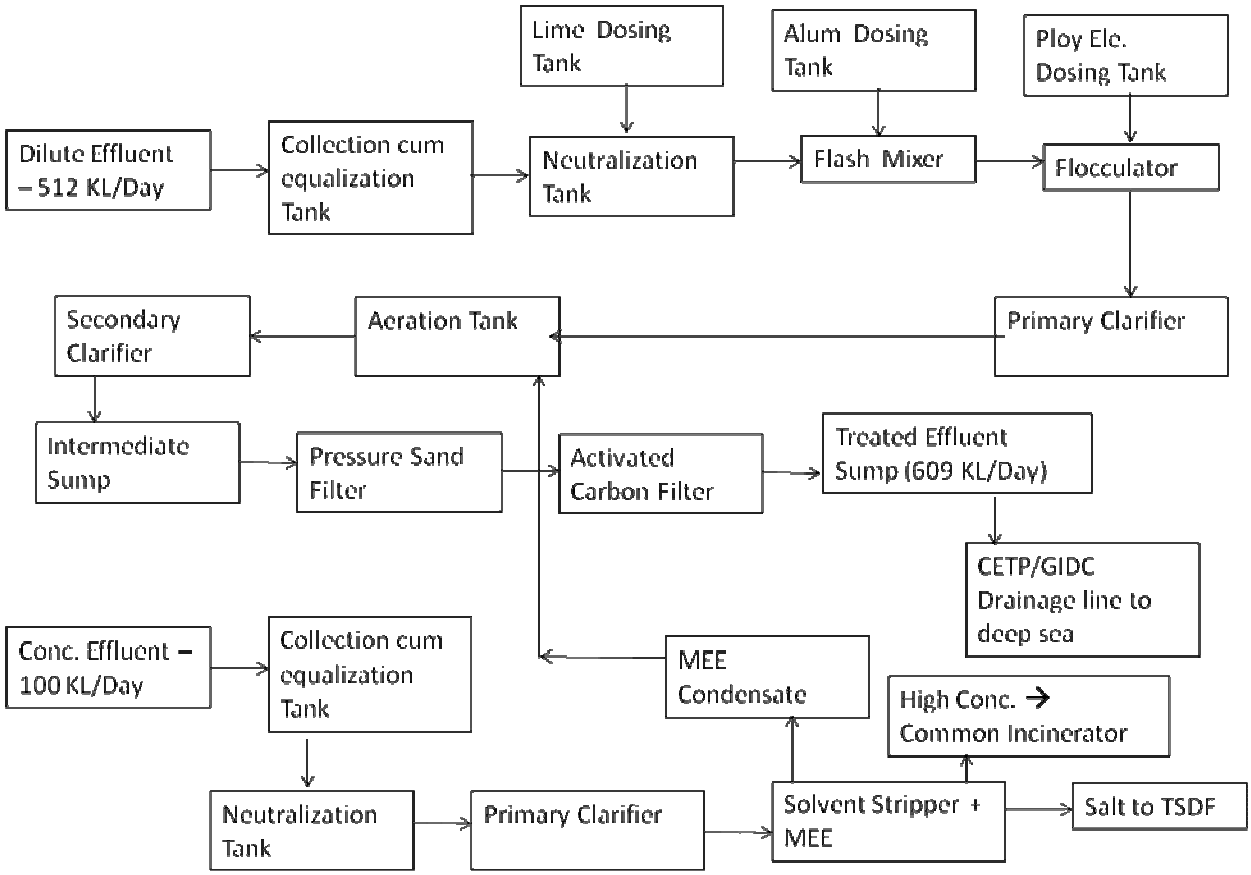
(Dilute Stream)

Sr. No.	Category of Wastewater	Before Treatment	After Treatment
1	pH	2.5-5.5	6.5-8.5
2	COD (mg/L)	6500	240
3	BOD_3 (mg/L)	3500	100
4	TDS (mg/L)	1900	1800
5	Ammonical Nitrogen (mg/L)	20	10

(Concentration Stream)

Sr. No.	Category of Wastewater	Before Treatment
1	pH	2.5-5.5
2	COD (mg/L)	45000
3	BOD_3 (mg/L)	7000
4	TDS (mg/L)	75000
5	Ammonical Nitrogen (mg/L)	70

Flow Diagram:



MEE SYSTEM

PROCESS DESCRIPTION:

Capacity: 100 KL/Day

Industry has installed Multi Effect Evaporator for the treatment of industrial effluent (as an additional facility) having capacity of 100 KL/Day. The condensate water generated from the MEE shall be used in process

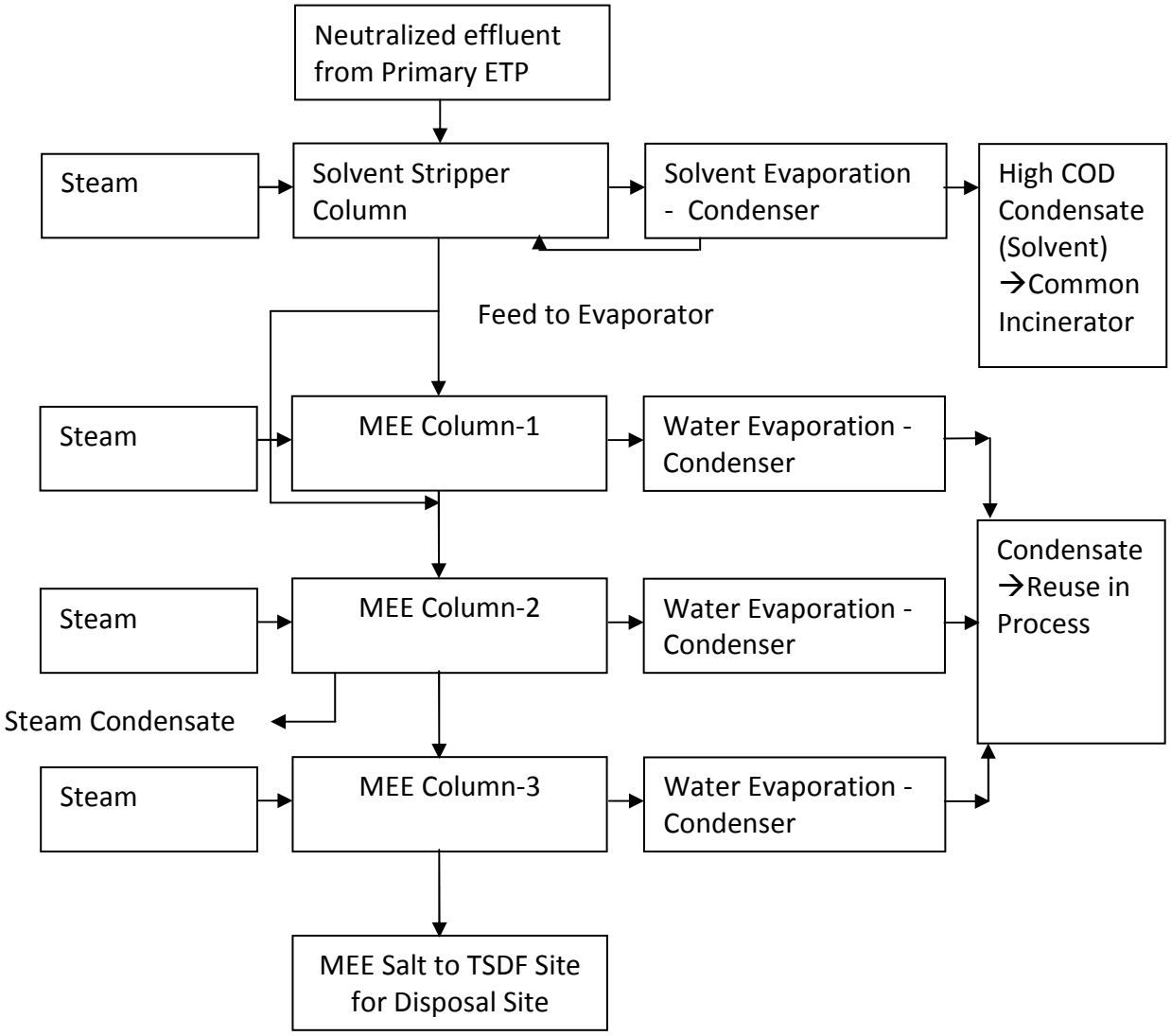
Neutral effluent from Primary Treatment Plant is passed through 3 stages Evaporator System and the evaporated water is collected in an Evaporated Water Collection Tank and then recycled to plant after filtering through sand filter and carbon filter. The sludge from the evaporators is filtered through Nutsch Filter whereby solid filtered sludge is obtained and the filtrate is recycled back to process.

Multi stage evaporator (3 - stages) is a long tube forced circulation type evaporators where in the first effect high pressure steam of 7.0 kg/cm^2 is used to evaporate waste water. The evaporated water in the form of steam at 2.0 kg/cm^{2}g pressure is used for evaporating the effluent in the second stage at atmospheric pressure. Evaporated water from the second stage is used for evaporating waste water in the third stage under vacuum of 650- 720 mm Hg. Finally evaporated water from the third stage is condensed in the steam condenser using cooling water on other side. Condensate from all the three stages is collected in condensate receiving tanks, which is pure water and hence reused in the process. Concentrated mass from each effect is collected in the crystallizer where, on cooling inorganic salts are precipitated along with organic contaminants. This mass is filtered in CF / Nutsch filter and filtrate is recycled back to process.

Design of MEE :

No. of Effects	:	3 (1 Falling Film + 2 Forced Circulation)
Waste Handling Capacity	:	100 m^3 / day
Feed Rate	:	5000 kg / hour (20 working hours / day)
Feed Concentration	:	10 % TDS
Feed Temperature	:	35 ^{o} C
Product Rate	:	1250 kg / hour
Product Concentration	:	40 %
Product Temperature	:	55 ^{o} C
Water Evaporation Rate	:	3750 kg / hour

Flow Diagram:



ANNEXURE: 6

DETAILS OF HAZARDOUS SOLID WASTE MANAGEMENT AND DISPOSAL

Sr. No.	Type of Hazardous Waste	Quantity (MT/Month)	Hazardous Waste Category	Storage, Collection & Disposal
1.	ETP Sludge	120	34.3	Collection, Storage, Transportation & Disposal to nearest TSDF at Dahej
2.	Process Sludge from $CaCl_2$ & DCP	300	--	Collection, Storage, Transportation & sell for agricultural use
3.	Used Oil/Spent Oil	200 Lit/Month	5.1	Collection, Storage, Transportation & Sell to GPCB Authorized Reprocessor
4.	Empty Drums/Container	500 Nos./Month	33.3	Collection, Storage, Transportation & Sell to GPCB Authorized Vendor
5.	Empty Bags	2000 Nos./Month	33.3	Collection, Storage, Transportation & Sell to GPCB Authorized Vendors
6.	Distillation Residue	110	28.1	Collection, Storage, Transportation & Disposal at nearest Common Incineration Site, Dahej or co-processing in cement industries
7.	MEE Salt	600	--	Collection, Storage, Transportation & Disposal to nearest TSDF at Dahej
8.	Fly Ash	300	36.2	Collection, storage & sell to brick manufactures
9.	Organic waste	120	20.3	Collection, Storage, Transportation & Disposal at nearest Common Incineration Site, Dahej or sell to cement industries
10.	Iron Sludge	510	--	Collection, Storage, Transportation & Disposal to nearest TSDF at Dahej or sell to cement industries
11.	HCl (30%)	4120	D2	Collection, Storage, Transportation & reuse in Calcium Chloride & Di Calcium Phosphate
12.	H2SO4 (70%)	2350	D2	Collection, Storage, Transportation & reuse in process and excess quantity will be sold to end user.
13.	Inorganic Salt	550	--	Collection, Storage, Transportation & Disposal to nearest TSDF at Dahej

ANNEXURE: 7
DETAILS OF FLUE & PROCESS GAS EMISSION

Flue Gas Emission

1. Details of Flue Gas Stack; Stack Attached To Steam Boiler (I, II)

SOURCES OF GASESOUS EMISSIONS	**STACK**		
Fuel Used	Coal: 80 MT/Day		
Capacity	25 TPH		
Type of Emissions	SO_2	NOx	SPM
Permissible Limits	100 ppm	50 ppm	150 mg/Nm^3
Stack Height	50 meters		
Stack Diameter at the Top	1.0 meter		
Air Pollution Control Measures	ESP with scrubber		

2. Details of Flue Gas Stack; Stack Attached To Thermic Fluid Heater Boiler (I, II, III)

SOURCES OF GASESOUS EMISSIONS	**STACK**		
Fuel Used	Coal: 45 MT/Day		
Capacity	15 Kcal/Hr (5 Kcal/Hr x 3 Nos.)		
Type of Emissions	SO_2	NOx	SPM
Permissible Limits	100 ppm	50 ppm	150 mg/Nm^3
Stack Height	50 meters		
Stack Diameter at the Top	1.0 meter		
Air Pollution Control Measures	ESP with scrubber		

3. Details of Flue Gas Stack : Stack Attached To D.G.Set

Sources of Gaseous Emissions	D.G. Set (2000 KVA) (1000 KVA x 2 Nos.)		
Fuel Used	HSD		
Stack Height	11 Meters		
Stack Diameter at The Top	200 MM		
Type of Emissions	SO_2	NOx	SPM
Permissible Limits	100 ppm	50 ppm	150 mg/Nm^3

4. Details of Process Vent

Sr.No.	Stack attached to	Stack Height	Air Pollution Control System	Parameter	Permissible Limit
Proposed					
1	MCB Plant	15 m	Alkali Scrubber	HCl Cl2	20 mg/Nm^3 9 mg/Nm^3
2	Process Vent	15 m	Alkali Scrubber	HCl Cl2 NH_3	20 mg/Nm^3 9 mg/Nm^3 175 mg/Nm^3
3	Herbicides Plant	12 m	Two Stage Water Alkali Scrubber	HCl SO2 HBR	20 mg/Nm^3 40 mg/Nm^3 5 mg/Nm^3
4	Fungicides Plant	12 m	Two Stage Water Alkali Scrubber	HCl SO2	20 mg/Nm^3 40 mg/Nm^3
5	Insecticides Plant	12 m	Two Stage Water Alkali Scrubber	HCl SO2	20 mg/Nm^3 40 mg/Nm^3
6	Process Vent	12 m	Water Scrubber	NOx	94 mg/Nm^3

ANNEXURE: 8
DETAILS HAZARDOUS CHEMICAL STORAGE FACILITY

NAME OF HAZARDOUS SUBSTANCE	MAX. STORAGE CAP.[Qty.]	ACTUAL STORAGE CAP.	PLACE OF IT'S STORAGE	OPERATING PRESSURE AND TEMP.	TYPE OF HAZARD	CONTROL MEASURE PROVIDED
Chlorine	90 Ton	900 Kg x 100 Tonner	Storage Shed	10 Kg/cm2 Ambient	Toxic	➢ Chlorine Kit, Caustic Pit, SCBA sets, Cl2 Shed, Cl2 Hood, EOT, etc. Provided.
Benzene	100 KL	50 KL X 2 Nos Tank	U/G Tank MS	ATP	Flammable	➢ Flame proof plant, pumping transfer, close process, etc. ➢ Double Static earthing ➢ Dyke wall ➢ Tanker unloading procedure. ➢ SCBA sets available . ➢ Flame proof plant, pumping transfer, close process, etc. ➢ Jumper clips on flanges ➢ Fire extinguishers ➢ Fencing and No Smoking and prohibited area. ➢ Tanker unloading procedure. ➢ Flame arrestor provided on vent line of the tank ➢ Hydrant system
Monochloro Benzene (MCB)	210 KL	70KL X 3 Nos Tank	Tank farm area A/G MS	ATP	Flammable	
Dichloro Benzene (DCB)	210 KL	70KL X 3 Nos Tank	Tank farm area A/G MS	ATP	Flammable	
Hydrochloric Acid	150 KL	50 KL X 3 Nos Tank	MS A/G Tank	ATP	Corrosive	➢ Safety Showers provided ➢ Caution note provided ➢ Dyke wall provided ➢ Level gauge provided. ➢ Double drain valve provided ➢ Scrubber provided ➢ Required PPEs provided to all employees

Sulfuric Acid	50 KL	25 KL X 2 Nos Tank	MS A/G Tank	ATP	Corrosive	➢ Safety Showers provided ➢ Caution note provided ➢ Dyke wall provided ➢ Level gauge provided. ➢ Double drain valve provided ➢ Scrubber provided ➢ Required PPEs provided to all employees
Nitric Acid	50 KL	25 KL X 2 Nos Tank	MS A/G Tank	ATP	Corrosive	➢ Safety Showers provided ➢ Caution note provided ➢ Dyke wall provided ➢ Level gauge provided. ➢ Double drain valve provided ➢ Scrubber provided ➢ Required PPEs provided to all employees
Bromine	5 KL	5 KL X 1 Nos Tank	Isolated Tank	ATP	Toxic	➢ Bromine will be stored in iso-container in separate storage area and transported in iso-container.
EDC	15 KL	15 KL X 1 Nos Tank	U/G Tank MS	ATP	Flammable	➢ Flame proof plant, pumping transfer, close process, etc. ➢ Double Static earthing ➢ Dyke wall ➢ Tanker unloading procedure. ➢ SCBA sets available . ➢ Flame proof plant, pumping transfer, close process, etc. ➢ Jumper clips on flanges ➢ Fire extinguishers ➢ Fencing and No Smoking and prohibited area. ➢ Tanker unloading procedure. ➢ Flame arrestor provided on vent line of the tank ➢ Hydrant system
Toluene	30 KL	15 KL X 2 Nos Tank	U/G Tank MS	ATP	Flammable	

ODCB/PDCB	40 KL	20KL X 2 Nos Tank	Tank farm area	ATP	Flammable	➢ Flame proof plant, pumping transfer, close process, etc. ➢ Double Static earthing ➢ Dyke wall ➢ Tanker unloading procedure. ➢ SCBA sets available . ➢ Flame proof plant, pumping transfer, close process, etc. ➢ Jumper clips on flanges ➢ Fire extinguishers ➢ Fencing and No Smoking and prohibited area. ➢ Tanker unloading procedure. ➢ Flame arrestor provided on vent line of the tank ➢ Hydrant system
ONCB/PNCB	50 KL	25 KL X 2 Nos Tank	Tank farm area	ATP	Flammable	
Dimethyl Formamide	20 KL	20 KL X 1 Nos Tank	Tank farm area	ATP	Flammable	
Hexane	30 KL	15 KL X 2 Nos Tank	Tank farm area	ATP	Flammable	
Nitrobenzene	20 KL	20 KL X 1 Nos Tank	U/G Tank farm area	ATP	Flammable	

ANNEXURE 9

SOCIO - ECONOMIC IMPACTS

1) EMPLOYMENT OPPORTUNITIES

The manpower requirement for the proposed project is expected to generate some permanent jobs and secondary jobs for the operation and maintenance of plant. This will increase direct / indirect employment opportunities and ancillary business development to some extent for the local population. This phase is expected to create a beneficial impact on the local socio-economic environment.

2) INDUSTRIES

Required raw materials and skilled and unskilled labors will be utilized maximum from the local area. The increasing industrial activity will boost the commercial and economical status of the locality, to some extent.

3) PUBLIC HEALTH

The company regularly examines, inspects and tests its emission from sources to make sure that the emission is below the permissible limit. Hence, there will not be any significant change in the status of sanitation and the community health of the area, as sufficient measures have been taken and proposed under the EMP.

4) TRANSPORTATION AND COMMUNICATION

In brief, as a result of the proposed project there will be no adverse impact on sanitation, communication and community health, as sufficient measures have been proposed to be taken under the EMP. The proposed project is not expected to make any significant change in the existing status of the socio - economic environment of this region.

ANNEXURE – 10

PROPOSED DRAFT TERMS OF REFERENCE:

1. **Project Description**

- Justification of project.
- Promoters and their back ground
- Project site location along with site map of 5 km area and site details providing various industries, surface water bodies, forests etc.
- Project cost
- Project location and Plant layout.
- Water source and utilization including proposed water balance.
- Product spectrum (proposed products along with production capacity) and process
- List of hazardous chemicals.
- Mass balance of each product
- Storage and Transportation of raw materials and products.

2. **Description of the Environment and Baseline Data Collection**

- Micrometeorological data for wind speed, direction, temperature, humidity and rainfall in 5 km area.
- Existing environmental status Vis a Vis air, water, noise, soil in 5 km area from the project site. For SPM, RSPM, SO_2, NOx.
- Ground water quality at 5 locations within 5 km.
- Complete water balance

3. **Socio Economic Data**

- Existing socio-economic status, land use pattern and infrastructure facilities available in the study area were surveyed.

4. **Impacts Identification And Mitigatory Measures**

- Identification of impacting activities from the proposed project during construction and operational phase.
- Impact on air and mitigation measures including green belt
- Impact on water environment and mitigation measures
- Soil pollution source and mitigation measures
- Noise generation and control.
- Solid waste quantification and disposal.

5. **Environmental Management Plan**

- Details of pollution control measures
- Environment management team
- Proposed schedule for environmental monitoring including post project

6. **Risk Assessment**

- Objectives and methodology of risk assessment
- Details on storage facilities
- Process safety, transportation, fire fighting systems, safety features and emergency capabilities to be adopted.
- Identification of hazards
- Consequence analysis through occurrence & evaluation of incidents
- Disaster Management Plan.

7. **Information for Control of Fugitive Emissions**
8. **Post Project Monitoring Plan for Air, Water, Soil and Noise.**
9. **Information on Rain Water Harvesting**
10. **Green Belt Development plan**