PRE-FESIBILITY REPORT

MANUFACTURING OF TECHNICAL GRADE PESTICIDES

PROPONENT – M/S Hindustan Rasayan Private Limited

Industrial Growth Center, Mansa Road

Bathinda (Punjab)

INTRODUCTION

PESTICIDE USAGE

The role of the pesticides in the well-being of human race needs no emphasis. Pesticide usage has become essential in order to maximize agriculture production and reduce public health pestilence. The rapid changes in cropping patterns, increased fertilization and adoption of programs for high yielding varieties have all contributed to increased use of pesticides. Further, pest problems keep on changing with the changing environment. New physiological kinds evolve as a result of mutations to withstand new conditions in nature. Many pest species develop resistant strains when the same pesticide is used far too often. The problems of pest resurgence and secondary pest out-breaks crop up with the indiscriminate use of pesticides. These associates problems offer a great scope for revolutionizing the use of pesticides. However, in India though the overall pesticide growth figures may appear impressive, the rate of consumption per hectare of cultivated land is very low in comparison per hectare of cultivated land is very low in comparison to other countries. India used 180 g of pesticides/ha. as against 10790g, 1870g and 1490 g/ha used in Japan, Europe and USA respectively. India spent just Rs. 2.15/ha. on pesticides while Japan, Europe and USA respectively during the year. India spent just Rs. 2.15 ha. on pesticides while Japan and USA spent Rs. 110/ha and Rs. 35/ha respectively during the same period. India consumed 12gm. of pesticides per kg. of fertilizer used against 146 gm. in Japan in and 19 gm. in USA in. This is one of the major factors that can be attributed to low per hectare yields in our country since the crops and especially the high yielding varieties cannot manifest their production potential in absence of proper pest protection. That the production potential remains suppressed for want of protection can be exemplified by considering how in wheat, a crop comparatively resistant to insect pestilence, we have had a “revolution” where as in paddy which is one of the most heavily infested crops, we have had no break-through. In case of wheat, the per hectare yield in India rose from 827 kg. in to 1338 kg. in corresponding yields of paddy in

India on the other hand was 1826 kg. as against 6185 kg. 5326 kg., 5105 kg and 4000 kg. in Japan, Egypt, USA and USR respectively.

With in the country itself, there is a great imbalance between different regions with regard to the use of pesticides. Of the total of approximately Rs. 5000 million spent on pesticides in at the farm level, South Contributed for about 45 percent of the total consumption in the rest of the country.

PROJECTED GROWTH

The rate of growth of pesticides after the introduction of high yielding varieties was between 25-30% per annum. However, since then the rate of growth has leveled off at about 15%. The Ministry of Agriculture has estimates that Demand will further reach to about 20%.

THE PRODUCTION GAP

This would thus appear from the above that there is an unabridged major gap between the demand and supply of pesticides for both public health and agriculture. The investments involved in setting up of basic manufacturing plants as compared to formulation units if fairly high. It has been possible for small scale entrepreneurs to go in for formulation business but financially not possible to invest in basic manufacturing facilities. In the country basic manufacturing are mostly with large scale MN companies and, in some cases, may be wholly owned by them. In view of the fact that the present companies of these subsidiaries have sizeable capacities for the manufacture of basic chemical in their own countries, they are reluctant to invest money for basic manufacture in India. Also, these companies are reluctant to transfer technology and losing monopoly sales especially when these products are proprietary.

TECHNOLOGY DEVELOPMENT

Many national laboratories under CSIR have done work on laboratory synthesis, bench scale number of pesticide products as a result of which recommendation for banning the import of technology for such products has been made. The development of technology does not however end with

research work up to limited pilot plant studies. It has to be systematically developed further in turn key type pilot plants and semi commercial plants keeping in view the availability of raw materials/intermediates etc. to achieve safety, quality and economy, which needs years of pilot plant and semi commercial plant studies and large funds, before it can be transferred smoothly to a commercial plants. Additionally and simultaneously extensive field testing and toxicological experimentation has to be undertaken. This is time consuming and involves substantial financial outlays. The small scale industry end entrepreneurs do not have the finances and technical manpower to utilize these technologies and the multinationals do not generally adopt them. National pesticides company singly or through joint ventures with the states, has to assume the major responsibility of implementing manufacturing programs so that the country is self-sufficient in a reasonable period of time rather than to depend on imported materials for an indefinite period. Imports not only area drain on foreign exchange but also have the disadvantage of erratic supply of materials are badly needed in the country. In addition, dependence on imports will lead to hampering the efforts in development of local expertise and local manufacturing industry. The local manufacture will provide additional employment directly and indirectly through ancillaries.

1. JUSTIFICATION OF THE PROJECT

The present project “Manufacturing of technical grade pesticides has been planned as the market requirements is much more compare to the installed capacity In our country. All technical grade pesticides as per the list enclosed are also essential agro input and not available in adequate quantity. Most of the products are imported more than 70% of the total requirement in our country. All the technical grade products which will be manufactured are having the various opportunities to sale out the products in the India as well as export to other countries.

The end use of these products are in the formulation of Wetable Powder, Emulsifiable Concentrate and various other type of Pesticides formulation which are used by farmers for plant protection. The present demand is very

high compare to the availability and can not be fulfilled in future as the demand is increasing by 10 to 15% every year.

The present project is based on the minimum scale capacity of the production to fulfill the market requirements and cost effective which will be helpful to provide the product to the customer at low price. Due to the export opportunity, we can also generate foreign currency.

The raw materials for the manufacturing are available in China and India. The existing site will have excellent facility to stores these raw materials.

The molecules are very effective and environment friendly technology will be used in the manufacturing to ensure environment protection and safety of men, machines & materials.

1. EXECUTIVE SUMMARY

M/s Hindustan Rasayan Pvt Ltd intends to manufacture Technical grade Pesticides under its Modern Project. The locations details of the project are placed below:

- Topography : Plain
- Nearest River : No river exist
- Nearest Seaport : None in 25 Kms
- Nearest sanctuary : None in 25 Kms
- Nearest Historical Place : None in 25 Kms
- Nearest National Park : None in 25 Kms
- Nearest Hill : None in 25 Kms

The new unit is to be designed for only 1000 TPA Technical grade pesticides. The unit will operate 300 days / year.

The new plant will be designed with the basic concept of green chemistry with modifications to optimize energy utilization and with significant reduction of manual interface. To meet the target production rate, all equipments capacities and their sizes will be optimized. An equipment list is prepared which includes the capacities and equipment sizes with minimum other details required to finalize the overall plot area.

The total area requirements for manufacturing facilities is given below in the table.

Facility	Area (Sq. Yard.)	Remarks
Manufacturing	7140	Process control and RMs Storage
Solvent Recovery System	1860	Recycling
Tank Farm	1000	
Total	10000	

The ground water requirement shall be approximately 5 KLD. Groundwater is not used for irrigation purpose in the vicinity. Only drinking water shall taken from groundwater. Water generated in the process shall be separated in distillation will be treated in ETP and reused to meet water requirements, for horticulture and greenery in the plant premises.

The power requirements will be 500 KVA. DG set of capacity 250 KVA will be used in the plant for power back up. The permission for 500 KVA power supply from electricity board will be obtained.

This project falls under activity 5(b) Category A as per SO:1533E 2006 Notification, hence to be considered and cleared by MoEF.

Proposed cost of the project is about Rs. 600 Lakh.

As per the notification of MoEF. Govt. of India provide Terms of Reference (TOR) for the factors to be addressed for Environmental Management.

We are requesting for issuance of TOR and exemption from Public Hearing since the project is located in notified industrial Area.

2. Introduction of the project / Background information

(i)	Identification of project and project proponent.	The project is for the manufacturing of Technical grade pesticides by M/S Hindustan Rasayan Pvt. Ltd.
(ii)	Brief description of nature of the project	Manufacturing of Pesticides used for the pest control in the agriculture & public health. The raw materials and finished products are chemicals and will be manufactured with most modern technology which will be environment friendly.
(iii)	Need for the project and its importance to the country and or region.	Pesticides are essential input for agriculture and the project will provide adequate availability of the required products at cheaper rates and will also reduce the import quantities.
(iv)	Demand-Supply Gap	Since the requirement of Pesticides is increasing @ 10% to 15% every year, there is a huge gap between the demand and supply.
(v)	Imports vs. indigenous production.	At present more than 70% requirement is fulfilled by import and there is urgent need to create indigenous manufacturing facilities to provide better Quality at optimum cost.
(vi)	Export Possibility	All the products have very high possibilities of Export
(vii)	Domestic / export markets	The technical grade pesticides will be sold to many formulators all over the country. At the same time export will be done to middle east, Latin America and south Asian countries
(viii)	Employment Generation (Direct and indirect) due to the project	Managers – 4 Nos., Supervisors – 8 Nos., skilled workers – 20 Nos. and semiskilled workers – 40 Nos.

3. Project Description

(i)	Type of project including interlinked and interdependent projects, if any.	Manufacturing of pesticides
(ii)	Location (map showing general location, specific location, and project boundary & project site layout) with coordinates.	Enclosed herewith
(iii)	Size or magnitude of operation	The total plant installed capacity will be 1000 MT per annum
(iv)	Project description with process details (a schematic diagram / flow chart showing the project layout, components of the project etc., should be given)	Enclosed herewith
(v)	Raw materials required along with estimated quantity, likely source, marketing area of final product/s, Mode of transport of raw material an Finished Product.	Please refer to annexure A
(vi)	Resource optimization / recycling and reuse envisaged in the	All the solvents used will be recovered and recycled for all products. Energy efficient equipment will be installed at all location.

	project, if any, should be briefly outlined.	Waste water will also be reused after proper treatment. There will be no discharge from the site.
(vii)	Availability of water its source, Energy / Power requirement and source should be given.	Our own bore wells will be created. Power requirement will be 500 KW and will be managed both by connection of state electricity board & our own DG sets.
(viii)	Quantity of wastes to be generated (liquid and solid) and scheme for their Management / disposal	Solid waste – 30 MT per annum Liquid waste – 20 MT per annum Membership registration will be obtained from authorized agency of SPCB for transportation & disposal of all wastes.
(ix)	Schematic representation of the feasibility drawing which give information of EIA purpose.	Enclosed herewith

4. Site Analysis

(i)	Connectivity	Well connected with main road path
(ii)	Land form, Land use and Land ownership	Plain land for agriculture and ownership is of our own.
(iii)	Topography (along with map)	Enclosed
(iv)	Existing land use pattern (agriculture, non-agriculture, forest, water bodies (including area under CRZ), shortest distances from the periphery of the project to periphery of	Industrial land, no forest, wild life national park, sanctuary, water bodies & eco sensitive area in the radios of 25 KM.

	the forests, national park, wild life sanctuary, eco sensitive areas, water bodies (distance from the HFL of the river), CRZ. In case of notified industrial area, a copy of the Gazette notification should be given.	
(v)	Existing Infrastructure	Refer to site plan
(vi)	Soil classification	Sandy & plain
(vii)	Climate data from secondary sources	Enclosed
(viii)	Social infrastructure available	Available

5. Planning Brief

(i)	Planning concept (type of industries, facilities, transportation etc.) Town and Country Planning / Development authority classification.	Green field project and all facilities will be created after environment clearance.
(ii)	Population Projection	
(iii)	Land use planning (breakup along with the green belt etc)	Coverage up to 50% for production Green belts up to 30% Remaining for warehousing, roads & other facilities.
(iv)	Assessment of infrastructure Demand (Physical & Social)	Green field project

(v)	Amenities / Facilities	Green field project

6. Proposed Infrastructure

(i)	Industrial Area (Processing Area)	7140 Sq. Yard.
(ii)	Residential Area (Non processing area)	1860 Sq Yard
(iii)	Green Belt	3300 Sq. Yard.
(iv)	Social infrastructure	
(v)	Connectivity (traffic and Transportation Road / Rail / Metro / Water ways etc.)	Good connectivity
(vi)	Drinking Water Management (Source & Supply of water)	Bore wells
(vii)	Sewerage System	Will be created
(viii)	Industrial Waste Management	ETP will be created for waste water treatment and other waste will be sent to waste management project facility.
(ix)	Solid Waste Management	Will be sent to approved agency / site for safe disposal
(x)	Power Requirement & Supply / source	500 KW will be obtained from state power corporation. Also DG sets will be installed.

7. Rehabilitation and Resettlement (R&R) Plan

(i)	Policy to be adopted (Central / State) in respect of the project affected persons including home ousters, land ousters and Landless laborers	Public liability insurance plan policy will be obtained for suitable amount. On site & off site emergency plans will be prepared and enforced by continuous training to all concern.

	(a brief outline to be given)	

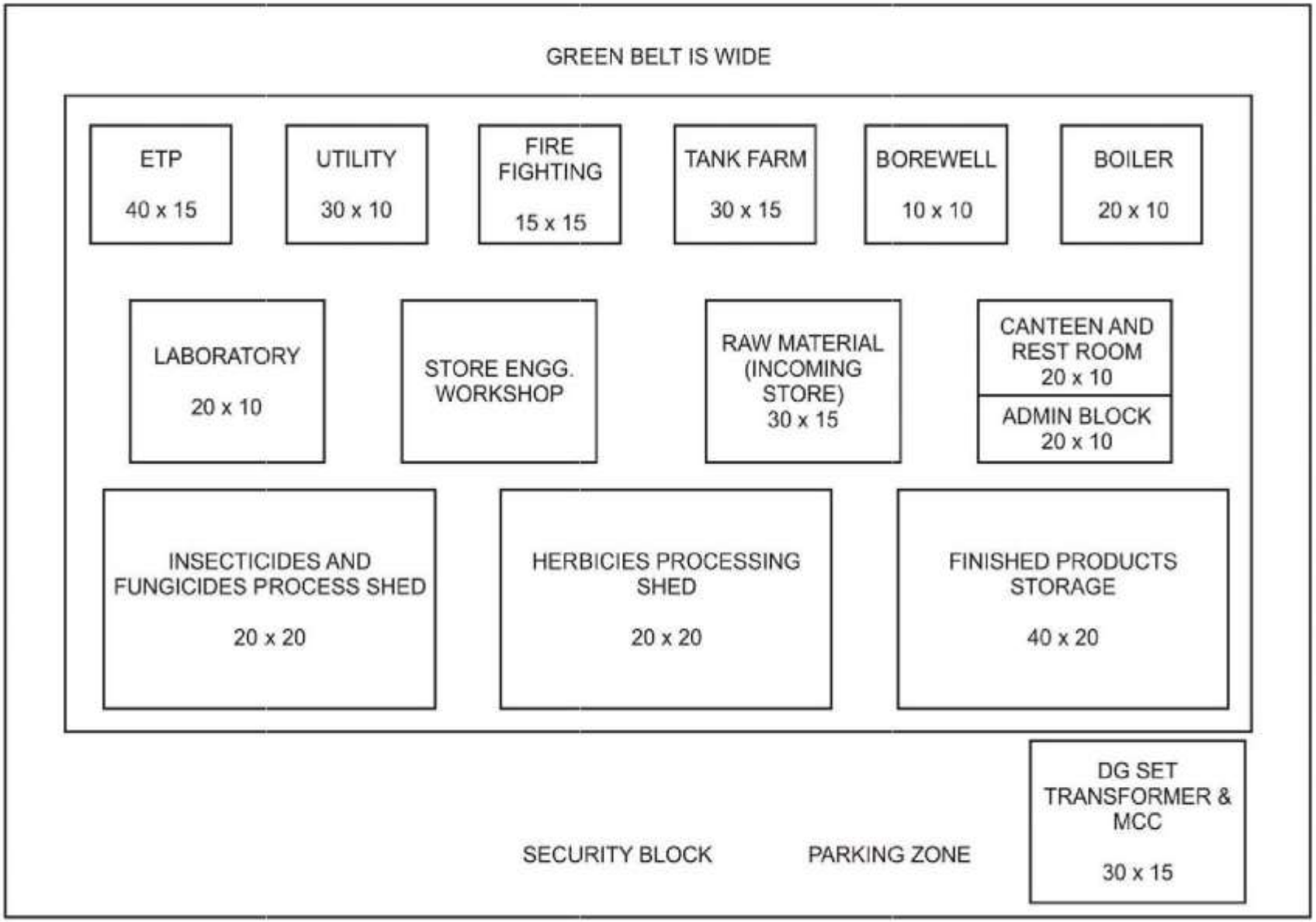
8. Project Schedule & Cost Estimates

(i)	Likely date of start of construction and likely date of completion (Time schedule for the project to be given)	Green field project. Construction and other infrastructure will be created as soon as environment clearance is obtained.
(ii)	Estimated project cost along with analysis in terms of economic viability of the project	6 corers

9. Analysis of proposal (Final Recommendations)

(i)	Financial and social benefits with special emphasis on the benefits to the local people including tribal population, if any, in the area.	Project will provide direct & indirect benefit to more than 200 people.

PROPOSED AGROCHEMICALS PLANT - HINDUSTAN RASAYAN PVT. LTD.



LIST OF PRODUCTS

1.	Clodinafop	100 MT/Year
2.	Hexaconojol	100 MT/Year
3.	Atrazine	100 MT/Year
4.	Glyphosate	100 MT/Year
5.	Lembdacyhelothrin	100 MT/Year
6.	Fifronil	100 MT/Year
7.	Thiram	100 MT/Year
8.	Ziram	100 MT/Year
9.	Thiomethoxam	100 MT/ Yea
10.	Imidacloprid	100 MT/Year

LIST OF PLANT AND MACHINES

S. No.	Machine Description	Capacity – No.
1	S.S. REACTOR	2KL-2
2	S.S. REACTOR	3KL-2
3	S.S. REACTOR	4KL-2
4	S.S. REACTOR	5KL-2
5	S.S. REACTOR	6KL-2
6	S.S. REACTOR	8KL-1
7	FILTER PRESS	23*18-2
8	FILTER PRESS	46 x 36-1
9	ROTATORY VACCUM DRIER	760 Kg.-2
10	NOTCH FILTER	1200 LT-2
11	NOTCH FILTER	2000 LT-1
12	CENTRIFUGE	24-25 Kg.-2
13	CENTRIFUGE	36-150 Kg.-2
14	CENTRIFUGE	250-300 Kg.-1
15	FLUID BED DRIER	60 Kg.-2
16	RIBBON BLENDER	600 Kg.-2
17	LATHE MACHINE 14’	14’-2
18	DRILL MACHINE	Normal-1
19	GRINDER MACHINE	Normal-1
20	COOLING TOWER	25 TR-2
21	COOLING TOWER	35 TR-2
22	HOT WATER BATH	1 KL-2
23	CHILLING COMP.	17 TR-2
24	HOT WATER BATH	3 KL
25	CHILLING COMP.	17 TR
26	OIL BOILER (THERMAL)	850 kg/hr-2
27	VACCUM EJECTOR	730 mm/hg-2
28	STEAM EJECTOR	740 mm/hg-2
29	OXYGEN FEEDER	10 cylinder-2
30	OPIL VACCUM PUMP	730 mm/hg-3
31	SCRUBBER SYSTEM	1500 rpm-2
32	SUBMERSIBLE BOREWELL-1	Size 4”-3

LIST OF UTILITIES

S.NO.	MACHINE DESCRIPTION	MAKE	CAPACITY
1	TUBEWELL PUMP	ROCKWELL	700 LTR/MIN
2	FIRE PUMP	KIRLOSKAR	18LPS/90M/30HP RPM2830
3	BLOWER (AIR POLLUTION)	AIR TECH	1000CFM
4	BLOWER (AIR POLLUTION)	AIR TECH	100 CFM
5	GEN-SET	CIMINS	250 KVA
6	AIR COMPRESSOR	IONGERSOL RAND	12 CFM
7	FIRE SIREN	EXPRESS	50 KM
8	SOLVENT PUMP-1	KIRLOSKAR	6.0 KL/HR
9	SOLVENT PUMP-2	KIRLOSKAR	6.0 KL/HR
10	SOLVENT STORAGE TANK	SAIFA ENGG.	100 KL
11	SOLVENT STORAGE TANK	SAIFA ENGG.	100 KL
12	WATER COOLER	SHRI RAM	80 LTR/Hrs/60/120

LIST OF LABORATORY EQUIPMENT

S. No.	Machinery Description	Make	Model No.	No.
1	HPLC (Chemistration)	Agilent	1100	1
2	HPLC with Software	Thermo-separation	P100	1
3	Gas Chromatograph with Software	Nucon	5765	2
4	U.V. Spectrophotometer	Perkin Ekmer	--	1
5	Ph. meter	Lab India Effem Technology	0006NBS DBK Digital Instruments	2
6	Polarimeter	Rajdhani Scientific Instrument Co.	12 SPI	1
7	Oven	Elcon	--	1
8	Vaccum Oven	--	--	1
9	Analytical Balance	Sartrius	BP121S	2
10	Analytical	Metler Toledo	AB1045	2
11	Wrist Action Shaker	PR Scientific	--	1
12	Vaccum Pump	Farcov	--	2
13	Vaccum Pump	Local	--	1
14	Water Bath	SM Industries	--	1
15	Magnetic Sttirer	Local	--	2
16	Flash Point Apparatus	Ashain Scientific	--	1
17	Refrigerator	BPL, Godrej	--	2
18	Bod Incubator	Calton	--	2
19	Melting Point Apparatus	Local	--	1

NAME OF PRODUCT

(1)	ATRAZINE		RAW MATERIAL
		-	Syanuric chloride
		-	Ethylamine & isopropylamine
		-	Sodium Hydroxide
		-	Carbon tetrachloride
(2)	IMDACLORID	-	Potassium carboxide
		-	2 chloro, 5 chloro mexye-pyridine (CCMP)
		-	Sodium hydroxide
		-	2 nitroxide
		-	Acetanitrile or DMF
(3)	GLYPHOSATE	-	N-Phosphonomethyl iminodiacetic acid (PIMIDA)
		-	Carbon powder
		-	Ammonia
		-	Sulphuric acid
		-	Oxygen
(4)	CLODINAFOP	-	Rhydroxy Phenoxy Proprioric Acid
		-	Chloro Difloro Pyridine (CDF)
		-	Propargyl Chloride
		-	Tetra butyl ammonium bromide
		-	Acetonitrile
		-	Isopropyl and Methyl alcohol

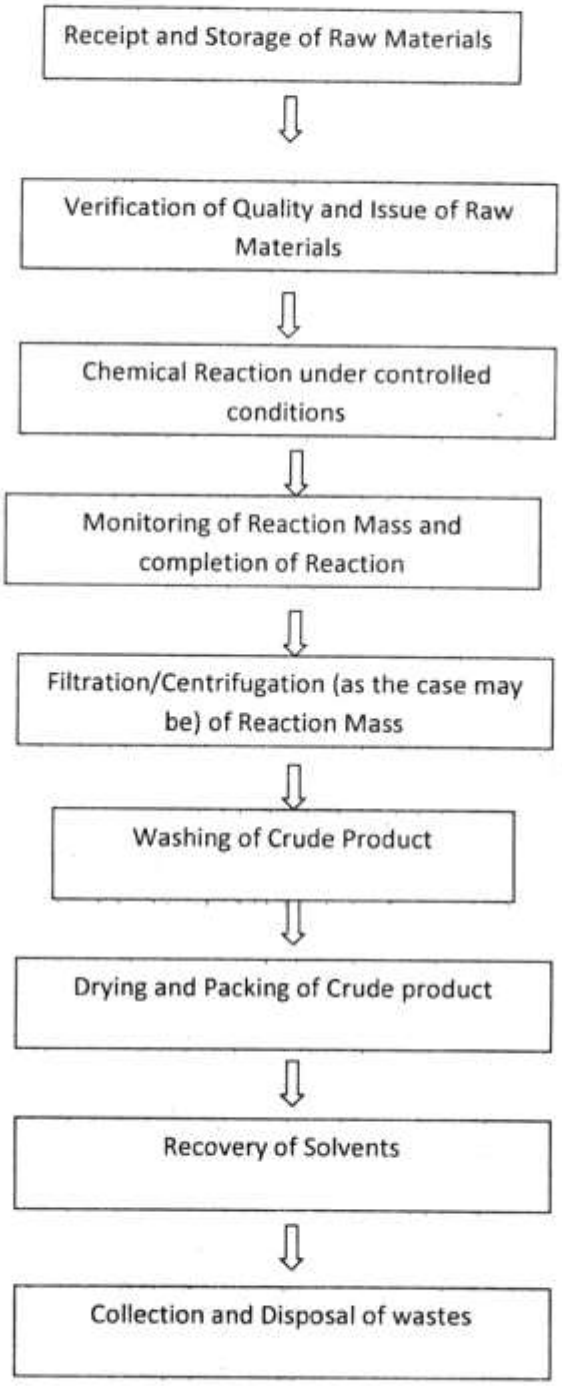
STORAGE AND TRANSPORTATION OF RAW MATERIAL & FINISHED PRODUCTS

All the raw materials required to manufacture of various technical and its formulation are procured from standard / approved suppliers. These materials are packed into Good quality of containers, drums & bags to ensure safe handling in transit as well as in loading / unloading and also in storage. Mostly raw materials are coming in full truck loads through approved and well known transport. Imported raw materials from China also sourced from large well known industrial companies with full care on packing & forwarding.

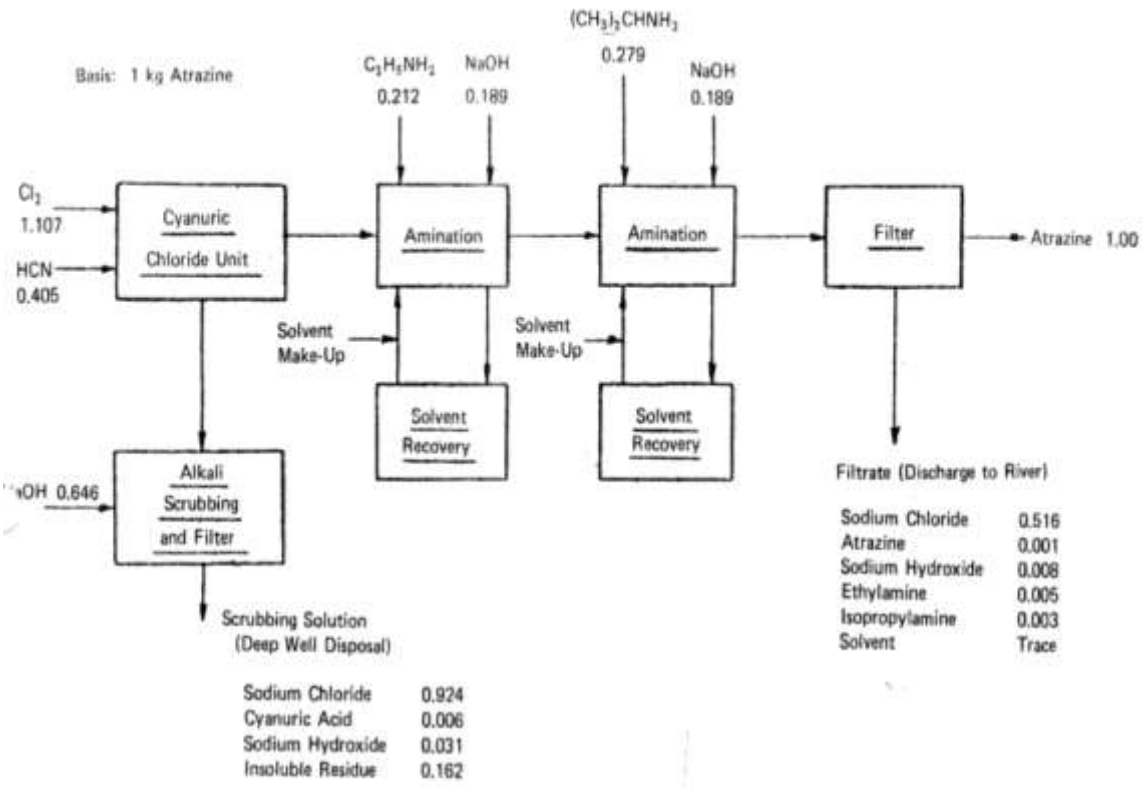
We will construct two big warehouses at our factory situated at Bathinda (PB) which is an approved & notified industrial area. These warehouse will be designed in consultation with expert architects and with modern techniques to ensure scientific storage conditions. Construction materials will be of grade A for walls, roof & flooring. Care will be taken to prevent exposure to moisture, sunlight, heat and other environmental parameters. All the materials will be stored only up to prescribed height and suitable gaps will be provided between various items.

Our company will obtained certificate for ISO-9001, ISO-14001 and ISO-18001. All activities of procurement, transportation, unloading, handling of materials, dispatch of finished products, storage / preservation / issue of materials / products will be controlled by prescribed standard operation procedures & work instruction at all levels of concerned employees to ensure safety & Environmental Protection. Regular internal audits will be conducts by qualified & trained auditors for continual improvement. Annual external audits are also conducted by auditors to verify compliance to the quality & Environment Management System of our company. Training needs will be identified for all category of employees to provide required training to improve competence level & to ensure corrective / preventive actions to maintain Safety & to prevent / reduce Pollution.

Process Flow Diagram for the manufacturing of Technical Grade Pesticides



Atrazine Manufacture

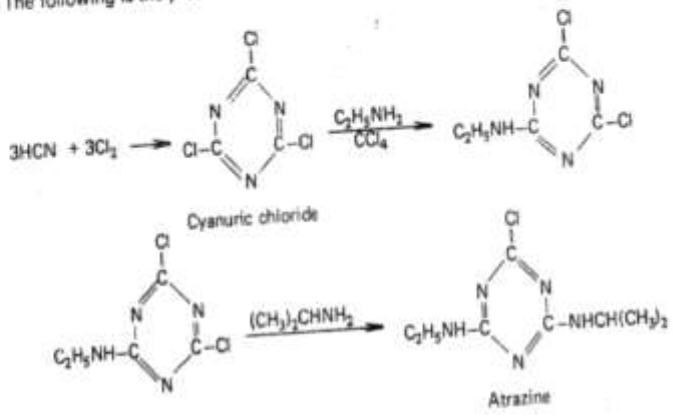


Manufacture

Atrazine is prepared by the reaction of cyanuric chloride with one equivalent of ethylamine followed by one equivalent of isopropylamine (in the presence of an acid-binding agent).

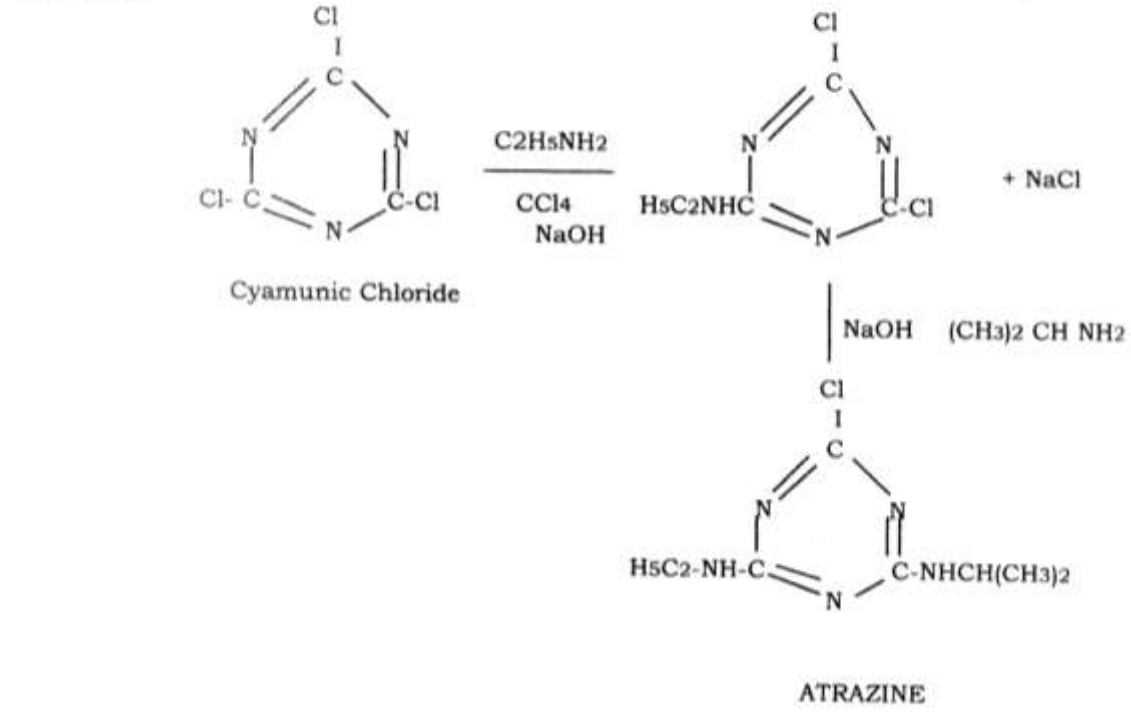
Figure is a production and waste schematic for atrazine manufacture.

The following is the production chemistry involved.



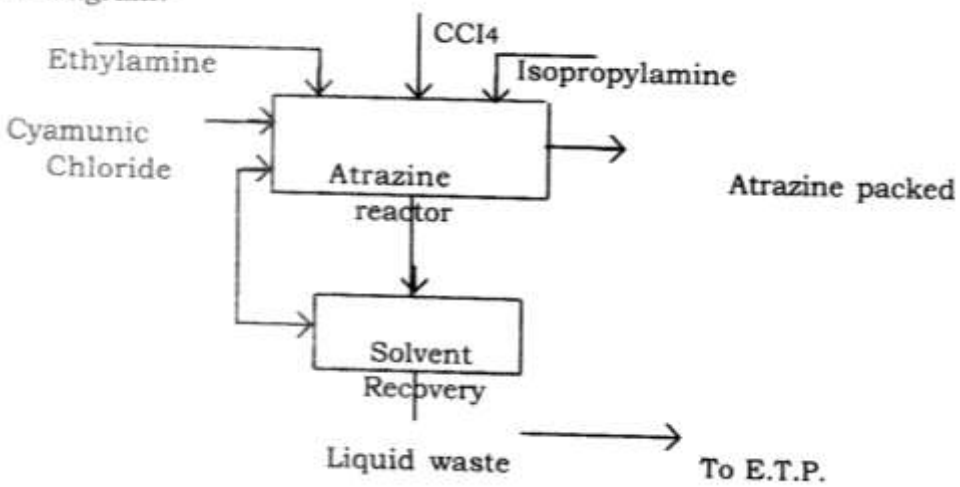
PROCESS OF MANUFACTURE
ATRAZINE TECHNICAL

REACTION:



Process : Carbon tetra chloride is taken into the reactor to which added cyamunic chloride, after addition is complete ethylamine and caustic soda solution are added simultaneously other then ISO-propyl amine and caustic soda are added after reaction is over, aqueous layer is separated and solvent is distilled off to get Atrazine.

Flow Diagram:-



RAW MATERIAL SPECIFICATIONS

CARBON TETRACHLORIDE

1.	Molecular Formula	:	$C Cl_4$
2.	Assay	:	99.8%
3.	Appearance	:	Colorless liquid
4.	Boiling Point	:	76^oC
5.	Melting Point	:	-23^oC
6.	Source of supply	:	Rahul Organic Limited, Mumbai

ETHYLAMINE

1.	Molecular Formula	:	C2H5NH2
2.	Assay	:	69 to 71%
3.	Flesh point	:	17^oC
4.	Appearance	:	colorless
5.	Density	:	0.8000
6.	Refrective index	:	1.3830-1.3850
7.	Source of supply	:	Alkyl amines and Chemicals, Mumbai.

SODIUM HYDROXIDE

1.	Molecular Formula	:	NaOH
2.	FW	:	40.00
3.	Assay	:	98^oC
4.	Boiling Point	:	1390^oC
5.	Melting Point	:	318^oC
6.	Density	:	2.1300
7.	Source of supply	:	Rahul organic limited, Mumbai

ISOPROPYLAMINE

1.	Molecular Formula	:	$(CH_3)CHNH_2$
2.	FW	:	59.11
3.	Assay	:	99%
4.	Flesh Point	:	-37^oC
5.	Boiling Point	:	33-34^oC
6.	Density	:	0.6900
7.	Source of supply	:	Sima products, Mumbai

CAUSTIC SODA

1.	Molecular Formula	:	$C_6H_4(OC_2H_5)_2$
2.	FW	:	166.22
3.	Melting Point	:	43-45^oC
4.	Source of Supply	:	Local Market

2, 4, 6-TRICHLORO 1, 3, 5 TRIAZINE

1.	Molecular Formula	:	C3N3Cl3
2.	M.W.	:	129
3.	Boiling Point	:	99-100^oC
4.	Melting Point	:	74-78^oC
5.	Source of supply	:	Mysore Ammonia Pvt. Ltd., Mumbai

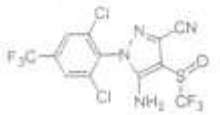
CHEMICAL COMPOSITION

1.	Atrazxine a.i.	:	95.00% w/w min
2.	Simazine and Propazine and trisubstituted triazines	:	3.70% w/w max
	(a) Tris (isopropylamino)-1,3,5-triazine		
	(b) Tris (ethylamino)-1,3,5-triazine		
	(c) Propazine		
	(d) Simazine		
3.	Monosubstitutedriazines	:	0.10% w/w max
	(a) 4,6-dichloro-2-ethylamino-1,3,5-triazine		
	(b) 4,6-dichloro-2-isopropylamino-1,3,5-triazine		
4.	Sodium Chloride	:	0.20% w/w max
5.	Water	:	1.00% w/w max
	Total	:	100.00% w/w

fipronil

Insecticide

IRAC 2B. phenylpyrazole



NOMENCLATURE Common name fipronil (BSI, pa E-ISO)
IUPAC name (±)-5-amino-1-(2,6-dichloro-α,α,α-trifluoro-*p*-tolyl)-4-trifluoromethylsulfinylpyrazole-3-carbonitrile
Chemical Abstracts name 5-amino-[2,6-dichloro-4-(trifluoromethyl)phenyl]-4-[(1*R*,1)-(trifluoromethylsulfinyl)-1*H*-pyrazole-3-carbonitrile
CAS RN (120068-37-3) EC no. 424-610-5 Development codes MB 46030, RPA-030 (both Rhône-Poulenc), BAS 350 I (BASF)

PHYSICAL CHEMISTRY Mol. wt. 437.2 M.f. $C_{12}H_4Cl_2F_6N_4OS$ Form White solid. M.p. 200–201 °C, (tech., 195.5–203 °C) V.p. 3.7×10^{-4} mPa (25 °C) K_{ow} log*P* = 4.0 (shake flask method) Henry 3.7×10^{-1} Pa m^3 mol^{-1} (calc.) S.g./density 1.477–1.626 (20 °C) Solubility In water 1.9 (pH 5), 2.4 (pH 9), 1.9 (distilled) (all in mg/l, 20 °C); in acetone 545.9, dichloromethane 22.3, hexane 0.028, toluene 3.0 (all in g/l, 20 °C). Stability Stable in water at pH 5 and 7; slowly hydrolysed at pH 9 (DT_{50} c. 28 d). Stable to heat. Slowly degrades in sunlight (c. 8% loss after 12 d continuous irradiation); rapidly photolysed in aqueous solution (DT_{50} c. 0.33 d)

COMMERCIALISATION History Discovered by Rhône-Poulenc in 1987. Reported by F. Colliot *et al.* (*Proc. Br. Crop Prot. Conf. - Pests Dis.*, 1992, **1**, 29). Introduced by Rhône-Poulenc Agrochimie (now Bayer CropScience) in 1993. Worldwide agricultural and environmental uses acquired by BASF AG in 2003. Manufacturers BASF

APPLICATIONS Biochemistry Insecticide which acts as a potent blocker of the GABA-regulated chloride channel. Insects resistant or tolerant to pyrethroid, cyclodiene, organophosphorus and/or carbamate insecticides are susceptible to fipronil. Mode of action Broad-spectrum insecticide, toxic by contact and ingestion. Limited xylem systemicity in some monocotyledonous crops. Can be used to control insects when applied as a soil or seed treatment. Good or excellent residual control following foliar application. Uses Control of multiple species of thrips on a broad range of crops by foliar, soil or seed treatment. Control of corn rootworm, wireworms and termites by soil treatment in maize. Control of boll weevil, red plant bugs on cotton, diamond-back moth on crucifers, Colorado potato beetle on potatoes by foliar application. Control of stem borers, leaf miners, planthoppers, leaf folders (rollers) and weevils in rice. Foliar application rates range from 10–80 g/ha, soil treatment rates 100–200 g/ha. Formulation types EC, FS, GR, SC, UL, WG. Selected products 'Fipronil' (Sundat), 'Prince' (BASF, Nissan), mixtures 'Fipronil Prince' (+ isoprothiolane) (Nihon Nohyaku).

ANALYSIS Product by hplc with u.v. detection. Residues by gc with ECD.

TOXICOLOGICAL & ENVIRONMENTAL REVIEWS JMPR Mtg. 92 (2001), *JMPR Evalu.* (1) (2001); *JMPR Evalu.* II 82 (1997), 91 (2000)

MAMMALIAN TOXICOLOGY Oral Acute oral LD_{50} for rats 97, mice 95 mg/kg. Skin and eye Acute percutaneous LD_{50} for rats >2000, rabbits 354 mg/kg. Not a skin or eye irritant (OECD criteria). Not a skin sensitiser. Inhalation LC_{50} (4 h) for rats 0.682 mg/l (tech., nose only exposure). NOEL (2 y) for rats 0.5 mg/kg diet, (18 mo) for mice 0.5 mg/kg diet, (52 w) for dogs 0.2 mg/kg b.w. daily (combined sexes). ADI (*JMPR*) 0.0002 mg/kg b.w. (2000); group ADI for fipronil and fipronil desulfinyl. Other Non-mutagenic, non-teratogenic, no adverse effect on reproductive performance. Clinical signs of toxicity consistent with the interaction of the molecule at a neurotransmitter receptor were observed in all species tested, but were completely reversible. Toxicity class WHO (a.i.) II; EPA (formulation) II

ECOTOXICOLOGY Birds Acute oral LD_{50} for bobwhite quail 11.3, mallard ducks >2000, pheasants 31, red-legged partridges 24, house sparrows 1120, pigeons >2000 mg/kg. Dietary LC_{50} (5 d) for bobwhite quail 49, mallard ducks >5000 mg/kg diet. Fish Acute LC_{50} (96 h) for bluegill sunfish 85, rainbow trout 248, European carp 430 µg/l. Daphnia LC_{50} (48 h) 0.19 mg/l, for *D. carinata* (48 h) 3.8 mg/l. Algae EC_{50} (96 h) for Scenedesmus subspicatus 0.068 mg/l; (120 h) for *Selenastrum capricornutum* >0.16, *Anotsoma fos-aquae* >0.17 mg/l. Bees Highly toxic to honeybees, both by direct contact and by ingestion. However, no risk to bees when used as a soil or seed treatment. Worms Non-toxic.

ENVIRONMENTAL FATE In plants, animals and the environment, fipronil is metabolised via reduction to the sulfide, oxidation to the sulfone, and hydrolysis to the amide. In the presence of sunlight, a photodegradate also forms via sulfoxide extrusion. The sulfide, sulfone and photodegradate are known to act at the GABA receptor site, whereas the amide does not. Animals In rats, once absorbed, the distribution and metabolism of fipronil is rapid. Elimination is mainly via the faeces as fipronil and its sulfone. The two major urinary metabolites were identified as conjugates of ring-opened pyrazole products. The distribution of radioactive residues in tissues was extensive after seven days. In goats and hens, the sulfone was the only metabolite identified in tissues. Plants When applied as an incorporated soil treatment to cotton, maize, sugar beet or sunflowers, uptake of fipronil into plants in all cases was low (c. 5%). At crop maturity, the major residue components observed in all plants were fipronil, the sulfone, and the amide. Following foliar application to cotton, cabbage, rice and potatoes, at crop maturity, fipronil and the photodegradate were the major residue components. Soil/Environment Results of lab. and field studies: Readily degraded, major degradates in soil (aerobic) are sulfone and amide. (anaerobic) are sulfide and amide. Photolysis of soil-applied fipronil gives the photodegradate together with sulfone and amide. K_{oc} 427 (Speyer 2.2) to 1248 (sandy loam). Both fresh and aged column leaching studies (5 cm) indicate that fipronil and its metabolites present a low risk of downward movement in soil; this is supported by field dissipation studies. Following soil incorporated in-furrow granular applications,

Hexaconazole

Molecular formula: C14H17CL2N3O
molecular weight: 314.2
CAS:

density: 1.29
temperature: 111 ° C
Vapor Pressure: 0.01mPa (20 ° C)
toxicity LD50 (mg / kg): Large - rat acute oral LD50 2189, 6,071 female rats, mice - 612, 918 female mice, rats with acute percutaneous LD50 greater than 2000, right rabbit skin stimulation, but a slight stimulus to the eyes. Fish poisoning LC50 (96h, mg / L): 5.94 carp, rainbow trout greater than 76.7. Contact bees acute LD50> 100 μ g / bees, oral LD50> 100 μ g / bees. No mutagenic role in the crop residue <0.01 to 0.03, in soil degradation fast, mobile poor.
traits: colorless crystal.
dissolution: solubility (20 ° C, g / L): 246 methanol, acetone 164, 59 toluene, hexane 0.8, water 0.018mg / L, respectively.
purposes: of Hexaconazole a triazole fungicide. Yes sterol demethylation inhibitor. Right Yan Zhen (especially Basidiomycetes gang gang and ascomycetes) disease caused by a broad spectrum of protection and eradication, to 10 ~ 20 mg / L spray can effectively control of powdery mildew and apple scab of apple, grape, grape-Block of grapes and hooks of silk shell to 20 ~ 50 mg / LL spray can of coffee, coffee rust spore camel to 20 ~ 50g/ha can prevent peanut tail fungal spore. If the 15 to 20 mg / L of grape powdery mildew and black rot, 10 ~ 20 mg / L of Apple's black pioneers disease and powdery mildew; 3g/ha [illegible]ying three times gal brown rust prevention, control effects than triadimefon (250g/ha spraying 3).
preparation or sources: the principal of Hexaconazole synthesis method that is the raw material for the p-dichlorobenzene, acylation of a 2,4 - dichlorobenzene trans ketones, with the iodine methane, dimethyl sulfoxide reaction by 2 - butyl - 2 - (2.4-dichlorophenyl) ethylene oxide, in the presence of sodium chloride, with the 1,2,4 - triazole response, a system of Hexaconazole.
Note: room temperature (40 ° C) for at least nine months is not biodegradable, acid, alkaline (pH-9) in aqueous solution within 30 days stability, PH7 solution within 10 days under ultraviolet irradiation stability.

categories: Fungicide

PROCESS FLOW DIAGRAM

GLYPHSATE TECHNICAL MANUFECTURING PLANT

Reaction of PIMIDA to Ammonia

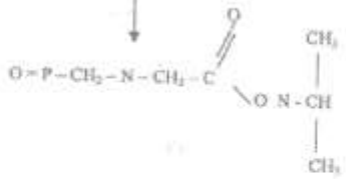
(Glyphosate) (Ammonium salt of Glyphosate)

GLYPHSOATE 62% IPA SALT FROM GLYPHOSATE TECHNICAL

REACTIONS –

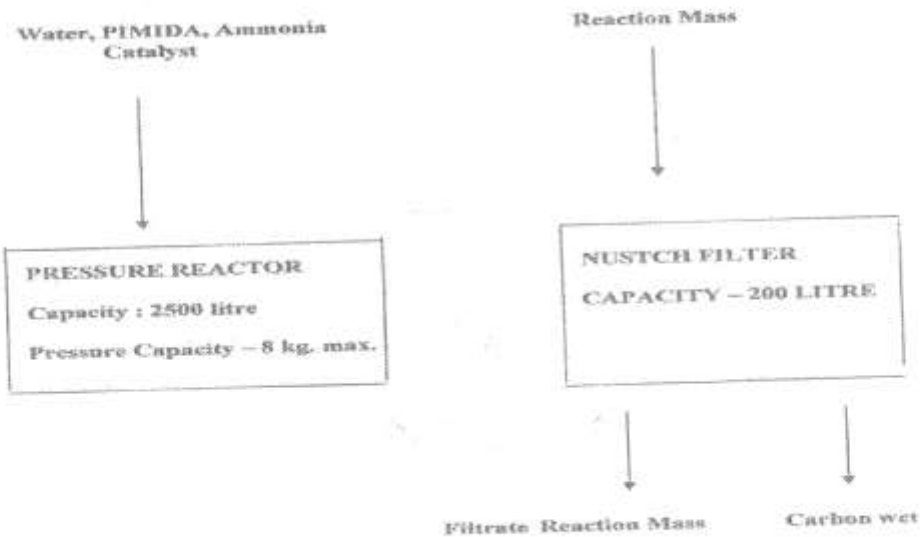
(GLYPHOSATE TECHNICAL)

(MIPA)

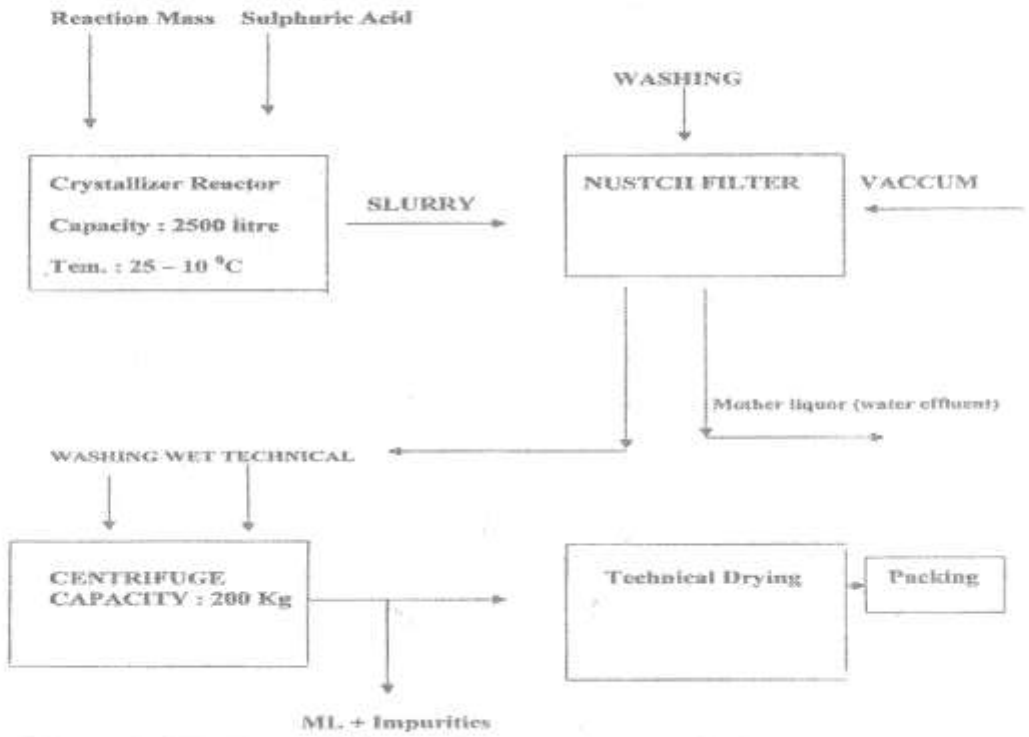


(GLYPHOSATE IPA SALT)

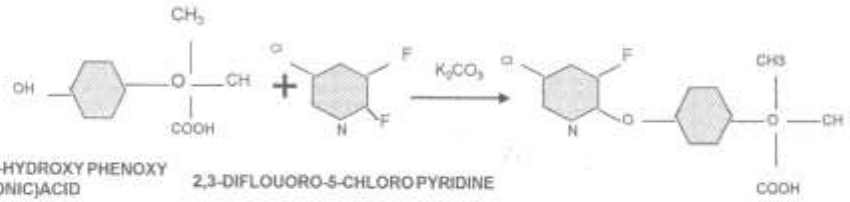
BLOCK FLOW PROCESS DIAGRAM :—



CONTD...


Reaction Mass
Sulphuric Acid
WASHING
Crystallizer Reactor
Capacity : 2500 litre
Tem. : 25 – 10 °C
SLURRY
NUSTCH FILTER
VACCUM
Mother liquor (water effluent)
WASHING WET TECHNICAL
CENTRIFUGE
CAPACITY : 200 Kg
Technical Drying
Packing
ML + Impurities

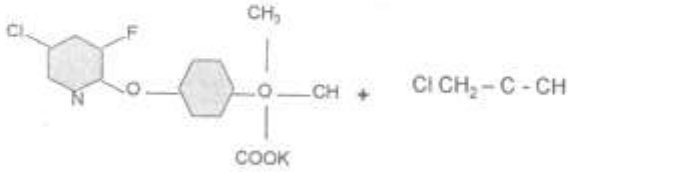
Process flow diagram
Clodinofop Propergyl Tech. Manufacturing



(+)-2-(4-HYDROXY PHENOXY PROPIONIC)ACID

2,3-DIFLOUORO-5-CHLORO PYRIDINE

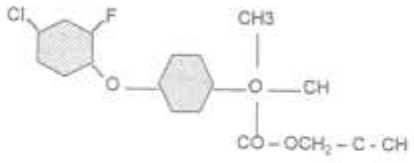
(+)-4-[-5-CHLORO-3-FLOUROPYRIDIN-2-YLOXY)-PHENOXY PROPIONIC ACID K-SALT



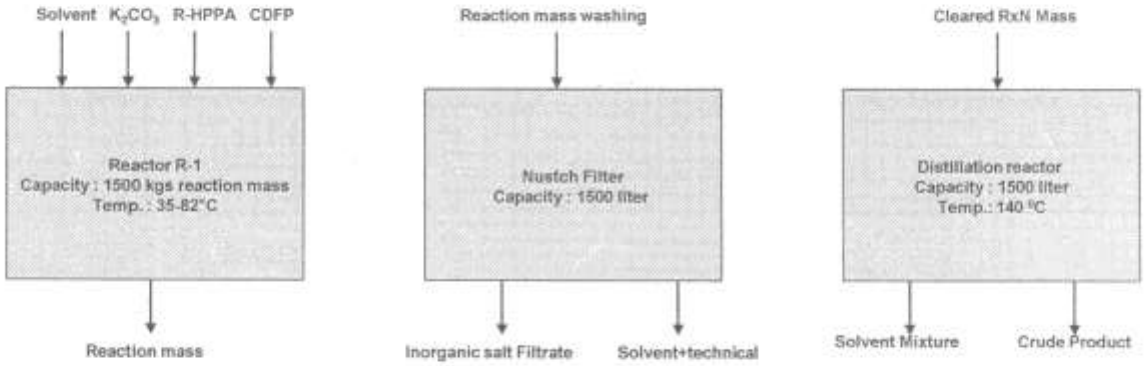
+ $Cl\,CH_2 - C - CH$

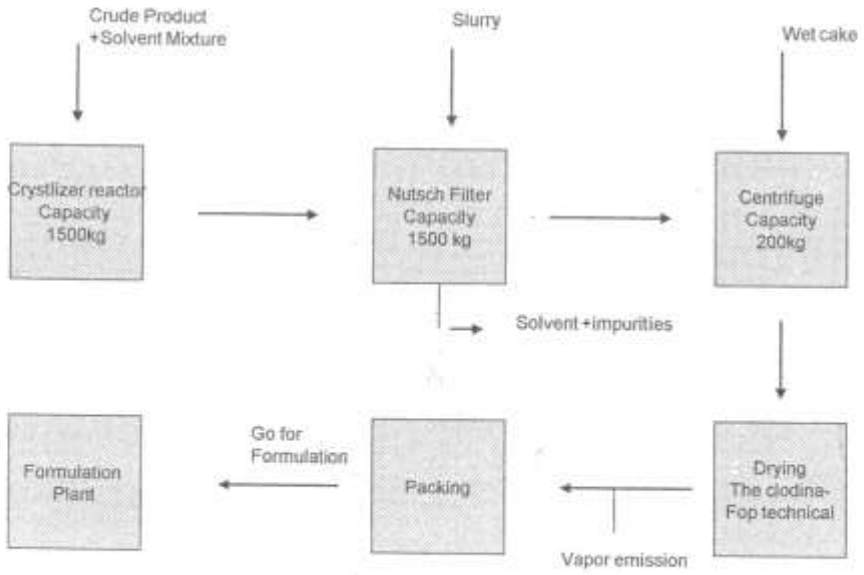
Proppargyl chloride

(+)-2-[4(-Chloro-3-Fluropyridine
-2-yloxy)-phenoxy propionic acid



Clodinafop–Propargyl Technical
$C_{17}H_{13}ClFNO_4$
Mw 349.5


Solvent
K_2CO_3
R-HPPA
CDFP
Reactor R-1
Capacity : 1500 kgs reaction mass
Temp. : 35-82°C
Reaction mass
Reaction mass washing
Nustch Filter
Capacity : 1500 liter
Inorganic salt Filtrate
Solvent+technical
Cleared RxN Mass
Distillation reactor
Capacity : 1500 liter
Temp.: 140 °C
Solvent Mixture
Crude Product


Crude Product
+Solvent Mixture
Slurry
Wet cake
Crystlizer reactor
Capacity
1500kg
Nutsch Filter
Capacity
1500 kg
Centrifuge
Capacity
200kg
Solvent +impurities
Formulation
Plant
Go for
Formulation
Packing
Drying
The clodina-
Fop technical
Vapor emission

THIOMETHOXAM TECHNICAL

(FOR INDIGENOUS MANUFACTURE)

CHEMICAL COMPOSITION

6.	(i)	Kind & name of active ingredient(s) : & percentage of each.	
I.		Technical Active ingredient : Thiomethoxam, 3-(2-chloro-thiazol-5-ylmethyl-5-methyl- (1, 3, 5) oxadiazinan-4-ylidene-n-nitroamine	: 97.0% w/w Min
II.		By products :	
(i)		N-(2-chlorothiazol-5-ylmethyl)-N'-methyl-N''-nitro-guanidine	: 0.9% w/w Max
(ii)		3-methyl-5-(2-phenysulfon-thiozol-5-ylmethyl) [1, 3, 5] oxadiazinan-4-ylidene-N-notroamine	: 0.3% w/w Max
(iii)		3-methyl-5-(2-phenylsulfanyl-thiazol-5-ylmethyl) [1, 3, 5] oxadiazinan-4-ylidene-N-nitroamine	: 1.0% w/w Max
(iv)		3-(2-bromo-thiazol-5-ylmethyl)-5-methyl-[1, 3, 5] oxadiazinan-4-ylidene-N-nitroamine	: 0.5% w/w Max
(v)		3-(2, 4-dicholoro-thiazol-5-ylmethyl)-5-methyl-[1, 3, 5] oxadiazinan-4-ylidene-N-nitroamine	: 0.3% w/w Max
(vi)		N-[3-(2-chloro-thiazol-5-ylmethyl)-5-mthyl-[1, 3, 5] oxadiazinan-4-ylidene]-benzenesulfonamide	: 0.3% w/w Max
III.		Additional By-products	: 1.5% w/w Max
(a)		Sodium Chloride	: 1.5% w/w Max
(b)		Water	: 1.0% w/w Max
(c)		Chlorobenzene	: 0.5% w/w Max
(d)		Benzene Sulfonic Acid	: 0.5% w/w Max
Total			: 100.0% w/w

LIST OF RAW MATERIAL AND SOURCE OF SUPPLY

	NAME OF RAW MATERIALS	SOURCE OF SUPPLY
1.	S-phenyl(I)viz. 3-methyl-5-(2-Phenylsulphanyl-thiazo-5-ylmethyl) -1,3,5 oxadiazinan-4-ylidene-N-nitroamine	M/s Search Chem Industries Ltd. Gujarat
2.	Con Hydrochloric Acid	M/s Union Acid & Chemical Industries M/s Arsha Chemicals Pvt. Ltd. Maharashtra
3.	27% NaOH Solution	M/s Rayalseema Alkalies & Allied Chemicals Ltd., Karnool. A.P. M/s Ballarpur Bilts Industries Ltd. Karwar, Karnataka.
4.	Sulfur Dioxide gas	M/s Jaysons Chemicals, Mumbai
5.	Chlorine gas	M/s Bilts Chemicals Limited Karwar, Karnataka. M/s Sree Rayalseema Alkalies & Allied Chemicals Ltd.
6.	Toluene	M/s Cochin Refinary
7.	Dimethyl Carbonate	M/s SPNE Chemie Group, France Local agents, Soni International Solvent Chemicals Links, Mumbai.

MANUFACTURING PROCESS

Thiamethoxam (II) is manufactured by chlorination of a-phenyl (I) viz. 3-methyl-5-(2-Phenylsulphanyl-thiazo-5-ylmethyl)-[1,3,5] oxadiazxinan-4-ylidane-N-nitroamine.

A solution of a-phenyl (I) in hydrochloric acid is treated with gaseous chlorine at low temperature. At the end of chlorination the excess chlorine is destroyed using sulfur dioxide. The reaction mixture is extracted with toluene to remove benzene sulfonyl chloride formed in the reaction.

The aqueous phase is neutralized with NaOH, when the product separates out. The resulting slurry is treated with dimethyl carbonate. Excess dimethyl carbonate is removed by distillation and the slurry left behind is filtered washed with water and then dried.

MANUFACTURING PROCESS

Thiamethoxam (II) is manufactured by chlorination of a-phenyl (I) viz. 3-methyl-5-(2-Phenylsulphanyl-thiazo-5-ylmethyl)-[1,3,5] oxadiazinan-4-ylidane-N-nitroamine.

Step-1

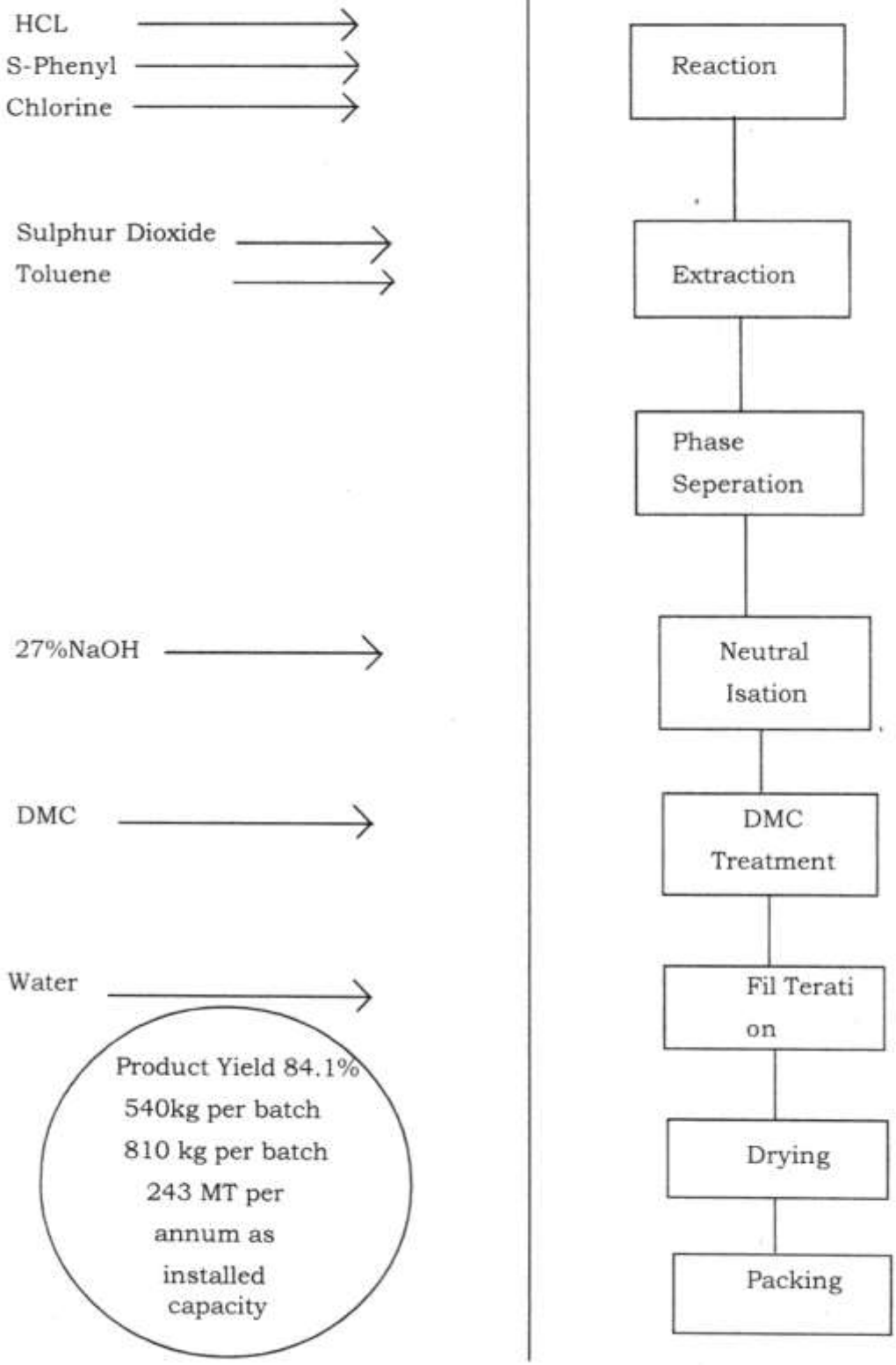
A solution of a-phenyl (I) in hydrochloric acid is treated with gaseous chlorine at low temperature. At the end of chlorination the excess chlorine is destroyed using sulfur dioxide. The reaction mixture is extracted with toluiene to remove benzene sulfonyl chloride formed in the reaction.

Step-2

The aqueous phase is neutralised with NaOH, when the product separates out. The resulting slurry is treated with dimethyl carbonate. Excess dimethyl carbonate is removed by distillation and the slurry left behind is filtered washed with water and then dried.

FLOW CHART DIAGRAM OF MANUFACTURING PROCESS

INPUT	FLOW DIAGRAM



ANNEXURE -1

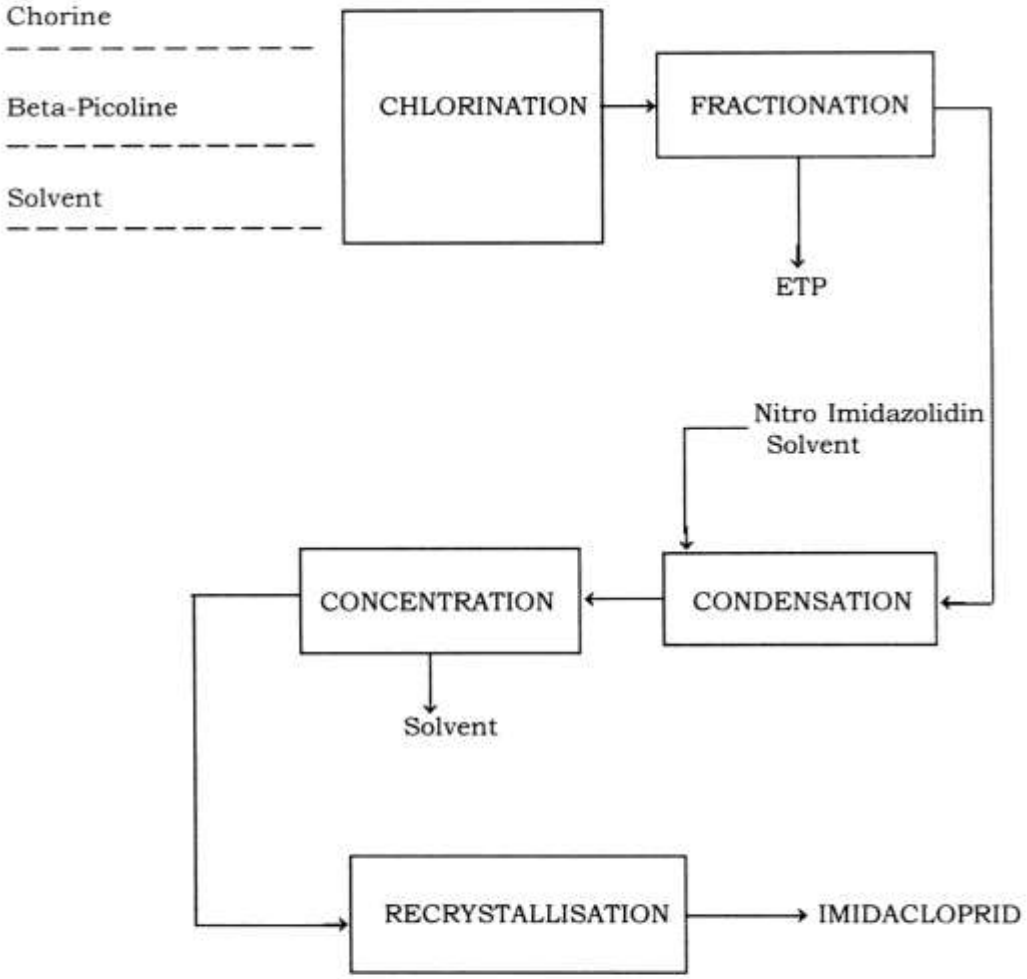
CHEMICAL COMPOSITIONS OF IMIDACLOPRID TECHNICAL

1.	Imidacloprid Technical a.i.	:94.0% w/w Min
2.	Nitro- guanidine	: 0.7 %w/w Max
3.	4,5-Dihydro-N-nitro-1H-imidazol-2-amine	: 0.3%w/w Max
4.	1-[5,6-Dichloro-3-pyridinyl methyl]=4,5-dihydro-N-nitro-1H-imidazol-2-amine	: 0.2%w/w Max
5.	1-[6-(2-Nitroguanidino-ethylamino)=3-pyridinylmethyl] -4,5-dihydro-N=nitro-1H-imidazol-2-amine	: 0.5%w/w Max
6.	1-[6-(2-Aminoethylamino)-3-prridinylmethyl]=-4,5-dihydro-N-nitro-1H-imidazol-2-amine	: 0.5%w/w Max
7.	1-{6-2(6-chloro-3-pyridinylmethylamino)-ethylamino-3-pyridinylmethyl)-4,5-dihydro-N-nitro-1H-imidazol-2-amine:	0.5%w/w Max
8.	Sum inorganic chloride (calculated as sodium chloride)	: 2.0%w/w Max
9.	Water	: 1.0%w/w Max
10.	Unknown	: 0.1%w/w Max
	Total	: 100.00% w/w

PROCESS OF MANUFACTURE OF IMIDACLOPRID TECHNICAL

Process of manufacture involves the reaction of 2-(Nitroamino) imidazolidine and 6- chloro-3-chloro methyl pyridine in present of potassium Carbonate. The Process of manufacture of 2(Nitroamino) imidazolidine involes the reaction of nitroguanidine and ethylene diamine in presence of aqueous Potassium Hydroxide.

FLOW SHEET DIAGRAM OF IMIDACLOPRID MANUFACTURE PROCESS



IMIDACLOPRID TECHNICAL
(SYSTEMIC INSECTICIDE)
(FOR INDIGENOUS MANUFACTURE)

INFORMATION ABOUT RAW MATERIALS

1. Ethylene diamine
   - Appearance : Clear colourless liquid
   - Molecular Formula : $C_2H_8N_2$
   - Molecular Weight : 60.1
   - Assay : 99.00%

2. 2-chloro-5-methylpyridine
   - Appearance : Clear liquid
   - Molecular Formula : C_6H_6ClN
   - Molecular Weight : 127.5
   - Assay : 97% min.

3. Nitroguanide
   - Physical Appearance : Crystalline white powder
   - Molecular Formula : $CH_4N_4O_2$
   - Molecular Weight : 104
   - Assay : 98.00% min.

4. Acetonitrile
   - Physical Appearance : Colourless liquid
   - Molecular Formula : C_2H_5N
   - Molecular Weight : 41
   - Assay : 99.8% min.

5. Sodium Hydroxide
   - Physical Appearance : White solid
   - Molecular Formula : NaOH
   - Molecular mass : 39.9971 g/mol

6. Potassium carbonate
   - Appearance : White powder
   - Molecular Formula : K_2CO_3
   - Molecular Weight : 138
   - Assay : 98%

For BEST CROPSCIENCE PVT LTD
Kamal Kumar

Fipronil

NOMENCLATURE	
Common Name	Fipronil (BSI, pa E-ISO)
IUPAC Name	(+-)-5-amino-1-(2,6-dichloro-ά, ά, ά,-trifluoro-p-tolyl)-4-trifluoromethylsulfinylpyrazole=3-cabonitrile.
Chemical Abstracts Name	5-amino-[2,6-dichloro-4-(trifluoromethyl)phenyl]-4[(1R,S)-(trifluoromethyl)sulfinyl]-1H-Pyrazole-3-carbonitrile
CAS RN	[120068-37-3]
EC No	424-610-5
Development Codes	MB 46030; RPA-030 (both Rhone-Poulenc); BAS 350 I (BASF)
PHYSICAL CHEMISTRY	
Molecule Weights	437.2
M.F.	$C_{12}H_4C_{l2}F_6N_4OS$
Form	White Solid
M.P	200-201˚C; (tech., 195.5-203˚C)
V.P.	3.7×10^{-4} mPa (25˚C)
K_{ow}	logP=4.0 (shake flask method)
Henry	3.7×10^{-5} Pa m^3 mol-1 (calc.)
S.g./density	1.477-1.626(20˚C)
Solubility	In water 1.9 (pH 5),2.4 (pH 9), 1.9 (distilled) (all in mg/l,20˚C). In acetone 545.9, dichloromethane 22.3, hexane 0.028, totuene 3.0 (all in g/l, 20˚C).
Stability	Stable in water at pH 5 and 7; slowly hydrolysed at pH 9 (DT_{50} c. 28d). Stable to heat slowly degrades in sunlight (c. 3% loss after 12 d continuous irradiation); rapidly photolysed in aqueous solution (DT_{50} c. 0.33 d).

COMMERCIALISATION:-

History:- Discovered by Rhone poulenc in 1987. Reported by F. Colliont et al. (proc. Br. Crop Prot. Conf.-Pests Dis., 1992,1,29). Introduced by Rhone Poulenc Agrochimie (now Bayer Crop Science) in 1993. Worldwide agricultural and environmental uses acquired by BASF Ag in 2003.

Manufacturers:- BASF

APPLICATIONS:-

Biochemistry:- Insecticides which acts as a potent blocker of the GABA regulated chloride channels. Insects resistant or tolerant to pyrethorid, cyclodiene, organophosphorus and/or carbamate insecticides are susceptible to Fipronil.

Mode of Action:- Broad spectrum insecticide, toxic by contact and ingestion. Toxic by contact and ingestion.Limited xylem systemicity in some monocotyledonous crops. Can be used to control insects when applied as a soil or seed treatment. Good to excellent residual control following foliar application.

Uses:- Control of multiple species of thrips on a board range of crops by foliar,soil or seed treatment. Control of corn rootworms and termites by soil treatment in maize. Control of boll weevil and plant bugs on cotton, diamond back moth on crucifers, Colorado potato beetle on potatoes by foliar application . control of stem borers, leaf miners, planthoppers, leaf folders/ rollers and weevils in rice. Foliar application ranges from 10-80 g/ha; soil treatment rates 100-200 g/ha.

Formulation Types:- EC; FS; GR; SC; UL; WG.

Selected Products:- 'Fiprosun' (Sundat); 'prince' (BASF,Nissan);

Mixtures:- Fuji-one prince (+isoprothiolane) (Nihyaku).

ANALYSIS:- Product by hplc with u.v detection.

Residues by glc ECD

TOXICOLOGICAL ENVIRONMENTAL REVIEWS:-

JMPR Mtg. 92 (2001): JMPR Evalin. I 93 (2001); JMPR Evalin II 82 (1997), 91 (2000).

MAMMALIAN TOXICOLOGY :-

Oral:-Acute oral LD_{50} for rats 97, mice 95 mg/kg .

Skin and Eye:-Acute percutaneous LD_{50} for rats > 2000, rabbits 354 mg/kg. Not a skin or eye irritant (OECD criteria). Not a skin sensitizer.

Inhalation:-LC_{50} (4 h) for rats 0.682 mg/l (tech.; nose only exposure).

NOEL:- (2y) for rats 0.5 mg/kg diet; (18 mo) for mice 0.5 mg/kg diet; (52w) for dogs 0.2 mg/kg b.w. aily (combined sexes).

ADI (JMPR) 0.0002 mg/kg b.w. [2000]; group ADI for fipronil and fipronil desulfinly.

Other:- Non Mutagenic, non teratogenic; no adverse effect on reproductive performance. Clinical signs of toxicity consistent with the interaction of the molecule at a neurotransmitter receptor were observed in all species tested, but were completely reversible.

Toxicity Class :-WHO (a.i.) II; EPA (formulation) II.

ECOTOXICOLOGY:-

Birds:-Acute oral LD_{50} for bobwhite quail 11.3, mallard ducks > 2000, pheasants 31, red legged partridges 34, house aparrows 1120, pigeons >2000 mg/kg. Dietary LC 50 (5 d) for bobwhite quail 49, mallard ducks >5000 mg/kg diet.

Fish:- Acute LC_{50} (96 h) for bluegill sunfish 85, rainbow trout 248, Europeon carp 430 ug/l.

Daphnia:- LC_{50} (48h) 0.19 mg/l; for D. carinata (48 h) 3.8 mg/l.

Algae:- Ec_{50} (96 h) for scenedesmus subspicatus 0.068 mg/l; (120 h) for selenastrum capricornutum > 0.16, Anabaena flos-aquate > 0.17 mg/l.

Bees:- Highly toxic to honeybees, both by direct contact and by ingestion. However, no risk to bees when used as a soil or seed treatment.

Worms:- Non-toxic.

ENVIRONMENTAL FATE:-

In plants, animals and the environment, fipronil is metabolized via reduction to the sulfide, oxidation to the sulfone, and hydrolysid to the amide. In the presence of sunlight, a photo degradate also forms via sulfoxide extrusion. The sulfide, sulfone and photodegradate are known to act at the GABA receptor site, whereas the amide does not.

Animals:- In rats, once absorbed, the distribution and metabolism of fipronil is rapid. Elimination is mainly via the faeces as fipronil and its sulfone. The two major urinary metabolites were identified as conjugates of ring opened pyrazole products. The distribution of radioactive residues in tissues was extensive after seven days. In goats and hens, the sulfone was the only metabolite identified in tissues.

Plants:- When applied as an incorporated soil treatment to cotton, maize sugar beet or sunflowers uptake of fipronil into plants in all cases was low (c.5%). At crop maturity, the major residue components observed in all plants were fipronil, the sulfone., and the amide. Following foliar application to cotton, cabbage, rice and potatoes, at crop maturity, fipronil and the photodegradate were the major residue components.

Soil/Environment:- Results of lab and field studies: readily degraded; major degradates in soil (aerobic) are sulfone and amide, (anaerobic) are sulfide and amide. Photolysis of soil applied fipronil gives the photodegradate together with sulfone and amide. K_{oc} 427 (Speyer 2.2) to 1248 (sandy loam). Both fresh and aged column leaching studies (5 soils) indicate that fipronil and its metabolites present a low risk of downward movement in soil; this is supported by field dissipation studies. Following soil incorporated in furrow granular applications quantifiable residues were confined to the top 30 cm of soil, with no significant lateral movement or residues.

CHEMICAL COMPOSITION

Fipronil a.i. 5-amino-1-(2,6-dichloro-3-cyano-1-(2,6-dichloro -4-trifluoromethylphenyl)-4-trifluoromethyl sulfanyl pyrazole	: 92.00%w/w min
Impurity:-	
5-amino-1-{ 2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethyl sulfonyl-1H-pyrazole-3-carbonitrile (Fipro Sulfone)	: 2.00%w/w max
5-amino-I-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethyl sulfanyl-1H-pyrazole-3-carbonitrile (Fipro Thio)	: 3.00%w/w max
5-amino-I-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethyl) 4-trifluoromethyl sulfonyl-1H-pyrazole -3-carboxylic (Fipro amide)	: 0.30%w/w max
Sulphur	: 1.00%w/w max
Water	: 2.00%w/w max
Total	: 100.00%w/w

Major Uses & Formulations

Fipronil 5% SC

Major Uses

Rice	Stem borer Brown plant hopper Green leaf hopper Rice leaf hopper Rice gall midge Whorl maggot White backed plant hopper	50-75	1000-1500	500	32
Cabbage	Diamond back moth	40-50	800-1000	500	7
Chillies	Thrips, Aphids, fruit borers	40-50	800-1000	500	7
Sugarcane	Early shoot borer & root borer	75-100	1500-2000	500	9 months
Cotton	Aphid, Jassid, Thrips, White fly	75-100	1500-2000	500	6
	Boll worms	100	2000	500	7

Fipronil 0.3% GR

Rice	Stem borer Brown plant hopper Green leaf hopper Rice leaf hopper Rice gall midge Whorl maggot White backed plant hopper	50-75	16670-25000		32
Sugarcane	Early shoot borer Root borer	75-100	25000-33300		9

Fipronil 80%WG

Rice	Stem borer Leaf folder	40-50 40-50	50 – 62.5 50 - 62.5	375 -500 375 -500	19
grapes	Thrips	40-50	50-62.5	750-1000	10

Fipronil 0.03% & 0.5%Gel

Ready to use household insecticide.	Used to control of German & American Cockroaches.