FLUROXYPYR MARKET ANALYSIS

COMPANY	MollyCule
CEO	Harshit Jaiswal
REPORT AUTHOR	Harshit Anand, Vishesh Vishwakarma
CHEMICAL FORMULA	$C_7H_5Cl_2FN_2O_3$
CHEMICAL NAME	Fluroxypyr

Use Case:

a) What is the use of this compound?

Fluroxypyr is specifically designed to target broad-leaved weeds while leaving grasses unharmed, making it particularly valuable in several applications:

- Turf Management: Extensively used in sports fields, golf courses, and ornamental lawns
- Agricultural Applications: Controls weeds in cereals (wheat, rice, barley, corn, sorghum, oats), onions, sugarcane, and pastures.
- Plantation Crops: Used in orchard crops like apple and plantation crops such as rubber and oil palm

b) Are there any alternatives for this compound? Name a few.

Several alternative herbicides compete with fluroxypyr in the broadleaf weed control market :

- Triclopyr (Garlon): Particularly effective for woody weeds control.
- Dicamba: Often used for broadleaf weed control, though facing resistance issues.
- Ammonium glufosinate: Non-selective alternative herbicide compared directly with fluroxypyr meptyl in field trials.
- Carfentrazone and Sulfentrazone: Contact herbicides used in turf applications

The market has responded to weed resistance issues by creating numerous combination products containing fluroxypyr mixed with other active ingredients. There are over 20 different fluroxypyr-containing products including mixtures with pyroxsulam, thifensulfuron, florasulam, flucarbazone, and other herbicides

c) Why is this compound superior to its alternatives?

- Selective Action: Targets broadleaf weeds while sparing grasses, making it ideal for turf management and cereal crops where grass preservation is critical.
- Resistance Management: Effective against kochia populations resistant to glyphosate, dicamba, and 2,4-D, addressing a major challenge in modern agriculture.
- Long-Term Efficacy: Outperforms glyphosate in residual activity, reducing regrowth of invasive species like Madeira vine between applications.
- Versatile Application: Can be applied at multiple weed growth stages and absorbed through both leaves and roots for comprehensive control.

d) Is this compound imported in India? What is the magnitude of imports?

- Fluroxypyr, a herbicide used to control broadleaf weeds, has been imported into India, but only in small quantities. Most shipments took place between 2013 and 2016. For example, in October 2016, 1 liter of a Fluroxypyr-meptyl formulation was imported from the U.S. for $299.
- Similarly, in April 2015, 2 liters of Fluroxypyr-meptyl 48% EC were imported from France, valued at $80. These numbers show that while the herbicide has been imported, the volumes have remained quite low.
- A major shift occurred in April 2022 when Parijat Industries became the first company in India to manufacture Fluroxypyr-meptyl technical with 97% purity. This local production could reduce the need for imports in the future.

In summary, India has imported small amounts of Fluroxypyr in the past, but with domestic manufacturing now in place, imports—currently valued in the hundreds of dollars per shipment—might decrease further.

Economic Feasibility :

a) What input raw materials are needed for its synthesis (same as reported in the Patent application)?

- Materials: 4-Amino-3,5-dichloro-2,6-difluoropyridine (1 mol) + Ethyl glycolate (1 mol)
- Solvent: Toluene
- Additional Reagents:
  - Potassium carbonate (base)
  - Tetrabutylammonium iodide (phase transfer catalyst)
- Acidification: Dilute hydrochloric acid (HCl) or sulfuric acid (H_2SO_4)
- Water: Deionized water

b) Provide preliminary economic feasibility based on cost of raw materials, solvents and product selling price.

The synthesis of **fluroxypyr** involves the reaction of **4-amino-3,5-dichloro-2 (methylsulfonyl) pyridine** with **Ethylglycolate** in the presence of solvents and catalysts. The cost structure is calculated per kmol of fluroxypyr produced (molecular weight: 255.03 g/mol).

Compound	Molecular Weight (g/mol)	Rate (INR /kg)	Rate (INR/kmol)	Quantity (kmol)	Amount (INR)
4-amino-3,5-dichloro-2 (methylsulfonyl) pyridine	241.09	1800	4,33,932	1	4,33,932
Ethylglycolate	104.10	1,500	1,56,150	1	1,56,150
Potassium Carbonate (Catalyst)	138.21	60	8,292	0.5	4,146

Toluene (Solvent)	92.14	74	6,818.36	Solvent	6,818
Total Input Costs					**6,01,046**
Fluroxypyr (1kmol) Revenue					6,37,575

Calculations:

- Total Input Costs (for Raw Materials): Rs 6,01,046 per kmol of Fluroxypyr
- Revenue based on selling price of Rs **2,500/kg** for Fluroxypyr:
  Rs 2,500 /kg x 255.03 kg/kmol = Rs 6,37,575 /kmol
- ·Net Profit: Rs 6,37,575 – Rs 6,01,046 = Rs 36,529
- Profit Percentage: (Rs 36,529 / Rs 6,37,575) * 100 = 5.72 %

References:

- https://icl-growingsolutions.com/en-gb/turf-landscape/categories/what-is-fluroxypyr/
- https://www3.epa.gov/pesticides/chem_search/reg_actions/registration/fs_PC-101103_01-Aug-00.pdf
- https://pubchem.ncbi.nlm.nih.gov/compound/Fluroxypyr
- https://www.agribusinessglobal.com/agrochemicals/herbicides/parijat-industries-becomes-first-company-to-manufacture-fluroxypyr-meptyl-technical-in-india/

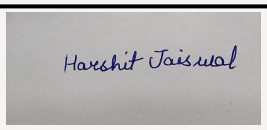
List of Contribution of Author:

Harshit Anand (230459) :

- Conducted a market analysis of fluroxypyr, covering its uses, advantages, and alternatives.
- Assessed import trends in India, highlighting key exporters and the transition to local manufacturing.

Vishesh Vishwakarma (231166):

- Conducted an economic feasibility study by analyzing the cost of raw materials, solvents, and the selling price of fluroxypyr.
- Evaluated input costs for synthesis based on patent data and market prices for key materials and solvents.
- Assessed product pricing trends to determine profitability.

NAME	ROLL NO	SIGNATURE
HARSHITJAISWAL	230460	
HARSHIT ANAND	230459	
VISHESH VISHWAKARMA	231166