

**PROJECT PROFILE**  
**ON**  
**ALUMINIUM SULPHATE**

**MONTH & YEAR**  
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# ALUMINIUM SULPHATE

## INTRODUCTION

Aluminium Sulphate finds wide uses in water treatment, paper sizing, and various other miscellaneous uses in petrochemical industries, dyestuffs, food and pharmaceuticals. In its Hydrated form,  $\text{Al}_2 (\text{SO}_4)_3 \cdot 18\text{H}_2\text{O}$  it is commonly known as Alum. Ferric Alum is known as Ferric Aluminium Sulphate. It is the Alum with Iron content.

The Chemical formula for Alum is  $\text{Al}_2 (\text{SO}_4)_3 \cdot 18 \text{H}_2\text{O}$  but usual commercial form is closer to  $\text{Al}_2 (\text{SO}_4)_3 \cdot 14 \text{H}_2\text{O}$ . Aluminium Sulphate appears in white crystalline solid, with a sweet taste

## Categories and Grades

**There are two broad categories of Alum as follows:**

Ferric Alum which is generally made from Bauxite and Iron free Alum (non Ferric Alum), generally made from Alumina. Commercially, hydrated Aluminium Sulphate is called Alum and is sold under such names as Filler Alum Commercial Alum, Paper Maker's Alum etc.

The Technical grade for Aluminium Sulphate is provided in two forms: a partially dehydrated solid and an aqueous solution of this material containing about 27%  $\text{Al}_2 (\text{SO}_4)_3$ .

The reagent grade  $\text{Al}_2 (\text{SO}_4)_3 \cdot 18\text{H}_2\text{O}$  is slightly, odourless, Colourless monoclinic crystals, having a specific gravity of 1.69.

The solid material, 'Dry Alum' is partially crystalline and may be discoloured to a brownish-green owing to impurities (chiefly iron) in the ores from which it is made. The solution form, 'liquid Alum' may exhibit a similar discolouration.

## **B. PRODUCT USES & SPECIFICATION**

**Water Treatment:** The major area of use for Alum is in water treatment and clarification. Its clarifying action is attributed to Aluminium hydroxide formation by hydrolysis. This, in turn, carries down all the colloidal impurities and forms a slimy layer at the bottom.

**Sizing of Paper:** The other major area of use is in sizing of paper. It reacts with sodium resinate to give insoluble Aluminium resinate. For sizing of paper, Alum should be free from Ferric ions or else the paper will be discoloured. Ferrous ions do not harm since they form a soluble colourless resinate which, however, would represent a loss of resinate. Alum imparts certain degree of resistance to penetration by liquids during sizing of paper.

**Miscellaneous Applications:** Alum is also required in various other industries like Dyes, Food, Petroleum's, Pharmaceuticals, fire-proofing, tanning etc.

### **SPECIFICATION**

	Al <sub>2</sub> O <sub>3</sub>	Insoluble form	Form
Non ferric alum powder	17%	Nil	powder
Ferric alum(second quality more in soluble)	15-16%	4.5%	Slab 20.kg
Ferric alum slab	7%	Nil	Solution of 2 pH

## **Aluminium Sulphate granulated (ALG)**

### **General Details**

ALG is Iron free and is delivered in a granulated form for easy and safe handling. It is produced by International organisations such as Kemira of Finland. The granules are free flowing and easy to feed with a screw feeder with a minimum of dust.

The granules dissolve easily if handled in the right way. There is no risk of clogging. The granules have a high density. This is an advantage in terms of both freight cost and storage space.

### **Specifications of Aluminium Sulphate Granulated**

Al <sub>2</sub> O <sub>3</sub> total acc.to Din 19600	17.2%
Total Fe as Fe <sub>2</sub> O <sub>3</sub>	0.07%
Crystal water	435
Al <sub>2</sub> O <sub>3</sub> free	0.5%
Insoluble matter in water	0.03%

## **C.MARKET POTENTIAL**

The assessment of demand for Alum is made for the following sector.

Ferric alum is an important chemical used in the paper industry and in water treatment.

### **Paper industry**

The most important use of Alum is in the paper industry for sizing of papers.

The paper industry uses Aluminium Sulphate for the clarification of process water, pH control of pulp slurries, setting of dyes and

precipitating colloidal clay and dissolved resin into the size on the fibres of the paper (setting of size).

A paper mill consumes Ferric and non Ferric Alum at the rate of around 4 kgs/100 kgs of finished paper.

### **Water treatment**

The next important outlet is in water and sewage treatment as a coagulant: Reaction of Alum with alkali in the water produces an Aluminium hydrate floc which drags down various impurities and aids in removing bacteria and in controlling the taste of water.

Alum sold to municipalities for these uses is required to be basic to a slight excess of  $Al_2O_3$ .

The Alum used for this application is usually in the solution form. Frequently it is acidic containing a slight excess of Sulphuric acid for potable and waste water treatment processes.

### **Miscellaneous applications**

In addition to this, Alum also finds application in textile units, soaps. Cosmetics, fire extinguishers etc.

### **Demand**

The estimated demand of Aluminium sulphate in the country is around 400000 tonnes per annum.

The estimated growth rate in demand is 6 to 7% per annum.

There are several small scale and medium scale units manufacturing Alum. But as the demand increases the production level of Aluminium Sulphate also has to be increased.

## **D. TECHNICAL ASPECTS**

### **1. INSTALLED CAPACITY:**

The production capacity of Aluminium Sulphate per day is estimated at 10 Tonne on 3 shift basis and the capacity per annum works out to 3000 Tonnes.

### **2. PLANT & MACHINERY**

The machinery required for the manufacturing of Aluminium sulphate is given below.

Steel reactors equipped with a reflux condenser and jacket for steam heating.
Air circulated steam heated coiled tray drier, with vacuum drying system.
De-mineralised water plant
Storage tanks
Boiler
Filtration unit
Pulveriser
Laboratory equipments (Spectrophotometer, Thin layer chromatography Centrifuge, oven and other laboratory glassware and equipments
Pollution control equipment

The total value of machinery is estimated at Rs.90.00 lakhs on a turnkey basis.

### **3. MANUFACTURING PROCESS**

Production of Aluminium sulphate in India starts from bauxite.

Bauxite from Jamnagar (Gujarat) which contains high percentage of Alumina and low Iron content continues to be the best source for the manufacture of this heavy chemical.

### **Technology and process**

There is batch process as well as continuous process for the manufacture of Alum. The Batch process is adopted in the country.

Bauxite ore containing preferably less than 3% Iron is transported to the plant site and Crushed to a size of 50 to 75 mm. The crushed ore is further powdered by using a pulveriser.

It is often seen that finer the size of bauxite, quicker would be the reaction rate. Usually ground bauxite of size 100 to 140 mesh is used in the process. It is essential that the Ferric oxide content shall be less than 3% in the ore, to obtain a satisfactory product containing less than 0.1% Iron.

Prepared Ore is subjected to reaction with Sulphuric acid in open lead lined digesters at temperature of around 105 deg. C. The desired strength of Sulphuric acid in open lead lined digesters is 52 deg. be. The total reaction time is around 12 to 16 hrs. The reacted solution is taken to a settling tank. After settling, the sludge is removed and discarded. The clear solution is concentrated in open pan evaporators.

The concentrated solution is poured into large wooden vats, where it solidifies. This block is broken down into smaller pieces and sold. Where powdered form is required, it is subjected to pulverisation.

#### **4. RAW MATERIAL REQUIREMENTS**

Raw material required-for 3000

MTs

	Per MT	Qty MTs	Rate Rs	Value Rs lakhs
Bauxite	0.40	1200	60000.00	720.00
Sulphuric acid	0.55	1650	22500.00	371.25
Water	6000.00	18000000	0.10	18.00
Flaked glue				7.00
Barium sulphide	0.09	270	25000.00	6.00
				1122.25

#### **5. LAND & BUILDINGS:**

Land required -one acre –cost Rs.15.00 lakhs

Building 7000 sq.ft cost Rs.56.00 lakhs

#### **6. Utilities**

##### **Power:**

The total power load requirement is about 100 HP. The fuel requirement is 250 litres per day.

##### **Water:**

Water requirement is 6000 litres per MT of production. Therefore the daily requirement is about 60000 litres.



**Man Power Requirement:**

<b>Category</b>	<b>Nos</b>	<b>Monthly Salary</b>	<b>Total Salary</b>
Supervisor	3	9000	27000
Skilled	3	7000	21000
Helpers	6	5000	30000
Accounts/Assistants	2	6000	12000
<b>TOTAL</b>			<b>90000</b>
Add Benefits 20%			18000
<b>TOTAL</b>			<b>108000</b>
Total Wages Per Annum (Rs.Lakhs)			<b>12.96</b>

**7. IMPLEMENTATION SCHEDULE:**

If the finance is arranged, the project can be implemented in six months period.

**8. ASSUMPTIONS**

Installed capacity per annum	3000 MT
Capacity utilization-Year -1	60%
Year-2	70%
Year-3	80%
Selling price per unit	Rs. 60000 per MT
Raw materials	Rs.930.00 lakhs at 100%
Consumables /Packing materials per MT	Rs.2200
Power and Fuel-100% (Rs.lakhs)	Rs.61.04 lakhs
Wages & salaries -100% (Rs.lakhs)	Rs.12.96 lakhs
Repairs & Maintenance- p.m.	Rs.20000
Depreciation	Written down value method
General & administration Expenses per month	Rs.100000
Selling expenses	3% on sales value

Interest on term loan and Working capital finance	14% per annum
Income tax provision	34% per annum

### **LIST OF MACHINERY SUPPLIERS**

Name of the equipment	Name of the suppliers
Boilers	<p>Cethar Vessels Ltd., No.4, Dindigul High Road, Trichy</p> <p>Firetech Boilers Pvt. Ltd. No.211, 2<sup>nd</sup> Cross, 38th Main, B.T.M. Layout 2nd Stage, Bangalore-68</p>
Reactors	<p>Chemitherm Plants &amp; Systems P. Ltd., 31, First Main Road R.A.Puram, Chennai-600 028</p> <p>Phgazh Chemical Plant &amp; Equipment Pvt Ltd 69-2<sup>nd</sup> Main Road Ambattur Industrial Estate Chennai 600 058</p>
Centrifuge	<p>Hydrabad Met Chem. Pvt. Ltd., 34, C.I.E., Phase II, Gandhinagar, Opp. IDPL Colony Hyderabad-500 037</p> <p>Spark Engineers Pvt. Ltd., 5/332, State Bank Colony II Salem-636 004</p>

Mixer	<p>ACE Pack Machines 23, V.N. Industrial Estate Bharathi Colony, Near Athiparasakthi Temple Peelamedu, Coimbatore-641 004</p> <p>Drycon Systems F-14, IInd Main Road, Anna Nagar East Chennai-600 102</p>
Dryers	<p>The Anup Engineering Ltd., Behind 66 KV Electric Sub Station Odhav Road, Ahmedabad-382 415</p> <p>ATRE Thermal Products Pvt. Ltd., Pushpa Heights, 1st Floor, Bibwewadi Corner, Pune-411 037</p>
Pulveriser	<p>ACE Pack Machines 23, V.N. Industrial Estate Bharathi Colony, Near Athiparasakthi Temple Peelamedu, Coimbatore-641 004</p> <p>Frigmaires Engineers PO Box 16353, 8, Janata Industrial Estate Senapati Bapat Marg Opp Phoenix Mill, Lower Parel (W) Mumbai-400 013</p>

## LIST OF RAW MATERIALS SUPPLIERS

Name of the raw material	Name of the supplier
Sulphuric acid	<p>There are more than one hundred units producing Sulphuric acid in the country, at various capacity levels.</p> <p>The total installed capacity for Sulphuric acid in the country is around 6.5 million tonnes per annum.</p> <p>Tanfac Industries Ltd., 14, SIPCOT Indl Complex Kudikadu, Cuddalore</p> <p>Adheswara Chemicals Pvt. Ltd., 82, Panapakkam Village, Uthukottai Taluk, Chengai MGR Dist.</p>
Bauxite	Indigenously available from Mines in Rajasthan

## FINANCIAL ASPECTS

### 1. COST OF PROJECT

	[Rs.lakhs]
Land	15.00
Building	56.00
Plant & Machinery	90.00
Technical know how fees	2.50
Other Misc. assets	5.00
Pre-Operative expenses	20.00
Margin for WC	29.18
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	217.68

### 2. MEANS OF FINANCE

Capital	96.68
Term Loan	121.00
	<hr/>
	217.68

### 3. COST OF PRODUCTION & PROFITABILITY STATEMENT

	[Rs.lakhs]		
Years	1	2	3
Installed Capacity (MT)	3000	3000	3000
Utilisation	60%	70%	80%
Production/Sales (MT)	1800	2100	2400
Selling Price per MT	Rs.60,000		
Sales Value (Rs.lakhs)	<hr/>	<hr/>	<hr/>
	1080.00	1260.00	1440.00
Raw Materials	734.55	856.98	979.40
Packing materials	39.60	46.20	52.80
Power & fuel	36.62	42.73	48.83
Wages & Salaries	12.96	13.61	14.29

Repairs & Maintenance	2.40	2.64	2.90
Depreciation	14.38	12.24	10.43
Cost of Production	840.51	974.40	1108.65
Admin. & General expenses	12.00	12.60	13.23
Selling expenses	32.40	37.80	43.20
Interest on Term Loan	16.94	14.82	10.59
Interest on Working Capital	18.21	18.21	18.21
Total	920.06	1057.83	1193.88
Profit Before Tax	159.94	202.18	246.12
Provision for tax	54.38	68.74	83.68
Profit After Tax	105.56	133.44	162.44
Add: Depreciation	14.38	12.24	10.43
Cash Accruals	119.94	145.68	172.87

#### 4. WORKING CAPITAL:

	Months	Values	%	Margin	Bank
	Consumptions			Amount	Finance
Raw Materials	1.00	61.21	25%	15.30	45.91
Finished goods	0.25	17.51	25%	4.38	13.13
Debtors	1.00	90.00	10%	9.00	81.00
Expenses	1.00	0.50	100%	0.50	0.00
		169.22		29.18	140.04

#### 5. PROFITABILITY RATIOS BASED ON 80% UTILISATION

<u>Profit after Tax</u>	=	<u>162.44</u>	11%
Sales		1440.00	
<u>Profit before Interest and Tax</u>	=	<u>274.92</u>	77%
Total Investment		357.72	
<u>Profit after Tax</u>	=	<u>162.44</u>	168%
Promoters Capital		96.68	

## 6. BREAK EVEN LEVEL

Fixed Cost (FC):

	[Rs.lakhs]
Wages & Salaries	14.29
Repairs & Maintenance	2.90
Depreciation	10.43
Admin. & General expenses	13.23
Interest on TL	10.59
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	51.44
	<hr/>

Profit Before Tax (P) 246.12

$$\text{BEL} = \frac{\text{FC} \times 100}{\text{FC} + \text{P}} = \frac{51.44 \times 80}{297.56} \times 100$$

14% of installed capacity

