


Recovery of Fe2O3 & TiO2 from Bauxite Processing Waste

Introduction

Ferric oxide ($Fe_2 O_3$) is an inorganic compound also known as hematite. Ferric oxide is used in the iron industry in the manufacturing of alloys and steel. The Food and Drug Administration (FDA) has approved ferric oxide pigment for use in cosmetics. Moreover, ferric oxide granules are used in the form of filtration media for removing phosphates in saltwater aquariums.

FOR Fe2O3

- **In iron industries for producing steel and alloys**
- **Ferric oxide powder, also called jeweler's rouge, is used for polishing lenses and metallic jewelry**
- **Its granular form is used as a filtration media for pulling out phosphates in saltwater aquariums**
- **As FDA-approved Pigment Brown 6 and Pigment Red 101, for use in cosmetics.**
- **In biomedical applications, because its nanoparticles are non-toxic and biocompatible**

Recovery of Fe2O3

Fe2O3 is another material in red mud that has attracted a number of researchers. Until now, there are three means to recover iron from red mud: smelting, solid-state reduction and magnetic separation. In smelting process, red mud is charged into blast furnace or rotary furnace with a reducing agent. Then, iron oxide in red mud is reduced to generate pig iron that can be used in steel production.

However, smelting process has some demerits. High energy and capital costs are associated with blast furnace (BF) operation because scale of operation is high. Red mud must be mixed with some good-grade iron ore to maintain the minimum grade of the charge to BF. In addition, titanium reacts with other constituents of the slag to form multiple oxides that are difficult to leach.

In the solid-state reduction process, the mud is mixed with a reducing agent or contacted with a reducing gas to produce metallic iron. The product can be an input either in a steel-making furnace or a conventional blast furnace. Compared to smelting process, solid-state reduction process consumes less energy. But, it also has some disadvantages. First, the metallic iron produced is quite difficult to separate from the rest of product. So, it is easily polluted by gangue materials. Second, the product is in a very fine form.

The recovery rate of Fe2O3 was 45% (weight percent). Another means is to convert hematite or goethite in red mud to magnetite firstly, which is followed with magnetic separation. Obviously, this process is more complex than magnetic separation.

Directly. But it also has some advantages. First, goethite is easier to separate magnetically and needs less energy to reduce compared to hematite. So, the extra cost of reducing hematite to magnetite can be compensated by the energy difference between reducing hematite and magnetite to metallic iron.

Titanium Dioxide, also known as titanium (IV) oxide or titania, is a white crystalline powder, made up of ilmenite and rutile, which are used as the main raw materials. It is created using either the chloride process or sulfuric acid, referred to as the sulfate process. Titanium dioxide is extensively used as a white pigment in paints and coatings application. Also, it has a wide range of applications, ranging from paints and sunscreens to food coloring.

FOR TiO2

Uses for white pigment Four million tons of pigmentary TiO2 are consumed annually. Apart from producing a white colour in liquids, paste or as coating on solids, TiO2 is also an effective opacifier, making substances more opaque. Here are some examples of the extensive range of applications:

(1)Paints

(2)Plastics

(3) Papers

(4) Inks

(5) Medicines

(5) Most toothpastes

(6) Skimmed milk; adding TiO2 to skimmed milk makes it appear brighter, more opaque and more palatable

Recovery of TiO2

Generally, there have been two main methods developed by which the titanium can be recovered from red mud: pyrometallurgical recovery and hydro-metallurgical recovery. The pyro- metallurgical method generally comprises the separation of pig iron. The red mud is calcined at a range of temperatures, from 800 to 1350°C, and is smelted through a reducing agent using an electric-furnace to obtain melted iron as well as slag that includes titanium dioxide, silica and alumina. The metallic iron is removed from the slag and the slag is digested to recover the titanium and aluminium from the solution.

The pyro-metallurgical process is not an energy-friendly method and, hence, the hydrometallurgical technique usually attracts more attention from the research community. A number of the acids' extractability have been analysed to recover titanium from red mud, such as dilute and concentrated H2SO4 and hydrochloric acid. The solvent extraction technique has been applied to extract titanium from red mud using HCl, which comprised di- and mono-.

Red mud can also be considered a secondary source of the most important modification of titanium compound, titanium dioxide.

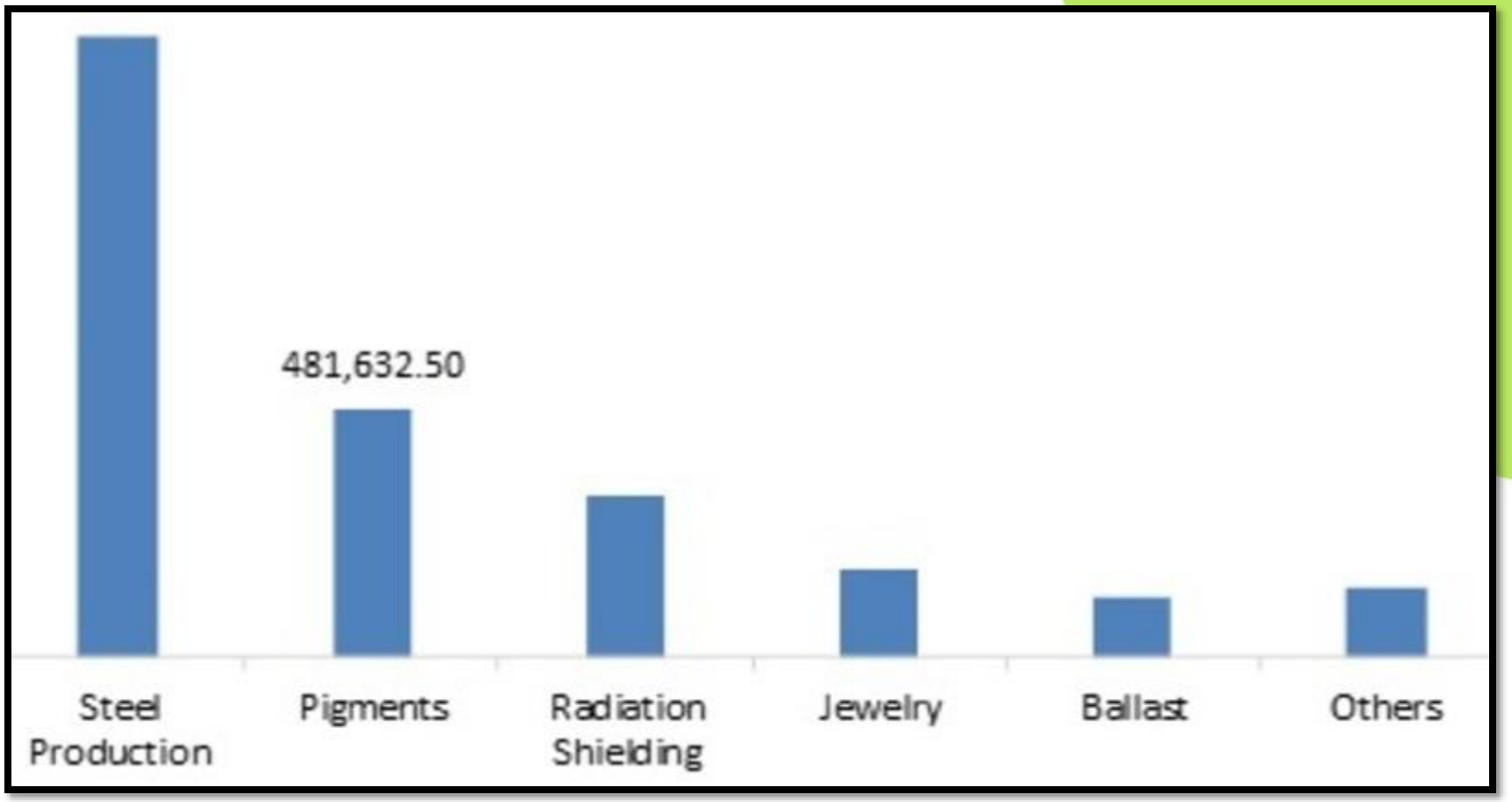
Market Outlook

The Global Ferric Oxide Market is expected to register a CAGR of 4.99% to reach a value of USD 2,414,382.9 Million by 2030.

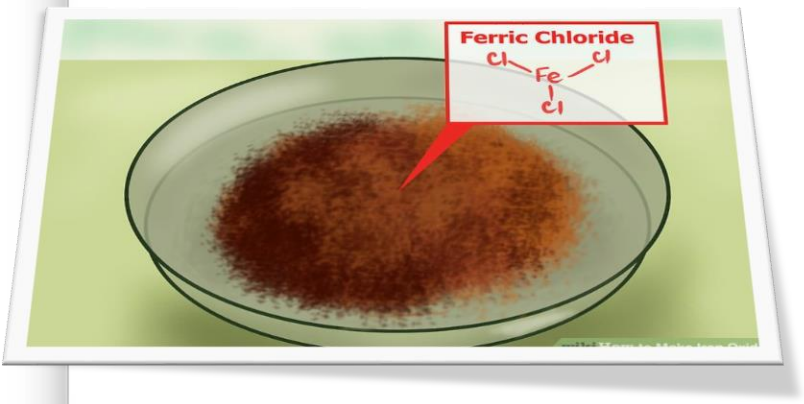
The growing construction industry output is expected to be one of the most significant drivers for the iron oxide market on a global scale. Iron oxide finds a profound rate of application in the construction industry such as in the colouring of various construction materials, including concrete blocks and bricks, ready-mixed concrete and roofing tiles. With the steady growth of the construction industry, stemming from increasing urban and civil infrastructure projects, the demand for iron oxides is expected to increase significantly. Additionally, the use of iron oxide for applications such as paints & coatings, plastics, ceramics and chemicals would necessitate its bulk consumption.

The primary driver of the global ferric oxide market is its growing adoption in steel production. The increasing application of steel in the major end-use industries such as transportation, construction, energy, packaging, and consumer appliances is also a prime factor driving market growth. Steel finds application in the manufacturing of automobile structures, panels, doors, engine blocks, gears, suspension, wheels, fuel tanks, steering, and braking systems. The use of iron oxide pigments to impart colors to construction materials, paints, inks, plastics, papers, cosmetics, rubbers, concrete blocks, and tiles is another key driver of the market.

Global Ferric oxide Market Revenue, by Application, 2030 (USD Million)



The growing construction industry output is expected to be one of the most significant drivers for the iron oxide market on a global scale. The growing adoption of iron oxide nanoparticles in wastewater treatment is an excellent opportunity for the players in the market. With the steady growth of the construction industry, stemming from increasing urban and civil infrastructure projects, the demand for iron oxides is expected to increase significantly. Additionally, the use of iron oxide for applications such as paints & coatings, plastics, ceramics and chemicals would necessitate its bulk consumption.



The ferric oxide market is witnessing consolidation, driven by the pursuit for sustainability among market participants, owing to the imposition of stringent regulations on the production of ferric oxide, which are increasing the overhead costs for ferric oxide manufacturers. This has prompted ferric oxide manufacturers to consolidate production and business operations through acquisition of external enterprises having a sufficient infrastructure and resources.

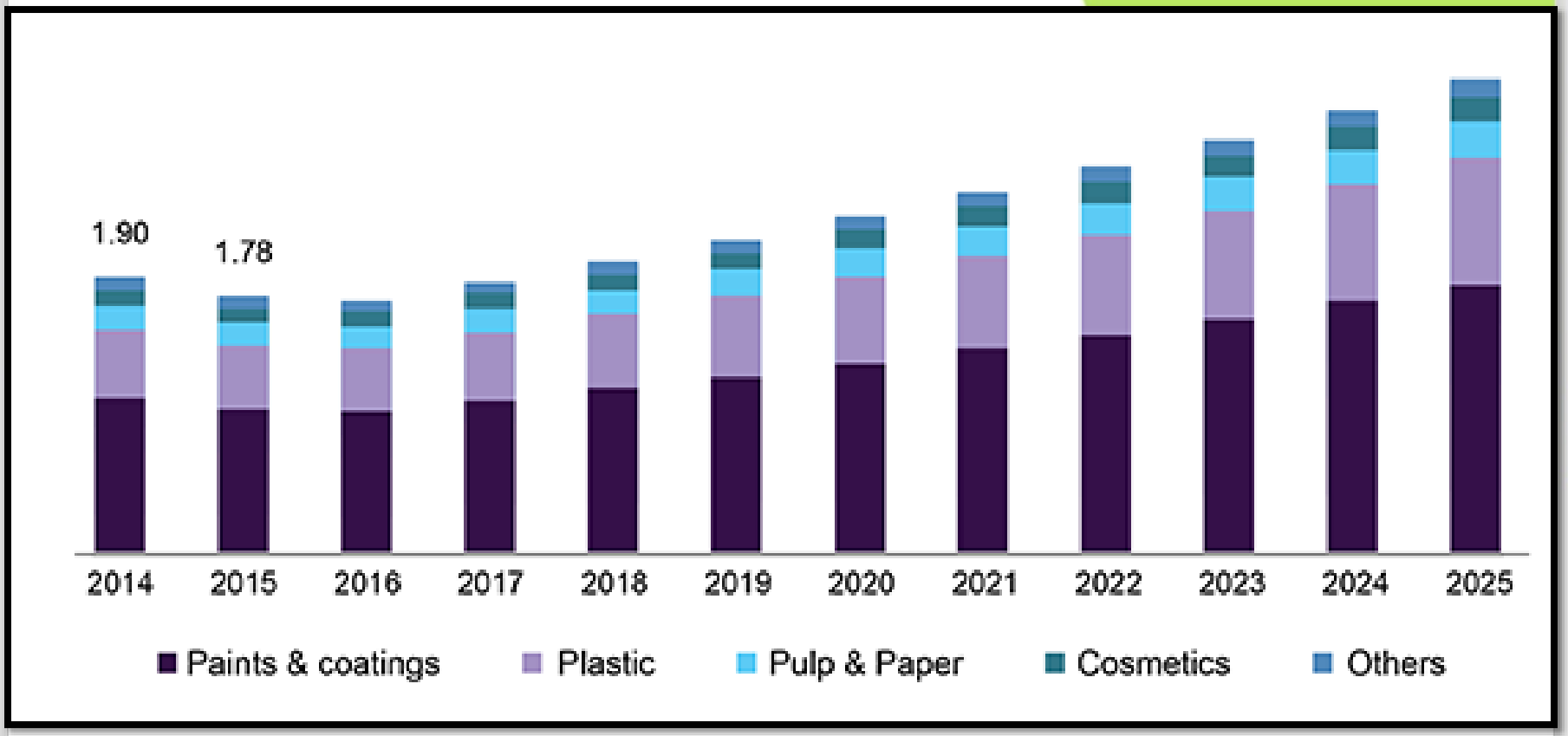
Some of the major players operating in the Ferric Oxide market:

- **Cathay Industries**
- **Huntsman**
- **Lanxess**
- **Bayferrox**
- **Toda Kogyo**
- **Quality Magnetite**
- **Prochem**
- **BariteWorld**
- **Cathay Industries**
- **Nano-Oxides**
- **Pirox**

Titanium Dioxide

The global titanium dioxide market size was valued at USD 15.76 billion in 2018 and is expected to witness a CAGR of 8.7% from 2019 to 2025. Thus, rising number of residential and non-residential construction projects is augmenting the demand for paints & coatings, thereby boosting overall market growth. In addition, high demand for anti-corrosive architectural coatings in the pigments has increased the demand for titanium dioxide.

U.S. Titanium Dioxide Market Size, By Application, 2014-2025 (USD Billion)



The rising use of titanium dioxide in ceramic industry is one of the key factors expected to trigger the market growth in the forthcoming years. It is used as popular ingredient in different products including paint, plastic, paper, pharmaceuticals, and other items. It also provides variegation and crystallization to the color and texture of ceramic glazes. It further prevents pollutants including nitrogen oxide, sulfur oxide, carbon monoxide from affecting ceramic products.

The tightening of regulations globally over vehicular emissions and fuel efficiency concerns have compelled manufacturers to take measures in making vehicles lightweight. High availability of substitutes the rising prices of TiO2 and its negative effects on human are pushing end-user industries to use substitute products. This will hinder the growth of the titanium dioxide market during the forecast period.

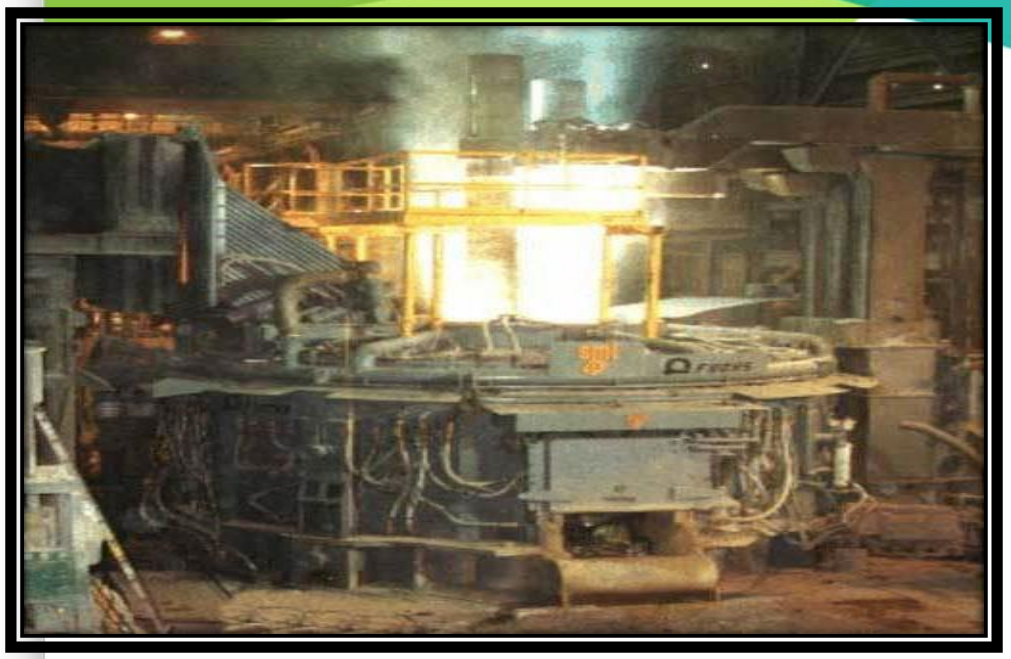
Titanium dioxide particles have wide application scope due to their high stability, photocatalytic properties, and anti-corrosive nature and are manufactured from anatase. They are used in consumer products, such as sunscreens, and as components for articulating implants for the hip and knee.

In the near future, its usage in plastics is set to rise at a breakneck pace thereby providing a major fillip to the global titanium dioxide market. Titanium dioxide find application in bettering numerous characteristics of plastics such as color, opacity, and strength. And with the ever-surging demand for plastic on account of the burgeoning world trade, the global titanium dioxide market growth it expected to remain supported.

Top Key Players of Titanium Dioxide (TiO2) Market:

- **KRONOS Worldwide Inc.**
- **Lomon Billions**
- **The Chemours Company**
- **Tronox Holdings plc**
- **Venator Materials PLC.**

Machinery Photographs



INDUCTION FURNACE

CRUSHER

BALL MILL

Project at a Glance

COST OF PROJECT				MEANS OF FINANCE			
Particulars	Existing	Proposed	Total	Particulars	Existing	Proposed	Total
Land & Site Development Exp.	0.00	440.00	440.00	Capital	0.00	435.30	435.30
Buildings	0.00	254.00	254.00	Share Premium	0.00	0.00	0.00
Plant & Machineries	0.00	407.50	407.50	Other Type Share Capital	0.00	0.00	0.00
Motor Vehicles	0.00	12.00	12.00	Reserves & Surplus	0.00	0.00	0.00
Office Automation Equipments	0.00	282.50	282.50	Cash Subsidy	0.00	0.00	0.00
Technical Knowhow Fees & Exp.	0.00	25.00	25.00	Internal Cash Accruals	0.00	0.00	0.00
Franchise & Other Deposits	0.00	0.00	0.00	Long/Medium Term Borrowings	0.00	1305.89	1305.89
Preliminary& Pre-operative Exp	0.00	5.00	5.00	Debentures / Bonds	0.00	0.00	0.00
Provision for Contingencies	0.00	39.00	39.00	Unsecured Loans/Deposits	0.00	0.00	0.00
Margin Money - Working Capital	0.00	276.18	276.18				
TOTAL	0.00	1741.18	1741.18	TOTAL	0.00	1741.18	1741.18

Project at a Glance

Year	Annualised		Book Value	Debt	Dividend	Retained Earnings		Payout	Probable Market Price	P/E Ratio	Yield Price/ Book Value
	EPS	CEPS	Per Share		Per Share	Per Share				No.of Times	
	`	`	`	`	`	%	`	%	`		%
1-2	5.90	8.69	15.90	24.00	0.00	100.00	5.90	0.00	5.90	1.00	0.00
2-3	9.18	11.61	25.08	18.00	0.00	100.00	9.18	0.00	9.18	1.00	0.00
3-4	12.49	14.63	37.57	12.00	0.00	100.00	12.49	0.00	12.49	1.00	0.00
4-5	15.75	17.62	53.32	6.00	0.00	100.00	15.75	0.00	15.75	1.00	0.00
5-6	18.94	20.59	72.26	0.00	0.00	100.00	18.94	0.00	18.94	1.00	0.00

Project at a Glance

Year	D. S. C. R.			Debt / - Deposits Debt	Equity as-Equity	Total Net Worth	Return on Net Worth	Profitability Ratio					Assets Turnover Ratio	Current Ratio
	Individual	Cumulative	Overall					GPM	PBT	PAT	Net Contribution	P/V Ratio		
	(Number of times)			(Number of times)		%	%	%	%	%		%		
Initial				3.00	3.00									
1-2	1.29	1.29		1.51	1.51	3.72		6.43%	3.42%	2.30%	2149.05	19.24%	3.44	1.07
2-3	1.65	1.46		0.72	0.72	2.33		7.32%	4.73%	3.07%	2430.10	18.65%	3.60	1.19
3-4	2.09	1.66	2.09	0.32	0.32	1.55		7.96%	5.72%	3.65%	2775.42	18.64%	3.59	1.33
4-5	2.62	1.87		0.11	0.11	1.09		8.42%	6.45%	4.09%	3120.74	18.63%	3.47	1.50
5-6	3.26	2.09		0.00	0.00	0.80		8.76%	7.00%	4.43%	3466.06	18.62%	3.30	1.86

Project at a Glance

BEP	
BEP - Maximum Utilisation Year	5
Cash BEP (% of Installed Capacity)	59.96%
Total BEP (% of Installed Capacity)	62.03%
IRR, PAYBACK and FACR	
Internal Rate of Return .. (In %age)	29.01%
Payback Period of the Project is (In Years)	2 Years 3 Months
Fixed Assets Coverage Ratio (No. of times)	18.369

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Tags

#Recovery_of_Fe2O3_from_Bauxite_Processing, #Iron_Oxide_Recovery, #Recovery_of_Ferric_Oxide, #Recovery_of_Ferric_oxide_from_Bauxite_Processing Waste, Ferric Oxide, Manufacturing Applications for Iron (III) Oxide, Manufacture of ferric oxide, Production of Iron (II) Oxide (Fe2O3), Process for the Manufacture of Iron Oxide, Process for Producing Iron Oxide, Iron Oxide Formula, Ferric Oxide Production, How to Make Iron Oxide, Preparation of iron oxide, Titanium Dioxide (TiO2) Production and Manufacturing, #Titanium_Dioxide, Manufacture of Titanium Dioxide, #Titanium_Dioxide_(TiO2) Production, Manufacturing Process of Titanium Dioxide, Titanium Dioxide Properties, Titanium Dioxide Uses, Titanium Dioxide Process Flow Diagram, Titanium Dioxide Manufacture, How to Make Titanium Dioxide, Manufacturing Process of Titanium Dioxide, Production of Titanium Dioxide, Titanium Dioxide Production, #Recovery_of_Titanium_Dioxide, Process for Recovery of Titanium Dioxide, Recovering Titanium Dioxide (Tio2), Recovery of Titanium Dioxide from Bauxite Processing Waste, #Project_Report_on_Recovery_of_Ferric_oxide_from_Bauxite_Processing_Waste, Detailed Project Report on Recovery of Ferric oxide from Bauxite Processing Waste, Project Report on Recovery of Titanium Dioxide, Pre-Investment Feasibility Study on Recovery of Ferric oxide from Bauxite Processing Waste, Techno-Economic feasibility study on Recovery of Titanium Dioxide, #Feasibility_report_on_Recovery_of_Ferric_oxide_from_Bauxite_Processing Waste, #Free_Project_Profile_on_Recovery_of_Ferric_oxide_from_Bauxite_Processing_Waste, Project profile on Recovery of Ferric oxide from Bauxite Processing Waste, Download free project profile on Recovery of Titanium Dioxide

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