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SULPHUR AND PYRITES

(FINAL RELEASE)

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In India, presently there are no mineable elemental sulphur reserves. Sulphur combines directly with almost all the elements with the exception of gold, platinum and the noble gases. In its native form, sulphur is a yellow crystalline solid. It can be found as a pure element or as sulphate or sulphide minerals. The crystallography of sulphur is complex. Depending on the specific conditions, the sulphur allotropes form several distinct crystal structures, with rhombic and monoclinic S_8 best known.

Pyrites is a common mineral comprised of iron and sulphur compounds. Pyrites includes a range of sulphide materials, such as marcasite, pyrite, and pyrrhotite. Pyrites was used as a substitute for sulphur in the manufacture of sulphuric acid by M/s Pyrites Phosphates and Chemicals Ltd (PPCL), however, there was no production of pyrites since 2003.

Sulphide occurs naturally in mineral ores, oil and coal deposits. Natural waters containing elevated concentrations of hydrogen sulphide are used for therapeutic baths and have been consumed for medical purposes. Hydrogen sulphide (H_2S), which exists as a colourless gas under normal conditions, has a characteristic odour of rotten eggs and occurs naturally in coal, natural gas, oil, volcanic gases and sulphur springs and lakes; H_2S is a central participant in the sulphur cycle, the biogeochemical cycle of sulphur on earth. Sulphides form an indispensable link in the sulphur cycle (the reversible interconversion of sulphide and sulphate) in nature.

Petroleum refineries and gas processing plants extract H_2S when making "clean fuels" and use it as a feed stock to produce sulphur and water. The domestic production of elemental sulphur is limited to by-product recoveries from petroleum refineries and fuel oil used as feedstock for manufacturing fertilizer. Tar sands-natural sand (Oil sands) formations containing about 10% bitumen and with high hydrogen sulphide content.

The sulphide ores contain sulphur and during the production of metal from sulphide ores, sulphur is released as SO_2 which is used to produce sulphuric acid. The sulphuric acid thus produced contains about 32.7% of sulphur and contributes in the industries which otherwise would have used elemental sulphur.

Table – 1 : Reserves/Resources of Pyrites as on 1.4.2015
(By Grades and States)

(In '000 tonnes)

Grade/State	Reserves Total (A)	Remaining Resources						Total (A+B)
		Feasibility STD211	Pre-feasibility STD222	Measured STD331	Indicated STD332	Inferred STD333	Total (B)	
All India : Total	**–**	**27129**	**32597**	**9590**	**77729**	**1527356**	**1674401**	**1674401**
By Grades								
Soil Reclamation	–	–	3000	–	–	3024	6024	6024
Beneficiable	–	27129	29597	–	–	4902	61628	61628
Low	–	–	–	9590	26310	1519430	1555330	1555330
Unclassified	–	–	–	–	51419	–	51419	51419
By States								
Andhra Pradesh	–	–	–	–	–	880	880	880
Bihar	–	13462	9680	–	51419	1500000	1574561	1574561
Himachal Pradesh	–	–	–	–	–	2560	2560	2560
Karnataka	–	–	–	–	–	3000	3000	3000
Rajasthan	–	13667	22917	9590	26310	18392	90876	90876
Tamil Nadu	–	–	–	–	–	24	24	24
West Bengal	–	–	–	–	–	2500	2500	2500

Figures rounded off.

Table – 2 : Reserves/Resources of Sulphur (Native) as on 1.4.2015
(By Grades and States)

(In '000 tonnes)

Grade/State	Reserves Total (A)	Remaining Resources						Total (A+B)
		Feasibility STD211	Pre-feasibility STD222	Measured STD331	Indicated STD332	Inferred STD333	Total (B)	
All India : Total	**–**	**-**	**-**	**-**	**-**	**210**	**210**	**210**
By Grades								
Sulphur (Native)	–	–	-	–	–	210	210	210
By States								
Jammu & Kashmir	–	–	–	–	–	210	210	210

Figures rounded off.

RESERVES/ RESOURCES

Total reserves/ resources of pyrites in the country as per NMI data, based on UNFC system as on 1.4.2015 have been placed at 1,674 million tonnes. There are no reserves and all resources are grouped under 'Remaining resources' category. Out of these, about 27 million tonnes are under feasibility (STD211) category. Out of the total resources, beneficiable grade resources are 62 million tonnes, low grade 1,555 million tonnes and soil reclamation grade resources are about 6 million tonnes. Balance of about 51 million tonnes resources falls under unclassified/ not-known grades. Major reserves/ resources are located in Bihar (94%) and Rajasthan (5%) (Table - 1).

Reserves/ resources of sulphur (native) have been estimated in the inferred (STD333) category only. Entire resources are located in Jammu & Kashmir (100%) and are placed at 0.21 million tonnes as on 1.4.2015 as per NMI data, based on UNFC System (Table-2).

PRODUCTION & STOCKS

Sulphur

The production of sulphur recovered as by-product from fertilizer plants and oil refineries were 561 thousand tonnes in 2016-17 as against 473 thousands tonnes in the preceding year.

The oil refineries in public sector reported production of sulphur. During the year 2016-17, Indian Oil Corp. Ltd contributed about 84.60% of the total production during the year. Among the states, Haryana accounted for 34.05% of the total sulphur production and it was followed by Gujarat 18%, Odisha 15.47%, Maharashtra 8.74%, Uttar Pradesh 8.31% , West Bengal 6.88%, Kerala 5.94% and the remaining production was contributed by Assam and Bihar.

In addition, refineries of Hindustan Petroleum Corp. Ltd and RIL, Essar oil also recover by-product sulphur which is in turn used as feedstock in manufacturing fertilizers and pharmaceuticals. The Vadinar refinery of Essar Oil Ltd is also reported to produce by-product sulphur. In Fertiliser Industry, the sulphuric acid is further used for manufacturing phosphoric acid and single superphosphate (SSP) from rock phosphate (Tables - 3 to 5).

Pyrites

Pyrites Phosphates and Chemicals Ltd (PPCL) had two pyrites production units located at Amjhore (Bihar) and Saladipura (Rajasthan) besides phosphorite division in Dehradun. The Government approved closure and hiving off of these two units in July 2002 and Amjhore unit in June 2003 and since then no activity is reported.

Petroleum Refining

The Jamnagar manufacturing division of RIL is the world's largest refining hub having crude processing capacity of 1.24 million Barrels Stream per Day (BSPD). Essar oil has about 700,000 BSPD of global crude-refining capacity (Vadinar+Stanlow).

Sulphur is a by-product produced in various refineries processing high Sulphur crude oil. Sulphur is produced from the sulphur rich fuel gas to reduce the emission level of sulphur in the atmosphere along with flue gases from the furnaces. While Mathura refinery started production of sulphur from beginning itself, Sulphur recovery units have been provided in Haldia, Koyali, Panipat, Mathura & Guwahati refineries.

Refinery-wise Sulphur production capacity of Indian Oil Corporation Ltd is as under :

Unit	Production Capacity ('000 MTPA)
Mathura	48.0
Haldia	24.0
Koyali	18.0
Panipat	144.0
Barauni	12.0
Guwahati	0.6

Specification of Sulphur at Mathura, Panipat, Koyali, Haldia, Barauni & Guwahati Refineries is as under:

Property	
Purity	99.9
Colour	Yellow
Shape	Lump

Table - 3 : Principal Producers of By-product Sulphur, 2016-17

Name & address of producer	Location of plant/refinery	
	State	District
Indian Oil Corporation Ltd, (Refineries Division), Scope Complex, Core-II, 7, Institutional Area, Lodhi Road, New Delhi -110 003.	Assam	Kamrup Metro, Tinsukia Chirang
	Bihar	Barauni
	Gujarat	Baroda
	Haryana	Panipat
	Odisha	Jagatsinghpur
	Uttar Pradesh	Mathura
	West Bengal	Purba Midnapur
Numaligarh Refinery Limited, 122S, G. S. Road, Christianbasti, Guwahati, Assam - 781 005.	Assam	Golaghat
Bharat Petroleum Corporation Ltd, Bharat Bhavan, 4 & 6, Currimbhoy Road, Ballard Estate, Mumbai-440 001, Maharashtra	Maharashtra	Mumbai
	Kerala	Ernakulam

Table – 4 : Production of By-product Sulphur 2014-15 to 2016-17 (By States)

(In tonnes)

State	2014-15	2015-16	2016-17 (P)
India	**464672**	**473322**	**560827**
Assam	5803	4312	6559
Bihar	8629	5561	8159
Gujarat	90096	101743	100952
Haryana	168598	178688	190946
Kerala	35414	32169	33288
Maharashtra	57691	56670	48991
Odisha	-	-	86734
Uttar Pradesh	48782	47836	46618
West Bengal	49659	46343	38580

Table – 5 : Production of By-product Sulphur 2015-16 and 2016-17 (By Sectors/States/Districts)

(In tonnes)

State/District	2015-16		2016-17 (P)	
	No. of units	Quantity	No. of units	Quantity
India/ Public sector	**11**	**473322**	**12**	**560827**
Assam	**4**	**4312**	**4**	**6559**
Chirang	1	935	1	1445
Tinsukia	1	12	1	279
Kamrup Metro	1	662	1	726
Golaghat	1	2703	1	4109
Bihar/ Begusarai	1	5561	1	8159
Gujarat/ Vadodra	1	101743	1	100952
Haryana/ Panipat	1	178688	1	190946
Kerala/ Ernakulam	1	32169	1	33288
Maharashtra/ Mumbai	1	56670	1	48991
Odisha/ Jagatsinghpur	0	0	1	86734
Uttar Pradesh/ Mathura	1	47836	1	46618
W. Bengal/ Purba Midnapur	1	46343	1	38580

USES

Flowers of sulphur (sublimed sulphur)

Powdered form of sulphur produced by sublimation; may contain up to 30% of the amorphous allotrope; used in rubber vulcanisation, agricultural dusts, pharmaceutical products and stock feeds.

Sulphur dioxide

Also referred to as sulphurous anhydride, sulphur dioxide has the chemical formula SO_2. It is produced by volcanoes and in various industrial processes. Sulphur dioxide, which exists as a colourless gas under normal conditions, has a characteristic strong odour and is highly soluble in water. Sulphur dioxide is used in many industrial processes such as chemical preparation, refining, pulp-making and solvent extraction and also is the feed stock to manufacture sulphuric acid. Sulphur dioxide is also used in the preparation and preservation of food because it prevents bacterial growth and browning of fruit.

Sulphuric acid

Sulphuric acid is a strong mineral acid with the formula H_2SO_4. It is soluble in water at all concentrations. Sulphuric acid has many applications and is produced in greater amounts than any other chemical besides water. Principal uses include ore processing, fertilizer manufacturing, oil refining, waste water processing and chemical synthesis.

Miscellaneous

One of the direct uses of sulphur is in vulcanisation of rubber. Sulphur is a component of gunpowder. It reacts directly with methane to give carbon disulphide, which is used to manufacture cellophane and rayon.

Elemental sulphur is mainly used as a precursor to other chemicals. Most of the sulphur is converted to sulphuric acid (H_2SO_4), which is of prime importance to the world economy.

The production and consumption of sulphuric acid are an indicator of a nation's industrial development. The principal use of the sulphuric acid is in the manufacture of phosphatic fertilizer.

Other applications of sulphuric acid include oil refining, waste water processing and mineral extraction. Sulphur compounds are also used in detergents, fungicides, dyestuffs and agrichemicals. In silver based photography, sodium and ammonium thio-sulphate are used as "fixing agents". Sulfites, derived from burning sulphur, are used to bleach paper. They are also used as preservatives in dried fruit and processed fruit products.

Sulphur is used as a light-generating medium in the rare lighting fixtures known as "sulphur lamps". The sulphur lamp is a highly efficient full-spectrum electrodeless lighting system whose light is generated by sulphur plasma that has been excited by microwave radiation.

Nitrogen (N), phosphorus (P) and potassium (K) are critical components of a well-fertilized crop. But to achieve yields and more nutritious foods, crops need sulphur (S). It improves protein and oil percentage in seeds, cereal quality for milling and baking, marketability of dry coconut kernel (copra), quality of tobacco, nutritive value of forages, etc. It is associated with special metabolisms in plant and the structural characteristics of protoplasm. Judicious application in sulphur-deficient soils is a cost effective way to produce more food and feed.

Concrete binder made with sulphur is an eco-efficient alternative to conventional Portland cement for paving stones, sidewalks and building foundations. In road construction, sulphur technology can replace up to 30 percent of asphalt binder, a very energy intensive input in blacktop roads. Sulphur-enhanced roads and parking lots offer a longer life cycle.

INDUSTRY

The Dharamsi Morarji Chemical Company Limited (DMCC) was the first producer of sulphuric acid and Phosphate fertilizers in India. DMCC has designed and commissioned over 50 sulphuric acid plants from 50 MTPD to 1350 MTPD in India, Middle, Far-East and South Africa. DMCC has designed and commissioned Single Super Phosphate Plants from 50 MTPD to 1000 MTPD.

Trident Chemicals started as Varindra Agro Chemicals Ltd in the year 1985 with an initial production capacity of 36300 MTPA of sulphuric acid. i.e.100 MTPD. This plant was originally set-up at Sanghera and was later shifted to Dhaula in the year 1997 and its production capacity was also escalated to 100,000 MTPA in the same year i.e. 275 MTPD. In 2010 Trident Chemicals have extended with the state-of-the-art technology plant imported from QVF Germany to add up a new product line Sulphuric Acid LR grade with the production capacity of 33 MTPD.

Edayar Zinc Limited (Binani Zinc Limited) having production capacity of sulphuric acid 665 MT in 2015-16. The company's plant is located at Village Edayar, District Eavrnaculam.The company contributed R 35.68 lakh from sale of sulphuric acid.

Bodal Chemicals Ltd having two sulphuric acid plant of capacity 450 TPD & 650 MTPD at Padra, Vadodara. The company produces a range of chemicals which are used as raw materials for dye intermediates and dyestuff. Some of the key products in the segment include sulphuric acid & sulphur.

Coromandel International Ltd (Coromandel) formerly Coromandal Fertilizers Limited (CFL) is a leading manufacturer of a wide range of fertilizers & pesticides. The plant is located at Ennore, Tamil Nadu would also expand the de-bottlenecking the existing sulphuric acid plant-1 & plant-2 from 1,400 MTPD to 1,700 and 300 MTPD to 400 MTPD respectively.

The present production facility of the Fertilizers and Chemicals Travancore Limited (FACT) includes manufacture of 3,30,000 MTPA of sulphuric acid of Cochin Division & 3,79,500 MTPA of Udyogamandal Division. As per Annual Report 2015-16 of FACT during the year 2015-2016, the division produced 202,010 MT of sulphuric acid as compared to 315,340 MT of sulphuric acid in the year 2014-2015. Detail project report (DPR) has been prepared for a new 2000 MTPD sulphuric acid plant in Cochin Division.

Gujarat State Fertilizers & Chemicals Limited (GSFC) has got two sulphuric acid plants with a rated capacity of 1350 MTPD & 400 MTPD. The main raw material for sulphuric acid is sulphur which is imported. The 400 MTPD SA III plant was supplied and commissioned in 1981 by Simon Carves (India) Ltd on turnkey basis. The 1,350 MTPD SA IV plant was supplied and commissioned in 1993 by M/s Dharams Morarji Chemicals Company Ltd on turnkey basis. GSFC is contemplating to install 3000 MTPD sulphuric acid plant on EPC basis at its Sikka Unit. This will reduce the import dependency for sustaining the plant operation on continuous basis for production of Phosphatic Fertilizers at Sikka Unit. For sulphuric acid, possibilities are being explored for production of sulphuric acid from molten sulphur or direct purchase of sulphuric acid produced from smelter.

As per Annual report 2016-17 of HZL, company has seven sulphuric acid producing plants. Sulphuric acid production of Chanderiya lead - zinc smelter was 5,44,065 MT during 2016-17 as compared to 6,18,426 MT during 2015-16. Sulphuric acid production of Dariba Smelting Complex was 4,46,997 MT during 2016-17 as compared to 4,99,222 MT during 2015-16. Similarly sulphuric acid production of zinc smelter Debari was 1,91,636 MT during 2016-17 as compared to 2,24,675 MT during 2015-16. Total sulphuric acid production of HZL was 11,82,698 MT during 2016-17 as compared to 13,42,323 MT during 2015-16.

Khaitan Chemicals & Fertilizers Group has Single Super Phosphate (SSP) production capacity of 11,13,500 MT along with Sulphuric Acid (SA) production capacity of 2,70,600 MT. As per Annual Report 2016-17 of Khaitan Chemicals & Fertilizers Group, production of sulphuric acid was1,05,792 MT during 2016-17 as compared to 86,279 MT in 2015-16. On the other hand sales of sulphuric acid during 2015-16 & 2016-17 was 46,567 tonnes & 51,710 tonnes respectively.

Ankur Fertilizers Pvt Ltd (AFL), Budhana road, Muzaffarnagar, Uttar Pradesh has been manufacturing sulphuric acid since 1980, which was previously known as Natraj Organics. Their plant is located in the state of Uttar Pradesh with a capacity of 100 MTPD.

Hindalco is one of the leading sulphuric acid manufacturers in India. The company has three sulphuric acid plants totalling a capacity of 16,70,000 MTPA. Besides sulphuric acid, Hindalco is also a manufacturer of phosphoric acid in India.The plant designed to treat 285,000 tonnes of sulphuric acid and 300,000 tonnes of rock phosphates produces 180,000 tonnes of merchant-grade phosphoric acid (52 to 54 %) per year.

CONSUMPTION

The total consumption of elemental sulphur in 2015-16 was about 1.16 million tonnes. The main consumer of sulphur was fertilizer industry which accounted for about 77% (Table - 6).

Table – 6: Estimated Consumption* of Sulphur 2013-14 to 2015-16 (By Industries)

(In tonnes)

Industry	2013-14	2014-15 (R)	2015-16 (P)
All Industries	**1996900**	**1167900**	**1161000**
Chemical	272800	120200	120100
Fertilizer	1544500	892500	899000
Iron & steel**	16900	11800	9000
Paint	2000	1000	1000
Rubber	2000	1900	1900
Sugar[e]	121100	140500	130000
Others	37600	Nil	Nil

Figures rounded off.
** Includes actual reported consumption and/or estimates made wherever required and paucity of data,hence coverage may not be complete.*
*** The consumption relates to manufacturing sulphuric acid in the steel plants.*
(e) estimate based on sugar production.

TRADE POLICY

Imports of sulphur of all kinds other than colloidal sulphur, precipitated sulphur and sublimed (flowers) sulphur under heading No. 2503 are allowed freely under the Foreign Trade Policy (FTP), 2015-20. Similarly, the imports of unroasted pyrites under heading No. 2502 are allowed freely.

WORLD REVIEW

The world sulphur industry remained divided into two sectors, discretionary and non-discretionary sector, the mining of sulphur or pyrites is the sole objective, this voluntary production of either sulphur or pyrites (mostly naturally occurring iron sulphide) is based on the mining of discrete deposits, with the objective of obtaining as nearly a complete recovery of the resource as economic conditions permit. Reserves of sulphur in crude oil, natural gas and sulphide ores are large. As most sulphur production is a result of the processing of fossil fuels, supplies should be adequate for the foreseeable future.

As petroleum and sulphide ores can be processed long distances from where they are produced, sulphur production may not be in the country for which the reserves were attributed. For instance, sulphur reserves from Saudi Arabia may be recovered at oil refineries in the United States or elsewhere in the world.

In 2016, the world production of sulphur was estimated at 75.30 million tonnes and that of pyrites at 8 million tonnes in terms of sulphur content as compared to 75.10 million tonnes & 8.2 million tonnes respectively in the preceeding year (Table-7).

Elemental sulphur is obtained from ores by conventional mining or by the Frasch method of mining or as a by-product of sour natural gas processing, sour crude refining, tar sand processing and stack gas clean-up (recovered sulphur). Recovered sulphur production accounted for over 98% world elemental sulphur production.

In Frasch method, three concentric pipes are used. The outermost pipe contains superheated water, which melts the sulphur, and the innermost pipe is filled with hot compressed air, which serves to create foam and pressure. The resulting sulphur foam is then expelled through the middle pipe. The Frasch process produces sulphur with 99.5% purity content, and it needs no further purification. Frasch sulphur production on a commercial scale was operated in Brazil and Mexico. Elemental/native sulphur was mined in China, Poland and Russia.

USA

USA ranked 2nd in world in sulphur production and in 2015 sulphur production in USA was about 9.3 million tonnes.

China

China was the only country among the top producers whose primary sulphur source was pyrites. China accounted for about 94% of world pyrites production. China was the leading producers of sulphur in all forms. Fertilizer production consumed about two-third of the sulphuric acid produced in China.

Table – 7 : World Production of Sulphur & Pyrites (By Principal Countries)

(In '000 tonnes of sulphur content)

Country	2014	2015	2016
World: Total (Sulphur)	**75700**	**75100**	**75300**
(Pyrites) (rounded off)	**8200**	**8200**	**8000**
Brazil (Sulphur)	527	530[e]	531[e]
(Pyrites)	19	20[e]	20[e]
Canada (Sulphur)[ab]	5842	5745	5317
China (Sulphur)[e]	12500[e]	12500	12500
(Pyrites)[e]	7700[e]	7700	7700
Chile (Sulphur)[b]	1849	1488	1596
Finland (Pyrites)	353	353	206
(Sulphur)[ab]	446	479	480
Germany (Sulphur)[ac]	1146	1012	930
India (Sulphur)[abe]	2700	2700	2700
Iran (Sulphur)[d]	2100	2200	2200[e]
Italy (Sulphur)[ad]	740	740	740[e]
Japan (Sulphur)[ab]	3442	3363	3518
Jordan (Sulphur)[ae]	490	490	490
Kazakhstan (Sulphur)[ab]	3069	3119	3140
Netherlands (Sulphur)[abe]	530	507	512
Peru (Sulphur)[de]	556	556	556
Turkey (Pyrites)	43	22	25[e]
Turkmenistan (Sulphur)[ae]	410	410	410
Korea, Rep. of (Sulphur)[ab]	2278	2528	3078
Mexico (Sulphur)[ab]	1549	1414	1229
Poland (Sulphur)[abe]	890	931	925
Russia (Sulphur)[ace]	7146	7156	7140
(Pyrites)[e]	71	71	71
Saudi Arabia (Sulphur)[ae]	4400	4400	4400
South Africa (Sulphur)[abe]	250	277	281
USA (Sulphur)[ab]	9637	9536	9780
UAE (Sulphur)[ae]	2530	2530	2530
Venezuela (Sulphur)[ae]	420	420	420
Spain (Sulphur)[abe]	1054	1054[e]	1054[e]
Qatar (Sulphur)[ae]	1754	1665	1667
Other countries (Sulphur)	7425	7350	7176

Source : *World Mineral Production, 2012-2016 (BGS)*

a :- From petroleum refining and/or natural gas.
b :- From metal sulphide processing.
c :- Other
d :- Sulphur, all forms.

FOREIGN TRADE

Exports

Exports of sulphur (excluding sublimed, precipitated and colloidal) decreased marginally by 2% to 6,16,472 tonnes in 2016-17 as compared to 6,28,164 tonnes tonnes in the preceeding year. Exports were mainly to China (85%), Indonesia (10%) & South Africa (4%). On the other hand exports of sulphur (including sublimed, precipitated and colloidal) increased considerably by 36% to 17,020 tonnes in 2016-17 as compared to 12,506 tonnes in the preceding year. Exports were mainly to Netherlands (22%), USA & Thailand (11% each) & China (7%) (Tables-8 to 12).

Imports

Imports of sulphur (excluding sublimed, precipitated and colloidal) decreased by 6% to 1.34 million tonnes in 2016-17 from 1.43 million tonnes in the previous year. Imports were mainly from Saudi Arabia (41%), Qatar (23%), UAE (18%), Japan (5%) and Bahrain (4%). Imports of sulphur (including sublimed, precipitated and colloidal) decreased sharply by 72% to 249 tonnes in 2016-17 from 885 tonnes in the previous year. Imports were mainly from Germany (20%), China (15%) and Hong Kong (9%) (Tables -13 to 17).

Table – 8 : Exports of Sulphur (Excl. Sublimed, Precipitated & Colloidal) :Total (By Countries)

Country	2015-16 (R)		2016-17 (P)	
	Quantity (t)	Value (₹'000)	Quantity (t)	Value (₹'000)
All Countries	**628164**	**5157081**	**616472**	**3469350**
China	503308	4034135	521873	2885689
Indonesia	29700	181698	60500	340083
South Africa	57	921	27039	140305
Brazil	-	-	2019	22386
Oman	19	943	2105	21304
Sri Lanka	788	15053	825	13949
Yemen Republic	660	12699	400	7478
Turkey	-	-	99	7411
Nepal	1469	23611	455	5816
Myanmar	++	3	425	5669
Other countries	92163	888018	732	19260

Table –9 : Exports of Sulphur (Sublimed, Precipitated & Colloidal) : Total (By Countries)

Country	2015-16 (R)		2016-17 (P)	
	Quantity (t)	Value (₹'000)	Quantity (t)	Value (₹'000)
All Countries	**12506**	**1116630**	**17020**	**1861386**
Netherlands	1967	235982	3677	421800
USA	315	35789	1892	217225
Thailand	699	83037	1894	207630
China	3442	85335	1121	124488
South Africa	750	97013	926	111127
Brazil	762	88230	1047	110549
Portugal	600	68350	912	99489
Russia	448	53095	770	89472
Indonesia	375	40505	808	87184
Italy	299	34704	692	79847
Other countries	2849	294590	3281	312575

Table – 10: Exports of Sulphur (Colloidal)
(By Countries)

Country	2015-16 (R)		2016-17 (P)	
	Quantity (t)	Value (₹'000)	Quantity (t)	Value (₹'000)
All Countries	**2890**	**17643**	**43**	**1179**
Nepal	30	450	32	578
Brazil	-	-	7	410
UAE	1	33	3	178
Congo, Dem. Rep.	1	12	1	12
Jordan	-	-	++	1
China	2858	17146	-	-
Kuwait	++	1	-	-
Uganda	++	1	-	-

Table – 11 : Exports of Sulphur (Sublimed)
(By Countries)

Country	2015-16 (R)		2016-17 (P)	
	Quantity (t)	Value (₹'000)	Quantity (t)	Value (₹'000)
All Countries	**9556**	**1097523**	**16842**	**1855513**
Netherlands	1967	235982	3677	421800
USA	315	35789	1892	217225
Thailand	699	83037	1894	207630
China	584	68189	1121	124488
South Africa	750	97013	926	111127
Brazil	762	88230	1040	110139
Portugal	600	68350	912	99489
Russia	448	53095	770	89472
Indonesia	375	40505	793	86370
Italy	299	34704	692	79847
Other countries	2757	292629	3125	307926

Table-12 : Exports of Sulphur (Precipitated) (By Countries)

Country	2015-16 (R)		2016-17 (P)	
	Quantity (t)	Value (₹'000)	Quantity (t)	Value (₹'000)
All Countries	**60**	**1464**	**135**	**4694**
Nepal	59	1278	113	2179
Malawi	1	74	6	1512
Indonesia	-	-	15	814
UAE	-	-	1	129
Belgium	-	-	++	39
Sri Lanka	++	107	++	16
Singapore	-	-	++	4
Ecuador	-	-	++	1
Ethiopia	++	5	-	-

Table – 13-: Imports of Sulphur (Excl. Sublimed, Precipitated & Colloidal): Total (By Countries)

Country	2015-16 (R)		2016-17 (P)	
	Quantity (t)	Value (₹'000)	Quantity (t)	Value (₹'000)
All Countries	**1432632**	**14172610**	**1345520**	**8751428**
Saudi Arabia	415748	4194548	548366	3597521
Qatar	495750	4870906	312818	1974246
UAE	213666	2008392	244557	1535046
Japan	64214	655506	70190	483295
Bahrain	103358	993178	56909	365002
Kuwait	87484	889808	52503	351483
Iran	517	3507	39296	248471
Oman	7475	106653	9575	100678
Singapore	7010	65519	4734	35525
Turkmenistan	15980	140589	4871	29642
Other countries	21430	244004	1701	30519

Table – 14: Imports of Sulphur (Sublimed, Precipitated & Colloidal): Total (By Countries)

Country	2015-16 (R)		2016-17 (P)	
	Quantity (t)	Value (₹'000)	Quantity (t)	Value (₹'000)
All Countries	**885**	**106389**	**249**	**38254**
Germany	50	9945	50	11167
China	5	633	38	6088
Hong Kong	-	-	23	5508
Chinese Taipei/ Taiwan	66	16632	18	4654
Korea, Rep. of	37	2632	48	3003
Spain	++	3	22	2239
Japan	56	7544	12	2009
USA	384	53844	18	1571
France	283	14449	15	838
Belgium	3	472	3	558
Other countries	1	235	2	619

Table – 15: Imports of Sulphur (Precipitated) (By Countries)

Country	2015-16 (R)		2016-17 (P)	
	Quantity (t)	Value (₹'000)	Quantity (t)	Value (₹'000)
All Countries	**831**	**99028**	**140**	**23567**
Hong Kong	-	-	23	5508
China	5	633	28	5095
Chinese Taipei/ Taiwan	66	16632	18	4654
Germany	38	6085	30	4243
USA	384	53574	18	1313
Japan	51	6977	3	890
France	283	14449	15	838
Belgium	3	464	3	558
Italy	++	34	2	292
UK	-	-	++	133
Other countries	1	180	++	43

Table – 16: Imports of Sulphur (Colloidal) (By Countries)

Country	2015-16 (R)		2016-17 (P)	
	Quantity (t)	Value (₹'000)	Quantity (t)	Value (₹'000)
All Countries	**44**	**5731**	**66**	**9533**
Germany	12	3718	19	6476
Korea, Rep. of	27	1433	38	1793
Japan	5	567	9	1119
UK	-	-	++	145
USA	++	13	-	-

Table – 17: Imports of Sulphur (Sublimed) (By Countries)

Country	2015-16 (R)		2016-17 (P)	
	Quantity (t)	Value (₹'000)	Quantity (t)	Value (₹'000)
All Countries	**10**	**1630**	**43**	**5154**
Spain	-	-	22	2214
Korea, Rep. of	10	1190	10	1192
China	-	-	10	993
Germany	++	142	1	448
USA	++	257	++	258
UK	++	30	++	49
Belgium	++	8	-	-
Czech Republic	++	3	-	-

FUTURE OUTLOOK

Country is deficient in sulphur and pyrites which are essential for fertilizer industry. Recovered sulphur output was expected to increase significantly worldwide. Refineries in developing countries were expected to improve environmental protection measures and eventually, compare with the environmental standards of plants in Japan, North America and Western Europe in future. Higher sulphur recovery is likely to result from several factors, viz, higher refining rates, higher sulphur content in crude oil, lower allowable sulphur content in finished fuels and reduced sulphur emissions mandated by regulations.

World consumption of natural gas is expected to maintain strong growth, and sulphur recovery from that sector will likely to continue to increase. Natural gas continued to be the fuel of choice in many regions of the world in the electric power and industrial sectors, in part because of its lower carbon intensity compared with coal and oil, which makes it an attractive fuel source in countries where governments are implementing policies to reduce greenhouse gas emissions.

Some of the future gas production is expected to come from unconventional natural gas resources such as shale gas and coal bed methane.

Use of unconventional gas resources will certainly affect the sulphur supply outlook for the future as these gases have low sulphur content. However, increased sulphur from sour gas processing in China, central Asia is projected to more than compensate for the decrease in sulphur resulting from unconventional natural gas sources. Ore leaching will likely be the largest area of sulphur consumption growth. Copper and nickel leaching are the major consumers of sulphuric acid.

In the near term, increased global production and continued demand will keep the sulphur market balanced, which is expected to be followed in the long term by a surplus worldwide. International sulphur trade is expected to increase significantly, driven by demand for sulphuric acid in industrial sectors (particularly new ore-leaching operations) and a modest increase in demand for fertilizers.

World sulphur production decreased slightly however, it is likely to steadily increase for the foreseeable future. The largest increases in sulphur production during the next 5 years are expected to take place in Iran, Kazakhstan, Qatar, Russia, Saudi Arabia, Turkmenistan and the United Arab Emirates. New sulphur demand associated with phosphate/ fertilizer projects is expected in Algeria, Brazil, Egypt, Morocco and Saudi Arabia.

According to TechSci Research report, "Global Sulphuric Acid Market, By Manufacturing Process, By Application, By Region Competition Forecast and Opportunities, 2011 - 2025", the global sulphuric acid market is projected to register sales of $18 Billion in 2020, on account of surging demand for phosphate fertilizers such as DAP (diammonium phosphate), MAP (monoammonium phosphate), TSP (triple superphosphate), SSP (single superphosphate), etc. Global demand for phosphate fertilizers is projected to increase from 42.1 million tonnes in 2015 to 45.6 million tonnes by 2019. Furthermore, global phosphoric acid production is anticipated to increase from 46 million tonnes in 2015 to 51.9 million tonnes by 2019, thereby augmenting consumption of sulphuric acid for production of phosphate fertilizers in the coming years. Thus, expanding capacity to produce more phosphates, coupled with growing application of sulphuric acid as a raw material for chemical manufacturing processes and in metal leaching are further expected to drive global sulphuric acid market through 2025.