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SULPHUR & PYRITES

(FINAL RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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46 Sulphur and Pyrites

Sulphur is an essential raw material for many chemical industries and is essentially used for the production of sulphuric acid which in turn is used for the production of chemical fertilizers, textiles, dyestuffs, pickling and galvanising of steel, storage batteries, refining of petroleum, explosives and other acids.

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 naturally occurring mineral comprised of the elements iron and sulphur (FeS_2). It is used for manufacture of sulphuric acid, and as direct feed for soil conditioning. Pyrite is a fairly ubiquitous mineral and it occurs most commonly in sedimentary rocks. Pyrite has a brass yellow colour, brownish black streak, metallic lustre and occurs as cubic crystals. Pyrites includes a range of sulphide materials, such as, marcasite, pyrite and pyrrhotite. Marcasite usually occurs in low temperature metasediments and sedimentary rocks. Pyrrhotite occurs usually in magmatic or contact metasomatic deposits associated with basic igneous rocks and high temperature sulphide veins and is often nickeliferous. Pyrites was used as a substitute for sulphur in the manufacture of sulphuric acid. However, there was no production of pyrites since 2003.

Native sulphur deposit has been reported in Puga Valley of Leh district in Jammu & Kashmir. The grade of the deposit ranges from 9% to 24% of sulphur. Small occurrences of native sulphur are also reported from Barren Island of Bay of Bengal. Sulphur along with hot springs were reported from various parts of Chamoli, Rudraprayag, Uttarkashi, etc. districts in Garhwal & Kumaun divisions of Uttarakhand. In Andhra Pradesh, native sulphur occurs in granular form with clay and silt in coastal areas of Krishna and East Godavari districts. Occurrences are also reported from Alappuzha district of Kerala and Kangra district of Himachal Pradesh.

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 contain 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.

RESERVES/ RESOURCES

The total reserves/ resources of pyrites in the country as per NMI data, based on UNFC system as on 1.4.2015 has 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. The balance of about 51 million tonnes resources fall 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 and are placed at 0.21 million tonnes as on 1.4.2015 as per NMI data, based on UNFC System (Table-2).

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

PRODUCTION & STOCKS

Sulphur (By-product)

The production of sulphur recovered as by-product from fertilizer plants and oil refineries was 890 thousand tonnes in 2018-19 as against 825 thousands tonnes in the preceding year.

The oil refineries in Public Sector reported production of sulphur. During the year 2018-19, Indian Oil Corp. Ltd contributed about 69% of the total production. Among the States, Odisha accounted for 26.88% of the total sulphur production and it was followed by Kerala (25.36%), Haryana (19.85%), Gujarat (10.33%), Uttar Pradesh (5.81%), Maharashtra (5.27%), West Bengal (4.90%) and the remaining production was contributed by Assam and Bihar.

In addition, refineries of Hindustan Petroleum Corp. Ltd, RIL and Essar oil also have reported recovering of by-product sulphur which in turn is used as feedstock in manufacturing fertilizers and pharmaceuticals. The Vadinar refinery of Essar Oil Ltd is also reported to produce by-product sulphur. In Fertilizer 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

In fossil fuels, sulphur is naturally present as an impurity when fuel are burned, the sulphur is released as sulphur dioxide – an air pollutant. Hydrodesulfurisation (HDS) is a catalytic chemical process widely used to remove sulphur from natural gas and from refined petroleum products, such as, gasoline or petrol, jet, fuel, kerosene, diesel and fuel oils. Sulphur is a by-product produced in various refineries processing high sulphur crude oil. Sulphur is produced from the sulphur-rich fuel gas as a process to reduce the emission level of sulphur in the atmosphere along with flue gases from the furnaces. Mathura refinery started production of sulphur from beginning itself and sulphur recovery units have been provided in Haldia, Koyali, Panipat, Mathura and Guwahati refineries.

Refinery-wise Sulphur (by-product) 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, 2018-19

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	Begusarai
	Gujarat	Vadodara
	Haryana	Panipat
	Odisha	Jagatsinghpur
	Uttar Pradesh	Mathura
	West Bengal	Purba Midnapur
Numaligarh Refinery Limited, 122S, G. S. Road, Christanbasti, Distt- Guwahati, Assam - 781 005.	Assam	Golaghat
Bharat Petroleum Corporation Ltd, Bharat Bhavan, 4 & 6, Currimbhoy Road, Ballard Estate, Mumbai-400 001, Maharashtra	Maharashtra	Mumbai
	Kerala	Ernakulam

***Note:** Sulphur is recovered as by-product from fertilizer plants and oil refineries (excluding units working under Private Sector)*

Table – 4 : Production of By-product Sulphur 2016-17 to 2018-19 (By States)

(In tonnes)

State	2016-17	2017-18	2018-19 (P)
India	**560826**	**825173**	**890400**
Assam	6559	8051	7100
Bihar	8159	7330	7050
Gujarat	100952	95343	91962
Haryana	190946	180431	176755
Kerala	33287	155695	225857
Maharashtra	48991	58904	46967
Odisha	86734	231075	239344
Uttar Pradesh	46618	47691	51738
West Bengal	38580	40653	43627

(P): provisional

Table – 5 : Production of By-product Sulphur 2017-18 and 2018-19 (By Sectors/States/Districts)

(In tonnes)

State/District	2017-18		2018-19 (P)	
	No. of units	Quantity	No. of units	Quantity
India/ Public sector	**12**	**825173**	**12**	**890400**
Assam	**4**	**8051**	**4**	**7100**
Chirang	1	1548	1	1680
Tinsukia	1	523	1	334
Kamrup Metro	1	643	1	376
Golaghat	1	5337	1	4710
Bihar/ Begusarai	1	7330	1	7050
Gujarat/ Vadodara	1	95343	1	91962
Haryana/ Panipat	1	180431	1	176755
Kerala/ Ernakulam	1	155695	1	225857
Maharashtra/ Mumbai	1	58904	1	46967
Odisha/ Jagatsinghpur	1	231075	1	239344
Uttar Pradesh/ Mathura	1	47691	1	51738
W. Bengal/				
Purba Midnapur	1	40653	1	43627

(P): provisional

USES

Flowers of Sulphur (sublimed sulphur)

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

Sulphur dioxide (SO_2)

Sulphur dioxide is a by-product gas generated during processing of sulphide ores as well from other industries. It 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 in the manufacturing of 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 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". Sulphites, 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 per cent of asphalt binder, a high 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 1,350 MTPD in India, Middle, Far-East and South Africa. DMCC has designed and commissioned Single Super Phosphate Plants from 50 MTPD to 1,000 MTPD. DMCC is currently planning to set up a sulphuric acid plant at Dahej.

Trident Chemicals started as Varindra Agro Chemicals Ltd in the year 1985 with an initial production capacity of 36,300 MTPA of sulphuric acid i.e., 100 MTPD. As per annual report of Trident Chemicals during 2017-18, the company ranked amongst north India's largest commercial and battery grade sulphuric acid manufacturer with an installed capacity of 1,00,000 TPA.

Coromandel International Ltd, formerly Coromandal Fertilizers Limited (CFL), is a leading manufacturer of a wide range of fertilizers & pesticides. The Company has commissioned a new sulphuric acid tank at Vizag plant with storage capacity of 25,000 MT and 5.6 km of pipeline for transferring the acid.

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. The Company produced 2,93,000 MT of sulphuric acid during 2018-19 as compared to 2,63,850 MT of sulphuric acid in the previous year at Cochin Division.

Gujarat State Fertilizers & Chemicals Limited (GSFC) has two sulphuric acid plants with a rated capacity of 1,350 MTPD & 400 MTPD. GSFC is contemplating to install 3,000 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.

The Hindustan Zinc Ltd, has eight sulphuric acid producing plants. The total sulphuric acid production of HZL was 12,83,239 MT during 2018-19 as compared to 14,04,095 MT in the previous year.

Khaitan Chemicals & Fertilizers Group has sulphuric acid production capacity of 2,70,600 MT. The sulphuric acid plants are located at Nimrani, Distt Khargone, M.P.; Goramachia, Distt Jhansi, U.P.; Malwan, Distt Fatehpur, U.P. and Somni, Distt Rajnandgaon, Chhattisgarh. Khaitan Chemicals & Fertilizers Group produced 1,80,443 MT of sulphuric acid during 2018-19 as compared to 94,873 MT in the previous year.

Hindalco is one of the leading sulphuric acid manufacturers in India. The Company has three sulphuric acid plants with a total capacity of 16,70,000 TPA.

TRADE POLICY

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

WORLD REVIEW

Reserves of sulphur in crude oil, natural gas and sulphide ores are large. As sulphur is produced as a result of the processing of fossil fuels, its supplies should be adequate for the foreseeable future. Besides, the reality is that petroleum and sulphide ores mostly get processed at long distances from where they are produced, sulphur production reported therefore may not be in the country to which the reserves were attributed. For instance, sulphur from Saudi Arabian oil may be recovered at refineries in the United States or elsewhere in the world.

In 2018, the world production of sulphur ore was estimated at 70.40 million tonnes and that of pyrites at 7.20 million tonnes in terms of sulphur content as compared to 70.60 million tonnes & 7.20 million tonnes respectively in the preceding year (Table-6).

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% of 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.

To provide a generalised view of the development in various countries, the country-wise description sourced from latest available publication of Minerals Yearbook 'USGS' 2017 is furnished as below:

Canada

Canada ranked fifth in the world in sulphur production, and is one of the leading sulphur and sulphuric acid exporters. In 2017, sulphur production, in all forms, in Canada was slightly higher than it was in 2016. About three-fourths of Canada's sulphur was recovered at natural gas and oil sands operations in Alberta. Minor quantities of sulphur were also recovered from oil sands in Saskatchewan and from oil refineries in other parts of the country, besides by-product sulphuric acid is produced from metallurgy. Canada's sulphur production is expected to remain stable over the medium term and is likely to increase during the long term as a result of expanded oil sands production. Sulphur production from natural gas is expected to decrease with declining as natural gas production.

China

China was the leading global producer of sulphur in all forms and the leading producer of pyrites, with about 25% of its sulphur in all forms coming from that source. The country was the leading sulphur importer with a total of 11.2 Mt, which was about one-third of global imports. Imports represented about 55% to 60% of elemental sulphur, the bulk of which was used in manufacturing sulphuric acid. The Government of China removed the export tariffs from phosphate fertilizers in 2017. No tariff was imposed on diammonium phosphate and monoammonium phosphate through 2017 and into 2018.

Oman

Duqm Refinery and Petrochemical Industries LLC contracted with Técnicas Ruenidas to build a new refinery in Oman. The contract included the engineering, supply, construction and commissioning of the refinery. In addition, to the 2,30,000-bbl/d crude distillation unit, the refinery would have three 355-metric-ton-per-day sulphur recovery units.

Table – 6 : World Production of Sulphur & Pyrites (By Principal Countries)

In tonnes (sulphur content)

Country	2016	2017	2018
World: Total (Pyrites)	**7100000**	**7200000**	**7200000**
World: Total (Frash)	**600000**	**700000**	**600000**
World: Total (Recovered)	**70400000**	**70600000**	**70400000**
World: Total (Sulphur ore)	**300000**	**300000**	**300000**
China			
(Recovered)	9630000*	9600000*	9600000*
(Pyrites)	6770000*	6800000*	6800000*
USA			
(Recovered)[a]	9070000	9070000	9009000*
(Recovered)[b]	673000	575000	670000*
Russia			
(Recovered)[a]	6092000*	6092000*	6092000*
(Recovered)[c]	954000*	954000*	954000*
(Sulphur Ore)	94418	96316	83707
(Pyrites)	71000*	71000*	71000*
Canada			
(Recovered)[a]	4746100	4802900	4792100
(Recovered)[b]	635300	524000	532500
Saudi Arabia			
(Recovered)[a]	3900000*	3700000*	3900000*
Kazakhstan			
(Recovered)[a]	2546500	2947300	2947000*
(Recovered)[b]	604000*	604000*	604000*
UAE			
(Recovered)[a]	2530000*	2530000*	2530000*
Iran			
(Recovered)[d]	2200000	2200000	2200000*
Korea, Rep. of			
(Recovered)[a]	2000000	2000000	2000000
(Recovered)[b]	1078000*	1078000*	1078000*
Japan			
(Recovered)[b]	1700085	1583867	1710961
(Recovered)[a]	1817790	1788620	1697355
Qatar			
(Recovered)[a]	1733000*	1678000*	1649000*
Chile			
(Recovered)[b]	1595595	1524437	1476456
India**			
(Recovered)[b, f]	1200000*	1200000*	1200000*
(Recovered)[a]	560826	825173	895000*
Kuwait			
(Recovered)[a]	990000*	850000*	850000*
Australia			
(Recovered)[b]	810000*	810000*	810000*
(Recovered)[a]	90000*	90000*	90000*
Zambia			
(Recovered)[b]	363000	679500	700000*

(Contd.)

(Table-6) Concld

Country	2016	2017	2018
Poland			
(Frash)	620500	663000	617370
(Recovered)[b]	280000*	280000*	280000*
(Recovered)[a]	24500	23000	23770
Mexico			
(Recovered)[b]	556000*	556000*	556000*
(Recovered)[a]	673285	551218	442657
Peru			
(Recovered)[d]	556000*	556000*	556000*
Spain			
(Recovered)[b]	539000*	539000*	539000*
(Recovered)[a]	515000*	515000*	515000*
Netherlands			
(Recovered)[a]	530000*	520000*	520000*
(Recovered)[b]	112000*	86000*	96000*
Italy			
(Recovered)[a,d]	550000	511000	510000*
Jordan			
(Recovered)[a]	490000*	490000*	490000*
Germany			
(Recovered)[a]	577684	537882	419597
(Recovered)[c]	351865	328247	254400
Turkmenistan			
(Recovered)[a]	410000*	410000*	410000*
Belgium			
(Recovered)[a, b]	400000*	400000*	400000*
Bulgaria			
(Recovered)[b]	392000*	392000*	392000*
(Recovered)[a]	60000*	60000*	60000*
Uzbekistan			
(Recovered)[a]	385000*	385000*	385000*
(Recovered)[b]	131000*	131000*	131000*
France			
(Recovered)[a]	370000*	370000*	370000*
(Recovered)[c]	78400*	78400*	78400*
Finland			
(Recovered)[b]	349504	344441	343377
(Pyrites)	206000	291000	271000
(Recovered)[a]	130000*	130000*	130000*

Source: *BGS, World Mineral Production, 2014-2018*

a) From petroleum refining and/or natural gas

b) From metal sulphide processing

c) Other; d) Sulphur, all forms

e) Including Frasch

f) Years ended 31st March following that stated.

*** India's production of Sulphur (by-product) during 2016-2017, 2017-18 and 2018-19 was 5,60,826 tonnes and 8,25,173 tonnes and 8,90,400 tonnes respectively.*

** Estimated*

FOREIGN TRADE

Exports

Exports of sulphur (excluding sublimed, precipitated and colloidal) decreased considerably by 16% to 4,79,651 tonnes in 2018-19 as compared to 5,73,856 tonnes in the preceding year. Exports were mainly to China (91%), Papua New Guinea (7%) and Tanzania (1%). On the other hand, exports of sulphur (including sublimed, precipitated and colloidal) increased marginally by 2% to 18,080 tonnes in 2018-19 as compared to 17,697 tonnes in the preceding year. Exports were mainly to Netherlands (20%), USA (12%), Russia (9%) and Indonesia & Thailand (8% each) (Tables-7 to 11).

Imports

Imports of sulphur (excluding sublimed, precipitated and colloidal) increased by 12% to 1.35 million tonnes in 2018-19 from 1.21 million tonnes in the previous year. Imports were mainly from UAE (37%), Qatar (34%), Saudi Arabia (11%), Japan (5%) and Kuwait (3%). Imports of sulphur (including sublimed, precipitated and colloidal) decreased considerably by 66% to 160 tonnes in 2018-19 from 469 tonnes in the previous year. Imports were mainly from Republic of Korea (31%), Germany (27%), China (17%) and Japan (10%) (Tables -12 to 16).

Table – 7 : Exports of Sulphur (Excl. Sublimed, Precipitated & Colloidal) :Total (By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**573856**	**4254427**	**479651**	**4332476**
China	492127	757712	435881	3800154
Papua New Guinea	-	-	34620	323221
Tanzania	20	382	5634	111466
Turkey	231	17110	373	27521
Sri Lanka	1257	20710	1148	23124
Nepal	873	13494	1119	19309
UAE	95	3944	131	5743
Oman	1071	10068	116	3072
Ethiopia	92	2225	105	2746
Korea, Rep. of	-	-	41	2201
Other countries	78089	428781	482	13918

Figures rounded off

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

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**17697**	**1896114**	**18080**	**2128393**
Netherlands	3588	420077	3643	460233
USA	2125	216181	2231	253114
Russia	634	72917	1551	184656
Indonesia	1415	144887	1518	169129
Thailand	1741	179382	1447	161864
South Africa	990	114697	1050	129133
Brazil	989	98478	1101	126900
China	1213	120904	985	111168
Italy	709	84952	774	100411
Spain	799	85269	794	92777
Other countries	3494	358369	2986	339008

Figures rounded off

Table – 9: Exports of Sulphur (Colloidal)
(By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Quantity (t)	Value (`'000)	Quantity (t)	Value (`'000)
All Countries	**8**	**520**	**3**	**210**
UAE	8	453	2	147
Nepal	++	49	1	57
Singapore	++	4	++	5
Malta	-	-	++	2
Malawi	++	10	-	-
Georgia	++	2	-	-
Qatar	++	2	-	-
Netherlands	++	1	-	-
Zambia	++	1	-	-

Figures rounded off

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

Country	2017-18 (R)		2018-19 (P)	
	Quantity (t)	Value (`'000)	Quantity (t)	Value (`'000)
All Countries	**17637**	**1894931**	**18077**	**2128091**
Netherlands	3588	420076	3643	460233
USA	2125	216181	2231	253114
Russia	634	72894	1551	184656
Indonesia	1415	144887	1518	169129
Thailand	1741	179382	1447	161864
South Africa	990	114696	1050	129133
Brazil	989	98478	1101	126900
China	1213	120904	985	111168
Italy	709	84952	774	100411
Spain	799	85269	794	92777
Other countries	3433	357213	2982	338706

Figures rounded off

Table-11 : Exports of Sulphur (Precipitated)
(By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Quantity (t)	Value (`'000)	Quantity (t)	Value (`'000)
All Countries	**52**	**663**	**1**	**92**
Sri Lanka	++	24	++	65
Ethiopia	++	1	++	12
Saudi Arabia	-	-	++	7
Jordan	-	-	++	5
Zimbabwe	++	9	++	2
Nepal	52	598	++	1
Israel	-	-	++	++
Russia	++	24	-	-
New Zealand	++	4	-	-
South Africa	++	2	-	-
Other countries	++	2	++	++

Figures rounded off

Table – 12-: Imports of Sulphur (Excl. Sublimed, Precipitated & Colloidal): Total
(By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Quantity (t)	Value (`'000)	Quantity (t)	Value (`'000)
All Countries	**1206433**	**10628790**	**1346777**	**15219696**
UAE	364417	3356574	491783	5476609
Qatar	332893	2942291	457628	5083600
Saudi Arabia	262115	2052763	151659	1853264
Japan	74286	717498	64948	775092
Kuwait	6998	64304	46648	502551
Singapore	13264	104477	42938	461250
Iran	1042	14307	38700	345173
Taiwan	96	11036	16596	253548
Korea, Rep. of	5961	82590	14468	200894
Bahrain	80298	769177	10919	125507
Other countries	65063	513773	10490	142208

Figures rounded off

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

Country	2017-18 (R)		2018-19 (P)	
	Quantity (t)	Value (`'000)	Quantity (t)	Value (`'000)
All Countries	**469**	**56992**	**160**	**25155**
Germany	55	10100	44	11522
Korea, Rep. of	68	5919	49	3899
China	227	25076	27	2890
Japan	13	1801	16	2750
USA	50	6625	13	2476
Netherlands	2	335	11	1574
UK	1	455	++	38
France	++	8	++	6
Vietnam	30	3273	-	-
Spain	15	1692	-	-
Other countries	8	1708	-	-

Figures rounded off

Table – 14: Imports of Sulphur (Precipitated) (By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Quantity (t)	Value (`'000)	Quantity (t)	Value (`'000)
All Countries	**47**	**6791**	**27**	**3908**
Germany	38	4109	22	2565
Japan	3	882	5	1193
USA	++	122	++	147
UK	-	-	++	3
Taiwan	4	1076	-	-
Netherlands	2	335	-	-
Spain	++	96	-	-
Italy	++	62	-	-
China	++	60	-	-
Denmark	++	39	-	-
Other countries	++	10	-	-

Figures rounded off

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

Country	2017-18 (R)		2018-19 (P)	
	Quantity (t)	Value (`'000)	Quantity (t)	Value (`'000)
All Countries	**82**	**11122**	**60**	**10960**
Germany	16	5545	21	8018
Japan	9	875	11	1558
Korea, Rep. of	57	4543	28	1162
USA	++	103	++	188
UK	++	52	++	28
France	++	3	++	6
Belgium	++	1	-	-

Figures rounded off

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

Country	2017-18 (R)		2018-19 (P)	
	Quantity (t)	Value (`'000)	Quantity (t)	Value (`'000)
All Countries	**338**	**39080**	**73**	**10287**
China	226	25016	27	2890
Korea, Rep. of	12	1376	21	2737
USA	50	6400	13	2140
Netherlands	-	-	11	1574
Germany	++	447	1	939
UK	1	403	++	7
Vietnam	30	3273	-	-
Spain	15	1596	-	-
Malaysia	4	524	-	-
Japan	++	45	-	-

Figures rounded off

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 are 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 is likely to maintain an increasing trend. Some of the future gas production is expected to come from unconventional natural gas resources, such as, shale gas and coal-bed methane.

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.

According to TechSci Research report, Global Sulphur Fertilizers Market is projected to reach USD 6.35 billion by 2023 at a CAGR of over 3% owing to the growing need of sulphur fertilizers for higher productivity due to the constantly growing demand for agriculture. Based on the type, the sulphur fertilizers segment is expected to lead the market in the next five years, as the uptake of sulphur in agriculture will definitely remain unabated.