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DIATOMITE

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**GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES**

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10 Diatomite

Diatomite is a chalk-like, soft, friable, very-fine-grained siliceous sedimentary rock that is light in colour (white and yellowish) white if pure, commonly buff to grey in situ. It is composed of fossilised remains of unicellular aquatic algae-like plants called diatoms which are both marine & lacustrine in origin. Diatoms are microscopic, single-celled organisms, often appearing as colonial aquatic plants (algae). Diatom cells contain an elaborate internal siliceous skeleton. More than 10,000 living diatom species have been identified, in addition to another 10,000 known diatom fossil forms. Diatomite deposits are the remains from the cell wall of diatoms, which are composed of amorphous hydrous silica. Diatomite has the ability to absorb soluble silica to form a highly porous skeletal framework. The dead remains of these diatoms over the ages have fossilised and formed the deep-bedded deposits in ocean & lake floors. The special properties of diatomite, i.e., light weight (low in density), high porosity and high absorptivity have facilitated its application as filter medium and absorbents. It is chemically inert & highly stable. Diatomite consists of approximately 90 per cent silica and the remainder consists of compounds, such as, aluminium and iron oxides. It is also called 'Kieselguhr'. Diatomaceous earth is a common alternate name, but the term is more appropriate for unconsolidated or less lithified rock of the same origin.

Another lesser known mineral, namely, siliceous earth has many similarities with diatomite in character. Siliceous earth is, however, an inorganic material which has chemical composition of more than 80% of amorphous silica. This amorphous phase is very rare and used widely in industrial-scale because of its high porosity, fine particle size, very low density and its high surface area. Its chemical and physical features are same as diatomite which is also amorphous silica consisting of fossilised remains of diatoms, a type of hard-shelled algae. Siliceous earth differs from diatomite in its origin and seems to be formed from volcanic ash. However, due to the many similarities in both materials, siliceous earth finds similar uses as diatomites and therefore, has been included in this Review.

RESERVES/RESOURCES

The occurrences of diatomite are reported from Gujarat, Rajasthan, Tamil Nadu, Andhra Pradesh and Camorta & Trincat Islands in Andaman and Nicobar archipelago. As per NMI database, based on UNFC system, the total resources of diatomite as on 1.4.2015 has been estimated at 2.89 million tonnes, all of which fall under Remaining Resources. The resources are distributed in Rajasthan (72%) and Gujarat (28%) (Table - 1).

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

(In '000 tonnes)

Grades/State	Reserves Total (A)	Remaining Resources			Total Resources (A+B)
		Feasibility STD211	Inferred STD333	Total (B)	
All India: Total	–	634	2251	2885	2885
By Grade					
Unclassified	–	634	2251	2885	2885
By States					
Gujarat	–	–	811	811	811
Rajasthan	–	634	1440	2074	2074

Figures rounded off

PRODUCTION

Diatomite

Production of diatomite has not been reported since 1991-92. Pandava and Khadriliya areas in Bhavnagar district, Gujarat were the producing areas prior to 1991-92.

Siliceous Earth

The production of siliceous earth was 77,739 tonnes during 2018-19 as against 86,662 tonne in 2017-18 (Tables - 2 to 4).

There were sixteen reporting mines in the year 2018-19 and fifteen reporting mines in 2017-18.

Mine-head closing stocks of siliceous earth in the year 2018-19 were 86,278 tonnes as against 93,014 tonnes in 2017-18 (Table-5).

The average daily employment of labour in 2018-19 was 112 as against 106 in the previous year.

Table – 2 : Principal Producers of Siliceous Earth 2018-19

Name & address of producer	Location of mine		Name & address of producer	Location of mine	
	State	District		State	District
Babu Lal Mali Vill. Mokhab, Tehsil-Shiv Barmer-344 701, Rajasthan.	Rajasthan	Barmer	M/s Seema Minerals & Metals, 203. A, Mewar Industrial Area, Madri, Udaipur-313 003, Rajasthan.	Rajasthan	Jaisalmer
Balbeer Singh Rathore Jayani, Post-Katholi, Tehsil- Jayal Nagaur- 341 001, Rajasthan	Rajasthan	Jaisalmer	Jai Shri Ram Minerals, C/o Surya Prakash Parmar, Swamiyo ka Vas, Shiv, Barmer – 344 701, Rajasthan.	Rajasthan	Jaisalmer
			Narayan Singh Rathore Chandan Singh ki Dhani, Shiv Barmer -344 001, Rajasthan.	Rajasthan	Barmer

(contd.)

**Table – 3 : Production of Siliceous Earth, 2016-17 to 2018-19
(By States)**

(Qty in tonnes; Value in `'000)

State	2016-17		2017-18		2018-19 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	77270	55340	86662	53164	77739	51897
Rajasthan	77270	55340	86662	53164	77739	51897

**Table – 4 : Production of Siliceous Earth, 2017-18 and 2018-19
(By Sectors/States/Districts)**

(Qty in tonnes; Value in `'000)

State/District	2017-18			2018-19 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	15	86662	53164	16	77739	51897
Private Sector	15	86662	53164	16	77739	51897
Rajasthan	15	86662	53164	16	77739	51897
Barmer	6	23695	17893	6	32817	24951
Jaisalmer	9	62967	35271	10	44922	26946

Table – 5 : Mine-head Closing Stocks of Siliceous Earth during 2017-18 & 2018-19 (By State)

(In tonnes)		
State	2017-18	2018-19 (P)
India/ Rajasthan	93014	86278
Rajasthan	45029	57905

USES

Diatomite is commonly used after calcination in plate and frame filter units. Processed diatomite finds a wide range of applications due to its properties like porosity, low bulk density, soluble impurities, high absorptive capacity for liquids, large surface area, low thermal conductivity, mild abrasive nature and chemical inertness.

Diatomite is an excellent filtering material for many liquids especially beverages, fruit juices, soft drinks, beer and wine. It is used in chemicals like sodium hydroxide, sulphuric acid and gold salts. Filtration of cooking oils (vegetable and animal) and sugar (cane, beet and corn) is an application where diatomite is predominantly used. It is also used as an absorbent of vegetable oil, polyethylene, rayon liquors and as a flattening agent in paint, plastic, rubber, drugs, toothpaste, polishes and chemicals. Diatomite is utilised for safe handling and storage of hazardous chemicals like sulphuric acid. Besides, diatomite is also used as an abrasive in metal polishing in automobiles and toothpastes; as pozzolanic admixtures in Cement Industry; as animal feed stuff conditioners; and in explosives. It is also used as a coating material in the manufacture of ammonium nitrate fertilizer which is hygroscopic. Diatomite clay is the new revolution in hydroponics. In pharmaceuticals, it is used to filter syrups and other bulk drugs in liquid form. It is used as a facial exfoliator to promote skin health. Research has also shown that food-grade diatomaceous earth may offer positive benefits for controlling cholesterol levels which in turn would improve heart health. The cleaning of grease and oils continued to be the largest end use for diatomite. In Oil Industry, before packing, it is used for filtering oil which not only gives it a shine but also helps in removing any suspended impurity. Wine and beer are filtered through diatomite filters before packing to remove molasses. Filter candles are made from diatomite filter

aids for drinking water purification. Processed diatomite granules 15 to 50 mm, are used in denim wash (commonly known as stonewash) to give it shine and design.

Diatomite is also used as caking agent in fertilizers, plastics and as a natural insecticide for organic pest control. Potable water treatment and biological filtration are areas of expansion in diatomite consumption. Siliceous earth is mainly used as filler & filter, heat & sound resistant material and in Ceramic Industry. Filtration and cleaning of vegetable oils and animal fats and manufacturing of medicines are other uses. In advance applications, it is used as carrier for catalyst in chemical processes and for mineral fertilizers & herbicides, pesticides and fungicides. It is also used as raw material for refination and filtration as well as constituent of synthetic molding mass. It is increasingly used for the removal of microbial contaminants, such as, bacteria, protozoa and viruses, from public water systems. Recently, diatomite derived products included filter aids (50 per cent), filters (15 per cent), absorbents (5 per cent), and other minor uses, including specialised pharmaceutical and bio medical applications (less than 1 per cent).

Siliceous earth, on the other hand is used in powder form which may vary from 80 mesh to 500 mesh powder. It is also used in granule form in some specific operations and in paint, filler, rubber, catalyst, fertilizer, pesticides, agriculture and many other industries.

Diatomite is increasingly used in agriculture segment in fungicides, insecticides and rodenticide owing to its dehydration properties. Other diatomite applications include its use as a growing medium in hydroponic gardens wherein its characteristics, such as, inertness, water holding capability and porosity allows the soil to breathe.

PROCESSING

Diatomite deposits are usually mined as open pit operations. If necessary, the mined crud is dried and crushed. Dried diatomite is collected in cyclones and fed through air separators to remove coarse material and impurities. Calcination and flux calcination are used to thermally volatilise organic material and oxidise iron. Calcination is also used to increase diatomic hardness, specific gravity and refractive index. The fusing of small diatomite

particles into clusters can also be accomplished through calcination, which results in increased pore size and volume. Diatomite products are sold as various grades of calcined powders.

INDUSTRY

M/s. Seema Minerals & Metals, Udaipur, Rajasthan produces various grades of diatomaceous earth of which some grades are as follows:

- Diatomaceous Earth for insulation in Fire Proof Cabinets and safes.
- Diatomaceous Earth for calcium silicate boards.
- Diatomaceous Earth for water purification.
- Diatomaceous Earth for Animals Feed.
- Diatomaceous Earth for agriculture crops.
- Diatomaceous Earth for filtration.
- Calcined Diatomaceous Earth.
- Diatomaceous Earth Oil absorbents.
- Diatomaceous Earth for insecticides.

SUBSTITUTION

Many materials can be substituted for diatomite. However, the unique properties of diatomite assure its continued use in many applications. Expanded perlite and silica sand compete for filtration. Filters made from manufactured materials, notably ceramic, polymeric, or carbon membrane filters and filters made with cellulose fibers are becoming competitive as filter media. Alternate filler materials include clay, ground limestone, ground mica, ground silica sand, perlite, talc, and vermiculite. For thermal insulation, materials such as various clays, exfoliated vermiculite, expanded perlite, mineral wool, and special brick can be used. Transportation costs will continue to determine the maximum economic distance that most forms of diatomite may be shipped and still remain competitive with alternative materials. Many alternatives exist for diatomite as a pozzolan, but its use as an ingredient of portland cement has increased in recent years. The encroachment of natural and synthetic substitute materials into diatomite markets has not been significant.

TRADE POLICY

As per the Foreign Trade Policy, 2015-2020, the imports and the exports of siliceous fossil meals (kieselguhr, tripolite, diatomite) and similar siliceous earth, whether or not calcined under ITC (HS) Code 251200 (25121010, 25120020, 25120030 and 25120090) are free.

WORLD REVIEW

World resources of crude diatomite are adequate for the foreseeable future. The USA has the largest reserves at 250 million tonnes followed by China with 110 million tonnes and Turkey with 44 million tonnes. World's largest producing district in terms of volume is near Lompoc, CA in USA (Table- 6).

The world diatomite production decreased marginally by 8% to 2.27 million tonnes in 2018 from 2.46 million tonnes in the preceding year. The USA dominated the world production by accounting for 35% output which was followed by China (19%), Turkey (7%), Denmark, Japan, Peru, Mexico & France (4% each) and Argentina (3%). Production in Denmark was mostly of molar, an impure diatomite containing a large proportion of clay (Table- 7).

Table – 6: World Reserves of Diatomite (By Principal Countries)

(In '000 tonnes)	
Country	Reserves
World: Total	Large
USA ⁽¹⁾	250000
China	110000
Turkey	44000
Argentina	NA
Denmark ⁽⁵⁾ (processed)	NA
France	NA
Germany	NA
Japan	NA
Mexico	NA
Peru	NA
Russia	NA
Spain	NA
Other countries	NA

Source: USGS Mineral Commodity Summaries, 2020.

(1) Processed ore sold or used by producers.

(5) Includes sales of molar production.

**Table – 7: World Production of Diatomite
(By Principal Countries)**

(In tonnes)			
Country	2016	2017	2018
World: Total	2225000	2459000	2270000
USA ^(c)	686000	768000	790000*
China	420000*	420000*	420000*
Turkey	61722	169584	170000*
Japan	100000*	100000*	100000*
Denmark (Molar) ^(d)	114375	176422	99000
Peru	107265	96590	96547
Mexico	96686	96374	92700
France	90000*	90000*	90000*
Argentina	200000	57000	60000*
Germany	54764	56721	58340
Spain ^(b)	48231	70550	51536
Russia	47300	52000	50600
Other countries	198424	306044	191173

Source: BGS World Mineral Production, 2014-2018.

*Estimate

(b) Including the mineral Tripoli,

(c) Sold or used by producers

(d) Molar is an impure diatomite containing a large proportion of clay

**Table – 8: Exports of Diatomite
(By Countries)**

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	52236	456665	27893	273001
Saudi Arabia	49854	406022	25470	225166
Taiwan	1818	20949	1896	24730
France	21	2123	51	5871
USA	43	14614	39	3878
Tanzania	8	1247	36	2557
Sri Lanka	58	1850	129	2226
Philippines	-	-	30	1527
Nepal	5	365	32	1430
Oman	36	1124	27	941
Ecuador	182	2986	52	887
Other countries	211	5385	131	3788

Figures rounded off

FOREIGN TRADE

Exports

Exports of diatomite decreased substantially by 47% to 27,893 tonnes in 2018-19 from 52,326 tonnes in the previous year. Exports were mainly to Saudi Arabia (91%) and Taiwan (7%) (Table-8).

Exports of kieselguhr decreased drastically by 51% to 61 tonnes in 2018-19 from 124 tonnes in the previous year. Exports were mainly to China (57%) and Switzerland (43%). There were no exports of tripoli earth in both the years, i.e., 2017-18 and 2018-19 (Table-9).

Imports

Imports of diatomite increased drastically by 50 % to 3,647 tonnes in 2018-19 from 2,426 tonnes in the previous year. Imports were mainly from Mexico (49%), China (31%) and USA (16%) (Table-10).

Imports of kieselguhr were 42 tonnes in 2018-19 as compare to negligible in the previous year. Imports of kieselguhr were mainly from Spain (50%) and USA (45%) (Table-11).

Imports of tripoli earth were 8 tonnes in 2018-19 as against negligible in the previous year (Table-12).

**Table – 9: Exports of Kieselguhr
(By Countries)**

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	124	2577	61	1341
Switzerland	52	1377	26	746
China	70	1025	35	576
Ethiopia	-	-	++	17
Korea, Rep. of	++	2	++	2
South Africa	++	1	++	++
Bhutan	2	170	-	-
USA	++	2	-	-
Nepal	++	++	-	-

Figures rounded off

**Table – 10 : Imports of Diatomite
(By Countries)**

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	2426	88318	3647	139462
Mexico	332	11083	1781	59579
China	1261	36030	1145	39907
USA	815	38355	596	28316
Spain	18	2823	30	4673
Korea, Rep. of	-	-	71	4444
Germany	++	8	21	2060
France	++	19	2	319
Thailand	-	-	1	162
Denmark	-	-	++	2

Figures rounded off

**Table –12: Imports of Tripoli Earth
(By Countries)**

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	++	8	8	238
UK	-	-	8	238
Germany	++	4	-	-
USA	++	4	-	-

Figures rounded off

FUTURE OUTLOOK

Diatomite market is expected to witness substantial growth owing to increasing use in industrial applications including filter aid and filler material. Natural filtering characteristics due to its unique honeycomb structure and its rising use in filtration application as well as food and beverage market are key drivers for the growth of diatomite market.

Filtration market is the largest consumer of diatomite owing to high levels of purifying capabilities. In addition, growing use of diatomite in industries, such as, paints, plastics, insecticides, pharmaceuticals, chemicals, adhesives, sealants, paper etc. is expected to propel market growth over the forecast period. In addition, its use in Plastic Industry as an anti-blocking agent assists in separation of plastic parts during manufacturing and separation of plastic bags. Growing health and safety concerns associated with inhalation

**Table - 11: Imports of Kieseluhr
(By Countries)**

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	++	98	42	3994
Spain	-	-	21	2750
USA	++	13	19	820
Switzerland	-	-	2	275
UK	++	58	++	119
Germany	++	18	++	16
Belgium	-	-	++	14
China	++	9	-	-

Figures rounded off

of crystalline silica during diatomite processing is expected to affect market growth over the forecast period.

North America accounted for largest market share in terms of demand owing to large amount of diatomite reserves available in the region. In addition, increasing demand from various industrial applications including water treatment, absorbents and crop protection chemicals is expected to augment market growth over the forecast period. The United States had the highest demand for diatomite in North America owing to growing demand in manufacturing crop protection and water treatment chemicals. Asia Pacific accounted for second largest market share owing to increasing demand from crop protection chemicals and industrial applications particularly in China. Furthermore, demand from countries including India, Korea, Japan and Australia is expected to provide better opportunity for diatomite market over the forecast period. Europe contributed a significant share for diatomite owing to increasing demand from crop protection and water treatment particularly in Spain, Germany and United Kingdom. Middle East is expected to witness significant growth owing to increasing use of diatomite in various stages of oil & gas exploration.

The economic stability of diatomite was largely on account of its use as a viable filtration medium. Despite challenging market condition for many industrial commodities, world diatomite production remained stable. The demand for diatomite as filtration medium still remains strong particularly in the filtration of spirit as well as human blood plasma and in other biotechnical applications.