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DIATOMITE

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GOVERNMENT OF INDIA
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10 Diatomite

Diatomite is a siliceous sedimentary rock that is white and yellowish in colour. It is composed of fossilised remains of unicellular aquatic algae-like plants called diatoms which are both marine & lacustrine in origin. 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, high porosity & high absorptivity have facilitated its application as filter medium and absorbents. It is chemically inert & highly stable. The diatomite consists of approximately 90 percent silica and the remainder consists of compounds, such as, aluminium and iron oxides. It is also called 'Kieselguhr'.

Siliceous earth is 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 diatomites which is also amorphous silica consists of fossilised remains of diatoms, a type of hard-shelled algae. Siliceous earth differs from diatoms in its origin and seems to be formed from volcanic ash. Due to these similarities in both materials, siliceous earth finds similar uses as diatomites and 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 have 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

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

Siliceous Earth

The production of Siliceous earth was 59 thousand tonnes during 2017-18 as against 77 thousand tonnes in 2016-17.

There were twelve reporting mines in the year 2017-18 as compared to sixteen mines in the preceding year. The production of siliceous earth was reported only from State of Rajasthan during the year.

Mine-head closing stocks of siliceous earth in the year 2017-18 were 91,327 tonnes as compared to 72,980 tonnes in the previous year (Tables-2 to 5).

The average daily employment of labour in 2017-18 was 83 as against 92 in the previous year.

Table – 2 : Principal Producers of Siliceous Earth

Name & address of producer	Location of mine	
	State	District
J.B. Mines & Chemicals, Indewar,Tehsil-Merta Nagaur-341 510, Rajasthan.	Rajasthan	Jaisalmer
Bhom Singh Rathore, 297, Hanwant-ABJS Colony, Jodhpur-342 001, Rajasthan.	Rajasthan	Barmer
Jai Shri Ram Minerals, C/o Surya Prakash Parmar, Swamiyo ka Vas Shiv, Barmer – 344 701, Rajasthan.	Rajasthan	Jaisalmer
Ashok Kumar Khatri, Inko ki Pol, Pokaran, Jaisalmer -345 021, Rajasthan.	Rajasthan	Jaisalmer
M/s Seema Minerals & Metals, 203. A, Mewar Industrial Area, Madri, Udaipur-313 003, Rajasthan.	Rajasthan	Jaisalmer

(contd.)

Table – 3 : Production of Siliceous Earth, 2015-16 to 2017-18 (By States)

(Qty in tonnes; Value in `'000)

State	2015-16		2016-17		2017-18 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**47386**	**20735**	**77270**	**55340**	**58875**	**57457**
Rajasthan	47386	20735	77270	55340	58875	57457

Table – 4 : Production of Siliceous Earth, 2016-17 and 2017-18 (By Sectors/States/Districts)

(Qty in tonnes; Value in `'000)

State/District	2016-17			2017-18 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**16**	**77270**	**20735**	**12**	**58875**	**57457**
Private Sector	16	77270	20735	12	58875	57457
Rajasthan	**16**	**77270**	**20735**	**12**	**58875**	**57457**
Barmer	7	28951	10286	4	9440	6772
Jaisalmer	9	48319	10449	8	49435	50685

Table – 5 : Mine-head Closing Stocks of Siliceous Earth during 2016-17 & 2017-18 (By States)

(In tonnes)

State	2016-17	2017-18 (P)
India/ Rajasthan	72980	91327

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. 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 is 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 and filter, heat and 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 and herbicides, pesticides and fungicides. It is also used as raw material for refination and filtration as well as constituent of synthetic molding mass. Siliceous earth 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.

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.

TRADE POLICY

As per the Foreign Trade Policy 2015-2020, imports are permitted free and no policy restrictions on the exports of siliceous fossil meals (kieselguhr, tripolite, diatomite) and similar siliceous earth, whether or not calcined under HS code 251200 (25121010, 25120020, 25120030 and 25120090).

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 total world diatomite production increased by 11% to 2.47 million tonnes in 2017 from 2.21 million tonnes in the preceding year. The USA dominated the world production by accounting for 28% output which was followed by China (17%), Argentina (8%), Turkey (7%), Denmark, Japan, Peru, Mexico & France (4% each) and Russia (2%). 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 (rounded)	**Large**
Argentina	NA
China	110000
Denmark (processed)	NA
France	NA
Japan	NA
Germany	NA
Mexico	NA
Peru	NA
South Africa	NA
Spain	NA
Turkey	44000
USA	250000
Other countries	NA

Source: *Mineral Commodity Summaries, 2019.*

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

(In '000 tonnes)

Country	2015	2016	2017
World : Total	**2390**	**2217**	**2469**
Argentina[e]	200	200	200
China[e]	420	420	420
Denmark (Molar)[*]	127	114	110
France[e]	90	90	90
Japan[e]	100	100	100
Mexico	90	97	96
Peru	121	107	97
Russia	66	47	47[e]
Turkey	87	62	170
USA**	832	686	700[e]
Other countries	257	294	439

Figures rounded off.

Source: *World Mineral Production, 2013-2017.*

[*] *Molar is an impure diatomite containing a large proportion of clay.*

** *: Sold or used by producers.*

FOREIGN TRADE

Exports

Exports of diatomite increased substantially by 36% to 52,236 tonnes in 2017-18 from 38,427 tonnes in the previous year. Exports were mainly to Saudi Arabia (95%) and Chinese Taipei/Taiwan (3%) (Table-8).

Exports of kieselguhr increased drastically by three fold to 124 tonnes in 2017-18 from 39 tonnes in the previous year. Exports were mainly to China (56%) and Switzerland (42%). There were no exports of tripoli earth in both the years, i.e. 2016-17 and 2017-18 (Table-9).

Imports

Imports of diatomite decreased to 2,426 tonnes in 2017-18 from 3,142 tonnes in the previous year. Imports were mainly from China (52%) which was followed by USA (34%) and Mexico (14%) (Table-10).

Imports of kieselguhr were negligible in 2017-18 as well as in the previous year. Imports of kieselguhr were mainly from UK, Germany and USA (Table-11).

Imports of tripoli earth were negligible in the year 2017-18 as against 19 tonnes in the previous year (Table-12).

Table – 8: Exports of Diatomite
(By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (``'000)	Qty (t)	Value (``'000)
All Countries	**38427**	**362900**	**52236**	**456663**
Saudi Arabia	36075	320144	49854	406022
Chinese Taipei/ Taiwan	1587	19153	1818	20949
USA	19	10798	43	14614
Ecuador	208	3558	182	2986
France	41	1846	21	2123
Sri Lanka	16	264	58	1850
UK	59	1244	94	1756
Malaysia	20	734	38	1365
Tanzania	-	-	8	1247
Oman	19	672	36	1124
Other countries	383	4487	84	2627

Table – 9: Exports of Kieselguhr
(By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (``'000)	Qty (t)	Value (``'000)
All Countries	**39**	**931**	**124**	**2577**
Switzerland	-	-	52	1377
China	35	540	70	1025
Bhutan	-	-	2	170
USA	-	-	++	2
Vietnam	++	2	++	2
South Africa	-	-	++	1
Sri Lanka	++	2	-	-
Bangladesh	3	322	-	-
Israel	1	65	-	-

Table – 10 : Imports of Diatomite
(By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (``'000)	Qty (t)	Value (``'000)
All Countries	**3142**	**113035**	**2426**	**88318**
USA	677	34443	815	38355
China	1160	33323	1261	36030
Mexico	1213	41502	332	11083
Spain	72	3077	18	2823
France	++	10	++	19
Germany	++	9	++	8
Japan	++	31	-	-
Australia	20	640	-	-

Table – 11: Imports of Kieselguhr
(By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (``'000)	Qty (t)	Value (``'000)
All Countries	**++**	**139**	**++**	**98**
UK	++	73	++	58
Germany	-	-	++	18
USA	++	51	++	13
China	++	15	++	9

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

Country	2016-17		2017-18	
	Qty (t)	Value (``'000)	Qty (t)	Value (``'000)
All Countries	**19**	**817**	**++**	**8**
Germany	-	-	++	4
USA	19	817	++	4

INDUSTRY & PRODUCTION

M/s. Seema Minerals & Metals, Udaipur, Rajasthan manufacture various grades of Diatomaceous Earth in 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.

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 market drivers for the growth of diatomite market. Physical and chemical characteristics of diatomite including high surface area, abrasiveness and high silica content promote its use in various applications including filtration, functional additives, absorbents and pharmaceuticals which is expected to drive market growth over the forecast period.

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 is expected to propel market growth over the forecast period. Filtration industry accounts for largest market share among diatomite application owing to widespread use as a filter media. Superior filtration properties of diatomite promote use in water treatment, beer and wine making, motor oil processing and pharmaceutical manufacturing. As functional additives, diatomite is used in paint industry where it is added as a whitening agent and extender. 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. Absorbent application include use of diatomite in clean up of spills in automotive, industrial and waste remediation industries owing to its characteristics such as porosity and high surface area. Growing use of diatomite as mild abrasives in toothpastes, facial scrub and metal polishes is on a rise owing to characteristics such as small sized silica particles, high surface area, angular in shape and friable. Cosmetics application of diatomite includes its use in cosmetic powder such as talc to absorb the oils. Pharmaceutical application of diatomite includes its use as an absorbent with adsorbent properties which is used to regulate the release of cationic drugs. 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. Preserving and protecting the available diatomite reserve is expected to be a major restraint owing to factors including microbial degradation and degradation due to abrasion. Microbial degradation involves certain bacteria species which can accelerate the rate of dissolution of silica in dead and living diatoms thereby degrading the available diatomite reserves. Degradation of diatomite reserves by abrasion involves depletion of reserves due to various natural phenomenon including, sand storms and floods. Growing health and safety concerns associated with inhalation 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. 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 are expected to provide better opportunity for diatomite market over the forecast period. Europe contributed for 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. In addition, use of diatomite in water treatment is on a rise owing to its superior filtration properties.

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.

The large world reserves and near stability in demand are certain to keep the viability of diatomite steady in the foreseeable future, especially in the filler and absorbent markets.