

DIATOMITE



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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 diatomites 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 the 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.

DIATOMITE

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 13,900 tonnes during 2019-20 as against 80,237 tonnes in 2018-19 (Tables- 2 to 4).

There were fourteen reporting mines in the year 2019-20 as against sixteen reporting mines in 2018-19.

Mine-head closing stocks of siliceous earth in the year 2019-20 were 67,941 tonnes as against 86,493 tonnes in 2018-19 (Table-5).

The average daily employment of labour in 2019-20 was 67 as against 133 in the previous year.

Table – 2 : Principal Producers of Siliceous Earth 2019-20

Name & address of producer	Location of mine		Name & address of producer	Location of mine	
	State	District		State	District
Narayan Singh, Chandan Singh ki Dhani, Vill. Mokhab, Tehsil-Shiv Barmer -344 701, Rajasthan.	Rajasthan	Barmer	Babu Lal Mali Vill. Mokhab, Tehsil-Shiv Barmer-344 701, Rajasthan.	Rajasthan	Barmer
Jaipur Magmatics Private Ltd Ground Floor, Nandanam-II, A-2, Tilak Marg, Jaipur- 341 001, Rajasthan	Rajasthan	Barmer	Ashok Kumar Khatri, Village-Sajit, P.O. Fathegarh, Jaisalmer-345 021, Rajasthan.	Rajasthan	Jaisalmer
			Ram Swaroop Meghawal, Village-Sajit, P.O. Fathegarh, Jaisalmer- 345 027, Rajasthan.	Rajasthan	Jaisalmer

(contd)

**Table – 3 : Production of Siliceous Earth, 2017-18 to 2019-20
(By States)**

(Qty in tonnes; Value in ₹'000)

State	2017-18		2018-19		2019-20 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	86662	53164	80237	50205	13900	10235
Rajasthan	86662	53164	80237	50205	13900	10235

**Table – 4 : Production of Siliceous Earth, 2018-19 and 2019-20
(By Sectors/States/Districts)**

(Qty in tonnes; Value in ₹'000)

State/District	2018-19			2019-20 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	16	80237	50205	14	13900	10235
Private Sector	16	80237	50205	14	13900	10235
Rajasthan	16	80237	50205	14	13900	10235
Barmer	6	32817	25158	6	9810	7719
Jaisalmer	10	47420	25047	8	4090	2516

DIATOMITE

Table – 5 : Mine-head Closing Stocks of Siliceous Earth during 2018-19 & 2019-20 (By States)

(In tonnes)

State	2018-19	2019-20 (P)
India	86493	67941
Rajasthan	86493	67941

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 biomedical 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 crude 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 volatise 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 Animal 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. Diatomite still remain competitive despite availability of alternative materials. Many alternatives exist for diatomite as a pozzolan, however, its use as an ingredient of portland cement has not diminished but on the contrary 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 reserves/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 increased marginally by 4% to 2.60 million tonnes in 2019 from 2.50 million tonnes in the preceding year. The USA dominated the world production by accounting for 38% output which was followed by China (16%), Turkey (9%), Denmark, Peru & Mexico (4% each) and France & Argentina (3% each). 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
Argentina	NA
China	110,000
Denmark ⁽⁵⁾ (processed)	NA
France	NA
Germany	NA
Japan	NA
Korea, Rep. of	NA
Mexico	NA
New Zealand	NA
Peru	NA
Russia	NA
Spain	NA
Turkey	44,000
United States ¹	250,000
Other countries	NA

Source: USGS, Mineral Commodity Summaries, 2021

NA - Not available

¹ Processed ore sold or used by producers.

⁵ Include sales of molar production.

DIATOMITE

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

(In tonnes)			
Country	2017	2018	2019
World: Total	2400000	2500000	2600000
USA ^(c)	768000	957000	980000
China ^(e)	420000	420000	420000
Turkey	169584	242789	243000 ^(e)
Denmark (Molar) ^(d)	110000	99375	108750
Peru	96590	96532	91103
Mexico	96374	92700	92635
France ^(e)	90000	90000	90000
Argentina	70419	72436	72400 ^(e)
Mozambique	179	66429	66000 ^(e)
Other countries	574246	386929	356218

Source: BGS, World Mineral Production, 2015-2019.

(b) Including the mineral Tripoli,

(c) Sold or used by producers

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

FOREIGN TRADE

Exports

Exports of diatomite decreased substantially by 85% to 4,303 tonnes in 2019-20 from 27,893 tonnes in the previous year. Exports were mainly to Taiwan (44%), Saudi Arabia (37%), Ecuador (6%), UAE (3%) and Sri Lanka (2%) (Table-8).

On the other hand exports of kieselguhr increased drastically by 84% to 114 tonnes in 2019-20 from 62 tonnes in the previous year. Exports were mainly to Switzerland (45%), China (31%) and UAE (24%) (Table-9).

Imports

Unlike exports, imports of diatomite increased substantially by 36 % to 4,950 tonnes in 2019-20 from 3,648 tonnes in the previous year. Imports were mainly from Australia (47%), USA & China (19% each) and Mexico (14%) (Table-10).

Imports of kieselguhr were at 66 tonnes in 2019-20 which increased substantially by 57% as compared to 42 tonnes in preceding year. Imports of kieselguhr were mainly from Netherlands (84%) and Spain (16%) (Table-11).

Imports of tripoli earth at 19 tonnes in 2019-20 registered an increase of more than two fold from 8 tonnes in the previous year. Imports were mainly from USA (Table-12).

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	27893	273001	4303	72841
Taiwan	1896	24730	1896	25170
Saudi Arabia	25470	225166	1612	16939
USA	39	3878	15	8323
Ecuador	52	887	260	4415
Tanzania	36	2557	67	4277
France	51	5871	33	3679
UAE	6	201	130	2912
Sri Lanka	129	2226	96	1691
China	14	259	50	942
Malaysia	18	704	17	689
Other countries	182	6521	127	3803

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	62	1341	114	2399
Switzerland	26	746	51	1500
China	35	576	35	599
UAE	-	-	27	203
Tanzania	-	-	++	78
Germany	-	-	++	13
Philippines	-	-	++	2
Botswana	-	-	++	2
Qatar	-	-	++	1
Nepal	-	-	++	1
Denmark	-	-	++	++
Other countries	1	19	-	-

Figures rounded off

DIATOMITE

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	3648	139463	4950	152228
Australia	-	-	2312	49902
USA	596	28316	916	42157
China	1145	39907	958	31536
Mexico	1781	59579	703	24463
Spain	30	4673	15	3650
Turkey	-	-	46	398
Thailand	1	162	1	82
Germany	21	2060	++	21
France	2	319	++	20
Korea, Rep. of	71	4444	-	-
Other countries	++	2	-	-

*Figures rounded off***Table – 11: Imports of Kieselguhr
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	42	3995	66	9246
Netherlands	-	-	56	7368
Spain	21	2750	11	1390
Germany	++	16	++	337
UK	++	119	++	68
USA	19	820	++	59
Belgium	++	14	++	25
Switzerland	2	275	-	-

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	8	238	19	1115
USA	-	-	19	1088
Germany	-	-	++	28
UK	8	238	-	-

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 of crystalline silica during diatomite processing is expected to affect market growth.

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. 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.

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.