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DIATOMITE

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GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

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15 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 reserves/resources of diatomite as on 1.4.2015 have been estimated at 2.89 million tonnes, all of which fall under remaining resources. The reserves/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 in Bhavnagar district, Gujarat were the producing areas prior to 1991-92. As per DMG, Rajasthan, production of siliceous earth was reported at 28,000 tonnes during 2015-16 as against 1,32,000 tonnes in the previous year. Rajasthan is the sole producer of siliceous earth.

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 in agriculture as well 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 are used as substitutes for diatomite. However, the unique properties of diatomite assure its continuance in many applications. Expanded perlite and silica sand are considered as viable substitutes of diatomite for filtration purposes. Other filtration technologies use ceramic, polymeric or carbon membrane. Alternate filler materials include talc, ground silica sand, ground mica, clay, perlite, vermiculite and ground limestone. For thermal insulation materials, such as, various clays & special brick, mineral wool, expanded perlite and exfoliated vermiculite can be used.

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- 2).

The total world diatomite production decreased by about 7% to 2.37 million tonnes in 2015 from 2.55 million tonnes in the previous year. The USA dominated the world production by accounting for 35% output which was followed by China (18%), Argentina (8%), Denmark & Peru (5% each), Japan, France, Mexico & Turkey (4% each) and Russia & Spain (3% each).

Production in Denmark was mostly of molar, an impure diatomite containing a large proportion of clay (Table- 3).

Table – 2: World Reserves of Diatomite (By Principal Countries)

(In '000 tonnes)

Country	Reserves
World: Total (rounded off)	**Large**
Argentina	NA
China	110000
Denmark (processed)	NA
France	NA
Japan	NA
Mexico	NA
Peru	NA
Russia	NA
Spain	NA
Turkey	44000
USA	250000
Other countries	NA

Source: *Mineral Commodity Summaries, 2017.*

Table – 3: World Production of Diatomite (By Principal Countries)

(In '000 tonnes)

Country	2013	2014	2015
World : Total	**2373**	**2546**	**2374**
USA	782	901	832
China[e]	420	420	420
Argentina	209	200[e]	200[e]
Denmark (Molar)*	128	119	127
Peru	125	151	121
Japan[e]	90	90	100
Francee	85	90	90
Mexico	87	88	88
Turkey	85	62	87
Russia	70[e]	72	70[e]
Spain[@]	54	60	62
Other countries	238	293	177

Source: *World Mineral Production, 2011-2015.*

*** Molar is an impure diatomite containing a large proportion of clay; @ Including Tripoli.*

FOREIGN TRADE

Although there is no reported production of diatomite in India, the country did export diatomite to a tune of 30,597 tonnes in 2015-16 as against 87,845 tonnes in the previous year. Exports were mainly to Saudi Arabia (94%) and Chinese Taipei/ Taiwan (5%) (Table-4).

Exports of kieselguhr decreased drastically to 90 tonnes in 2015-16 from 137 tonnes in the previous year. Exports were mainly to China (39%), France (29%), Netherlands (18%) and Algeria (11%). There were no exports of tripoli earth in both the years, i.e. 2014-15 and 2015-16. Export of other similar siliceous earth was 9,985 tonnes in 2015-16 as against 7,791 tonnes in 2014-15 (Table-5).

Imports of diatomite decreased slightly to 2,023 tonnes in 2015-16 from 2,122 tonnes in the previous year. Imports were mainly from USA (54%) which was followed by China (30%) and Mexico (15%) (Table-6).

Import of kieselguhr is negligible in 2015-16 as against 20 tonnes in the previous year. Imports of kieselguhr were mainly from UK and China (Table-7).

Imports of tripoli earth were 20 tonnes in 2015-16 as against nil in the previous year. Imports of other similar siliceous earth were 561 tonnes in 2015-16 as against 1,676 tonnes in 2014-15 (Table-8).

Table – 4: Exports of Diatomite (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**87845**	**778088**	**30597**	**328270**
Saudi Arabia	86354	756656	28891	300724
Chinese Taipei/ Taiwan	707	7804	1382	16374
Sri Lanka	34	2164	60	2185
France	3	463	15	1873
USA	-	-	3	1771
Malaysia	70	2006	37	1411
Oman	45	1220	45	1380
UK	26	404	52	775
Ghana	-	-	30	490
Congo, Peop. Rep.	-	-	32	414
Other countries	606	7371	50	873

Table – 5: Exports of Kieselguhr (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**137**	**2494**	**90**	**1901**
France	-	-	26	713
China	70	928	35	514
Netherlands	-	-	16	278
Algeria	-	-	10	162
Nepal	++	24	1	119
Bangladesh	-	-	2	107
Germany	-	-	++	4
Uganda	-	-	++	2
UAE	-	-	++	1
Switzerland	51	1264	-	-
Other countries	16	278	++	1

Table – 6: Imports of Diatomite (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**2122**	**87085**	**2023**	**87085**
USA	1388	56131	1101	52754
China	100	2731	609	19873
Mexico	545	19642	300	13063
Japan	1	75	6	836
Australia	20	486	6	166
Spain	25	5426	1	327
Germany	20	789	++	66
France	3	1092	-	-
Other countries	20	713	-	-

Table – 7: Imports of Kieselguhr (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**20**	**803**	**++**	**73**
UK	-	-	++	67
China	-	-	++	6
Netherlands	20	803	-	-
Other countries	-	-	-	-

Table – 8: Imports of Tripoli Earth (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**-**	**-**	**20**	**825**
USA	-	-	20	825
Other countries	-	-	-	-

FUTURE OUTLOOK

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.