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(Part- III : Mineral Reviews)

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PERLITE

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GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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21 Perlite

Perlite is hydrated, amorphous, siliceous volcanic glass of rhyolitic composition with perlitic texture and pearly lustre. The perlitic texture is often a visible onion peel-like concentric cracking, caused by expansion of the glass upon hydration. It expands in the form of tiny spheres when heated. Colour of crude perlite is light grey to glossy black, whereas the colour of expanded perlite ranges from snowy white to greyish white. It can expand up to 20 times of its original volume at a temperature between 850 °C and 1150 °C. This expansion is due to the presence of 2 to 5% combined water in crude perlite which when heated vaporises to form countless tiny bubbles. Expanded perlite is a white, light weight and durable material that resists decay. Expanded perlite is not only amazingly light weight, but also has exceptional physical properties. Unexpanded (raw) perlite has a bulk density around 1,100 kg/m^3 (1.1 g/cm^3), while typical expanded perlite has a bulk density of about 30–150 kg/m^3.

Perlite is used in industry in both the forms-Crude Perlite and Expanded Perlite. Most perlite is expanded to produce ultra light perlite by heating. Crude perlite is prepared by crushing and screening to various size fractions.

RESERVES/RESOURCES

The only deposit of perlite is located in the Village Patanvav, Rajkot district, Gujarat. It is found to occur in Osam Hill in the form of discontinuous sill. Depending upon the colour, luster and expansion values, the grade of perlite is classified as high, medium and low grade. (i) Perlite which is jet black in colour with glassy luster with expansion values more than 15 to 20 times, is termed as High Grade; (ii) Perlite having black colour, dull luster with mixture of rhyolitic material is termed as Medium Grade; and (iii) Perlite which is black in colour with vitrified, greyish patches and mixture of rhyolitic material is termed as Low Grade.

The total resources of perlite as per NMI database, based on UNFC system as on 1.4.2015 has been estimated at 2.41 million tonnes, out of which 12% are High-Grade, 12% Medium-Grade, 6% Low-Grade and the remaining 70% fall under Unclassified category. The entire resources of perlite are placed under Remaining Resources category (Table -1).

Typical Analysis of Crude Perlite (in percentage)	
SiO_2	72–76
Al_2O_3	11–17
K_2O	4–5
Na_2O	2.9–4.0
CaO	0.5–2.0
Fe_2O_3	0.5–1.5
MgO	0.1–0.5
TiO_2	0.03–0.20
H_2O	2–3

Table - 1: Reserves/Resources as on 1.4.2015 of Perlite (By Grades/State)

(In '000 tonnes)

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Grade/State	Reserves	Remaining Resources					
	Total (A)	Feasibility	Pre-feasibility		Reconnaissance	Total (B)	Total Resources
		STD211	STD221	STD222	STD334		(A+B)
All India: Total	**-**	**140**	**683**	**595**	**988**	**2406**	**2406**
By Grades							
High	-	19	-	264	-	283	283
Medium	-	79	-	221	-	300	300
Low	-	42	-	110	-	152	152
Unclassified	-	-	683	-	988	1671	1671
By State							
Gujarat	-	140	683	595	988	2406	2406

Figures rounded off.

PRODUCTION AND STOCKS

No production of perlite was reported since 2007-08 and also no stocks were reported during the year 2019-20. However, as per Bulletin of Mining Leases & Prospecting Licences, 2019, one lease having 144.88 Ha area was granted in Rajkot district, Gujarat.

USES

There are different uses of perlite in both crude and expanded form. There are many applications of perlite, such as, producing paint, ceramics, foundry sand, drilling muds, filters, abrasives, matrices for hydroponic plant culturing, for garment washing and loose filling material in insulation and packaging. Usability is mainly controlled by the swelling capacity, which is measured by comparing the bulk density of raw and swelled material. Perlite uses can be grouped under three general categories– construction, horticultural and industrial applications.

Construction Applications

In the construction and manufacturing fields, expanded perlite, on account of its acoustic properties, being light weight, fire resistant and an excellent insulator is used in light weight plasters and mortars, insulation, ceiling tiles and as filter aids.

In addition to providing thermal insulation, perlite enhances fire resistance, reduces noise transmission and is resistant to rot, vermin and termites. Perlite is also ideal for insulation against low temperature. When perlite is used as an aggregate in concrete, a light weight, fire resistant, insulating concrete is produced which is ideal for roof decks and other applications. Perlite is also used as an aggregate in portland cement and gypsum plasters (green plaster) for exterior applications and for fire protection of beams and columns. Other construction applications include: light weight curtain/ partition wall, noise reduction, under-floor insulation, chimney lining, paint texturing, ceiling tiles and roof insulation boards. Perlicon is expanded perlite based concrete. The expansion is due to presence of two to six per cent combined water in the crude perlite rock. Demand for good quality expanded perlite in India has been showing an upward trend.

Horticultural Applications

In horticulture, expanded perlite is used throughout the world as a component of soil-less growing mixes, where it provides aeration and optimum moisture retention for superior plant growth. Studies have shown that outstanding yields are achieved with perlite hydroponic systems. Other benefits of perlite in horticulture are its neutral pH value and the fact that it is sterile and weed-free. In addition, its light weight makes it ideal for growing plants in small containers. Besides, perlite is a good carrier for fertilizer, herbicides & pesticides and for pelletising seed. Horticultural perlite is used both by home gardeners as well as commercial growers. Green roofing, where perlite is used as the sole growing medium for plants on roofs, has become a popular trend, and offers a unique sustainable way to insulate a roof while adding foliage to the surface. In greenhouse plantations, landscaping and for in-house plants, use of perlite has shown encouraging results with clean & safe handling. Approximately 10% of annual perlite consumption all over the world is reported under horticultural applications. Perlite can be used by mixing with sand in about 1:1 ratio for better results.

Industrial Applications

Industrial applications of perlite are the most diverse, ranging from high performance fillers for plastics to cements, for petroleum, water and geothermal wells. Other applications include its use as a filter media for pharmaceuticals, food products, chemicals and water for municipal systems and swimming pools.

Perlite finds application additionally as an abrasive in soaps, cleaners and polishes. Its high resistance to heat is taken advantage in manufacturing refractory bricks, high temperature insulation, molten metal topping, light weight fillers, mortars and pipe insulation. Crude perlite is used in retention of heat in Foundry and Ferroalloys Industry. Small quantities of perlite are also used in cryogenic insulation and in ceramics as clay.

SUBSTITUTES

There are a number of materials for construction applications, such as, diatomite, expanded clay, shale, pumice & slag and for horticultural use, vermiculite, coco coir, wood pulp & pumice are alternative soil additives and are sometimes used in conjunction with perlite. These materials can be used in place of perlite without losing any of the benefit that perlite provides. Bentonite and Zeolite are the alternatives in animal feed suppliment.

WORLD REVIEW

Insufficient information is available to make reliable estimates of resources in perlite-producing countries. However, the perlite resources in Greece are 120 million tonnes, Iran 73 million tonnes, Turkey 57 million tonnes, USA contributed 50 million tonnes and Hungary 49 million tonnes (Table-2). Asia Pacific is expected to be the fastest growing market for expanded perlite in the next few years. The major reason for this is the growing demand for expanded perlite in developing Asian countries, such as, India, China, Malaysia, Indonesia and Thailand. The major perlite producing countries in the World during 2019 are China 1,300 thousand tonnes, Greece 719 thousand tonnes, and Turkey 700 thousand tonnes, (Table-3). In 2017, the quantity of processed crude perlite sold or used by U.S. mines increased to the highest level since 2005, and estimated apparent consumption increased to its highest level since 2014. Although China was the leading producer, most of its perlite production was thought to be consumed internally. Greece and Turkey remained the leading exporters of perlite. As per the Ministry of Commerce under the HS Code: 25301020, the total imports of Perlite during 2017-18, 2018-19 and 2019-20 was 50.06, 48.25 and 45.72 thousand tonnes respectively. However, small quantity of export of perlite was also reported during the same period.

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

(In '000 tonnes)

Country	Reserves
World: Total	**NA**
Greece	120,000
Iran	73,000
Turkey	57,000
USA	50,000
Hungary	49,000
Other countries	NA

***Source**: USGS Mineral Commodity Summaries, 2021.*
***Note**: Sufficient information is not available to make reliable estimates of resources in perlite-producing countries. Resources of Iran were revised based on industry information.*

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

(In '000 tonnes)

Country	2017	2018	2019
China	1219	1300	1300(e)
Greece	933	790	719
Hungary	71	80	80(e)
Iran(a)	369	194	194(e)
Italy(e)	60	60	60(e)
Slovakia	48	36	32
Russia(e)	45	45	45(e)
Argentina	20	19	20(e)
Turkey	1117	649	700
USA	570	510	520(e)
Mexico	16	26	26(e)
Ukraine	17	17	17(e)

***Source:** BGS World Mineral Production, 2015-2019.*
***(a)** Year ended 20 March following that stated.*

FUTURE OUTLOOK

Perlite is an amorphous volcanic glass. Due to its low bulk density, high heat resistance, low sound transmission, high surface area, low thermal conductivity, chemical inertness and light weight make it more acceptable in industrial applications. Expansion properties from 2 to 20 times of its initial volume in high temperatures, set perlite as a sought after raw material in construction products.

Rising construction activities all across the globe and growing application of expanded perlite in various industries including oil & gas are key factors which are anticipated to spur the growth of global market during the near future. The government has planned about 100 smart cities which will invite investment of more than 2 trillion in the coming years which will help attain significant gains to crude perlite market size. Asia Pacific is likely to be the fastest growing market of expanded perlite during the near future owing to high industrialisation and construction activities due to rapid urbanisation in emerging Asian economies and growing demand for expanded perlite for gardening purposes in this region.