

GYPSUM



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MINOR MINERALS

30.12 GYPSUM (MINOR) and SELENITE (MAJOR)

(ADVANCE RELEASE)

**GOVERNMENT OF INDIA
MINISTRY OF MINES
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30-12 Gypsum and Selenite

Gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) is a hydrated calcium sulphate used widely in various industries because of its special property of losing three-fourth of the combined water of crystallisation when moderately heated (calcined) to about 130°C . Besides, calcined gypsum when cooled, finely ground and made plastic with water can be spread out, cast or moulded to any desired surface or form. On drying, it sets into a hard rock-like form. Selenite is a colourless, transparent, naturally occurring crystalline variety of gypsum and is used extensively in Ceramic Industry and for manufacturing surgical grade plaster of Paris, whereas alabaster is a fine-grained, massive variety, white or shaded in colour. Silky and fibrous variety of gypsum is called satin spar. Anhydrite (CaSO_4) is a calcium sulphate mineral found associated with gypsum commonly as a massive or fibrous mineral.

Gypsum that occurs in nature is called mineral gypsum. In addition to mineral gypsum, seawater and some chemical and fertilizer plants are sources of by-product marine gypsum and by-product chemical gypsum, respectively. The latter is obtained as by-product phospho-gypsum or fluoro-gypsum or boro-gypsum, depending upon the source. Phosphoric acid plants are important sources of by-product phospho-gypsum.

Marine gypsum is recovered from salt pans during production of common salt in coastal region, particularly, in Gujarat and Tamil Nadu. The recovery of by-product gypsum and marine gypsum together is substantial and is comparable with the production of mineral gypsum.

FGD Gypsum is a unique synthetic product derived from flue gas desulphurisation (FGD) systems at electric power plants. Sulphur dioxide emission control systems used by coal-fired power plants remove sulphur from combustion gases using 'scrubbers'. In addition to FGD gypsum, synthetic gypsum includes materials, such as, phospho-gypsum, titano-gypsum, fluoro-gypsum and citro-gypsum.

Various grades of gypsum (as per $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ content) are produced and consumed by industries like cement, fertilizer plants, plaster of Paris, etc. Gypsum also acts as a neutralising agent and helps in improving soil permeability.

In gypsum, calcium or magnesium carbonate, chlorides, other sulphate minerals, clay minerals or silica are considered as deleterious constituents. As a result, mostly mine production of gypsum possess purity ranging between 70 and 95%.

RESERVES/RESOURCES

As per NMI database, based on UNFC system, the total reserves/resources of mineral gypsum in India as on 1.4.2015 has been estimated at 1,330 million tonnes of which 37 million tonnes have been placed under 'Reserves' and 1,293 million tonnes under 'Remaining Resources' category.

Of the total reserves/resources, Fertilizer/Pottery grade accounts for about 80% and Cement/Paint grade 13%. The Unclassified and Not-known grades together account for 5% resources. The remaining two per cent of resources is shared by Surgical Plaster and Soil Reclamation grades. By States, Rajasthan alone accounts for 81% resources, Jammu & Kashmir 14% and Tamil Nadu 2% resources. The remaining 3% resources are in Gujarat, Himachal Pradesh, Karnataka, Uttarakhand, Andhra Pradesh and Madhya Pradesh (Table-1).

EXPLORATION & DEVELOPMENT

The exploration & development details, if any, are covered in the Review on "Exploration & Development" under "General Reviews".

PRODUCTION

GYPSUM

As per Govt of India Notification S.O. 423(E), dated 10th February 2015, 'gypsum' has been declared as 'Minor Mineral', hence the producers report the production data directly to the respective States and not to IBM. However, efforts were made to collect this information through correspondence with the State Directorates of Mining and Geology of individual States or visiting their websites. But data of only a few States could be collected. All possible information/data that could be gathered has been presented in this Review. Statewise production of gypsum during 2017-18 to 2019-20 is furnished in Table-2.

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

(In '000 tonnes)

Grade/State	Reserves			Remaining Resources					Total Resources (A+B)	
	Proved STD111	Probable STD121 STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221 STD222	Measured STD331	Indicated STD332	Inferred STD333		Reconnaissance STD334
All India: Total	35141	311 1169	36621	10826	93127 33419	9071	713834	428097	4518	1292892 1329513
By Grades										
Surgical Plaster	621	-	621	-	1039 82	-	-	3773	-	4894 5515
Fertilizer/Pottery	18933	-	18978	2296	9266 270	7680	703244	320454	-	1043211 1062189
Cement/Paint	11547	311	12549	7980	82430 30372	1148	3184	39191	10	164315 176864
Soil reclamation	-	-	-	185	392 2573	100	206	7939	2180	13576 13576
Unclassified	367	-	413	3	- 116	78	5548	33548	2328	41621 42034
Not-known	3670	-	4057	356	-	66	1652	23191	-	25265 29322
Others	3	-	3	5	- 5	-	-	-	-	11 14
By States										
Andhra Pradesh	-	-	-	-	-	-	-	404	-	404 404
Gujarat	4	5 24	33	4	-	616	308	15446	-	16374 16407
Haryana	-	-	-	-	-	-	-	-	2180	2180 2180
Himachal Pradesh	-	-	-	-	- 1365	-	-	3081	-	4446 4446
Jammu & Kashmir	11383	153 442	11977	4602	9844 6570	7680	2673	146914	2328	180610 192588
Karnataka	-	-	-	-	-	-	-	3784	-	3784 3784
Madhya Pradesh	-	-	-	-	-	-	-	69	-	69 69
Rajasthan	23617	153 658	24428	6201	82814 18663	750	710604	236847	-	1055878 1080306
Tamil Nadu	137	-	183	19	469 6786	25	249	19540	10	27099 27282
Uttarakhand	-	-	-	-	- 35	-	-	2012	-	2047 2047

Figures rounded off.

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Table-2: Statewise Production of Gypsum

State	(In tonnes)		
	Year		
	2017-18	2018-19	2019-20
Rajasthan	1816834	4664000	3006000
Gujarat	147	46	50

Source: As received from State DGMs and their website.

SELENITE

M/s RSMML, a Public Sector company, is a leading producer of natural gypsum and selenite variety, producing from Thar desert areas of Rajasthan. Gypsum with (+)70% CaSO₄.2H₂O purity produced by RSMML fulfils the demands of the cement industries and powder gypsum is used by farmers as a direct fertilizer for re-conditioning of alkaline soils for reducing alkanity and improving crop production.

The production of selenite was 1,167 tonnes in the year 2019-20 as against 2,906 tonnes during the previous year. The entire production of selenite was reported by Rajasthan State Mines & Minerals Ltd

(RSMML), a Public Sector Undertaking, that operates two mines, one each in Barmer and Bikaner district of Rajasthan.

The mine-head closing stocks of selenite were 24 tonnes at the end of the year 2019-20 as against 885 tonnes at the end of the year 2018-19.

The average daily labour employed in selenite mines during 2019-20 was 12 as against 16 in the previous year.

As selenite is not listed under minor minerals, its production details are covered in this Review (Tables 3 to 5).

Table – 3 : Principal Producer of Selenite, 2019-20

Name & Address of Producer	Location of Mines	
	State	District
Rajasthan State Mines & Minerals Ltd, C 89-90, Janpath, Lal Kothi Scheme, Jaipur – 302 015, Rajasthan.	Rajasthan	Barmer Bikaner

**Table – 4 : Production of Selenite, 2017-18 to 2019-20
(By State)**

State	(Qty in tonnes; Value in `'000)					
	2017-18		2018-19		2019-20 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	469	939	2906	5812	1167	2353
Rajasthan	469	939	2906	5812	1167	2353

**Table – 5 : Production of Selenite, 2018-19 and 2019-20
(By Sector/State/Districts)**

State/District	(Qty in tonnes; Value in `'000)					
	2018-19			2019-20 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	3	2906	5812	2	1167	2353
Public sector	3	2906	5812	2	1167	2353
Private sector	-	-	-	-	-	-
Rajasthan	3	2906	5812	2	1167	2353
Barmer	2	2045	4090	1	1059	2137
Bikaner	1	861	1722	1	108	216

Note : " - " Nil

USES AND SPECIFICATIONS

Cement, fertilizer (ammonium sulphate) and plaster of Paris are the three important industries in which gypsum is utilised. Gypsum of less purity in crushed form is utilised in portland cement manufacturing for controlling the setting time of portland cement (i.e., as a retarder to prevent quick set). It is added to the clinker just before final grinding to finished cement. Proportion of gypsum in Cement Industry is 4-5% of the cement produced. Both mineral and by-product gypsum are used in cement manufacture. Calcined gypsum finds use in manufacturing Plaster of Paris. It is also used in manufacturing partition blocks, sheets & tiles, insulation boards for stucco and lattice works. Gypsum board is primarily used as a finish for walls and ceilings. It is also used as a binder in fast dry tennis court clay. Low-grade gypsum is calcined and used as gypsum plaster after preparation of mortar. It is used for internal plastering and masonry work. Requirement of low-grade gypsum for use in Building Industry as per IS:12654-1989 (Reaffirmed 2010) is: $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ not less than 60%. In pottery, calcined gypsum is used for preparation of moulds in the production of sanitarywares. The used and discarded moulds are in turn again used as source of gypsum in cement and other industries. Low-grade gypsum is used in conditioning of alkaline soil and as manure in agriculture mainly for correcting black alkali soils. BIS has also prescribed IS:6046-1982 (First Revision; Reaffirmed 2008) for gypsum for agricultural use.

Selenite, a crystalline variety is used to a limited extent for gypsum plate for petrological microscopes, known as Sensitive Tint. It is also used in the Ceramic Industry for making moulds to manufacture surgical grade plaster of paris and also for producing white cement. Plaster of Paris Industry requires high purity gypsum. Different grades of plaster of Paris are manufactured depending upon the period for setting. For surgical plaster, a minimum 96% $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ grade gypsum is required.

High-purity gypsum can be utilised for manufacturing of ammonium sulphate fertilizer. Ground pure white gypsum is also used as a filler in paper, paints and textile goods. Ground low-grade gypsum is used in mine dusting,

manufacture of black board chalks and as a filler in insecticides. Besides, gypsum is also used in other industries like pharmaceutical, textile and asbestos products.

Alabaster, a dense, massive, granular and translucent variety, is employed as ornamental stone in statuary and interior decoration.

BIS specification for by-product gypsum (IS:10170-1982, reaffirmed 2008) lays down a minimum 70% content of $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ and maximum limit of 0.75% Na, 1.0% F and 15% free moisture on dry basis. The material should pass through 2 mm sieve, but 50% of material should also pass through 0.25 mm (60 mesh) sieve. The specifications of by-product gypsum for use in plaster, blocks and boards are as per IS:12679-1989 (reaffirmed 2010). Besides, BIS has prescribed IS:1290-1973 (Second Revision; reaffirmed 2011) for mineral gypsum.

Substantial quantity of mineral gypsum as well as phospho-gypsum was used in Agricultural Sector for conditioning of alkaline soil and in Cement Industry. The remaining nominal consumption was in plaster of Paris, asbestos products, ceramic, fertilizer, refractories, textile, pharmaceutical and paint industries. The entire quantity of marine gypsum and gypsum moulds was also consumed in cement and ceramic industries respectively.

CONSUMPTION

The details of consumption of commodity, i.e., mineral in the present case, is drawn from the database of Mining Tenement System (MTS) of IBM. Under Rule 45(1) of MCDR 2017, the holder of mining lease or any person or company engaged in trading or storage, end-use or export of mineral mined in the country have to get registered with IBM and submit monthly/annual returns under this rule to IBM.

As per the information received from various gypsum natural consuming units, the estimated consumption of gypsum-natural increased only by 1.5% from 5,744 thousand tonnes in 2018-19 to 5,832 thousand tonnes in 2019-20. In the year 2019-20 the Cement Industry is the only industry which alone accounted cent per cent consumption. Industry-wise estimated consumption is furnished in Table - 6.

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**Table-6: Estimated Consumption* of Gypsum-natural (2017-18 to 2019-20)
(By Industries)**

(In tonnes)

Industry	Year		
	2017-18	2018-19 (R)	2019-20 (P)
All Industries	3968600 (90)	5743900 (111)	5831800 (108)
Cement	3968600	4369300	5831800
Others (Plaster of Paris, Refractory)	-	-	-

Figures rounded off

** Includes actual reported consumption and/or estimates made wherever required. Paucity of data, hence coverage may not be complete.*

Figures in parenthesis indicate Number of plants reported/estimated

WORLD SCENARIO

The world reserves of gypsum are large. China was the largest producer of gypsum followed by Iran, Thailand, USA, Iraq, Turkey, Spain, Mexico, Oman, Japan, Russia, Germany and Australia.

TRADE POLICY

As per 'Export-Import Policy, 2015-2020, gypsum, anhydrite, plasters (consisting of calcined gypsum or calcium sulphate) whether or not coloured, with or without small quantities of accelerators or retarders are free under heading 2,520 of import policy.

FUTURE OUTLOOK

India's domestic resources of gypsum are large enough to meet increased demand. With renewed focus on improving the economy and upscaling industrial developments, India lays greater emphasis on creation of infrastructure. As per the Working Group report, augmentation of infrastructural activities will endanger further growth of the Cement Industry which concomitantly will raise the consumption of

gypsum and thereby its demand, with consequence, leading to increased dependence on imports and synthetic gypsum to meet cement demand. Further, as per the report, steps would be necessary to find out suitable mining technology to exploit deep-seated gypsum resources in Bhadvasi deposit, Nagaur district Rajasthan. State-of-the-art technology needs to be adopted for the exploitation of deep-seated gypsum.

Other segments that would attract attention would be production of gypsum wallboard which is currently negligible in India. It could find better prospects because of its light weight and other special characteristics. It being an excellent partition material could facilitate its utility in high rise building constructions. In view of the environmental problem arising from huge accumulation of phospho-gypsum at different fertilizer plants, possibilities of finding other possible means for its utilisation has become a necessity. Low-grade gypsum being cheaper could find better prospects in its application more as a soil conditioner for reclamation of alkaline soils.