8. Uses, Specification, Consumption and Trade

8.1 USES

The word 'barytes' is used in the trade for mineral barite or its concentrates[1,2,3].

Barytes, after suitable grinding and pulverising, has many uses. The principal use is as 'weighting agent' in the preparation of drilling mud. The high specific gravity (around 4.2), insolubility in water and inertness to acids make it suitable as weighting agent.

Next to oil well drilling, other important consumer of barytes is in chemical industry for manufacture of barium chemicals like barium sulphate (Blanc fixe), carbonate, chloride, oxide, hydroxide, nitrate, peroxide, etc. These chemicals find wide applications as 'filler' in paints, rubber, linoleum, oil, cloth and photographic paper. Barium carbonate is used as rat poison and in ceramic industry to prevent the development of scum on wares. New uses of barium chemicals are in television picture tubes, optical glasses etc.

Barytes is also used as an extender in paint and varnishes and as a filler in rubber, paper and textile goods. It is also used for manufacture of white pigment called lithopone ($ZnS + BaSO_4$). However, in India, barytes has not been used in manufacture of lithopone. Barytes also finds application in explosive and pyrotechnic industry.

In electric furnace metallurgy, barytes is used to increase the life of acid furnace lining. It is also used in lubricating oils and to recover sugar from molasses by the barium saccharate process. Barium radio isotopes are used in tracing the flow of fluids through pipes. X-Ray tubes are sometimes encased in a cover containing barytes. White plaster containing barytes is used to cover the walls of rooms in which X-Ray sets are housed. Barytes is useful when added in a batch mixture for glass making in continuous tanks, as it dissolves in the soda ash to form a heavy solution which sinks to the bottom and when temperature is raised, it reacts with silica to form gaseous sulphur dioxide and oxygen which tend to stir the melt and remove absorbed gas. It homogenises the melt and gives greater brilliance to the finished glass. Barium metal burns readily to an oxide and combines with many gases and is therefore used for removing traces of gases from radio valves. A number of barium alloys with aluminium, lead, magnesium, etc. have been developed.

Minor uses of barytes include ballast for ships, heavy concrete aggregate for radiation shielding and pipe weighting in low lying areas. The barytes may also be used as an aggregate in concrete shield for future atomic power plants[4,5,6].

(1) OIL WELL DRILLING

The main use of barytes is in finely ground form (325 mesh US standard) as a weighting agent in muds circulated in rotary drilling of oil and gas wells. The drilling mud is an engineered mixture of finely ground barytes with suitable proportions of colloidal clay like bentonite and water. The drilling muds are used during drilling to perform a variety of functions i.e. (a) to remove the cuttings from bottom of the hole and transport them to surface without interfering with down-hole testing and logging, (b) to control wall pressure, (c) to cool and lubricate the drill bit and pipe, (d) to plaster the walls of drill hole to prevent caving and (e) to counteract the high gas and oil pressure to their formation, levels to prevent outburst.

There are two main types of drilling mud i.e. (i) water based, and (ii) oil based. The water based

mud consists of barytes, bentonite and water, whereas the oil based mud consists of barytes, organo clay and oil. The water based mud is generally used when there is plentiful supply of salt water i.e. in offshore drilling[7,8].

(2) CHEMICAL INDUSTRY

India is producing about 30,000 tonnes of barium chemicals. The demand for chemical grade barytes in Indian industries is of the order of 50,000 tonnes per year.

The barium chemicals find applications in a variety of industries because of their high density, high brightness, inertness and radiation absorption character. The production of important barium chemicals and their specific properties which make them suitable for particular application are discussed below[9].

(i)Barium Sulphide

Barium sulphide (black ash) derived from barytes, forms the starting point for most barium chemicals. Barium sulphide is produced by reduction of barium sulphate (barytes) with finely powdered coal in a rotary kiln at a temperature of 1100° to 1250°C. The end product contains about 80 to 85 percent BaS depending on the impurity content of the starting materials. Further impurities are removed by counter-current leaching of the furnace clinker with water and filtration to produce barium sulphide solution and a leach residue containing most of the impurities[1,4,10].

(ii) Barium Carbonate

Quantitatively, the most important of all the barium chemicals barium carbonate finds application in a number of industries including glass, chemicals, ceramics, ferrites/titanates and others. It is produced by two methods in which the starting material is black ash in each case. The method can be summarised by the following equations:-

1. $BaS + CO_2 + H_2O = BaCO_3 + H_2S$

2. $BaS + Na_2CO_3 = BaCO_3 + Na_2S$

Barium carbonate is used to enhance the quality of finished product, such as in the manufacture of glass, enamels and permanent magnets. In industries, it finds application because of its ability to convert soluble sulphates into insoluble barium sulphate. Its another application is in the production of barium chemicals.

(iii) Blanc Fixe

'Blanc fixe' is a chemically precipitated barium sulphate which can be prepared by a number of different routes according to the end use. The main preparatory techniques can be summarised in the following equations :

$$BaCl_2 + Na_2SO_4 = BaSO_4 + 2\,NaCl$$

$$BaCO_3 + H_2SO_4 = BaSO_4 + H_2O + CO_2$$

$$BaS + H_2SO_4 = BaSO_4 + H_2S$$

$$BaS + Na_2SO_4 = BaSO_4 + Na_2S$$

'Blanc fixe' is used as a white filler in paints, paper, rubber, inks and other materials where a degree of purity higher than natural barytes is required. In the paper industry 'blanc fixe' is used for paper coating and in the manufacture of photographic paper. The market for filler grade 'blanc fixe' in the paint industry has suffered in recent years from replacement by titanium dioxide and other less expensive fillers.

'Blanc fixe' can also be prepared by precipitating and spray-drying to conform to international pharmaceutical specification for use as contrast media for radiological application. A number of grades are produced of different grain size and density for different applications. In addition, these very pure and expensive grades are used for specialised plastics[4,10].

(iv) Lithopone

Lithopone can be prepared by reaction of barium sulphide with zinc sulphate to form a precipitate of barium sulphate and zinc sulphide.

$$BaS + ZnSO_4 = BaSO_4 + ZnS$$

'Lithopone', formerly manufactured in large tonnage for use as a white pigment in paints, has been largely replaced by titanium dioxide.[1,4,10]

(v)Barium Chloride

Barium chloride can be produced directly from barium sulphide by reaction with hydrochloric acid or chlorine gas or through reac-

tion of barium carbonate with hydrochloric acid. Two types of chlorides are used in industry i.e.(i) anhydrous ($BaCl_2$) or (ii) crystal ($BaCl_2 . 2H_2O$). Barium chloride is used in case- hardening and heat treating baths in leather and cloth, in making magnesium metal, in preventing scum on bricks, in water treatment and as a laboratory reagent. Fused barium chloride may be electrolyzed to produce barium metal[1,4,10].

(vi) Barium Hydroxide

Barium hydroxide is produced by oxidation of hot barium sulphide solution in air and can be represented by the following equation:

$$3\ BaS + O_2 + 2H_2O = 2\ Ba(OH)_2 + BaS_3$$

On cooling, barium hydroxide octahydrate crystals are formed which can be calcined to produce the mono-hydrate. The barium sulphide formed during the oxidation process can be used as a starter material in the preparation of barium chloride, as per the following equation.

$$BaS_3 + 2\ HCl = BaCl_2 + H_2S + 2S$$

Barium hydroxide is used in ceramic industry to prevent scumming in ceramics. It is also used in lubricating oils and to recover sugar from molasses by the Barium Saccharate process[1,4,10].

(vii) Barium Nitrate

Barium nitrate is produced by reacting nitric acid with $BaSO_4$ solution. Barium nitrate is used in green signal flares, tracer bullets, primers, detonators and enamels[6,10].

(3) PAINT INDUSTRY

The paint industry is the third largest consumer of filler grade barytes and it is derived barium salts. However, their usage in paints has gradually been reduced by replacement of cheaper and less dense filler such as calcium carbonate and dolomite. High grade barytes which has been acid washed to remove impurities is suitable for use in paint industry, although neither it, nor 'blanc fixe' possesses any pigmentary properties.Instead, their function is to optimise the optical properties of the pigment in the system by ensuring complete distribution of the pigment particles so that their optical properties are maximised. The size distribution of the filler is, therefore, critical and it is predominantly this factor which governs the grade of the filler chosen. The grain size, shape and refractive index of the filler and pigment determine the optical efficiency of the system. As a filler in varnishes, water carried paints and anti rust primers, barytes and 'blanc fixe' produce a high degree of impermeability and durability through their close packing density.

In painting automobiles, barytes is used as a filler for the primer coat. The barytes contributes to the gloss of the top coat. When the primers are applied by the electro-deposition process, the body structure is dipped into a tank containing water and paint primer. The method eliminates one of the primary coats, thus reducing the quantity of barytes used.

Barytes, blanc fixe and lithopone are also used in artist's colours in small quantities, particularly in the lower range students colours. 'Blanc fixe' is used in preference to barytes because of its better colour and closer grain size distribution[4,6,10].

(4) PAPER INDUSTRY

Barytes is used only occasionally as a filler in the paper industry since it cannot achieve the uniform whiteness of 'blanc fixe'. As a filler, 'blanc fixe' imparts high degree of opacity to paper and is consequently used in light weight bond paper where good opacity is required to prevent characters from showing through. It also adds to the brightness of paper thereby reducing the amount of printing ink required. However the price of 'blanc fixe' is fairly prohibitive and its use is restricted to heavy weight papers and paper coating to provide a smooth surface finish.

An important use of 'blanc fixe' paste is in the manufacture of photographic paper for black and white prints. The paper is coated with 'baryta', a mixture 70 percent 'blanc fixe' and gelatine, prior to coating with a layer of silver halide emulsion. The baryta layer provides an inert base which will not react with the applied silver halide. It is opaque and provides a good mat reflective layer to give good definition. Varying the composition

can result in mat, semi-mat or glossy finish to the photographic papers. The paper can additionally be coated, embossed or calendered for the high gloss[4,6,10].

(5) PLASTICS AND RUBBER INDUSTRY

The plastics and rubber industries utilise barytes in components like fan belts, hoses, mats, gaskets and in sound proofing. Barytes is also used simply as a weighting agent in the manufacture of sports goods. The rubber core of tennis balls may contain upto 10 percent barytes of moderate grade. Barytes is also used as a weighting filler in a number of miscellaneous products including playing cards, ropes, rubber mats and tiles. Barytes is used in white sidewalls for tires. Sidewalls consist mainly rubber, zinc oxide and small quantity of barytes[4,6,10].

(6) FRICTION MATERIALS

Barytes is used as an inert filler in friction materials including brake and clutch facing. Brakes consume varying amounts of barytes according to the end use, whether it is industrial machinery, trucks or cars. Again, the grade of filler used is essentially a compromise between the grade and price. The market for barytes as a filler in friction materials is fairly stable being dependent on the fortunes of all automotive industry rather than suffering from competition from other materials.[4,10]

(7) GLASS INDUSTRY

In glass making, barytes is added to the glass melt to flux the heat insulating froth that forms the melt surface, thus saving fuel, and to act as an oxidizer and decolorizer. The barium oxide which improves the quality of glass in a number of ways providing a higher refractive index, imparting greater hardness and scratch resistance, improved gloss, better flow properties to the molten glass, greater resistance to attack from aggressive media, and acting as radiation filler in television cathode ray tubes. The development of television in the 1950's called for large demand of barium carbonate in the manufacture of glass tubes but the advent of colour television necessitated the replacement of barium by strontium carbonate which can absorb the increased amount of gamma radiation produced by higher cathode potentials utilised in colour televisions to improve picture brightness.

Barium oxide is an important constituent of crystal glassware imparting a higher refractive index and low dispersion and at the same time increasing the hardness while replacing potentially harmful lead. Small application of barium carbonate is in the manufacture of reflective glass beads for use in road marking paints[4,6,10].

(8) CERAMIC INDUSTRY

In structural ceramics, barium carbonate serves to bind the soluble sulphates (gypsum) in the ceramic raw material and the formation of insoluble barium sulphate prevents discolouration of bricks and tiles and inhibits the formation of efflorescence on the surface of the fired bodies. Barium chloride and hydroxide can be used as alternative to the carbonate in this application. Barium carbonate is also added to glaze mixes, which on melting is converted to barium oxide which improves the hardness and lustre of the glaze, consequently improving its resistance to abrasion and leaching. Similarly, the addition of barium carbonate to enamels improves their resistance to corrosion and weathering.

Barium carbonate is also used in electroceramics field i.e. the manufacture of barium titanates and ferrites. Barium titanates ($BaTiO_3$) are produced in two forms viz. disc and monolithic. The barium titanates are pill shaped and formed from a mixture of ceramic and electrode which is fired and then anodised while the ferrites is formed by sandwiching layers of ceramic and electrode. Barium titanates possess a high dielectric constant which renders them suitable for manufacture of small condensers for use in computers, telecommunications and the automotive industry.

Barium carbonate is added to a steatite base to produce a non-conducting steatite ceramic suitable for use as electrical components. Barium carbonate addition results in enhanced electrical

resistance, greater mechanical strength and reduced dielectric loss. Barium carbonate is also used in the manufacture of magnetic ferrite material which are produced by sintering 1 mole barium carbonate with 6 moles iron oxide at a temperature between 1100° and 1350°C. The material is then ground and fired. The reaction of formation can be summarised as;

$$BaCO_3 + Fe_2O_3 = BaFe_2O_4 + CO_2$$

$$BaFe_2O_4 + 5\ Fe_2O_3 = BaFe_{12}O_{19}$$

The ferrites find use particularly in the automotive industry and also in reed switches, motors, dynamic speakers, earphones, telephones and microphones[4,6,10].

(9) RADIATION SHIELDING

The following qualities are worth of consideration while selecting a material for use in radiation shields.

(1) Density : Closely packed light elements attenuate neutrons while heavy elements are better for gamma ray attenuation.

(2)Fabricability : The material must be capable of being used as aggregate in concrete.

(3)Durability : The material must not lose its attenuation properties or be susceptible to cracking.

(4)Heat transfer properties : The heat generated by radiation must be easily removed.

Barytes is an excellent concrete aggregate for use in reactor shields but its use is based in part on its availability close to an installation site. Generally, ordinary concrete would be the cheapest shield material to use but where limited space is a consideration, special high density concretes can reduce the width of the shield. Barytes concrete such as with a density of 3.5 to 3.6 g per sq.cm. is a suitable material.

The mean volumetric weight of barytes concrete is about 50 percent higher than that of ordinary concrete and is an effective shield for gamma radiation. Radiation shielding represents a steady source of demand for barytes, both for use in aggregates and in plaster, to meet the demands of new construction and running repair work.

(10) PURIFICATION

An important application of barium carbonate is in the purification of brine for chlor-alkali electrolysis by the removal of sulphate. Generally, the sulphate content of brine is controlled by the solubility product of calcium sulphate but periodically barium carbonate needs to be added to reduce further the sulphate content. Barium carbonate combines with the sulphate impurity to form insoluble barium sulphate which precipitates. "New Cell" technology is a major influence on barium carbonate consumption in two respects. Firstly, in mercury cells graphite anodes are being replaced by titanium anodes which can tolerate higher sulphate levels. But on the other hand, the membrane cells which are coming more commonly into use are more sensitive to sulphate impurities and should lead to a small increase in barium carbonate consumption. On balance however, barium carbonate consumption for this application is expected to continue to decline particularly where a low sulphate containing evaporated salt rather than rock salt is used. Barium carbonate is also utilised in the purification of factory effluence by the removal of sulphuric acid, dissolved sulphates, chromic compounds, and sulphates from ortho-phosphoric acid manufactured by the wet process[4,10].

(11) MISCELLANEOUS

In the preparation of metallic sodium barium chloride acts as fluxing agent in a molten bath along with calcium chloride and sodium chloride. The barium chloride constitutes about 40 percent of the bath and at the outset, large tonnages are required. However, as the barium chloride is not consumed by the process, it requires only occasional topping up.

Barytes is used in explosives because of its density which helps to pack the explosive. Additionally, because of its inertness barytes, like graphite may serve to coat explosives particles and prevent friction between them prior to firing.

8.2 SPECIFICATIONS

Specification of barytes vary according to its different uses. These are discussed below :

(1) OIL WELL DRILLING

Barytes, for drilling mud must be finely ground, 90 to 95 percent of the material must pass through 325 mesh screen, heavy and chemically inert. Barytes for this purpose must have a specific gravity of 4.2 or higher, it must be free from soluble salts. The colour of barytes and a small percentage of silica or iron oxide are not regarded as objectionable. It should be, however, free from clayey material as it lowers the specific gravity[1,6,11].

There are two international specifications for oil-well drilling. The specification prescribed by the American Petroleum Institute (API) U.S.A. and Oil Company Materials Association (OCMA) U.K. are given below:[12]

Characteristic	Oil Company Material Association(OCMA)	American Petroleum Institute(API)
1. $BaSO_4$	92 percent (min.)	92 percent (min.)
2. Sp.Gr.	4.25 (min.)	4.25 (min.)
3. Water soluble solids	0.10 percent (max.)	250 ppm (max.)
4. Fineness, U.S. standard	90 percent+5 percent finer than 325 mesh	90 percent + 5 percent finer than 325 mesh

The Indian Standard Specification IS:2881 was first published in 1964 and subsequently revised in 1978 and 1984. The IS - 2881 : (1984) for barytes suitable for petroleum industry in oil well drilling operation, classified as Grade 2, is given below.[13].

IS - 2881 : (1984)

Description - The material consists essentially of barium sulphate and is white, greyish white or very light pinkish white in colour, free from dirt and foreign matter.

Requirement of barytes for oil well drilling.

Sl. No.	Characteristic	Requirement Grade 2
1.	Insoluble max. silica percent by mass	90.0
2.	Fineness (determined by wet method):	
	(a) Passing through 75 micron IS sieve (percent by mass-max.)	97
	(b) Passing through 53 micron IS sieve (percent by mass-max.)	90 + 5
3.	Relative density at 27°C min.	4.15*
4.	Matter soluble in water (percent by mass-max.)	0.02

** For off-shore drilling the value shall be 4.20*

There are practical limitations that dictate the size and specifications of barytes. The upper size limit is chosen so that minimum quantity of barytes is discarded in the process designed to remove coarse sand and drilled solids from the mud. Also coarse material may cause excessive wear to the mud pumps and other equipment and make the filter cake rough and permeable. The upper size limit is chosen at 74 microns (U.S. sieve number 200) and is nominally sand size and a maximum quantity is normally specified. It would be desirable to limit the quantity of fine barytes since large quantities of fine material will increase the surface area and hence the viscosity. Also, excessive fines can produce losses of material during pneumatic handling procedures and create a dust problem[11].

In respect of other characteristics like $BaSO_4$, water soluble solids and specific gravity, there is slight variation in specification quoted by API, OCMA and IS : 2881 - (1984). Oil wells in India mostly are low pressure wells. The users industry namely Oil India Ltd. and Oil & Natural Gas Corporation have prescribed the following grades of specification in petroleum industry.[9]

Characteristics	Oil India Ltd.	Oil & Natural Gas Corporation
$BaSO_4$	94 percent (min.)	90 percent (min.)
Sp.Gr.	4.15	4.1 to 4.2
Solubility in water	0.02 percent(max.)	0.02 percent (max.)
Size	300 mesh	200 to 300 mesh

(2) CHEMICAL INDUSTRY

In chemical manufacturing, purity is the principal concern; a maximum of one percent of ferric oxide (Fe_2O_3) and strontium sulphate ($SrSO_4$) and a trace of flourine usually are specified. The mesh size is also important for chemical manufacturers. If the material is too fine, dust is lost if it is too coarse, mixing with carbonaceous material is poor, while most chemical manufacturers specify a size range of 4 to 20 mesh, others purchase lump barytes and grind to their own needs[11,14].

The specifications of barytes for consumption in chemical industries is 95 percent $BaSO_4$ and one percent silica.

The Indian Standard Specification IS : 2881 - (1984) has prescribed Grade I for chemical industry. The Grade I has two qualities namely quality A and quality B. The specification is as follows :[11,13,15]

IS : 2881 (1984)Specification for chemical industry

Sl. No.	Characteristic	Requirement Grade I	
		QUALITY A	QUALITY B
1.	Insolubles max. minus silica percent by mass	97.0	90.0
2.	Silica (as SiO_2) percent by mass, max.	2.0	6.0*
3.	Aluminium (as Al), percent by mass, max.	0.10	
4.	Iron (as Fe), percent by mass, Max.	0.10	1.5

*Silica and aluminium oxide together shall be 6.0 percent max.

The unitwise specifications of barytes in chemical industry in respect of 6 units are given in table 8.1.[9]

TABLE-8.1 : UNITWISE SPECIFICATIONS OF BARYTES IN CHEMICAL INDUSTRY

Sl. No	Name & address of consumers	Purpose for which used	Specifications	Sources of supply
1.	Barium Chemicals Ltd., P.O.Ramavaram, Distt.Khammam, Andhra Pradesh	As a source of elemental barium for manufacture of barium compounds	Off-colour variety with a sq.gr.of 4.1 Size : 100 mesh $BaSO_4$-89 to 94% SiO_2-10% max.	1. Viswabharathy Mining Corpn.,A.P 2. Captive mine Garla in Khammam, A.P.
2.	Barium Industry (outside Malakhera gate) Alwar, Rajasthan	-do-	Off-colour variety $BaSO_4$-98%	1.Narahari Prasad Sharma, Shivpuri, M.P. 2. Rajasthan Mineral Traders, Alwar, Rajasthan. 3. Ramnarain & Brothers, Rajasthan.
3.	Chawla Chemical Industries Pvt.Ltd., Haji Adam Mansion, 2nd Floor, 6, Homji street, Bombay-1.	-do-	Off-colour variety Size:150 to 200 mesh $BaSO_4$- 94% min.	1.Tiffin's Barytes Asbestos & Paints Ltd., T.N. 2. Narsu and Company,Cuddapah A.P. 3. E.Mori Shetty Kurnool, A.P. 4. B.H.Reddy, Kurnool, A.P.
4.	Golden Chemicals Pvt.Ltd., Tobacco House, S.V. Road, Vile Parle, Bombay-400056	-do-	Powdered & lump barytes. $BaSO_4$- 92 to 95%	1.Mahesh Minerals Bombay. 2. M.G. Engineering Works, Bombay-1.

Sl. No	Name & address of consumers	Purpose for which used	Specifications	Sources of supply
5.	Jeevan Jyoti Chemicals Private Ltd. Mustafa buldg., Sir P.M. Road Bombay-1	As a source of elemental barium for manufacture of barium compounds	Grey coloured barytes $BaSO_4$- 92 to 94%	1.Nav Bharat Trading Co., Bombay. 2. Bharat Trading International, Bombay. 3.Krishna Mineral, Kodur, A.P. 4. Universal Chemical,Bombay. 5. Hindustan Minerals, Bombay 6. Chawla Chemicals, Bombay
6.	Travancore Chemicals & Manufacturing Co. Ltd., Kalamassari, Alwaye, Kerala	-do-	Grey lumps barytes, sp.gr:4.2 to 4.5 $BaSO_4$- 95% min. Silica- 3% max. Iron-1% max. Calcium & Magnesium 1% max.	1. Shri V. Subbiah, Kodur, A.P. 2. Shri Krishna Mineral Works, Cuddapah, A.P. 3. ABCO.barytes, Ramanathapuram T.N. 4.C.M.Ramanatha Reddy, Kodur, A.P.

(3) PIGMENTS FOR PAINTS

For the manufacture of pigment, manufacturers prefer snow white barytes containing a minimum of 95 percent $BaSO_4$. It should be free from mud, clay or siliceous minerals. Silicates are on the whole less deleterious than free silica as it tends to form barium silicate which may absorb barytes. Presence of iron oxide is undesirable. A maximum of one percent Fe_2O_3 is allowed. The presence of iron oxide, clay, silica, etc. often flux at temperatures below 1300° C the furnace temperature usually required for reducing barytes to the sulphide with coal or coke. It is estimated that one percent of iron oxide may render 4 percent of barium sulphide inactive. Some compounds of iron or manganese are

regarded harmful. Fluorspar is objectionable as it corrodes furnace lining[11].

The ISI has standardised specification for both natural barytes and precipitated barytes (IS : 64 - 1972). The natural barytes is the Type 1 of the ISI which has been further sub- divided into Grade 1 and Grade 2. The precipitated barytes is the Type 2 of ISI. The IS : 64 - 1972 specification is given in table 8.2[15,16].

The unit-wise specification of barytes in important paint industry is given in table 8.3[9].

The American Society for Testing Materials (ASTM) presents specifications for barytes used in pigments (D 602-42) which are given below. The specifications cover the barium sulphate pigments, commercially known as barytes and 'blanc fixe'.[17]

ASTM Standard Specification for Barium Sulphate Pigment(D 602-42)

Sl. No:	Characteristics	Barytes %	Blanc fixe %
i)	Barium sulphate, (min.)	94	97
ii)	Ferric oxide, (max.)	0.05	0.02
iii)	pH, (min.)	3.5	3.5
iv)	Matter soluble in water, (max.)	0.2	0.2
v)	Moisture and other volatile matter (max.)	0.5	0.5
vi)	Coarse particle (total residue retained on a No: 325 (44 sieve),(max.)	0.5	0.5
vii)	Free silica (quartz, clays and other materials, (max.)	2.0	2.0

TABLE- 8.2 : REQUIREMENTS FOR BARIUM SULPHATE PIGMENTS FOR PAINTS

Form and Condition - The material shall be in the form of dry powder or in such a condition that it can be reduced to the powder form by crushing without grinding action, under a palette knife.

Sl. No:	Characteristics	Requirements		
		Type 1		Type 2
		Grade I	Grade II	
i)	Composition:			
	a) Barium (as $BaSO_4$), percent by mass, min.	95	95	97
	b) Carbonates (as $BaCO_3$) percentby mass, max.	2.24	2.24	0.45