

PROSPECT FOR BENTONITE BASED INDUSTRIES IN GUJARAT

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iNDEXTb

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PREFACE

With the increased use in the drilling mud and foundry, private entrepreneurs are attracted to go for bentonite based projects. With the increasing demand in external market in South Asian countries, it has opened doors to go for export-oriented units (EOUs) in the State. Further, new Gujarat Industrial Policy has given a thrust to employment and balanced growth in Saurashtra and Kutch regions.

In view of above, a close analysis with consuming industries specifications, details of prospecting reports, physico-chemical properties, districtwise production details, exports from different ports, list of importers, testing procedures, existing bentonite based units with future estimated demand, are compiled by Industrial Extension Bureau (iNDEXTb) for the interested entrepreneurs who desire to go for bentonite based projects in the State.

I wish to place on record the efforts put in by Shri JV Bhatt, Senior Development Officer (Mineral) and his team under the guidance of Shri AK Ojha, General Manager (Tech.) in the preparation of a report on 'Prospects for Bentonite based Industries in Gujarat.'

I acknowledge with thanks the cooperation received from the bentonite miners, traders, consumers, industries associations of Gujarat and State Directorate of Geology and Mining of Rajasthan and Gujarat in making this report.

Ahmedabad
October 17, 1990

P.K.Laheri
Industries Commissioner &
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1.0 INTRODUCTION

- 1.1 Bentonite is one of the two naturally occurring minerals of montmorillonite group with decolourising and absorbing properties, the other mineral of this group being fuller's earth. On exposure, almost all Bentonites assume a slightly darker shade due to absorption of moisture. Two types of Bentonites viz., swelling and non-swelling types are commonly known in trade. sodium Bentonite is of swelling type while calcium Bentonite is non-swelling. Bentonite is believed to have been formed by the alteration of volcanic ash deposits, mostly of Upper Cretaceous Age. The commercial importance of Bentonite depends more on its physico-chemical properties such as base exchange capacity, thixotropy, settling time, swelling power, pH value, etc. than on chemical composition. Treated Bentonite has been found to be superior of fuller's earth. In recent years, Bentonite has been used in pelletizing of iron ore fines, in ceramic nuclear fuels and ceramic moderators.
- 1.2 Freshly cut surfaces show waxy lustre and conchoidal fracture. All Bentonites are colloidal in nature. The colloidal particles carry electrical charges and may exhibit Brown movement in dilute dispersions or solutions. The presence of soluble salt and/or organic matter adversely affects the plasticity of Bentonite, especially in regard to their capacity to provide high green and dry compression strengths to foundry sand mixtures.
- 1.3 Sodium and calcium Bentonites are distinctly characterised by high ratios of their dominant exchangeable base. Intermediate type Bentonite may have either sodium or calcium base dominant but in low or nearly equal ratios-mixed Bentonite may exhibit low, high or equal ratios of sodium and calcium ions but contain a higher percentage of non-clay materials and/or other clay minerals. Plasticity and bonding strength of all bentonites and dilatency (swelling capacity) viscosity (resistance to flow), thixotropy (gelling strength) of sodium bentonite are all due to colloidal nature of bentonite. Sodium bentonite (high swelling- high gel) are strongly hygroscopic exhibiting a great affinity for water.
- 1.4 It swells five times its weight or 15 times its volume when immersed in water. It forms gelatinous material resembling soft soap called 'mineral soap' or 'soap clay'. Thixotropic qualities of sodium bentonite are shown by a reversible transformation of the fluid-gel system formed by a clay-water mixture. If undisturbed, the mixture becomes gel; when agitated the gel reverts to a fluid. Both viscosity and thixotropy are governed by ion exchange. The base exchange phenomena of bentonite is considered generally to result from excess negative charges of the silicate layers in the Montmorillonite crystals. Exchangeable cation occurs between these layers and the ions within the crystal lattice are not replaceable.
- 1.5 Non-swelling bentonite (sub-bentonites meta-bentonites) are calcium bentonites. Calcium bentonite is more common than sodium bentonite because calcium is higher in the replacement series.

2.0 BENTONITE RESOURCES

- 2.1 Bihar, Gujarat, Jammu & Kashmir and Rajasthan are the important States where commercial deposits of Bentonites are found. However, best known deposits of this mineral in the country are confined to Barmer district in Rajasthan.

Table 2.1 gives the State-wise Bentonite reserves in India.

2.2 Bihar

In Bihar, bentonite occurs at Tinpanar and Dkudih in the Rajmahal hills of Santhal Parganas district. Grey and greenish clays similar to Bakudih occur at Pirpainti and Taljhari though Bakudih deposit is superior to Taljhari. In Bakudih area, bentonite occurs as pockets and is quarried in large quantities. Minimum reserve estimates are 100,000

In Kathua district, bentonite occurs in Uttarbaini- Paromondal area. The bentonite bed is traceable over 24 km. and thickness varies from 13 to 40 mm. In this case also, due to thickness of the bed, large-scale mining is not economical and as such the deposit is being worked on a small scale by hand picking.

2.4 Tamil Nadu

The deposits of bentonite clays occurs within a radius of 50 km. of Madras, Vaidyapur, Vallam Kannatungal, Mappedu, Kilachri, Rriyattur, Krishnapuram, Koppur and Ambattur. The beds of bleaching clays range in thickness from 0.6 to 2.2 m. extending down to a depth of 7 to 28 m. in some cases and 85.89 million tonnes reserves have been estimated as per table 2.1. Test on vegetable oils have indicated them to be bleaching clays. The clays can be activated for bleaching after heating to 300° - 400° C or after acid treatment. The clays occur at shallow depth and can be reduced. It is reported that the reserves of bleaching clays on a conservative estimate will exceed 5 million tonnes for the first 4.5 m of excavation.

2.5 Rajasthan

Bentonite deposits of Rajasthan are the most extensive and also superior in quality to other known deposits of different States, Bentonite deposits of Barmer district are the most important and have been investigated in detail by putting 118 boreholes (by auger drill) by GSI in recent years and total 101.24 million tonnes reserves have been estimated. The important deposits of the area can be grouped into 7 zones viz.

(i) Harwecha-sheo Hati Singh ki Dani; (ii) Akli-Thumbi-Giral; (iii) Sonri; (iv) Bisala; (v) Bhadres; (vi) Barmer; and (vii) Mohwar.

The bentonite exposed at Hati Singh-ki-Dani is 6-7 m thick and may be more. In Akli quarries, bentonite bed is more than 12 m. thick. From Akli to Giral and Thumbli area and at Sonri is over 6 m thick, while at Bhadres, it is more than 7 m. Bentonite formations in the remaining area are not thick.

The bentonite from the above areas vary widely in their physical and chemical properties. The swelling ranges from 5 to 10 times and the gel volume from 2 to 22 cc. Bentonite with 20 cc value is confined to the area near Akli. The pH value of 6.25% suspension varies from 6.3 (slightly acidic) to 9.9 (alkaline). The bleaching properties of both raw and acid treated bentonite were tested. These bentonite are not naturally bleaching clays but bleaching properties are considerably improved after activation. The activated fuller's earth for bleaching petroleum. The base exchange capacity of the bentonite ranges from 26 to 54 milli equivalents per 100 gm. Barmer bentonite have been classified as Alkali sub-bentonite and alkali earth sub-bentonites.

Other occurrences of bentonite in the State are from Gajner in Bikaner district and Dargama in Sweai-Modhopur district. Rajasthan is the second State where bentonite production is reported. Barmer bentonite is famous in the bentonite market. It contributes 30% to 35% share in the total country's production. Table 2.1 indicated sizeable quantity of reserves but due to inland occurrences of bentonite pockets in the State, it has not taken export market. Due to long distance from the sea coast, bentonite lease holders of the State are not able to channelise their export markets in comparison to Gujarat State leaseholders.

2.6 Gujarat

Bentonite occurs in Amreli, Banaskantha, Bhavnagar, Bharuch, Jamnagar, Kutch, Mehsana, Sabarkantha and Surendranagar districts of Gujarat. Bentonite deposits of Gujarat are mostly of non- swelling type. The deposits in Bhavnagar have an over-burden mostly ranging from 1.5 to 3 m. and the thickness ranges from 6 to 9 m. Figure 1 gives bentonite processing and quarrying centres in Bhavnagar district. Most of the bentonite

samples from this area swell 2 to 3 times and have a base exchange capacity between 20 to 30 milli equivalents per 100 gm.

Gujarat State has a number of deposits in Kutch, Bhavnagar, Amreli, Sabarkantha, Jamnagar, Banaskantha, Mehsana etc. Of these, Bhavnagar and Kutch have the major deposits. Details of the deposits are given in table 2.6.1. The State Department has carried out exploration in Bhavnagar and Kutch districts. Total 90 million tonnes reserves has been proved as per table 2.1 Drilling has been carried out in Bhavnagar district and 44 million tonnes reserves of all the grade has been estimated. Geological Survey of India has also done prospecting in Nakhatrana, Mandvi and Mundra talukas of Kutch district. Figure 2 will give Bentonite processing and quarrying centres in Kutch district. Preliminary survey has been carried out in Amreli and Jamnagar districts. Most of the bentonite production is reported from Kutch and Bhavnagar Districts Table 2.6.2 gives the districtwise Bentonite production in Gujarat. Sabarkantha and Bharuch district's production are mostly consumed by foundry industries located in Ahmedabad and Ankleshwar region. They are sedimentary bentonite and plastic in nature.

Table 2.6.1

Districtwise Bentonite Resources in Gujarat

Sr. No.	District	Taluka	Village	Reserve in Mln.Tonnes
1	Amreli	Rajula	Kadiali, Kajwadar, Bhatwadar	0.6
2	Banaskantha	Santalpur	Piperals, Fangli	
		Vav	Duokarade, Aluvas	
3	Bhavnagar	Bhavnagar	Alapar, Badi, Adhewada, Chitra Juna Ratanpur, Budhal, Malanka	44
		Ghogha	Badi, Morchand, Tahadi, Rajpara, Malpar, Padwa, Lakhanaka, Thordi	
4	Bharuch	Jhagadia	Panavania, Vasanau, Damlai	
		Valia	Vagdkot	
5	Jamnagar	Kalpur	Nandana, Bhopalka	35.56
6	Kutch	Abdasa	Miyani, Naredi, Nendru, Khere, Chiyasar	27
		Anjar	Kumbhariya, Ratatalav	
		Bhachau	Bhachau	
		Raper	Kidianagar, Hamipur	
		Mandvi	Goinasar, Wandh, Hamala, Kotda, Nagrecha, Sherdi, Nana Ratadia	
		Mundra	Ramania, Tumbdi, Beraja, Bocha	
		Bhuj	Kumka	
		Nakhatrana	Kotada	
7	Mehsana	Vijapur	Kot, Pedhamli, Ransipur	
8	Sabarkantha	Himatnagar	Kadoli, Tajpuri, Dedhoruta, Maherpura	
		Prantij	Harsol	
9	Kheda	Kapadwanj	Mahmedpura	

Source: "Mineral Statistics of Gujarat", a publication of Deptt. of Geology & Mining, Govt. of Gujarat.

SUMMARY

Oil & Natural Gas Commission has increased its activities in the Western Region. Drilling activities are in progress in Kutch, North Gujarat and South Gujarat Regions. The Commission is also engaged in the drilling activity in 'Godavari Basin' and 'Shivasagar'. Bentonite is consumed for drilling mud on a large scale. Global tenders are floated from the Dehra Dun Office.

In Gujarat, Bentonite is quarried in Kheda, Sabarkantha, Bharuch, Jamnagar, Amreli, Bhavnagar and Kutch districts. Bhavnagar and Kutch are the leading districts where Bentonite quarrying activities are concentrated and both the districts account 95% of State's production.

Private lease holders covering 621 hectares of land under the Bentonite quarry exploit on an average 50,000 tonnes to 120,000 tonnes are per annum. At present, there are 211 quarry lease holders of Bentonite in the State.

State has 30 Bentonite processing units with an installed capacity of 150,000 MT per year catering to the needs of indigenous and export market. Iron ore pelletization, foundry, insecticides, pesticides, paint etc. industries consumes bentonite due to its absorption and adsorption characteristics. Activated Bentonite is used for the decolorization of crude oil and edible oils.

Department of Mines & Geology and Geological Survey of India have carried out detailed prospecting in Bhavnagar and Kutch districts and 105 million of reserves has been proved.

Most of the Bentonite is of sedimentary in nature with non-swelling property and can be used for foundry purposes. While in case of high swelling sodium based Bentonite, they are igneous in nature and can be used for oil well drilling and other industrial uses.

Igneous Bentonites are formed in semi-arid conditions where evaporation exceeds precipitations, possible in stagnant saline water with parent igneous materials. Original structures are partially retained during weathering in the profile. Bentonite pockets are scattered and disconnected in occurrences.

Sedimentary Bentonite are reworked and redeposited elsewhere from the origin. They are continuous with gypsum partings.

Gujarat has 1300 km. coast line and Bentonite pockets occur along the Kutch and Saurashtra coast. Export through the Bhavnagar, Mundra, Mandvi and Kandla Ports to Australia, Saudi Arabia, Malaysia, Singapore, Kuwait, Iraq etc. are carried out by Ashapura Minechem and Kutch Bentonite firms.

Bentonite processing is concentrated in Bhavnagar and Bhuj while activation on Bentonite is carried out in Valsad district. Demand and supply gap for the activated Bentonite and processed Bentonite exists in inland and export market.

There exists a scope to establish Bentonite processing, granulation, paint grade processed Bentonite and activation units in the state. Profiles on these products with suggested locations included in this Report will be useful to entrepreneurs who select the Bentonite based projects.

Table 2.6.2

Districtwise Bentonite Production in Gujarat

District	Prod.	%	Prod.	%	Prod.	%	Prod.	%
Kutch	85733	80.51	47631	75.18	72562	88.80	135189	92.85
Bhavnagar	18756	17.61	14899	23.51	8099	9.91	8330	5.72
Bharuch	30	0.03	450	0.71	534	0.65	1600	1.10
Jamnagar	93	0.09	30	0.05	28	0.03	8	0.01
Sabarkantha	1604	0.75	242	0.38	480	0.59	5	0.31
Amreli	-	-	4	0.01	18	0.02	5	0.01
Surendranagar	1271	1.19	102	0.16	-	-	-	-

Source: "Mineral Statistics of Gujarat", a Publication of Deptt. of Geology & Mining.

3.0 MARKET POTENTIAL

- 3.1 Sodium based Bentonites are comparable to the famous vyoming bentonites of USA. Bentonite is one type of clay having very high plasticity and swelling. The Kutch variety of bentonite is natural sodium based with very high base-exchange capacity. This type of bentonite is confined only to Western part of Kutch district in India. Due to high cost of vyoming bentonites, the Kutch bentonite is favoured by indigenous as well as foreigners.

Kutch Bentonites are located near the ports and hence cost of mining and processing is cheaper and that is the reason for development of Bentonite processing units in Gujarat.

3.2 Status of the Industry

Presently, there are more than 30 units processing Bentonites with a total installed capacity of 150,000 MT/year. Most of the units are in small scale sector and catering to the need of indigenous as well as export market. The units are doing extremely well and are not in a position to meet the indigenous as well as export demand.

3.3 Present Production

As mentioned earlier, there are around 30 units processing bentonite powder with an installed capacity ranging from 10 MT/day to 40 MT/day. The majority of units are located in Kutch and Bhavnagar districts. Because of the availability of raw materials in the region, these units were developed to cater to the national and international demand.

In Gujarat, generally the mines lease holders do the processing of bentonite too. As per the latest figures, there are 211 quarry lease holders in Gujarat producing Bentonite. Chart-1 gives the district-wise bentonite production and production trend of bentonite in Gujarat. The production of bentonite for last 5 years was as under:

Table 3.3.1

Bentonite Production in Gujarat

Year	Production(in MT)	Year	Production(in MT)
1984	85075	1988	1,45,594
1985	106487	1989	1,82,742
1986	63358	1990	1,36,602
1987	81721	1991	1,33,135

Source: Statistical Section, Directorate of Geology & Mining, Govt. of Gujarat

tonnes. Bihar bentonite in untreated form shows poor swelling characteristics but set instantaneously when converted to sodium clay. This holds good for the setting behavior of the clay. Bihar bentonite shows poor physical properties which are mainly due to the presence of gypsum and exchangeable Ca^{2+} and Mg^{2+} . The percentage of latter is high and in this respect, this bentonite is comparable only to Bhimbar (Kashmir) bentonite. Bihar is the third State in production of Bentonite. It contributes 2% to 4% share in the total country's production. Table 2.1.2 reflects that during 1984-85, the production of bentonite has gone up while in case of 1985 it has gone down.

Table 2.1

Statewise Bentonite Reserves in India

State	[In Tonnes]			
	Measured	Indicated	Inferred	Total
Bihar	40500	-	61200	101700
Jammu & Kashmir	-	20400	5000	25400
Rajasthan	33491000	10760000	56990000	101241000
Tamil Nadu	-	3352800	5236667	8589467
Gujarat	44300000	-	44700000	90000000

Table 2.1.2

Production of Bentonite

State	[Qty. Tonnes/Value.Rs. '000]								
	Qty.	%	Value	Qty.	%	Value	Qty.	%	Value
Bihar	3363	2.57	55	3090	1.92	68	4513	4.31	99
Gujarat	85075	64.92	4222	106687	66.32	5451	63358	60.53	3192
Rajasthan	42600	32.51	3706	51089	31.76	3065	36800	35.16	2951
TOTAL	131038	100	7983	160866	100	8584	104671	100	6242

2.3 Jammu & Kashmir

The occurrences of bentonite are reported from Mirpur and Kathua districts in Jammu & Kashmir. In Mirpur district, bentonite occurring as long narrow outcrop at Bimbar, extends upto Thandi choi at a distance of 48 km. The thickness of the bed varied from 0.3 to 1.2 m, but generally not exceeding p. 6 m total 25,400 tonnes of bentonite reserves is estimated as per table 2.1. Good quality white bentonite is only 5 to 15 cm. in thickness. Another deposit of bentonite in this district extends over a distance of 31 km. near Jammu and may be a continuation of Bhimbar deposit. The thickness of bentonite bed does not exceed 7 cm. In both, Bhimbar and Jammu areas another horizon of bentonite can be traced 33 to 21 m. above the main bed.

Bentonites from both the areas are creamy white, greyish white to light grey with a waxy appearance. The chemical analyses of the bentonites indicate that they are low in iron and alumina and high in calcium than Barmer bentonites. The Bhimbar bentonite is calcium base but can be converted to sodium base by suitable treatment. It is not amenable to open cast mining due to thickness of beds. This bentonite was used for cleaning in woollen and textile mills of Punjab and a small quantity was used in surgical dressing.

The Bentonite was processed by other units located near to Kandla or Bhavnagar. As mentioned earlier, there are around 30 units doing pulverization job and confined to above two places.

3.4 Assessment of present market

Within the country, the foundry industry, well drilling, iron ore pelletisation units are the largest consumer of bentonite. Their annual consumption of bentonites is estimated at around 211, 800 MT/year (1987-88) for their various operations. The sectorwise estimated consumption of Bentonite in various sectors of industries was as under for the year 1987-88.

Table 3.4.1

Industrywise Consumption of Bentonite

Sr.No.	Industry	Estimated Consumption
1	Foundry	87800
2	Well drilling	8000
3	Iron ore pelletization	27000
4	Small Foundries & other industries	89000

Total		211800

3.5 Export Market

Due to exploration of oil and natural gas in Gulf Countries, the demand for Indian Bentonites powder has increased tremendously. As a matter of fact, majority of petroleum companies are controlled by Americans and hence, they prefer American Bentonite. But because of good quality and political awareness, the Indian bentonite has emerged as alternate to American Bentonite.

The estimated consumption of bentonite by the Gulf countries viz. Sultanate of Oman, UAE, Kuwait, Saudi Arabia, etc. for their oil- well drilling work would be around 20,000MT/month. When the Americans were controlling the oil companies, the bentonites used is to be imported from USA at a higher price. But with the increased political awareness on the part of the people of gulf countries, now a days oil companies buy India's bentonites.

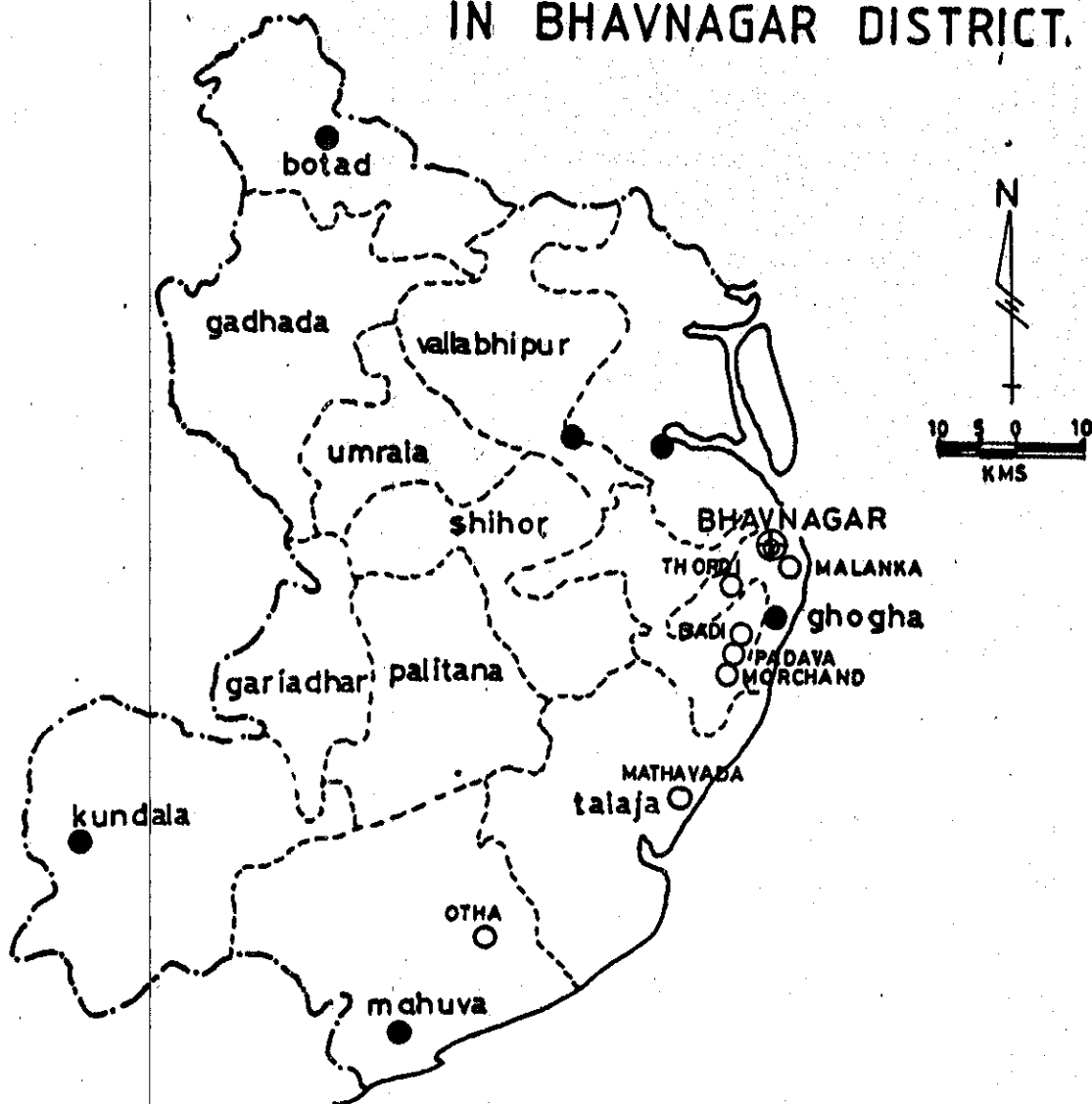
As regards the demand of 20,000 MT in the export market per month, the installed capacity for processing of Bentonites is around 12,000 MT/month.

Export figures from Gujarat ports as given in table 3.5.1 that Mandvi, Mundra are the main ports in Kutch while Ghogha and Mahuva are two ports in Bhavnagar district where exports are reported. Data indicates that export has declined during 1998-90 compared to previous year.

3.6 Future Scenario

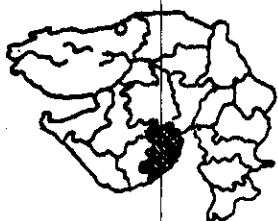
The future of Bentonite will depend on indigenous demand as well as international demand. As far as indigenous demand is concerned, it shall depend mostly on the development of end consumer industries.

BENTONITE PROCESSING AND QUARRYING CENTRES IN BHAVNAGAR DISTRICT.



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manufacturing pellets. Based on these norms, the requirement of Bentonite in this sector will be as per table 3.9.1, considering an optimistic growth rate of 5%.

Table 3.9.1

Estimated requirement of Bentonite in Iron & Pelletization Industry

(Value in MT)

Consumption during 1987-88	Estimated Demand	
	1994-95	2000-2001
27000	36000	46000

3.10 Other Industries

There are a number of other important areas like bleaching of oil and insecticides which consume Bentonite. Small quantities are consumed in refractory and ceramics, asbestos products, rubber, paints and pharmaceuticals and civil engineering works. Because of lack of data on consumption pattern, a growth rate of 5% is assumed in all these sectors for estimating the future demand. The estimated consumption in all these sectors would be around 70,000 MT. Estimated demand for the year 1994-95 is worked out based on a growth rate of 5%, as under:

Table 3.10.1

Estimated consumption and demand estimation in other industries

Sr.No.	Particulars	Value (in MT)
01	Present Consumption	89000
02	Estimated growth rate	@5%
03	Estimated Demand - 1994-95	112610
	- 2000-2001	137000

3.11 Estimated Total Demand

Considering the demand in various sectors of industries as also the export demand, the combined, it can be seen that all the end user industries are growing. The oil well drilling work is taken up on priority basis by Government of India. In the Seventh Plan, there are projections for how much drilling is to be done. Similarly, projections are also available for alloy and steel industry, foundry industry etc. The combined demand is estimated as per table. 3.11.1.

Table 3.11.1

Combined total demand of Bentonite in all sectors

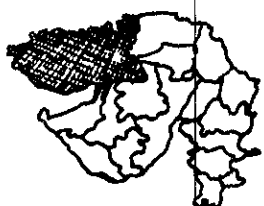
Sr. No.	Sector	Consumption during 1987-88	Estimated Demand	
			1994-95	2000-2001
1	Foundry	87800	117660	150000
2	Well-drilling	8000	10000	12000
3	Iron ore Pelletization	27000	36000	46000
4	Small foundries & other industries	89000	112600	137000
	Total	311800	516260	585000

BENTONITE PROCESSING AND QUARRYING CENTRES IN KACHCHH DISTRICT



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Swelling or collidal bentonite is characterized by the fact that it may absorb upto 5 times its weight of water and increase in volume upto 15 times its dry bulk. When treated with 18-20 parts of water, such bentonite will form a thin sol in which the mineral will remain suspended almost indefinitely. The swelling property is reversible as the material can be dried and re- swelled an infinite number of times and still retain its properties. Many sodium bentonites are unaffected by temperatures upto 205! C and so can be dried and wetted any number of times without losing their properties.

When dispersed in water, bentonites rapidly break-down into very small particles. Thus, the prepared varieties of wyoming bentonite when so treated yield about 60-65% of particles finer than 0.1 micron whilst about 90% are finer than 0.6 micron and about 97% will pass a 325 mesh (44Micron) sieve. Non-swelling or calcium bentonites also break-up to small sized particles usually rather coarser than those yielded by the swelling bentonite.

The chemical composition of some commercial bentonite is shown in Annexure I which illustrates the differences in regard to content of alkalis and calcium between the highly colloidal or sodium bentonites.

Another useful property of the sodium bentonites is that of base exchange. Thus in water suspension, sodium bentonite and will give up sodium and potassium in exchange for calcium or magnesium and will also react strongly with salts of some organic bases which they can extract from solutions.

4.2 Specifications

Bentonite has four major industrial applications and the specifications for the same are given below:

A. Drilling Fluid Mud

(i) As per American Petroleum Institute std. (13 Fifth edition) 1972 (A.P.J. 13A)

Viscosity : Viscometer dial reading 600 RPM 30 min.

Yield : 16 per 100 (3 x plastic viscosity)

Filtrate : 13.5 cc (max)

Wet screen analysis residue on US sieve 200 40% (max)

Moisture : 10.0%

(ii) IWI Specifications Type-3 (IS 6186-1971)

Moisture : 12% (max)

pH : 7.5 to 9.0

Dry Fineness -

- 150 micron IS sieve 97%(min)

- 75 micron IS sieve 90%(min)

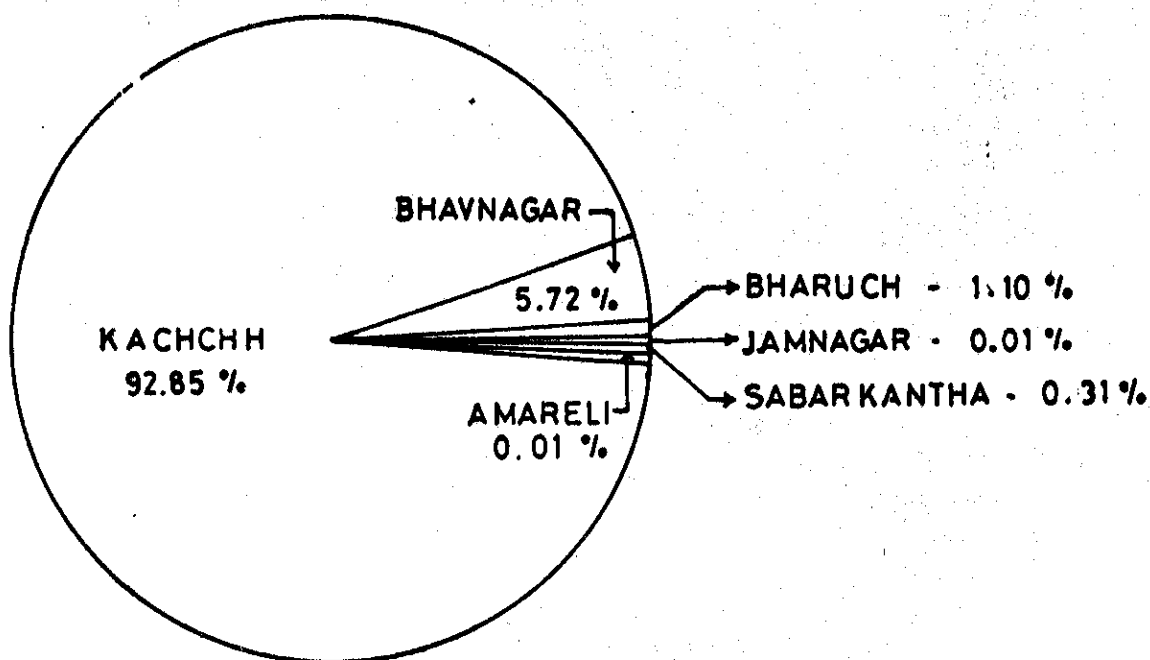
Viscosity : at 30°C in centipoise

Apparent : 15 (min)

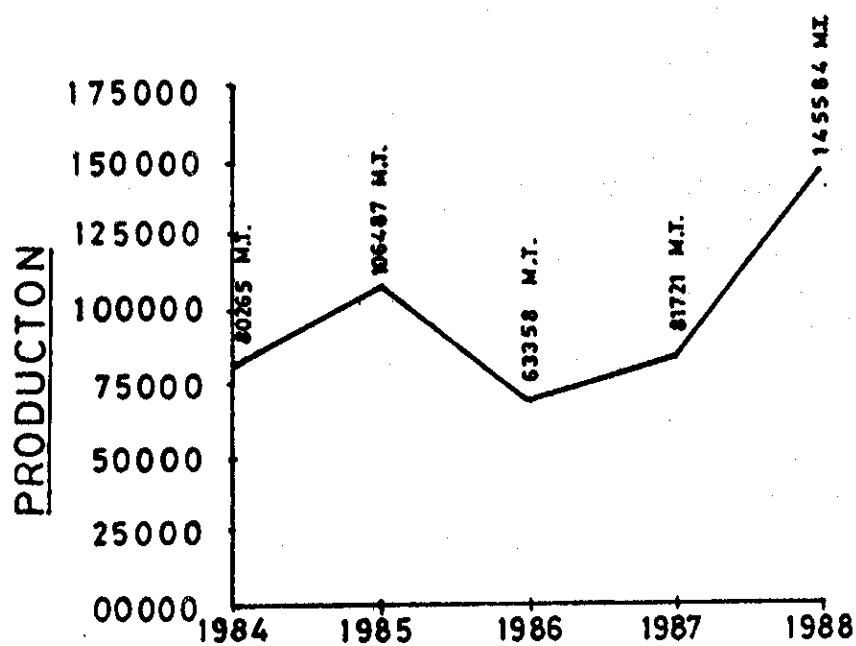
B. Foundry ISI Specification for Type-2 Grade A & B

	Grade A	Grade B
(1) Loss on drying % by Weight	5.0(min)	5.0 (min)
(2) pH	12.00 (max)	12.00(max)
(3)Gel Formation	9.0 to 10.5 25 (min)	9.0 to 10.5 10 (min)

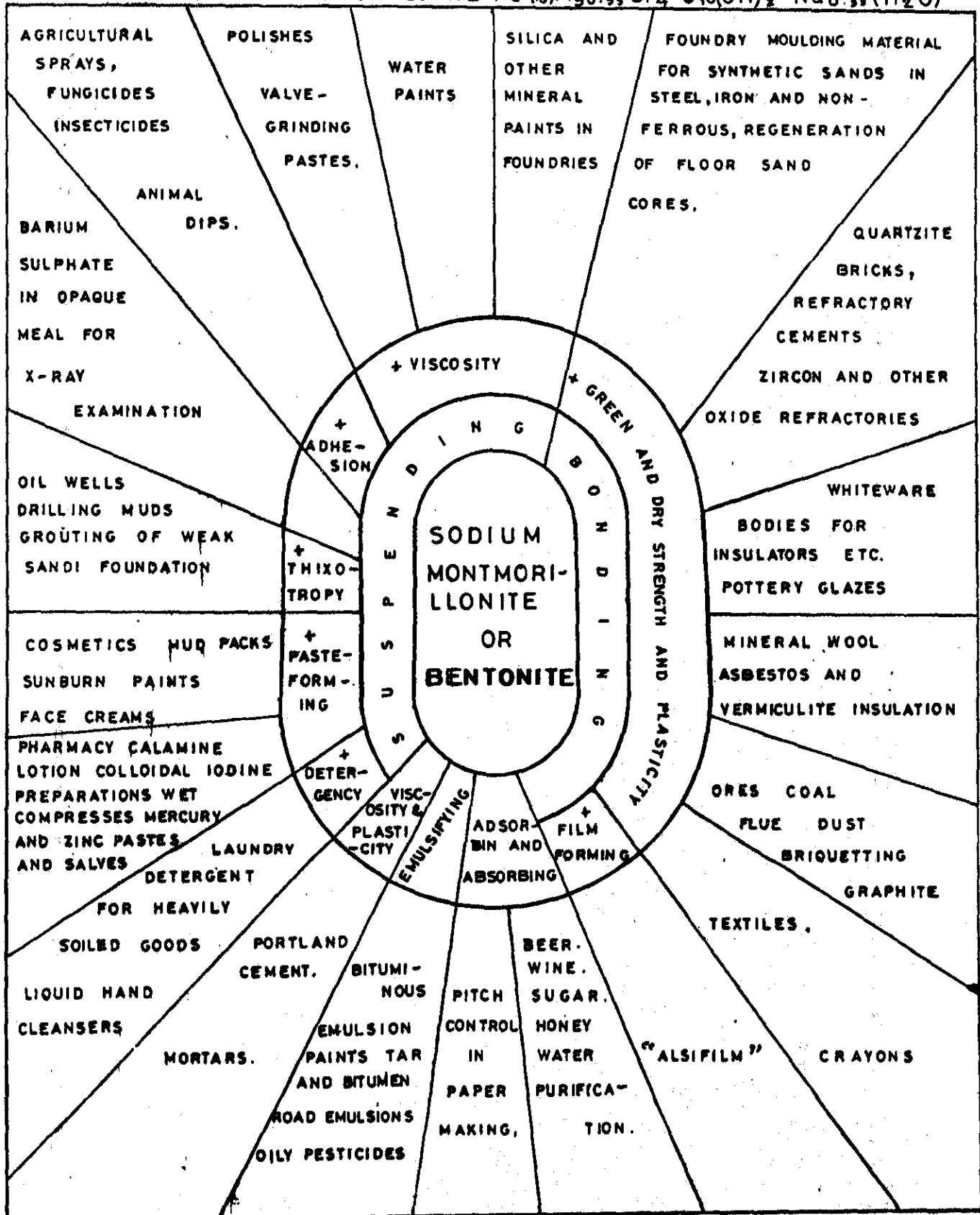
DISTRICT WISE BENTONITE PRODUCTION IN GUJARAT STATE-1989



PRODUCTION TREND OF BENTONITE IN GUJARAT



BENTONITE-SODIUM MONTMORILLONITE $Al_{1.67}Mg_{0.33}Si_4O_{10}(OH)_2Na_{0.33}(H_2O)$



SOURCE :- ROBERT SON'S SPIDERS' WEBS

FIG: 4.3(1) - VARIOUS INDUSTRIAL USES OF BENTONITE

3.7 Oil-well Drilling

Bentonite is used for oil well drilling operations. The consumption of bentonite varies from field to field. Approximately around 15 MT of bentonite is required for drilling 1000 M of well considering this norms, the estimated requirement of bentonite is as under for different years.

Table 3.5.1

Bentonite Exports from Gujarat Ports

Port	[Figures in MT]	
	1988-89	1989-90
Mandvi	46841	7011
Mundra	13289	9803
Bhavnagar	40	-
Ghogha	2465	2032
Mahuva	1428	793
Pipavav	318	490
Porbandar	-	945
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Total	64381	21074

Source: Gujarat Maritime Board - Annual View Report.

3.8 Foundry Industry

Bentonite is used in the foundry industry as a moulding sand binder in the cast iron, grey iron, malleable iron and steel castings. As per the rough consumption norms, around 10 MT of Bentonite is required for manufacture of 100 MT of grey iron/cast iron and malleable iron whereas in case of alloys and steel castings it is around 20 MT per 100 MT.

Based on these consumption norms, the estimated requirement of Bentonite in these sector would be as given in table 3.8.1

Table 3.8.1

Estimated requirement of Bentonite in Foundry Industry

Consumption during 1987-88	Estimated Demand	
	1994-95	2000-2001
87800	117660	150000
Growth @ 5% per year		

3.9 Iron & Pelletisation

Steel technology is undergoing rapid changes and more stress is being laid on the utilisation of iron ore pellets and sinters in place of natural ore. Pellets being harder, withstand transportation without breaking up and there is already good amount of international trade in this commodity.

Bentonite is used as a binding material in the preparation of pellets. In India, TISCO and Chowgule manufacture iron pellets. Around 1% of Bentonite is consumed for

and animal drips. Dust spray mixtures as similar composition are largely used in some areas of the United States for scattering by aeroplane.

Other Uses

Minor uses for bentonite include the employment of an alkali bentonite mixed with glycerine, in some facial beauty creams, in the de-inking of old newsprint as a thixotropic agent to prevent settling of mixed paints, in bleaching crude sulphur and as an addition to portland cements and pozzolanas, to increase their workability and decreases their permeability by solutions. The use of bentonite in certain electrical insulating compositions is dealt with in US Patent 2,739,085 of 1956.

Some of the swelling types of bentonites have been successfully used for making earthen dams and reservoirs more resistant to percolating water. The method is to mix the soil with 5-10 percent of dry bentonite and apply a layer of the mixture, several inches thick to the surface of the walls and bottom of the reservoir.

Calcium or non-swelling bentonites and uses of bentonite and a useful bibliography of the patent literature is given in Technical paper No. 609 issued by the United States Bureau of Mines in 1940.

Pelletizing ores, fluxes, fuels, etc.

In the beneficiation of some ores for metallurgical use, it is frequently necessary to pulverize the ore to carry out separations and concentrations. In some cases such ores can not be used until the fine material has been pelletized or agglomerated into larger units. An example is the zirconite iron ore of Lake Superior district, which must be finely ground to concentrate the iron content. The fine product can only be used in the blast furnace after it is pelletized into units of the order of 1 in or more in dia. Pellets can be prepared by mixing coke, zirconite ore and a small percentage of Wyoming type bentonite (sodium montmorillonite), then moistening, extruding or rolling to form pellets, followed by roasting at 200° to 400° F and firing at 1650° F to 1800° F. Quicklime may also be used as an ingredient. The amount of bentonite used is reported to be about 0.5% of the weight of the ore. It is not known how thoroughly other types of clay have been tried in pelletizing this iron ore. Wyoming type bentonite provides very high dry strength in moulding sands and these properties may make it particularly suited in pelletizing the ores.

Kilnefilter (1946) has indicated the possible use of Wyoming type bentonite in combination with corn flour or starch as a binder for non-plastic and poor-binding ore slimes. Combinations containing 2% bentonite were found satisfactory. The pellets were roasted at 200 to 400° F. Abbot and Anderson (1940) disclosed a process for pelletizing finely ground flourspar flux by using about 1% of the same type of bentonite and salfer liquor and roasting at 200° F to 400° F. Rich and Loctel (1940) disclosed the pelletizing of powdered fuel using about 5% bentonite with quebracho extract.

Activation of Bentonite

Many bentonites may be activated by suitable acid and heat treatment and so rendered more suitable for use in the clarification of oils. The exact mode of treatment varies somewhat with the particular bentonite to be activated but the following processes may be described as typical.

In one case, the sun dried mineral is crushed to 100 mesh and heated with a 25% solution of sulphuric acid. The treated earth is then washed, dried and crushed to pass 200 mesh. This treatment removes some of the alumina and all the combined water and so destroys the colloidal condition of the bentonite.

In another process, the clay is dried at 110° C finely ground and then digested with 96% sulphuric acid for several hours. The treated clay is then washed and dried.

3.12 Demand Supply and Gap available

The estimated total demand for Bentonite will be around 5.16 (L) MT in the year 1994-95 which present production is around 1.5 (L) MT leaving a wide gap between demand and supply. Apart from this, export demand is also good. A new unit coming up in this line may not have much problem. However, the unit has to manufacture the product as per the specifications supplied by client.

3.13 Price Realisation

Non-swelling and high swelling are the two main products. Sodium base high-swelling are processed by few firms. Individual firms have their trade name and they are sold in power and lump forms. Domestic and export market prices are to be obtained from dealers and producers. Table 3.13.1 gives price realisation.

Table 3.13.1

<i>Average Price Realisation</i>		
Product	Domestic Rs./Tonnes	Export
A. Lump	60/MT at Pit	
B. Powder - 200 mesh		
- Foundry grade	525/MT	
- Piling grade	625/MT	
- OCMA grade		US \$ 55 FOB
- API grade		US \$ 75 FOB
C. Grannules	Unbacked Rs.200/- Backed Rs.225-350/-	
D. Activated Powder		
- Bentosil AC	5600/MT	
- Bentosil AT	4275/MT	
- Bentosil T	2400/MT	
	(Ex-factory: Vapi)	

4.0 BENTONITE PROPERTIES & SPECIFICATIONS FOR INDUSTRIAL USES

4.1 Properties

Practically all natural bentonites contain small fragments of other minerals, termed 'grit' such as feldspar, calcium carbonate, gypsum, quartz etc. This grit may constitute from 5% - 10% of prepared commercial bentonite. Certain gritless bentonites termed 'dust' grades produced by air flotation are, however, marketed for use where freedom from grit is essential.

Bentonites ranges in colour when dry from cream to olive green in specific gravity from 2.4 to 2.8 and in refractive index from 1.547 to 1.557. Fusion point range from about 1330° C to 1430° C.

For commercial purposes, bentonites may be roughly divided into two groups.

(A) Those which absorb a large percentage of water with the accompaniment of considerable swelling and remain in suspension for long periods in water dispersions.

(B) Bentonites which do not swell to any appreciable extent when wetted and do not remain suspended in thin water dispersions. Between these two groups, bentonites intermediate in properties occur.

5.5 pH Value

Take 6.5 gms of bentonite sample, add 100 ml distilled water, mix it thoroughly with the help of mechanical stirrer to get the homogenous liquid. Check the pH of this liquid on any standard pH meter freshly calibrated. For second point use a buffer solution having pH closer to your operating pH value. In this case, use buffer solution having pH between 0 and 10.

5.6 Standard Mix Procedure

Take 10 kgs. of washed grade-I sand in a thoroughly cleaned laboratory muller. Put 10% of bentonite sample. Mix thoroughly for 3 minutes. Then add 4% water and again mix for atleast 7 minutes. Test this sand mix immediately for green compression strength and green shear strength on a standard 3 ram specimen.

- 5.7 In a 250 ml conical flask, take 5 gms. of clay-free new sand and 0.50 gm. of dried bentonite sample. Mix it thoroughly, add 50 mls of distilled water, stir the content to disperse the bentonite in water, boil for one minute and cool to room temperature. Add 2.50 ml of 0.5 N sulphuric acid and titrate with methylene blue solution (2.64 gms/litre) till end point. Find out the amount of methylene blue required to react with one gm of bentonite as :

1 ml of 2.64 gms/litre MB solution

= 2.64 miligram of MB

Hence titration reading $\times 2.64 \times 2 = 2$ mgm of MB per gm of bentonite.

6.0 PROBLEMS AND CONSTRAINTS OF BENTONITE QUARRYING

- 6.1 Bentonite Quarry Associations of Kutch and Bhavnagar have raised their constraints and difficulty in procurement and renewal of quarry leases. During discussion with the bentonite traders and dealers, it was brought to the notice that royalty rates for non-swelling and swelling bentonite may be kept different. The renewal period for the leases may be granted as per the other minor minerals. Special condition imposed in the Kutch district for the grant of bentonite quarry leases within the laterite profile may be lifted to encourage the bentonite quarrying in Kutch district. Link road, laboratory facilities, water pumping and hoarding of the area problems are narrated below as per the discussion with the bentonite associations and quarry applications.

Bentonite is considered as a specified minor mineral in Gujarat Minor Mineral Rule, 1966. The royalty rate per tonne is Rs.20.00. Bentonite deposits are mostly confined within laterite zone. In laterite profile bauxite and bentonite co-exists together, it is an alteration production from different igneous parent material. The irregularity of altered and unaltered clay zone in the pit creates the problems. Carbonate veinlets and zeolite have to be discarded. Gypsiferous partings have to be sorted out during sundry.

- 6.2 Private quarry owners are not equipped with full laboratory equipments for testing their products. Non-availability of certain costly equipments and ignorance of processing techniques has made certain hindrances to expand the activity. Loan or incentives are not provided to small quarry owners to develop their bentonite mining industry. It is essential that Directorate Laboratory clay testing unit facility should be made available at concessional rates to private quarry owners.
- 6.3 From the above data, it is clear that Gujarat mining faces problems. To avoid problems, certain remedial steps are suggested below for the expansion and development of bentonite mining :
- The potential and prospected bentonite area should be earmarked as quarry area.
 - The main link road connecting the major bentonite pockets should be metalled.
 - Water bailing pumps should be made available on rental basis to private quarry owners.

To pass through 150 micron Is sieve % by weight (min)	97
To pass through 75 micron IS sieve % by weight (min)	90
Fineness (wet) to pass micron IS sieve % by weight (min)	95
Calcium oxide replaceable Ca % by weight (min)	0.7

C. Pellestisation

Moisture : 10-13%

Ignition loss maximum 5.0% dried at 1100°F

Green Bali drop test - 8 drops from 18" on a steel plate.

Green ball compressive strength 30 Lb/Sq.Inch (min.)

Dry ball compressive strength 8 kg/sq.inch (min.)

D. Chemical Grade

ISI Specification Type - 1 (IS-6186-1972)

1. Loss on drying % by weight

(a) Min. 5

(b) Max. 12

2. pH : 9.0 to 10.5

3. Gel formation index: To pass the test should show 2 mt. of clear liquid separating at junction.

4. Swelling posers: To pass the test, should swell 4 CC in 24 hours.

5. Fineness: Dry

To pass through 75 micron IS sieve % by weight (min.) 0.01

To pass through 45 micron IS sieve % by weight (min.) 90.0

4.3 Uses

Figure-3 gives various industrial uses of Bentonite. There are discussed in subsequent paragraphs.

Refining Oils & Fats

Considerable quantities of bentonite are used in refining petroleum products and vegetable oils and in treatment of fats and greases.

In treating petroleum, both the swelling and non-swelling types are employed, the latter often after activation to remove tarry complexes and dissolved colouring matter, the last named by selective absorption.

The quantity required depends upon the nature of the products treated and varies from about one lb per barrel of petrol upto 100 lb per barrel of dark, heavy lubricating oil.

Drilling Muds

Bentonite is valuable as a constituent of drilling muds owing to its thickening and suspending properties and its ability to act as a seal. Bentonite used for this purpose is

PROJECT PROFILES

generally of the sodium or swelling type and of lower grade than that used for oil refining. A number of tests have been formulated by American Petroleum Institute to assist in the selection and evaluation of suitable material.

Foundry Uses

The third largest use for bentonite is in foundry practice, where the material is employed as a bounding agent and conditioner in molding sand used for casting ferrous and non-ferrous metals. In fact, it has been claimed that its use for this purpose is standard practice in most Canadian and United States foundries. Bentonite is stated to be particularly useful as a bond with the high silica sands used in steel foundries and as an ingredient in core ashes in which it serves to keep the carbonaceous ingredients in suspension.

Bentonite used as a bonding agent may be either the sodium swelling type or a calcium bentonite, according to requirements. The selection of a suitable bentonite is a matter which has received much attention, particularly in the United States. The cementing or bonding power, the amount of moisture necessary to develop maximum green strength, the high dry-bond strength, the effect on the permeability of the mold, the refractoriness, the life during repeated use are all important considerations. The American Foundrymen's Association has laid down methods by which these factors shall be determined for a given bentonite.

Bentonites for incorporation in foundry sands are usually sold in powder form, 90-95 percent of which will pass a 200 mesh sieve.

Detergents

Bentonite of the swelling type is a constituent of many proprietary detergents sold in Great Britain, the United States and Germany for scouring textiles.

One user in Great Britain requires a white or nearly white product which will form a viscous solution with ten times its weight of water. The product must be of such fineness that 98% will pass a 120 mesh sieve and 90% in 240 mesh sieve whilst the residue must not contain grit or hand particles. The loss on the drying at 100° C is limited to 15 percent, the pH of 25 percent suspension in distilled water must not be less than 8 or more than 9 when determined by the glass electrode. The bentonite must also have a packing density of not less than 0.85 and 2 mg. of the mineral must swell to 10 ml. when treated with water in accordance with the specification requirement.

Bentonite is also used in certain soaps to the extent of about 25 percent.

Ceramics

Small quantities of bentonite are sometimes incorporated in whiteware ceramic bodies to increase plasticity and modules of rupture both before and after firing and also as a suspending agent in glaze mixtures. Colour is of minor importance but a maximum swelling capacity is most desirable. A qualitative test sometimes applied to bentonite for these uses is to mix the mineral with 5% of MgO agitate the mixture with 25 times its weight of distilled water and allow it to stand for 24 hours. Under these conditions the best grade bentonite will form a stiff jelly which will have a pH value of about 11.5.

Many bentonites contain too much iron for use in ceramics, an exception however, being the mineral produced from Pouza. One of the Italian Pontine Islands which has large deposits yielding material carrying less than one percent of iron oxide.

Horticultural Uses

Bentonite is sometimes used in emulsion sprays for horticultural purposes and as a carrier or diluent for poisons such as nicotine sulphate, pyrethrum and rotenone colloidal mixtures of bentonite and sulphur are employed under various trade names, as fungicides

8.0 PROJECT PROFILES ON BENTONITE ITEMS

Kachchh bentonite is regarded as one of the world's best because of its high swelling property. State has twentyseven pulverising units. Processing is mostly carried out in Bhavnagar and Bhuj area. Few deposit possesses inherent bleaching properties. They are preferred for activation purpose.

Due to its varied industrial applications in foundry facing civil construction work for making embankments and other porous formations watertight, pharmaceutical industry and in the preparation of drilling muds.

Paint industries are importing bentonite from U.K and U.S.A and Federation of Republic Germany. From the physico chemical characteristics, a new paint grade bentonite and pharmaceutical grade products are identified for bentonite industries.

Considering the products as import substitute, it is suggested to process and upgrade Bhavnagar and Kachchh bentonite by suitable process. Organoclay modified by Quaternary amines develops rheological properties.

In view of project profiles, following items have been prepared and incorporated as a part of the report.

(i) Bentonite processing, (ii) Granulation, (iii) Activation, (iv) Drilling mud, (v) Organoclay (Rheological additive)

8.1 BENTONITE PROCESSING

8.1.1 Introduction

Bentonite is chiefly composed of clay mineral montmorillonite 75- 85%. Three layer clay mineral has the characteristic property of expanding along 'C' axis on wetting with certain liquids and has also the ability to exchange cations. It is used as a decolouriser for vegetable oils and other liquids such as fatty acids in place of absorbent and as rubber filler. Also it is used in oil well drilling, petroleum refining and pelletizing and agglomeration of ores to utilise the ore fines.

Bentonite ranges in colour from cream to olive green & its specific gravity is between 2.4 - 2.8. It is distinguished from other clay by the property of water absorption, being greater than in other plastic clays and the property of increase in volume and formation of a gelatinous mass. All bentonites contain a small amount of other minerals such as feldspar gypsum quartz etc. which are normally referred by the term 'Grit' & range from 5-10%. Its refractive index varies from 1.547 to 1.550 and fusion point from 1330°C to 1430°C. In appearance it may be dull or powdery but a fresh cut surface usually has a waxy lustre. It normally absorbs upto five times its weight of water and can swell upto 15 times its dry bulk. When dispersed in water bentonite rapidly breaks down into very small particles. Good quality bentonite when so treated can yield 60-65% of particles finer than 0.1 micron and 90% finer than 0.5 micron and 95% passing through 325 mesh (45micron) non swelling bentonites from comparatively coarser particles when suspended in water. Non swelling bentonite when treated with acid becomes activated and acquires the ability to absorb and remove colouring materials from oils, fats and greases.

The base exchange properties are well developed in some varieties of bentonite, i.e. when in suspension in water they can easily replace alkali and other oxides one with another. This property is normally utilised for softening of hard water.

Bentonite depending on the predominance of sodium (Na) or calcium (Ca) is classified as true bentonite or sub bentonite respectively. Bentonite is also classified on the basis of physical properties. True bentonite correspond to the swelling type and sub bentonite to the non swelling type.

A process used at one time in Germany for activating some non- swelling bentonites, consisted in mixing the dry mineral with soda ash so as to produce a swelling variety which was named 'Toxoton'. Another German named activated bentonite is 'Tonsil'.

5.0 TESTING PROCEDURES FOR BENTONITE

5.1 Gelling Time

10 ml of distilled water is taken in 25 x 150mm corning glass test-tube and 2.50 gms of dried sample bentonite is added in it. Again 15ml of water is added in it. (total 25 ml of water). Cork is fitted to the test-tube and the test-tube is shaken very vigorously for 2 minutes. After shaking for 2 minutes, the test- tube is allowed to rest in a vertical position. The minimum rest period, checked after every 30 seconds, required by the contents to form a gel i.e. to refuse falling down when the test-tube is inverted, is the Gelling Time.

5.2 Swelling Index/Gel Value

Weight 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, and 1.0 gm of dried bentonite and add these portions in the 15 x 150 mm of 15 x 125 mm test-tubes containing 10 ml of distilled water. Shake vigorously to ensure that all bentonite is dispersed homogeneously. Allow the test-tubes to rest for about 20 hours and then invert them at 45° to horizontal plane. The gel should remain the the tube for at least one minute.

When this has been done, prepared suspensions with different amounts of dried bentonite to discover the minimum weight of bentonite which will form a gel suspensions that just fails to flow down 20 hours later. If this weight is 'W', then swelling index (or gel value) is equal to $10/w$.

5.3 Liquid Limit

Take 50 gms. of dried bentonite sample in a 500 ml plastic beaker and add such an amount of distilled water that will form a slurry (using high speed mixer -RPM 10,000. 1" propeller) which will close the standard groove after 10 to 15 strokes. The slurry not being aged.

Let this amount of water be 'L' mls. Now prepare slurries containing 50 gms of dried bentonite and the following volumes of water.

L+ 20 mls and L+ 40 mls. Allow the slurries to age in air tight jars for 24 hours. Hand mix the aged samples thoroughly and fill the liquid limit apparatus cup to the indicated level and trim the surface to a smooth symmetrical shape. Using the grooving tool, prepare standard groove. Rotate the cam at 2 revolutions per second. Stop Cranking when the groove has just closed along 1 cm of its length. Note down the number of blows/strokes necessary for closing the groove. Carry this out a number of times for obtaining constant results. This should be carried out with the other slurried also.

Plot the water content, 'V' mls. against the regular scale of a semi-logarithmic graph paper, and the number of strokes against the log scale. From this graphy, find out volume of water corresponding to 25 strokes. Let this volume be 'V' mls. Multiply this by 2 i.e. $2V$ is the liquid limit of bentonite sample under consideration.

5.4 Swelling Capacity

Weight 2 gms of dried bentonite sample on a piece of paper. Take 100 ml of distilled water in 100 ml measuring cylinder. To this water, spray bentonite in very small quantities at a time when the whole 2 gms of bentonite has been transferred to measuring cylinder, allow to stand for 24 hours. Then measure the average volume of the bentonite settled at the bottom of the water column in the measuring cylinder. This volume is the swelling capacity of the bentonite sample.

(vii) **Refractory & Ceramics**

Bentonite is used as a binder in refractory products for imparting green strength. It forms in ingredient of refractories together with other raw materials such as sillimanite and alumina. Bentonite is a very useful component of ware mixture for improving the strength and workability of various shapes. It can be used as a substitute for part or all of the binding clay in the manufacture of crucible. It is also used as a means for cutting down the amount of bonding clay used in electrical and porcelain abrasive, wheels, etc.

(viii) **Pharmaceutical Aid**

Bentonite is used as a pharmaceutical aid and as a diluent in the manufacture of veterinary product, food supplement for poultry by a plant in India.

(ix) **Welding Electrodes**

Bentonite is used in the manufacture of welding electrodes and low hydrogen mild steel and certain types of standard steel electrodes. However, the requirement in this field is small.

(x) **Water and Sewage Treatment**

Bentonite is very effective for the purification of sewage and other turbid water as well as applicable to the purification of potable water. Bentonite also helps in softening water to some extent as a result of its base exchange property.

8.1.3 Manufacturing Process/Technology

Generally, bentonite is processed by a simple milling techniques that involve the removal of water and volatile matter CO₂ if present and grinding to the appropriate size. Small amount of chemicals Soda ash are sometimes added before grinding to control and balancing the properties of bentonite. The various steps involved in the manufacture of bentonite powder (-200 & -325 mesh) are as follows:

- Drying
- Pulverising & classification
- Storage
- Bagging

Drying

Bentonite deposits generally occur in seams and the quality of the materials differs from one seam to another and at times varies greatly within a single seam. Selective mining is being carried out in Rajasthan and Gujarat and different grades of bentonite as judged visually and determined by testing and are stocked separately. The mine ore is then spread over at the mine site in different heaps and is then dried in sun for 2-4 weeks. Impurities are removed by hand picking during drying at the mine site. Samples are taken from this to determine its physio- chemical parameters and further stock piled according to grading as High gel and Low gel quality.

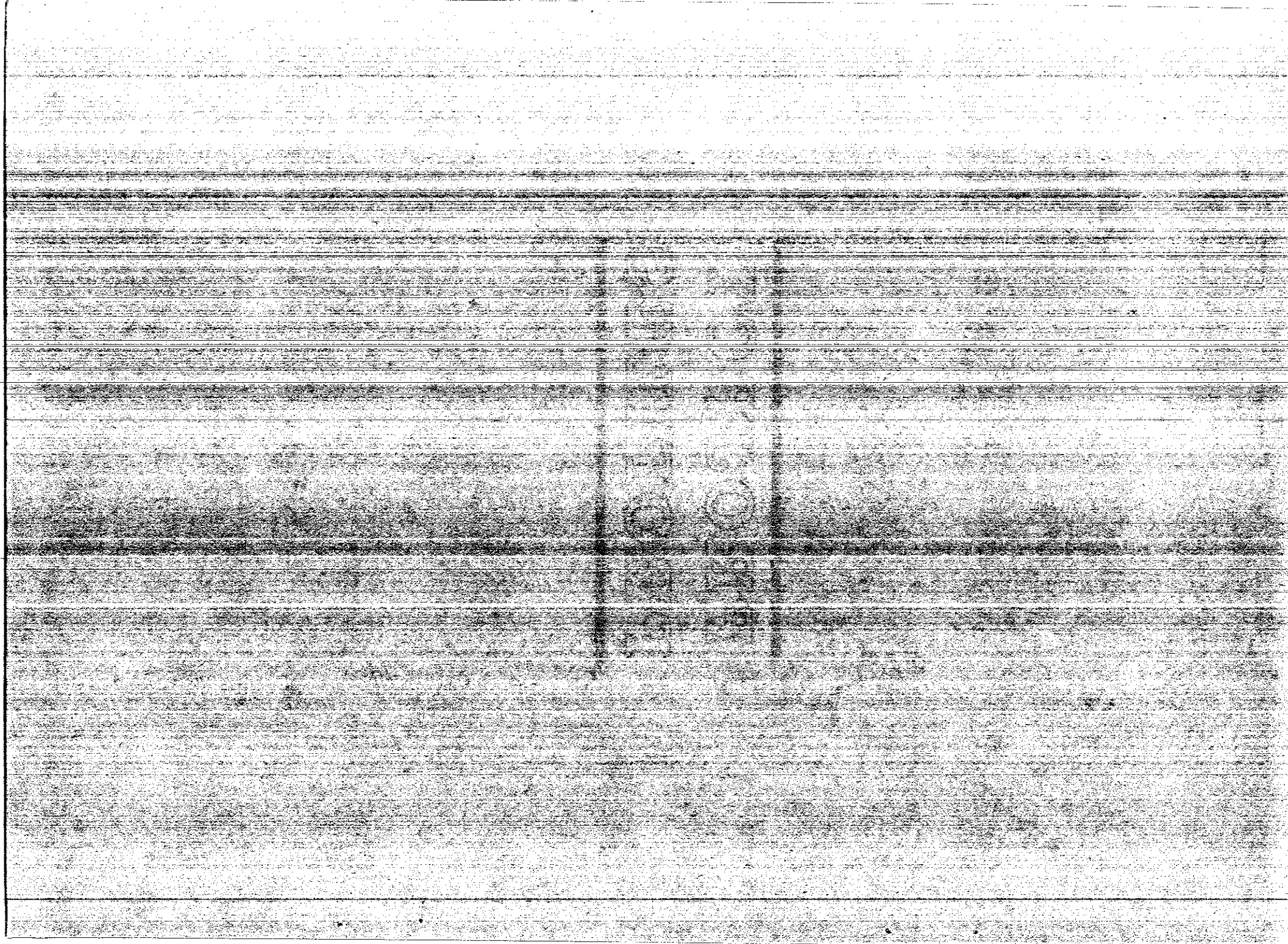
Chemicals (soda ash) are added in the form of solution as determined after first analysis results are obtained by permutations and combinations. In general quantity of soda ash is proportionate to swelling index of the bentonite. The higher swelling index, the smaller is the soda ash required. Swelling index of Akli (Barmer) bentonite becomes 12-15 after addition of soda ash. Soda ash required varies from 5 kg to 15 kg. per tonne. After testing, if the material fits the specification, then it is subjected to pulverising to 200 mesh or even finer size. By these treatments and processing, foundry and OCMA grade bentonites are prepared for the market so as to suit specification as required in oil well drilling and foundry application. Therefore, a pulverising/processing unit alongwith a testing laboratory is a basic necessity for the plant to be located at a suitable site in Rajasthan.

- iv. Large hoarded area should be released for new entrants.
- v. Loans and incentives should be given for the purchase of pulverizer and testing equipments to quarry owners.
- vi. Sub-bentonite and bentonite royalty rate should be made different.
- vii. Modern processing techniques, knowledge should be imparted to developing firms by sponsoring seminars and exhibitions.
- viii. Quarry leases are given only for three years, so it is essential that they should be given for minimum ten years as per line of other minor minerals.
- ix. In Kutch, no quarry leases are granted within 500 mtr. boundry of bauxite/laterite pockets. As per genesis, bentonite originates in same profiles so this condition may be deleted for the development of quarrying business.
- x. Bentonite property varies from pockets to pockets. To upgrade blending of different ores is essential. In view of above, business house to acquire different grade quarries in the potential area, considering the facts, it is advisable to relax the limit of 10 hectares areas as per G.M.M.R. Rules 15 (1) of specified minor minerals.

7.0 SCOPE FOR BENTONITE BASED UNITS

- 7.1 State Department of Geology & Mining has carried out preliminary survey in Amreli, Jamnagar, Sabarkantha districts and detailed assessment of Bhavnagar and Kutch Bentonite deposits. Prospecting result has proved 105 million tonnes reserves in the State/ Small scale bentonite processing units with installed capacity of 150,000 MT per year are in operation. These units are running satisfactorily and are not coping with the internal as well as export demand.
- 7.2 Within the country, the foundry, oil well drilling, iron ore pelletisation units are the largest consumer of Bentonite. Their annual consumption is estimated at around 211,800 MT. The demand of the bentonite is depending on the internal consuming industry. The foundry industry is the main consumer. As per rough consumption norms, 10 MT of bentonite is required for the manufacture of 100 MT of gray iron. While in case of alloy and steel casting, it is around 20 MT for 100 MT. In case of pelletisation, it is used as a binding material in preparation of pellets and about 1% of bentonite is consumed for manufacture of pellets.
- 7.3 In addition to above, there are number of consuming industries like insecticides, pesticides, refractories, ceramic, rubber, paints, pharmaceuticals and civil engineering where bentonite is consumed. The consumption pattern in above industry is not regular but refractory and ceramic industry demand is increasing day by day. Demand and supply gap with production exists, even in export, demand is increasing with the establishment of pelletization plants and oil well drilling activities. With increasing demand in pesticides and insecticides, bentonite granules are also a good demand.
- 7.4 State has vast coast line and bentonite occurrences are situated near sea coast so scope for establishment of 100% EOUs in Kandla or in Bhavnagar are also very bright. The potential pockets of the neighbouring State of Rajasthan can also be considered for exploitation and upgradation in case of 100 % EOU units as the quality variation from pockets to pockets is changing and captive quarries can also be acquired in the neighbouring states to feed the proposed EOU units.
- 7.5 Rajasthan deposits are far from the coast so processing unit at Gandhidham or Kandla can haul the raw lump from the quarries. Deman supply gap and export potentiality in international market of oil producing countries, scope for establishing bentonite based units in the State. Project profiles for activated Bentonite, Processing, Granulation and Paint grade Bentonite are considered viable projects.

	<u>Rs. Lakhs</u>
1. Land and Building	11.0
2. Plant and Machinery	16.0
3. Working Capital	2.0
	<u>29.0</u>
8.1.7 Utility	
1. Power 60 KW	
2. Manpower 20	
8.1.8 Suggested Locations	
The selection of plant location must be based on purely economic factors. Various factors which need to be taken into account are nearness to raw material source and market efficient means of transportation, availability of labour and power. The proposed unit can be located in the backward district of Kachchh or in Bhavnagar district. If it is 100% Export Oriented Unit, it can be located in Kandla Free Trade Zone.	
8.1.9 Government Policy/Key Elements	
<ul style="list-style-type: none"> • SSI Registration • Acquisition for quarry lease from Collector of concerned district. 	
8.1.10 List of Plant and Machinery Suppliers	
1. Techno-Bonaza Pvt Ltd	
71/10, GIDC Industrial Estate, Vatva, Ahmedabad 382 445	
2. International Co. Ltd	
101, Park Street, Calcutta 700 016	
3. Suresh Engineering Works	
Modasa Road, Dhansura 383 310, Dist.Sabarkantha	
8.1.11 List of Raw Material Suppliers	
1. Swastic Minerals	
Bunder Road, Mandri, Dist. Kachchh	
2. Shri I S Jani	
Bunder Road, Mandri, Dist. Kachchh	
3. Kutch Minerals	
Bunder Road, Mandri, Dist. Kachchh	
8.1.12 List of some of the Existing Units	
1. Ashapura Mine Chem Industries	2. Rajkumar and Co
Station Road	Plot No.3, Sector - 12
Bhuj - Kachchh	Gandhidham-Kachchh
3. Ashish Mines and Minerals	4. National Minerals
Plot A No.13, GIDC	Match Factory Compounds
Gandhidham- Kuchchh	Motitalar Road, Bhavnagar
5. Shri Kasam Ali and Sons	6. Shri Sai Corporation
High Court Road	V S Mehta Building, Navapura
Bhavnagar	Bhavnagar



granules in question is supplied to pesticides formulating companies who in turn, after impregnation of the required insecticides or weedicides supply to the farmers.

The insecticides/weedicides used by the farmers are in three forms- liquid, powder and granular.

It is this granular form that is becoming popular as its application needs no spraying equipments by the farmers.

8.2.2 Market Potential

There are 31 organised sector units and 110 SSI pesticide manufacturing units producing technical pesticides and formulation in Gujarat. The requirement of pesticides in the State is 6.1% of total requirement in the country. Survey of Development Commissioner, small Scale Industries estimated a formulation capacity of 3,700 tonnes of granules in small scale sector. Formulation units are mainly concentrated in Ahmedabad, Baroda and Bharuch which consume black bentonite granules. At present, 15 units located in Chitra, Ghogha and Bhavnagar are producing 2000 tonnes granules annually. Demand from pesticides industry is around 4000 tonnes. There exists a gap of 2000 tonnes in a demand supply.

Development of new types of pesticides formulation like water dispersal granules can also create a new market. Granule market exists in pesticides. Cyanamid India Ltd. and other similar firms need granules. Cattle-feed manufacturing units like "Sumuldan" and "Sabardan" purchase above granules.

Due to increase in cattle-feed manufacturing units, the product may develop a good market.

Manufacturing Process/Technology

The bentonite lumps are subjected to crushing or disintegrating in a crushing or disintegrating machine. This crushed material is then sieved by vibrating screens to obtain the required grain size as specified by the purchasing company. The grain size as specified by the purchasing company. The grain sizes mainly used are 10/20, 20/40, 18/36, 14/30 BSS. Thus obtained granules are then subjected to heat in an oil fired Rotary. Furnace to remove moisture and render the clay hard so that it does not break easily. This heated granules after cooling is again screened and packed in polythylene lined gunny bags (second hand) to obtain the finished product.

8.2.4 Plant and Machinery

1. One Disintegrator/Crusher 25 HP motor
2. Two 7' x 3' vibrating screens with 10 HP Motor
3. Oil fired rotary furnaces
4. Belt conveyors

8.2.5 Raw Materials

Nonswelling bentonite is available in Bhavnager, Sabarkantha and Bharuch districts. Private lease holders are having quarry lease in the district.

8.2.6 Project Size

Land & Building	11.00 lakh
Plant & Machinery	16.00 lakh
Working Capital	2.00 lakh
	<u>29.00 lakh</u>

8.1.2 Market Potential

Bentonite is one of the most important industrial minerals. It finds uses in foundry and pelletisation of iron ore, drilling muds, activated bleaching earth, civil engineering, refractory and ceramics, pharmaceutical aids, welding electrodes, fillers, insecticides, fungicides and several others.

(i) Foundry Sand Bond

In India, the largest use of bentonite is as a binding agent and conditioner in moulding sand used for casting various ferrous and non-ferrous metals. Bentonite used as binding agent may either be sodium swelling type or calcium non-swelling bentonite. For every tonne of steel casting about 90 pounds of bentonite is required.

(ii) Iron Ore Pelletisation

Use of bentonite in iron ore pelletisation has expanded rapidly with the growth of world's iron ore pelletisation industry. In India, bentonite is used in pelletisation of hematite iron ore fines. An iron ore pelletisation plant is coming up at Sandaur in Bihar. The plasticity of bentonite imparts high green strength to the pellets and the high dry strength results from its capacity to absorb and then gives off moisture for the purpose of pelletisation. Iron ore fines are usually ground to 70-90% minus 325 mesh and moisture content around 10%. To this, about 1% of bentonite is added and mixed thoroughly with the required amount of water. For every tonne of ore, about 15-20 pounds of bentonite is required. Swelling type bentonites are normally preferred for such uses.

(iii) Oil Well Drilling

Another important application of bentonite is in preparation of drilling mud material for oil well drilling both onshore and offshore ground water drilling and mineral exploration drilling in loose sedimentary formation. The purpose of these muds is to lubricate and cool the rotary cutting bits, carry away rock cutting fragments and to act as a seal against the escape of gas from the bore hole and to improve and prevent the hole from blowing out. Another function of such fluids is to condition the wall of the drill hole to prevent caving.

Bentonite possesses thixotropic properties and deposits a thin water proofing film on the walls of the bore holes and thus render permeable formation impervious. This also helps to prevent the circulation loss of drilling muds. The percentage of bentonite in drilling mud varies from 20-30% depending upon the drilling conditions and the quality of bentonite used. To be useful, the bentonite must have good swelling properties. Both natural and synthetic bentonite are reported to be used for preparing drilling muds.

(iv) Activated Bleaching Earth

In India, bentonite together with fuller's earth is used for manufacture of activated bleaching earths by the process of activation. Non-swelling bentonites are activated which are used mainly in bleaching and refining of vegetable and mineral oils.

(v) In Paper, Oil, Cloth, Linoleum Industry

Where a light coloured material can be produced or where the colour is not important, alkali bentonite of sub-bentonite type can be used in the manufacture of paper. It is very efficient in promoting retention of china clay. Retention of clay alone is 45% but with 10% bentonite, it is 84%. Alkali bentonite also gives a superior feel to the paper.

(vi) Rubber Industry

Bentonite required for rubber industry should be free from grit and should pass through 200 mesh sieve. The moisture should not be more than 45% and LOI not more than 85% due to its fine particles and capability of solution formation with water bentonite is being increasingly used in rubber industry.

8.3 ACTIVATED BENTONITE

8.3.1 Introduction

Bentonite deposits in India are of two types. Swelling type i.e. Sodium based and non-swelling type i.e. calcium based. The good quality of sodium based bentonite is available in Kachchh district of Gujarat and Barmer district of Rajasthan. The 286 million tonnes of deposits that are reported in India are sufficient to meet the internal demand as well as export market. Although the resources of bentonite are considered sufficient, but it is necessary that the exploration agencies should carry out necessary tests for classifying the various reserves which are already proved as per the users specifications.

Bentonite is a versatile mineral. It is used in oil well drilling, foundry, oil bleaching etc. It is also used in rubber, paper, ceramics, lubricant, soap and detergents, pharmaceuticals and insecticides industries.

The range of application for bentonite is extensive although certain grades of bentonite are particularly suited to particular end use.

The internal demand will increase as Oil & Natural Gas Commission has increased its drilling activities. Also requirements of bentonite in foundry and other industries will increase by 5% in view of expansion of these industries.

Demand for bentonite will come from newly industrialising countries. The need for earning foreign exchange by exporting non-conventional mineral is necessary, for importing plant, machinery and scientific technical know-how for finding new applications of bentonite.

Activation of Bentonite is widely practised abroad. Bentonite differs from place to place in its response to activation approach. Gujarat, Rajasthan, Jammu & Kashmir, Andhra Pradesh and Bihar are the leading producers of Bentonite in India.

In Gujarat Bentonite is quarried in Kaira, Sabarkantha, Bharuch, Jamnagar, Amreli, Bhavnagar and Kachchh districts. Bhavnagar and Kachchh are the leading districts where Bentonite quarrying activities are concentrated and both districts account for 95% of State's production.

It is learnt that on an average, one lakh tonnes of bentonite is exploited in a state of which 60% production will be non-swelling calcium based Bentonite which is raw material for the activation.

Exploration results indicated 100.04 million inferred reserves in the State. In Bhavnagar district 40 million reserves have been proved by the Department of Mines and Geology. Geological Survey of India has estimated 2.25 million tonnes in the operational areas in Mandvi and Bhachau talukas of Kachchh district.

8.3.2 Market Potential

Activated Bleaching earth is used mainly in bleaching and refining edible oils and fats vegetable oil, castor oil and mineral oils. Its uses are enumerated as under.

1. Refining Of Industrial Triglycerides

Industrial triglycerides e.g. Castor Oil are in most cases crude vegetable oil or animal fat and are treated similarly as the edible oils & fats. These industrial triglycerides are mainly used for production of paints, varnishes and soaps as well as of fatty acids and their chemical derivatives.

2. Refining Of Edible Oils And Fats

The crude edible oils such as mustard, groundnut, rice bran Soyabean, Sunflower, Cotton seed etc. exhibit a high degree of free fatty acid, colour owing to carotenes, carotenoids,

Pulverising and Classification

Small lumps are fed to pulverising through a bucket elevator for feeding to the 3 Roller Raymond Mill. The lumps are pulverised to -200 mesh.

Storage and Bagging

The material from Raymond Mill is collected in Hopper. The bentonite powder is further bagged in 50 kg gunny bags with Alkathene liners. The packed bags are then stitched with machines. Most of the bentonite is thus ground to approximately 90% finer than 200 mesh.

8.1.4 Plant & Machinery

All the plant and equipment are available indigenously. Bentonite processing plant basically consists of a pulverising unit, testing laboratory, a large area for keeping stocks of bentonite for curing and treatment purpose.

The main component of the plant is a pulveriser, which is available in models (1) Five Roller Raymond Mill and another three Super Roller Raymond Mill. The production capacity of five Roller Raymond Mill is three times that of three Roller Raymond Mill. The cost of its power consumption is also more than three times. It is felt, initially, three Roller Raymond Mill should be installed and as and when requirement increases, a five Roller Raymond Mill may be installed. The only disadvantage with the three Roller Raymond Mill is that as compared to five Roller Raymond Mill, it occupies large ground area.

Accurate sampling and testing for bentonite from different deposits/layers/depths has to be carried out before we take up grinding so as to decide the proportion of blending and chemical treatment necessary to obtain the optimum physio chemical parameters.

The physical properties of bentonite nevertheless may be made to meet the specific parameters by application of chemical additives. Therefore, establishment of well equipped laboratory is indispensable.

The other equipments required are -

- Material handling equipment such as flat belt conveyor and bucket elevator
- Storage site
- Weighing machine
- Hopper etc.

8.1.5 Raw materials

Bentonite deposits occur in Jamnagar, Bhavnagar, Kachchh, Sabarkantha, Amreli, Kheda and Bharuch districts. There are 263 quarry lease holders exploiting on average 50,000 tonnes to 1,20,000 tonnes per annum. 622 hectares land is acquired under the quarry lease by private parties in the State. Exploration result indicated 100.04 million inferred reserves. Deposits of Bhavnagar and Kachchh are important geological survey of India and Department of Mineral, Geology have prospected above deposit.

8.1.6 Project Size

A period to manufacture 6000 TPA of Processed Bentonite will involve an investment of Rs. 29.00 lakhs.

increasing with the economic development the demand is rising at a steady rate of 20% per annum.

The activated bentonite is used in the bleaching and refining of oils. An average 7000 tonnes is produced against the demand of 10,000 tonnes per annum. Demand and supply gap for the product has increased after the Gujarat Co-operative Oilseeds Growers Federation Ltd oil mills establishment.

The consumption of activated bentonite depends upon the nature of oil to be treated. It varies from 1 kg per barrel for petrol to 100 kg per barrel for dark heavy lubricants. In case of vegetable oils, it has good market in oil mills. Considerable quantities are used in refining petroleum products, vegetable oils and treatment of fats and greases. It removes tarry complexes and dissolved colouring matter. With the new oil findings by ONGC refining capacity of present Koyali & Mathura etc. are going to be expanded. In Co-operative Sector, edible oil are manufactured from Sunflower, Cottonseeds etc. Such units are coming up with the efforts of Dr. V. Kurien, Chairman of National Dairy Development Board in Gujarat and other parts, which will also need above product for decolourisation. It has also export market in Malasia and West Asian Countries.

8.3.3 Manufacturing Process

Slurry Formation

The Bentonite is transported to the factory site in lumps form by trucks. The lumps are analysed for their moisture and cation exchange capacity and then unloaded in respective storage tins allotted. The lumps are passed through a jaw crusher if desired and lumps less than 1/4" are fed to the slurry tank. First the slurry tank is filled with the desired water and the agitator put on. The lumps disintegrate on wetting and form a slurry.

Digestion

The slurry is then pumped by a centrifugal pump to the Digester (Wooden Vat). The sulphuric acid is added gradually with the agitator put on. After addition of sulphuric acid the direct injection of steam is commenced and digestion continued for 8 hours at 80°C. The steam supply is shutoff after 8 hours of injection and the slurry is filtered through a polypropylene filter press. The acidic mother liquor is drained off to Mother liquor tanks and the cake is collected in mobile HDPE trolleys.

Washing

The cake from filterpress is then reslurried in water in wash tanks (Wooden Vat) and then centrifuged in basket centrifuges. Here further wash water is added to remove contaminants and decrease the free acidity. The mother liquor is drained to Mother Liquor tanks and the cake is scrapped and loaded into mobile trolleys. The pH of material is desired to be A.O. If it is less the cake is again reslurried and centrifuged.

Roasting

The wet cake is sundried on open platform if desired or could be directly taken to the refractory lined batch rotary furnace. Here the material is roasted for five hours at 300-350°C and then discharged.

Pulverization & Bending

The roasted material is ground by a hammer mill to 200 mesh and taken off to blender for uniformity in a Batch. The material is directly discharged into laminated HDPE bags or craft paper bags and stacked in the finished stocks godown. All relevant quality control parameters are checked and segregation of lots as per quality control report is made.

Laporite Industries Limited, Kingsway, Lutonbeds, UK runs two activation plants. One plant utilises sulphuric acid and another, hydrochloric acid as activating or bleaching

8.2 BENTONITE GRANULATION

8.2.1 Introduction

Bentonite possesses a large surface area, carrier materials provide an adequate surface area for the absorption of the insecticide. The application of the insecticide-carrier mixture has several advantages like even distribution of the insecticide.

Bentonite consumption in insecticide industry varies from 2500 tonnes to 3000 tonnes annually.

State is the leading producer accounting for 80% of the total production in the country. State Directorate has estimated 40.79 million tonnes reserves of all grade in the Bhavnagar district. Out of this, most of the reserves is of nonswelling grade.

At present, 263 bentonite lease holders covering 612.09 hectare area are existing in the State. Non swelling bentonite is also reported from Sabarkantha and Bharuch districts. But bentonite granulation units have only flourished in Bhavnagar district. No unit is in existence in the non swelling bentonite producing districts.

Bentonite is basically a clay mined by open-cast mining in two groups.

a) Swelling or colloidal or sodium based

b) Nonswelling or Calcium based

The swelling or sodium based bentonite has its uses in foundry oilwell drilling etc.

The non-swelling or calcium based bentonite is the one used in the manufacture of clay granules. This particular bentonite is used because it has got very high absorption capacity or liquid holding limit, i.e. it can absorb thixotropic liquid to the extent of 25% W/V (Water/Volume). This property and its having a pH of 6-7, enables its use in granules.

Specification of calcined granules required by Cyanamid India Limited is given below:

Granules shall be double calcined.

Description	:	Free flowing, practically free from foreign matter and dust particles.
Sieve Test	:	100% passes through B.S.S. No. 22 mesh 100% retained on B.S.S.No.52 mesh
Bulk Density	:	Minimum 0.8 gm/ml
Moisture	:	Not more than 0.5%
pH (10% Aqueous solution)	:	5.0 to 7.0
Attrition Test	:	Note more than 0.25 gm per 100 gm. Take 100 gm sample on B.S.S No. 200 mesh and sieve the material for 6 hours on Ro-tap sieve shaker. The material passing through 200 mesh should not be more than 250 mg.
Sorptive Capacity	:	Minimum 18% Granules impregnated with 18% Kerosine should be free flowing and should not clump together after 30 minutes and colour of impregnated granules is not much darker than the original.
Packing	:	Should be in 50 kg thick polythene bags with a cover pack of bituminised polylined gunny bag.

Granules are used in insecticides and weedicides for application by farmers in agriculture after it has been impregnated by the killing chemicals/liquid. The bentonite clay black

Sr. No.	Name of Description of Machine	Nos.	Name of Manufacturers & suppliers	Cost [Rs.]
12	LDPE DAY TANK Model: CVS-200 2M3 Moulded HDPE storage tank	1	Gujarat Raj Plant Pvt Ltd Ahmedabad	5,600
13	FP FILTRATION PUMP Model: HCP/OT/40/315 Alloy-20 Pump for filtration of slurry @ 120 lpm, 2 kg/cm ² lead complete with base plate and coupling.	1	Hi-Life Manufacturing Co. Ahmedabad	63,500
14	FILTERS PRESSES Polypropylene plant & frame filter press consisting of CI body with rotchoct gears and 40 sets of plate frames.	2	Labh Industries	470,000
15	WASH TANK Wooden vat duly stiffened and fabricated from best quality teak complete with stirrer, 4" bottom and 3" sides.	1	Hetal Enterprise	106,000
16	CF FILTRATION PUMP Model: HCP/OI/40/315 Alloy-20 pump for filtration of slurry @ 120 gm 3 kg/cm ² , complete with base plate and coupling.	1	Hi-Life Manufacturing Co.	63,500
17	CENTRIFUGES Model: MFB-900 Basket size 900 x 375 mm SS basket & outer body MS with clutch, ring and V-belts without motor.	2	Favourite Engineering Co.	132,000
18	ROTARY FURNACE With conical open mouth ends 7.5 HP electric motor Elecon gearbox NUT VT/pulleys, countershaft with MS gear on mill 2 Nos. MS tier supports on mill rotating on supporting 2 Nos. wheels on each tier. 5 HP blower with butner and 18" dia chimney x 30 feet height overall dimension: 6 dia x 12' length.	1	Mech Metal Corporation	296,000
19	PULVERIZER 25" size, complete with cyclone separator and durt collator but without motor starter, motor pulley V-belts and foundation bolts.	1	Hanpana Tools Ahmedabad	56,600
20	BLENDER Model: MRB-2000 BW With total volumetric capacity of 2500 litre fabricated from MS complete with through shaft, ribbons inlet hopper, discharge, pulleys, V-belts but without motor, gear box of starter.	1	Manish Metals	52,100
21	JAW CRUSHER 8" x 4" complete with main machine, flywheel jaws etc. but without motor, starter, pulleys, V-belts, belt-guards foundation bolts etc.	1	Hankana Tools Ahmedabad	21,700
22	PLATFORM SCALE Model: Avery No.1 ND 3901 AAG, Portable platform scale capacity: 300 kgs. Size: 400 x 625 MM	1		5,260

8.2.7 Utility

Power	500 KW
Water	10,000 ltrs/day
Manpower	18

8.2.8 Suggested Locations

The districts of Kachchh and Bhavnagar may be preferred for setting up of such units in the State.

8.2.9 Government Policy/Key Elements

- As bentonite clay granules are used in pesticides, i.e. agriculture, it has got a very good potential but as the insecticides used are highly toxic in nature, any major change in Government Policy may adversely affect this industry.

8.2.10 List of Plant and Machinery Suppliers

- | | |
|---|--|
| 1. Sanbeam Engineering Works
150 Between Bazar Monghya
Bihar | 2. Suresh Engineering Works
Modasa Road
Dhansura 383 310 |
| 3. S.S Industries
Himaja Minerals
22, Ramkrishna Colony
Maninagar
Ahmedabad 380 008 | 4. Pioneer Equipment Company
P.O. Box 237
432, Padara Roads
Baroda 390005 |

8.2.11 List of Raw Material Suppliers

- | | |
|---|---|
| 1. Raj Mineral Company
3B Lati Chambers
Bhavnagar | 2. Shri Sai Corporation
VS Mehta Bldg; Navapura
Bhavnagar |
| 3. Ami Minerals
Station Road, Himatnagar | 4. Jay Minewrals
48 Sharda Society
Ahmedabad-380 007 |

8.2.12 List of Some of the Existing Units

- | | |
|--|---|
| 1. Pesticides & Mineral Prods.
F 53/54 Ruvapari Road
Bhavnagar | 2. New Chemicals & Mineral Co
Chunarwad, Ghogha
Dist. Bhavnagar |
| 3. Rajiv Minerals
Plot No.67, GIDC Chitra
Bhavnagar | 4. Bharat Granules
Rakhadia Hanuman, Ruvapari Rd
Kadava Patidar Wadi
Bhavnagar |
| 5. Jay Khodiyar Minerals
Plot No.245, GIDC Chitra
Bhavnagar | |

3. Ashapura Minerals, GIDC Estate, Chitra, Bhavnagar.

4. Ashish Mines and Minerals, Plot No. 12 GIDC Estate, Gandhidham.

For acid wash, water requirements per tonne is 50,000 gallons. Acid can be purchased from open market.

8.3.6 Cost Of Project

Rs. 54 lakhs for a project of 400 kgs per shift.

	Rs.lakh
1. Land	1.79
2. Building	9.30
3. Plant & Machinery	30.20
4. Office Furniture	0.30
5. Electrification & water connection	0.50
6. P & P Expenses	1.57
7. Electricity Deposit	0.30
8. Contingencies	3.54
9. Working Capital margin	54.00

6.3.7 Utilities

For manufacture of one ton activated Bleaching Earth 1.25 Tons of Bentonite and 500 kg Sulphuric Acid is required.

Cost of Bentonite for one ton is Rs. 400/-

So cost of 1.25 Tons is Rs. 500/-

Cost of Sulphuric acid per ton is Rs. 600/-

So cost of 500 kg of Sulphuric Acid is Rs. 300/-

For one ton of activated Bleaching each

Raw material cost:	Bentonite	Rs. 500/-
	Sulphuric Acid	Rs. 300/-
	Total	Rs. 800/-
		Per kg. Rs. 00.80

Power And Fuel

L.D.O. is used as fuel

For manufacturing one ton activated Bleaching earth 140 kg L.D.O. is required cost of 1 kg L.D.O is Rs. 5/-per kg. So fuel cost of one ton is Rs. 700/-.

For manufacturing of one ton activated Bleaching earth 75 K.Wt. electricity is required cost per one K.Wt. is Rs. 2/-.

So electricity cost of one ton is Rs. 150/-.

8.3.8 Suggested Location

Bhavnagar and Kachchh are leading producers of both types of bentonites. Plant can be located at Mahuva or Talaja in Bhavnagar or at Mandvi in Kachchh.

chlorophyll etc. and odour which are removed by the so called processes of refining, bleaching, deborizing respectively.

The so called bleaching is done by treatment of edible oil with varying doses of Activated Bleaching Earth (0.5 to 3%) at a fixed temperature vacuum and contact time.

3. Mineral Oils

Products obtained by fractionation of crude oil e.g. mineral oils, paraffins, waxes for special applications i.e. for manufacture of transformer oils, turbine oils and medicinal white oils, paraffins and waxes intended for use in the food industry need to be tested with Activated bleaching earths.

4. Waste Oils

A further special field of application is the regeneration of waste oil for the re-refining of lubricating oils.

5. Rolling Oils

Rolling oils (mixture of aliphatic hydrocarbons and various additives) are employed in the aluminium and metal processing industry serving as lubricants.

During use they get polluted with metal dust, water and foreign lubricating oils and are purified by use of bleaching earths.

6. Solvents For Dry Cleaners

In dry cleaning washing liquids comprising of chlorinated hydrocarbons (solvents) and various surfactants use of activated bleaching earths is made for removal of fatty acids, fats, oils, colour bodies and other impurities.

The edible oil used to be imported in massive quantities. But now after hectic efforts by Govt. oil seeds production specially, Soyabean, Mustard and ricebran have risen tremendously and thus the need for refined oils/vanaspati ghee is being tried to be met indigenously. The growing urban culture too because of mass communication media like TV & Video has set forth a trend in favour of refined oils in lieu of raw oils, which used to be used rurally e.g. 'Dhara' marketed by NDDDB has taken the country by the waist and even people in the rural areas are getting inclined towards the refined oils.

Moreover the so called solvent extracted oils which were exclusively used for soap manufacture are increasingly being used for vanaspati Ghee manufacture because of the excise rebate offered by the government. Besides the castor oil derivatives have a good export demand because of the recent devaluation.

All these factors have created a sudden vacuum of Activated Bleaching Earths. The present production of 6000 Tons/Annum is still less than half the actual demand. The import from Germany along during the year 1990-91 was 5000 Tons/Annum, more material to the tune of 2000 T/Annum is anticipated to have been coming from Japan, England, South Korea and America. And going by the trend at least 20% growth rate is expected every year. Our production of 1200 Tons/Annum, shall be very minor of the actual present gap in demand thus no marketing problem is envisaged. Even Germany, South Korea, Indonesia, America etc.

Besides price rise we shall have a leverage because raw material bentonite is available very near to Jamnagar, Kutch and Sabarkantha.

Quality wise also Jamnagar, Kutch and Sabarkantha material is one of the best bentonites in the country. So we shall be able to compete with a strong foot-hold in every aspect.

With India marching towards self sufficiency in edible oils getting less and less dependent on imported Balm oil and Soyabean oil and the per capita consumption of edible oil

8.4 OIL WELL DRILLING MUD CHEMICALS

8.4.1 Introduction

A variety of chemicals and minerals are required by Petroleum Industry for successful drilling, production and transportation of Crude Oil and Gas. These chemicals range from a simple products like common salt to complex derivatives of natural compounds, microbial products, synthetic macromolecules and specially processed minerals. Drilling deeper objectives in geologically hostile environment and obtaining production from depleted reservoirs pose problems and require speciality chemicals and minerals to accomplish the objectives of safe and fast drilling, achieving maximum production, transporting the crude oil and gas through long distance pipelines and mitigate the problem of corrosion in marine and other aggressive environments. Oil & Natural Gas Commission has concentrated its drilling operation in western region. Several shallow and deep wells have been drilled with sodium lignite mud in various projects. Lignite is purchased by ONGC in powder form packed in Polythene lined gunny bags. Sodium lignite is found to be a good emulsifier of hydrocarbon oils in drilling muds.

Lignite is found to be a comparatively inexpensive chemical to control the rheological and fluid loss property of drilling mud.

Drilling mud parameters can be well maintained with the use of sodium lignite. Such mud has the advantage over other thinners in respect of flash flocculation caused by direct treatment with alkalis.

8.4.2 Market Potential

In all projects of ONGC in drilling mud, sodium lignite is used in preparation of lignite at every drill site. With the use of lignite solution cost of drilling fluid is reduced. In addition to above, a variety of minerals are required by ONGC and Oil India Limited for oil well drilling such as bentonite barytes, muscovite flakes, kaolin, manganese etc.

Bentonite is used in oil well drilling as a drilling fluid, ingredient as a viscosifier and filtration control ingredient. It is also used to prepare aqueous mud and obtain light weight cement slurry. Bentonite is required by ONGC/OIL in several thousand tonnes per annum in powder form (100 mesh) Baryte in powder form (300 mesh) is used as a popular weighing material for drilling fluid and cement slurries. Muscovite flakes are required by ONGC in the range of 5 mesh to 80 mesh. Manganese Dioxide, Kaolin, Attapulgite clay, Caustic soda are the other raw materials required for the product.

Mud chemicals and treating chemicals have market in ONGC drilling projects in India. The requirement is likely to increase as more and more drilling activity both on-shore and off-shore takes place.

Some of the items manufactured are (1) Resins (2) Diesel M (3) Drilling detergent (\$) Lubricant deafoamers (5) Corrosion inhibitors (6) Foaming agents.

8.4.3 Manufacturing Process/Technology

The process of manufacture consists of coupling, complexing, curing, reduction reactions ensuring homogeneity and/or particle size distribution of the various raw materials resulting in the final product designed to impart the specific properties required of the product in the particular mud system that would most benefit drilling conditions.

The technology for indigenous manufacturing of items has to be imported from the listed manufacturers.

The present raw materials will be supplied by the joint collaborator.

agent. Raw material is crushed and reduced to a water suspension of 30 mesh particles. The suspension is charged into tile-lined mechanically stirred autoclaves together with suitable quantity of sulphuric acid. After a few hours reaction, the products are discharged to a washing filter. Filter cakes are fed to kilns for heating. After heat treatment, they are crushed to 200 mesh powder.

8.3.4 Plant & Machinery

Sr. No.	Name of Description of Machine	Nos.	Name of Manufacturers & suppliers	Cost [Rs.]
01	FRP STORAGE TANK (ST-1) 12000 L horizontal storage tank made from polyester resin for storage of spent sulphuric acid with inlet/outlet/manhole/overall dimensions. Vent connections.	1	Fibreglass Equipment Industries, Ahmedabad	60,000
02	LDO STORAGE TANK (ST-2) 12000 L horizontal storage tank in MS construction for storage of LDO of 6 mm cylindrical portion and 8 mm sides with inlet/outlet/manhole connections.	1	Self Fabricated	50,000
03	OVERHEAD WATER STORAGE TANK (ST-4) 10 M3 capacity moulded HDPE storage tank for water storage. Model CVS-1000	1	Gujarat Raj Plast Pvt Ltd Ahmedabad	28,000
04	DEEP BOREWELL WITH SUBMERSIBLE PUMP Pump Cora-7.89/19 (KSB Make) Bore: 180 Meters	1	Goodluck Mrktg. Pvt. Ltd Ahmedabad	28,742
05	DIGESTER 15 M3 capacity wooden vat duly stiffened and fabricated from best quality teakwood, complete with stirrer, 4" bottom and 3" sides. Overall dimensions: 8-1/2" dia x 9-1/2" height.	1	Hetal Enterprise Ahmedabad	106,000
06	Agitator and agitator support for slurry tank.	1	Self fabricated	10,000
07	SLURRY PUMP Model: HCP/OI/40/250-SS-304 65x40 pump suitable for pumping bentonite slurry 200 rpm at head of 10 mtrs complete with baseplate and coupling material of construction SS-304.	1	Hi-Life Manufacturing Co. Ahmedabad	19,800
08	ACID LIFT PUMP 32 X 25 X 100 Alloy - 20 sulphuric acid lpm at head of 10 meters comp. with base-plate & coupling.	1	Hi-Life Manufacturing Co. Ahmedabad	17,800
09	BOILER Model: US-500 Unisteam package type - two/three non-JBR LDO fired 500 kg/Nr. steam boiler comp. with feed water pump & motor, blower, feed pump, control panel, feed water tank.	1	Thermotech Systems Ahmedabad	201,500
10	WATER PUMP MODEL: CROMPTON MBK-2.2 - 2 HP (50-40) Monoblock pump suitable for discharge of 200 lpm at 18 meters lead.	1	Kampala Machinery Mart Ahmedabad	5,100
11	ACID DOSING TANK Model: CVS-200 2M3 Moulded HDPE storage tank	1	Gujarat Raj Plant Pvt Ltd Ahmedabad	5,600

8.4.7 Utility

- | | |
|-------------|--|
| 1. Power | 150 KW |
| 2. Water | 25,000 ltrs./day |
| 3. Manpower | 50 (10 Supervisory & 40 Non Supervisory) |

8.4.8 Suggested Locations

The plant can be located in backward district of Kachchh or in the Nandesari, Vapi or Panoli. Lignite, Bentonite, Kaolin, Soda ash are available domestically. So it is advisable to locate in the Saurashtra or Kutch district.

8.4.9 Government Policy/Key Elements

- No Objection Certificate from Gujarat Pollution Control Board.
- The foreign collaboration approval from Secretariate for Industrial Approval, Ministry of Industry, New Delhi.
- Certain raw materials are to be imported.

8.4.10 List of Plant & Machinery Suppliers

- | | |
|---|---|
| 1. Haliburton Services
1515, Louisiana Street,
United Bank Plaza, Suite - 2300
Houston, Texas Tz 77002 USA | 2. Imco Services
2400, West loop South
Houston, Texas 77027, USA |
| 3. Reed Tool Company
P.O. Box 2119
Houston, Texas 77001, USA | 4. Massina Incorporated
3612, Noble Suite 101
Dallas, Texas 75204, USA |
| 5. Milchem Inc.
PO Box 22111
Houston Tx-77027, USA | 6. Dowell Schlumberger Services &
Products
PO Box 2964, Dubai, UAE |
| 7. BJ-Hughes Inc.
5500, Northwert Central Dy.
Houston Texas 77092, USA | 8. Dresser Magcobar Industries
HQ. Dresser Tower, PO Box 6504
Houston, Texas 776265 USA |
| 9. Hughes Drilling Fluids
10777 N.W.Free Way
Ste. 700 Houston
Texas, USA | 10. Drillsafe International GmbH
P.O. Box 1320 Enschede
Str. 24,4460, Nordhorn,
West Germany |
| 11. Crodo Drilling Aids Ltd
1 Camberwell Green
London - SE 5
UK | 12. Nevisco Well Services Ltd
900, Norcen Tower 715-5th Ave.
Sweategory, Alberta T2F2x6
Canada |
| 13. Serlachius Pulp Mill
P.O.Box 436, SF-331-1
Tampare - 10, Finland. | 14. N.L. Baroid
P.O.Box 1675, Houston
Texas 77251, USA. |

8.4.11 List of Raw Material Suppliers

A. Indigenous

Minerals can be procured from the open market and other organic materials can also be procured from IPCL and refinery.

Sr. No.	Name of Description of Machine	Nos.	Name of Manufacturers & suppliers	Cost [Rs.]
23	REDUCTION CLEAR BOXES			
	a) Power master-70 horizontal ratio 40 : 1 (for blender)	1	Panchal Machinery Ahmedabad	24,000
	b) Power master-65 vertical downward ratio: 211 (for digester & wash tank)	3	Panchal Machinery Ahmedabad	51,000
24	ELECTRIC MOTORS			
	GEC make, TEFC. Sq.cage Induction Motors operating on 400/440 V, 3 Ph. 50 Cy AC supply all/440 RPM		Bharat Engineering Corpn. Ahmedabad	
	a) 30 HP (for pulverizer)	1		30,965
	b) 12.5 HP (for centrifuges)	2		34,672
	c) 7.5 HP (for blender)	1		10,890
	d) 7.5 HP (for CF filtration)			18,766
	e) 5.0 HP (for slurry tank, digester & wash tank jaw crusher)	5		34,650
	f) 2.0 HP (for acid lift pump)	1		5,370
25	LABORATORY EQUIPMENT			
	a) Lowbond Tintometex AIM-1501 Model: 'E' Universal.		Aimil Sales & Agency Pvt.Ltd	90,000
	b) Karl Fischer Apparatus Model: 349 with accessories.		DK Scientific Industries Ahmedabad	10,800
	c) Muffle Furnace Chamber Size: 9"x4"x4"		..do..	6,400
	d) Single Pan Balance Model: K-14, K-pay & Co. Cap-200 Gms. Accuracy: 0.1 mg.		..do..	6,000
	e) PH Motor. Digital with accessories		..do..	5,070
	f) Gyrotory sieve shaker with timer		..do..	8,000
	g) Hot air oven: 'CINTRX' Make 14"x14"x14" Size: Aluminium chamber. Temp. 250 + 2°C Thermostatically controlled.		Lalatronik Ahmedabad	4,800
	h) Vacuum Pump. Toshnical cat No.73.01 with 1/4 HP Motor.		DK Scientific Industries Ahmedabad	8,500
	i) Magnetic stirrer with Hot plate 'REMI' 2 FLH		..do..	1,775
	j) Water still Automatic 4 litres per hour complete SS		..do..	3,000
	k) Stirrer: 'REMI' with 1/20 HP motor with Dimmerstat and stand		..do..	2,800
	l) Miscellaneous glassware and Peagants (Backers, Test tubes, Indicators, Buchner funnels, Desicators, Mantiles, Burretc & stand pipettes, flasks, pegant bottles, AR reagents etc.)		..do..	15,000
26	Piping/Valves/Instrumentation Insulation structure			200,000
27	Plant Electricals (Starters, Switches, Cables, Capacitors)			150,000
				<u>26,62,646</u>
	Freight, forwarding, insurance, octroi, erection and commissioning and foundation, taxes, etc. are extra.			

8.3.5 Raw Material

There are 263 quarry lease holders exploiting on an average 50,000 tonnes to 1,20,000 tonnes of ore per annum. For bentonite quarrying 621 hectares of land is acquired by private lease holders. The list of leading suppliers is mentioned below:

1. Kutch Minerals, PO Mandvi, Kachchh.
2. Swastic Mineral, PO Mandvi, Kachchh.

Quarternary + Sodium Bentonite
Amine Bentonite

Organoclay + Salt

Sodium chloride is removed by washing organoclay due to presence of methyl groups and tallow groups on the quarternary amine becomes compatible with organic solvents and binders.

Gelation mechanism to obtain rheological developments needs care, as full dispersion and activation have to take place.

8.5.4 Plant & Machinery

- Pulveriser	- 1 No.
- Reaction Vessel	- 2 Nos.
- Settling tank	- 4 Nos.
- Water pump	- 2 Nos.
- Filters	- 2 Nos.
- Driers	- 2 Nos.
- Tray-plates	- 100 Nos.
- Electric Motors	- 5 (10 HP)
- Testing equipments	-

8.5.5 Raw Materials

Sodium Bentonite or Hectorite clay are the main clays. Quarternary amine modifying agent.

8.5.6 Project Size

The project envisages to manufacture 1500 kg. per month involving a cost of Rs. 70.00 lakhs.

	<u>Rs. lakhs</u>
1. Land & Building	15.00
2. Plant & Machinery	35.00
3. Capital Investment	<u>20.00</u>
Total	<u>70.00</u>

8.5.7 Utility

1. Power (per annum)	2500 KWH
2. Water (Per annum)	5000 KL
3. Manpower	50 Persons

8.5.8 Suggested Locations

Sodium based bentonites are mostly found in Kutch and Bhavnagar Districts. Plants can be located at Mandvi, Bhavnagar.

8.5.9 Government Policy/Key Elements

8.3.9 Government Policy/key Elements

- Small scale Industry Registratio from General Manager Office is Essential.
- Clearance from Gujarat Pollution Control Board must be taken for effluent disposal.
- Captive quarry can be acquired under GMMR 1966. Bentonite is a specified minor mineral. Priority is given to the applicants who desire to establish activation unit. Quarry leases are issued under Gujarat Minor Mineral Rules 1966 by district Collector. However, no quarry leases are granted within 500 mtrs radius of bauxite deposit in Kachchh district.

8.3.10 List Of Plant And Machinery Suppliers

Digestation Tank

- | | | | |
|----|--|----|---|
| 1. | Anup Engineering Ltd
Anil Road, PB No. 1164
Ahmedabad | 2. | Air coils Mfg Co. P Ltd
D Phalke Road, Dadar
Bombay |
| 3. | APV Equipment Ltd
Hamilton House, 3 Graham Road
Ballard Estate, Bombay-400 036 | | |

Oil and Gas Firing Equipment(Kiln)

- | | | | |
|----|--|----|--|
| 1. | Wester Works Engineering Ltd
5-D Vulcan Insurance Building
Veer Nariman Road, Churchgate
Bombay | 2. | Laxmi Boilers
B-3 Rustom Baug, Byculla
Bombay-400023 |
|----|--|----|--|

Pulverisers

- | | | | |
|----|--|----|--|
| 1. | Hind Pulveriser Works
B 3/2 Ambica Industrial Estate
Nagarwal Hanuman Road
Sukhramnagar
Ahmedabad - 380023 | 2. | Sayaji Iron Works Ltd
Chhani Road
Baroda |
| 3. | Pioneer Equipments Ltd
Padra Road
Baroda | 4. | Anup Engineering Ltd
Odhav
Ahmedabad |

Conveying and Material Handling

- | | | | |
|----|---|----|---|
| 1. | Pioneer Equipment Co. P Ltd
432 Padra Road
Baroda | 2. | Deccan Mechanical & Chemical
Industries Pvt. Ltd
78, Bhosari Industrial Area
Pune - 411026 |
|----|---|----|---|

8.3.11 Existing Units

1. Krajur Chemicals, 1507/A III Phase, GIDC Estate, Vapi, Dist. Valsad
2. Indy Pigment, Plot No, 143, Phase II GIDC Estate, Vatva
3. Satyabhuj & Co. PB No. 30, Industrial Area, Bikaner-344 001
4. DGM Chemicals, Kanchanjunga Building No. 10, Barakhamba Road, New Delhi-1
5. Indian Clay and Mineral Co., Tarabag Love Lane, Mazagaon, Bombay-400010

8.5.12 List Of Some Of The Existing Units

- | | |
|---|--|
| 1. NL Chemicals
311, Rue de Hospital
Bte - 6 1000 Brussels
USA | 2. United Catalysts India Ltd
240, Dr. D M Road
Bombay 400 001 |
|---|--|

8.5.13 Commercial Available Clays

Major products by generic class and Trade names are:

2-Methyl - 2 hydrogenated tallow ammonium bentonite

NL chemicals -- Bentone 34
Southernclay -- Claytone-40
United catalyst -- Tixogel VF

2-Methyle - 2 hydrigenerated tallow ammonium hectorite

NL chemicals - Bentonite 38
Southern clay - claytone HT

2-Methyl - 2 ebnzye hydrogenated tallow

Ammonium hectorite
United catalyst - Tikogel VZ

2 methyl 2 benzyl hydrogenated tallow

Ammonium bentonite
NL chemicals - Bentone 27

Organoclay requiring no chemical activators

NL chemicals - Bentone SD 1, SD 2, SD 3
Southern clay claytone APA, AF

Organoclay for water bore systems:

NL chemicals - Bentone LT, EW

Plant & Machinery

A. Indigenous

- | | |
|-----------------|--------------------|
| 1. Table Mixer | 2. Storage Tank |
| 3. Heating Tank | 4. Blend Y |
| 5. Filter Press | 6. Speed Rheometer |

B. Foreign Machinery

1. Portable roller over 230V alongwith ageing Cells
2. Gaskets and accessories
3. A beach blender running on 230V with three variable speeds
4. Viscometer of 115 V-60 HZ with six variable speeds alongwith transformer and accessories.
5. Hamilton Beach Blender 3 speed
6. High temperature High Pressure filter press 230V system including necessary pressure gauges.

8.4.5 Raw Materials

Sodium Dichromate (325 MT), Caustic Soda (950 MT), Lignite (1000 MT), Attapugite clay (150 MT), Kaolin (75 MT) Sod Hexa Metaphosphate (5 MT), Xylene (16 MT), Akohol (25 MT), Butanol (35 MT), Lime (75 MT) Indigenous raw materials are required.

Imported raw materials are also required as per the suggestion of manufacturer of the items. Following solvents are also needed:

- | | | |
|----------------------|-------------|---------------------------|
| 1. Kerosene | 2. Diesel | 3. Heavy Aromatic Naphtha |
| 4. Isopropye Alcohol | 5. Methanol | |

8.4.6 Project Size

The project envisages to manufacture of 10,000 tonnes with an estimated cost of Rs. 250.00 Lakhs as under:

	Rs. lakhs
1. Land	27.00
2. Building	41.00
3. Plant & Machinery	55.00
4. Technical know-how fees.	36.00
5. Training	10.00
6. Misc. Fixed Assets	14.00
7. Preliminary expenses	5.00
8. Preoperative	17.00
9. Contingencies	15.00
10. Margin Money	30.00
Total	250.00

The project cost is given on the basis of product mix items, technology and capacity given by the Dresser Magcobar Industries, Texas - 77 265 USA.

BENTONITE IMPORTERS DURING THE YEAR 1988-89

Sl. No.	Name of the Importers	Country	CIF value (in Rs.)
1.	Bombay Paints & Allied	UK	4,63,388
2.	Garware Paints Ltd	UK	2,13,636
3.	Colour Chem Ltd.	Japan	1,19,418
4.	Park Davis India Ltd	USA	1,65,412
5.	Cipla Ltd	USA	54,658
6.	Polymers Paints	UK	21,316
7.	Richardson Hindustan Ltd	UK/USA	1,25,658
8.	Centaur Labs P Ltd	USA	19,670
9.	Lakme Ltd	UK	30,942
10.	Strebel Industries	FRG	16,462
11.	Asian Paints & Allied	FRG	1,52,051
12.	Goodless Nerolac Paints	UK	62,526
13.	Procter & Gamble India Ltd.	USA	1,31,736
14.	Paints Industries	UK	21,418
15.	Paico Elect & Elec. Ltd.	FRG	44,360

Source: International Data Service - Bombay.

Bentonite
Ashapura Mine Chem
C/1 Mittal Court, Nariman Point
Bombay-400 021

Lignite
Gujarat Mineral Dev. Corpn.
Khajin Bhavan, Opp.Nehru Bridge
Ashram Road, Ahmedabad-380 009

Kaolin
Eklera China Clay Works
7 Ravi Chambers, 5th Floor
Nr. Relief Cinema, Ahmedabad-380 001

B. Imported

Patent raw materials will be made available by the foreign manufacturer who supplies the technology.

8.4.12 List of Some of the Existing Units

1. Hindustan Magcobar Chemicals Ltd
87, Sampatrao, Productivity Road
Baroda 390 005 (Plant: Panoli, District - Bharuch)
2. Triveni N.L. Ltd
Kailash, 2nd floor, 26, Kasturba Gandhi Marg
New Delhi 110001. (Plant: Ankleshwar, Dist. Bharuch, not in production)

8.5 ORGANOCLAY (RHEOLOGICAL ADDITIVE)

8.5.1 Introduction

An Organoclay - thickened coating is thixotropic in nature. But the degree of thixotropy is less than that of other types of thixotropic agents. Organoclays are frequently used at lower level of pigmentation.

Organoclays are normally supplied in Powder form. To thicken a coating, the powder must be incorporated in such a way that full dispersion and activation will take place.

The characteristic of bentonite depends on its montmorillonite content, the major constituent chemically hectorite is somewhat similar to bentonite but instead of aluminium and magnesium in its crystal lattice, it has magnesium and lithium. Hectorite clay is rare and its occurrence in commercial quantities is only in few parts of the world. The presence of hydro-key group on the clay platelet edges in both bentonite and hectorite contributes to the rheological activities. When either of them is dispersed in water, the platelet edge hydroxyls associate with one another through hydrogen bonding. The hydrogen bonding takes place through a water molecule bridge. Unless this hydrogen bonding (water molecule bridge) is modified to make clays organophilic, they do not function rheologically in solvent based system. Quarternary amine is used as the modifying agent for these clays to make organo-clay.

8.5.2 Market Potential

There are two basic ways to add organoclay to paint batch. (1) Insitu (2) Pregel Addition. At present, twenty paint companies are importing wyoming bentonite from USA, UK and United Republic of Germany. Total Rs. 1.78 crore CIF value of bentonite is imported during 1989. To feed the paint & beauty products market organoclay manufacturing has good scope. Its applications are in interior and exterior house paints, primers, under coats, fillers printing inks.

Due to demands in housing sector, it has good potentiality.

8.5.3 Manufacturing Process/Technology

The reaction of quaternary amine and bentonite clay produces 2- methyl-2 hydrogenated tallow ammonium bentonite (an organoclay) and sodium chloride.

Specifications:

- a) Moisture content shall not be more than 23% determined by drying to constant weight at 105° - 110°C.
- b) Sand content shall not be more than 2% sand as retained on 200 mesh by wet method.
- c) Viscosity measured by stormer viscometer at 600 rpm should not be less than 15 cp.
- d) Filtration loss should not be more than 20ml. in 30 minutes at 100 psi. Testing should be carried out according to the procedure of American Petroleum Institute.

8. Oil India Ltd
P O Duliajan, Assam

Specifications:

- a) Size specification may be in any form without specification for size.
- b) Mechanical analysis not more than 2.0% as retained on 200 mesh by wet method.
- c) Moisture content not more than 10% measured by drying to constant weight at 105° - 110°C.
- d) Base exchange capacity not less than 80 milli- equivalents per 100 gm.(on over dry basis)
- e) Viscosity 7.0% suspension at bentonite in distilled water stayed for a dry should have a viscosity not less than 15 centipoises with stones viscometer at 25°C.

9. Tata Electric Locomotive Co. Ltd
Pune

Specifications:

Scope: This specification covers 'Sodium Base' bentonite which is used either as binder for moulding sand or in the preparation of mould washers.

Visual Inspection - Shall be dry in the form of powder free from any lumps, grits etc.

Chemical Composition - Shall conform to the following requirements.

- (i) Cao (Replacable Ca ++) shall not be more than 1.0%.
- (ii) Na₂O/Cao ration shall be within 1 to 1.7 in the base exchange
- (iii) Alkali content as sodium and pottassium oxide shall be between 0.7 to 1.19.

Moisture content - Shall not be more than 10% but not less than 8%

pH Value - Shall not be less than 8.5

Acceptance Specifications - Shall conform to the following requirements

- (i) Gelling Time - Should be less than 60 seconds
- (ii) Swelling Capacity - Shall be between 24 and 32 as specification mentioned in paragraph under 'SWELLING CAPACITY'
- (iii) Swelling Index - 16 - 20
- (iv) Methylene blue requirement shall be between 410 and 440 mgm. of methylene blue per Gm of bentonite.
- (v) Liquid limit not less than 525
- (vi) Size - 90% shll pass through 200 mesh
- (vii) Standard Mix Test Green Compression Strength 13 - 14 psi. Green shear strength 4-4.5psi.

Condition of Supply : Shall be supplied in polyethylene lined gunny bags duly marked with suppliers name, batch no., etc.

Sampling Procedure: From each truck-load, samples shall be taken from 10 bags at random to be mixed up intimately and representative samples to be obtained by cone and quartering process.

- Technology details can be procured from M/s Akzo Chemicals, UK.
- Certificate of Pollution Control Board.
- Registration for SSI from Industries Centre.

8.5.10 List Of Plant & Machinery Suppliers

Pulveriser

1. VK Engineering Works
Plot No.36, Nirmalanagar
Kesharvag, Bhavnagar
2. Sabboo Engineering Works
Kuchamal Road, Rly. Station
Jodhpur-341 001
3. Techno Bonanza Pvt Ltd
71/10 GIDC Estate, Vatva
Ahmedabad

Storage Tank

1. India Tube Mills & Metal
Industries Pvt.Ltd
Dhiraj Chamber
9 H Somani Marg
Bombay
3. KCP Limited
Thiru Vattiyur
Madras 600 019

Reaction Vessels

1. APV Tex Maco Ltd
HK House, Ashram Road
Ahmedabad-380 009
2. Dalal Engineering Pvt Ltd
36-37, Jolly Maker Chamber II
Nariman Point, Bombay 400 021
3. Dalco Engineering Pvt Ltd
HAL Compound, Pimpri
Pune 411 018
2. K K Nag (Pvt) Limited
Shembekar Industrial Compound
Bombay - Pune Road
Chinchwad
Pune 400019

8.5.11 List Of Raw Materials Suppliers

Hectorite clay/bentonite

1. Ashapura Mine-Chem Inds.
C- Mittal Court, Nariman Point
Bombay 400 021
2. Shri Rajkumar Goenka
Jamuna Bldg; PO Gandhidham
Dist. Kutch
3. Janta Minerals
Mandvi
Dist. Kutch

Amines

1. Haribhai Organic Pvt Ltd
22 Shamallaldas Gandhi Marh
Princes St., Bombay-400 002
2. Amruta Organic Pvt Ltd
813 Raheja Centre
214 Nariman Point, Bombay- 21
3. Chemico
10/8 Old Hanuman Lane
Princes St., Bombay-400 002
4. Bombay Oil Inds. Ltd
LB Shastri Marh, Bhandup
Bombay-400 078

Properties	Highbond	Superbond	Unibond	Montogel
Gelling Index (With Mechanical stirring as per ISI method)	Above 95 C.C	Above 90 C.C	Above 80 C.C	Above 80 C.C
Swelling Capacity (Free Swelling)	36 to 40 M.L	34 to 38 M.L	34 to 35 M.L	30 M.L. M.L
Liquid Limit (As per BSA method)	700 to 750	650 to 700	625 to 650	550600
Base exchange in gm/MEq	96 to 108 MEq	92 to 98 MEq	85 to 90 MEq	80 to 85 MEq
Active Clay	96%	94%	90%	80%
Fusion Temperature	1340 ^o	1300 ^o	1300 ^o	1290 ^o

12. Cynamide India (GRANULES)

Granules shall be double calcined

Description	:	Free flowing, practically free from foreign matter and dust particles
Seive Test	:	100% passes thru B.S.S No.22 mesh 100% retained on B.S.S No. 52 mesh
Bulk Density	:	Minimum 0.8 gm/ml
Moisture	:	Not more than 0.5%
pH(10% Aqueous Solution)	:	5.0 to 7.0
Attrition Test	:	Not more than 0.25 gm. per 100 gm. Take 100 gm. sample on B.S.S No. 200 mesh and sieve the material for 6 hours on Ro-tap sieve shaker. The material passing thru 200 mesh should not be more than 250 mg.
Sorptive Capacity	:	Minimum 18% Granules impregmanted with 18% kerosine should be free flowing and should not clump together after 30 minutes and colour of impregmanted granules is not much darker than the original.
Packing	:	Should be in 50 kg. thick polythene bags with a over pack of bituminished polylined gunny bag.

Source: Based on Information supplied by Consumers in consumption returns.

**COUNTRYWISE EXPORTS & IMPORTS OF BENTONITE
FOR THE YEAR 1984-85 AND 1985-86**

Qty in Tonnes/Value in Rs. '000

Country	1984-85		1985-86	
	Qty	Value	Qty	Value
Exports				
Kuwait	17463	14158	11095	10771
UAE	34356	2241	2052	1310
Indonesia	-	-	2500	1216
Egypt, Arab Rep.	25	20	550	439
Saudi Arabia	710	430	530	397
Malasia	106	114	305	329
Hongkong	550	675	307	286
Singapore	1027	916	439	275
Netherlands	868	931	234	242
Sudan	-	-	2966	240
Other Countries	14065	11590	370	355
	69170	31115	21348	15860
Imports				
USA	-	9	18	251
Singapore	-	-	78	65
UK	12	51	7	51
	12	60	43	367

Source: Indian Minerals Yearbook 1989 published by Indian Bureau of Mines,
Nagpur.

- | | |
|---|---|
| <p>28. Indy Pigment
Plot No. 143, Phase II
GIDC Estate Vatva
Ahmedabad</p> <p>30. M/s The Narmada Valley Chemicals
PO Rajpipla
Gujarat</p> <p>32. M/s DGM Minerals
Kanchanjunga Building, No. 10
Barakhamba Road
New Delhi 110 001</p> <p>34. M/s The International Chemical Agency
Tower Chitpur Road
Calcutta 700 007</p> | <p>29. M/s Dinesh Chandra Industry
Opp Kamala Nehru Park
PO Box No. 96
Porbandar 360 575</p> <p>31. M/s Satyabhuj & Company
PB No. 30
Industrial Area
Bikaner 344 001</p> <p>33. M/s Indian Clay & Mineral Co
Tarabag, Love Lane
Mazagaon
Bombay 400 010</p> <p>35. M/s S V Earth & Chemicals Pvt Ltd
Krishnanagar Colony
137, Prenderghast Road
Secunderabad 500 003</p> |
|---|---|

BENTONITE GRANULATIONS

- | | |
|--|--|
| <p>36. M/s Saurashtra Agromineral Products
Bander Road, Ghogha
Dist. Bhavnagar</p> <p>38. M/s D V Solanki
Behind Moxmandir
Kumbhwada
Bhavnagar</p> <p>40. M/s United Pams
Nari Road
Near Railway Crossing
Bhavnagar</p> <p>42. M/s Jiten Minerals
Ghogha
Bhavnagar</p> <p>44. M/s Rajiv Minerals
Plot No. 67
Chitra GIDC Indl Estate
Bhavnagar</p> <p>46. M/s Bharat Granules
Rakhadi Hanuman
Ruvapari Road
Bhavnagar</p> <p>48. M/s Ami Minerals
Bunder Road
Opp: Bharat Salt Works
Bhavnagar</p> | <p>37. M/s A B Timerwala
Bander Road, Ghogha
Bhavnagar</p> <p>39. M/s Rubi Mineral Framing Company
Nani Bazar
Ghogha
Bhavnagar</p> <p>41. M/s Zubar Industries
Ghogha
Bhavnagar</p> <p>43. M/s New Chemicals & Mineral Co
Munarwad, Ghogha
Bhavnagar</p> <p>45. M/s Khizar Pesticides Industries
Old Bander Road
Bhavnagar</p> <p>47. M/s Benton Came
Plot No. 397/2
GIDC Chitra Indl Estate
Bhavnagar</p> |
|--|--|

BENTONITE CONSUMERS SPECIFICATIONS**Name of the Consumer**

1. **Cooper Engineering Ltd**
Satara Road, Maharashtra
Specifications: (i) SiO₂ .. Max 60%
(ii) Al₂O₃ .. 25 to 27%
(iii) FeO .. 5%
(iv) L.O.I .. 15%
2. **Dalmia Iron & Steel Ltd**
4, Dalhousie Square East, Calcutta
Specifications: (i) SiO₂ .. 45 to 50%
(ii) Fe₂O₃
Al₂O₃ &
TiO₂ .. 23 to 36%
(iii) CaO .. 2.5%
(iv) MgO .. Traces
(v) L.O.I .. 15.50%
3. **Bharaliya Electric Steel Company Ltd**
National Tobacco Bldg; 1 & 2 Old House Course
Calcutta - 1
Specifications: (i) Green Permeability - 180 to 200%
(ii) Moisture 0.2 to 3%
(iii) Strength 7 to 8 lbs
(iv) Min. 98% passed through 200 mesh
4. **The Indian Smelting & Refining Co Ltd**
(Ferrous Foundry)
Bombay-Agra Road, Bombay - 78
Specifications: Sodium base bentonite powder good swelling - 90% min. pH
number 7 Min.
5. **Shalimar Paint Ltd**
13, Camac Street, Calcutta - 16
Specification: Colour to Standard setting properly.
Swelling should be equal to standard.
6. **Indian Vegetable Product Ltd**
Forbes Building Home Street
Fort, Bombay - 1
Specifications: a) Screened through 200 mesh 80%
b) Moisture
c) Viscosity
7. **Oil & Natural Gas Commission**
Tel Bhavan
Dehradun, UP

BENTONITE PROSPECTING REPORTS

Sl. No.	Title of the Report	Year	District	Price (Rs.)
1.	Preliminary report on Bentonite in part of Bhavnagar & Ghogha taluka of Bhavnagar district	1971-71	Bhavnagar	1,000.00
2.	Report on the investigation for Bentonite in part of Bhavnagar Ghogha Taluka & Mahuva taluka of Bhavnagar district	1972-73 & 1973-74	Bhavnagar	2,500.00
3.	A report on Bentonite in Mewasa Virpur & Mota Asota villages of Kalyanpur taluka, Jamnagar district	1976-77	Jamnagar	1,000.00
4.	A report on the investigation of Bentonite in part of Mandvi and Mandra taluka, Kutch district	1976-7	Kutch	Not for sale
5.	A report on the occurrence of Bentonite around villages Ramania, Beraja & Bocha of Mundra taluka, Kutch district	1978-79	Kutch	Not for sale
6.	A report on detailed mineral survey for sub-Bentonite day occurrence around Marwad & Moyad villages of Prantij taluka of Sabarkantha district	1985-86	Sabarkantha	Not for sale
7.	Report on Bentonite occurrences in Sherdiwande area of Mandvi taluka, Kutch district	1974-75	Kutch	Not for sale
8.	Report on detailed investigation for Bentonite in Kajvadar, Bhatvadar & Balanivav villages of Rajula taluka in Amreli dist.	1980-81	Amreli	1,000.00
9.	Report on the occurrence of Bentonite clays in pat of Amreli district	1977-78	Amreli	1,000.00
10.	A report on the detailed mineral survey for sub-bentonite of Prantij taluka of Sabarkantha dist.	1987-88	Sabarkantha	1,000.00
11.	Investigation of bentonite in parts of Mandvi, Mundra talukas, Kutch district (GSI)	1968	Kutch	Not for sale
12.	Report on the investigation of bentonite in parts of Nakhatrana & Mandvi taluka of Kutch district (GSI)		Kutch	Not for sale

Source: Directorate of Geology & Mining, Govt. of Gujarat, Block No.1, New Mental Hospital Building
Meghaninagar, Ahmedabad-380 016 [Phone: 377353/377321-24]

Number of bags to be sampled shall depend on the number of total bags per consignment.

Tests - The following tests on representative samples shall be carried out for acceptance.

- i) Moist
- ii) pH Value
- iii) Gelling time
- iv) Seive Analysis
- v) Liquid Limit
- vi) Methylene Blue requirement
- vii) Standard Mix Test

Inspection and Testing Facilities - Each supplier shall have the facilities for testing materials as stipulated above and shall extend such facilities for necessary test as required by our authorised representative.

Identification Markings and Manufacturer's Certificate - Each bag shall bear the identification marks with batch number. Each consignment shall accompany test report of each batch with identification number and accompany each despatch advice or challan.

Use - To be used in moulding sand mixture and in various water base wash making.

10. M/s Punam Bentosil Pvt Ltd
19, Jai Hind Society, North South Road
No. 12,13 Juhu, Bombay 400 049
Specifications:

Properties	Unit	Grades			
		AC	OP	H	T
Bulk Densities	gm/CC	0.62	0.62	0.62	0.61
Moisture	%	15.00	12.00	15.00	4.00
Alkalinity	%	-	-	-	0.08
Acidity	%	0.4	0.4	0.15	-
Oil Retention	%	30.00	30.00	30.00	26.00
Bleaching Efficiency	%	90.00	95.00	80.00	75.00
Filtration	Min	7.00	7.00	7.00	7.00

The above properties are based on average test results as per IS 1035-1972 and are to be used only for general guidance.

They are not recommended to be the final values for quality control and are not binding on us.

11. M/s Ashapura Minechem Pvt Ltd
Mechanical Properties of Various Grades of Natural Sodium Based Bentonite Powder (Kutch)

Properties	Highbond	Superbond	Unibond	Montogel
Moisture	9 to 10%	9 to 10%	10 to 12%	10 to 12%
pH Value				
(2% Suspension)	8.5 to 9%	8.5 to 9%	8.5 to 9%	8.5 to 9%
(6% Suspension)	9 to 9.5%	9 to 9.5%	9 to 9.5%	9 to 9.5%

**BENTONITE TESTING CHARGES
GOVT. OF GUJARAT LABORATORY**

Sl. No.	Name of Test	Rate per test (in Rs.)
1	(a) Dry finess 75 microns or 150 microns or any oen one sieve	50
	(b) 75 microns and 150 microns or any two sieve	70
	(c) Set of five sieves	100
2.	Wet Fineness	70
3.	Gel Index Type I or II	55
4.	Swelling power	40
5.	Liquid limit	150
6.	Filter loss	80
7.	Specific gravity	60
8.	pH	30
9.	Base exchange capacity	190
10.	Moisture	40
11.	Viscosity:	
	(a) Dial reading at 300 RPM or 600 RPM	115
	(b) Both 300 RPM & 600RPM	205
	(c) Plastic Viscosity	205
	(d) Yeild point	205
12.	Oil absorption	50
13.	Exchangable cattion	150

Source: Petrography and Mineral Chemical Laboratory Director of Geology & Mining, Govt. of Gujarat, Dr. Jivraj Mehta Bhavan Sector No. 10, Bloxk No. 15, Gandhinagar 382 010 [Phone: 23282]

Rates are valid upto 31.12.1990.

BENTONITE BASED UNITS IN THE STATE

- | | |
|---|---|
| 1. M/S Meena Minerals & Abrasive Works
Industrial Estate
Gandhidham - Kutch | 2. M/S Ashapura Minerals
C-12, Industrial Estate
Gandhidham - Kutch |
| 3. M/s Ashapura Mine-cheme Industries
Station Road
Bhuj-Kutch | 4. M/s Arvind Chemical Industries
Hospital Road, Madhapur
Kutch |
| 5. M/s Mahalaxmi Minerals
Opp. Railway Godown
Anjar - Kutch | 6. M/s Kutch Oil & Allied Industries
Gandhidham - Kutch |
| 7. M/s Shah Minerals and Allied Industries
Gandhidham - Kutch | 8. M/s Bharat Minerals
GIDC Estate, Madhapur
Kutch |
| 9. M/s Abhinav Minerals
Industrial Estate
Gandhidham - Kutch | 10. M/s I. David & Co
Layja Road
Mandvi - Kutch |
| 11. M/s Suraiya Pvt Ltd
Layja Road
Mandvi Kutch | 12. M/s United Pannes
GIDC Estate
Gandhidham - Kutch |
| 13. M/s Miteshwar Minerals
Plot- 13 GIDC Estate
Gandhidham-Kutch | 14. M/s Ashish Mines & Minerals
Plot 13 GIDC Estate
Gandhidham-Kutch |
| 15. M/s Anupchand Madharji Shah
Vijaynagar
Gandhidham - Kutch | 16. M/s Shah & Pandya Minerals Enterprises
Survey No. (53) 2
At: Durgapur
Mandvi-Kutch |
| 17. M/s Yogeshvar Minechem Industries
Village Mithal
Taluka Nakhrana
Kutch | 18. M/s National Minerals
Match Factory Compound
Motitalar Road
Bhavnagar |
| 19. M/s Ashapura Minerals Company
328, GIDC Chitra Industrial Estate
Bhavnagar | 20. M/s Balco
Old Bunder Road
Bhavnagar |
| 21. M/s Swastik Mineral Chem Industries
21, Giriraj
Saibaba Society, Opp. Mahila College
Bhavnagar | 22. M/s Gujarat Mine-Came
Plot No. 234/235
GIDC Chitra Indl Estate
Bhavnagar |
| 23. M/s Jaykhodiar Minerals
Plot No. 245
GIDC Chitra Indl Estate
Bhavnagar | |

ACTIVATION

- | | |
|---|--|
| 24. M/s Tonite Chemical Products
H.No. 509/4 Jalabhairu Wadi
Mahadernagar
PO Billimora | 25. M/s Paras Chemical Industry
PO Talodh
Tal. Billimora
Dist. Valsad |
| 26. NIFCO
Opp Police Head Quarter
Magarwad
PO Valsad | 27. Krajur Chemicals
1507/A III Phase
GIDC Estate, Vapi
Dist. Valsad |

Sl. No.	Type of test/experiment	Rate (in Rs.)
25.	Determination of PIC(shrinkage) of fire bricks with 5 hrs. soaking.	165.00
26.	Determination of resistance of wear	38.00
27.	D.T.A. upto 1000°C	250.00
28.	T.G.A upto 1000°C	250.00
29.	Sp. gr. by R.D. Bottle	27.00
30.	Sp. gr. by Steel Yard Balance	16.00
31.	Study on the acid activation of Bentonite/fuller's earth including the following	1500.00
	a) Analysis of crude clay	
	b) Treatment with 25%, 50%, 100%, H2 So4 and 100°C	
	c) Followed by filtration, washing, drying grinding etc.	
	d) Determination of pH of crude and 4 treated fractions	
	e) Determination of bleaching characteristics of crude & treated product 5 fractions	
32.	Study on the alkali activation of Bentonite including the following	3000.00
	a) Chemical analysis of crude clay)	
	b) Treatment with 5%, 4%, 3%, 2%, 1% Sodium Carbonate solution at room temperature followed by drying, drinding, etc.	
	c) Determination of pH 6 fractions	
	d) Determination of Cal. value 6 fractions	
	e) Determination of swelling Index 6 fractions	
	f) Determination of filtration of loss of 6 fractions	
	g) Determination of Viscosity 6 fractions	
33.	Plastic Viscosity/yeild point	200.00
34.	Determination of bleaching characteristics of activated bentonite/fuler's earth	155.00
35.	Gloss & Whiteness	27.00

Source: Directorate of Mines & Geology, Udaipur Laboratory

Rates are effective from 21.5.1988 onwards.

BENTONITE PULVERISING COMPANIES & LEASE HOLDERS IN GUJARAT

Name of the Lease Holder	Tel./Fax No.	Factory
Virendra C. Kanani Kachchh Mines & Minerals Nr. GEB Control room, Swami Vivekanand Road Mandvi 370465	20574	Mandvi Kachchh
Shri B N Goenka Rajkumar Company Plot 3, Sector 12, Block B Gandhidham 370 230, Kuchchh	20516	Gandhidham Kachchh
M/s Kutch Oreclay Indravilla, Bundar Road Mandvi 3704675 Kuchchh	20251 20651 (Fac.) 20896 (R) 20034	Mandvi Kuchchh
M/s Ashapura International P.Ltd Opp: Kuchchh Dairy Madhapur - Kachchh	23641,22428 Fax 02832-23954	Madhapur/ Kuchchh
Shree Janata Minerals Mandvi		Kutch
Shri Vinod P Solanki Shree Ram Min-Chem International GIDC Area Madhapur 370020	22882(O) 23596(R)	Madhapur/ Kachchh
Shree Chandulal Tribhuvandas Patel Danapith Bhavnagar		Bhavnagar
Shree Kasamlai & Sons High Court Road Bhavnagar		Bhavnagar
Shree Natvarlal Mohanlal Shah Dashrimalino Wando Ghogha Darwaja Bhavnagar		Bhavnagar
Shree Raj Mineral Company 3/B Laliwala Chambers Lali Bazar Bhavnagar		Bhavnagar
Universal Mineral Corporation Bhavnagar		Bhavnagar
Merchant Minerals		Bhavnagar
Matru Chhaya Sir Patani Road Bhavnagar		
Shree Niranjani Mohanlal Vaghani Dasa Shrimalini Chawl Ghodha Gate Bhavnagar		Bhavnagar

Attributes	Advantages of BENTONE 34 in various systems:	
	Alkyd no hard settling no sag, no syneresis in thixotropic paints, no flooding, prevents excessive penetration	Epoxy Ester no settling or sag of the paint Polyacrylic no film cracking, higher film thicknesses are possible
	Bitumen good thixotropy, no melt, no flow at elevated temperatures, no embrittle- ment in cold water	
	Chlorinated Rubber Cyclized Rubber no settling, no stringing of the paint, good chemical stability of the coating due to homogeneous surface and higher thickness	
Chemical and Physical Data	Composition	organic derivative of a special smectite
	Colour	light cream
	Form	finely divided powder
	Moisture	max. 3%

BENTONE 38

for low to intermediate polarity organic media

	BENTONE 38 is an organic derivative of a special smectite. This highly efficient rheological additive is designed for low to intermediate polarity organic systems in which it develops optimum efficiency.	
Applications	Interior and exterior house paints Industrial paints Automotive finishes Refinish systems Coil coating systems Trichloroethylene dip coatings Primers	Aerosol paints Anti-corrosive paints Plastisols, plastigels, organosols Rubber release agents Adhesives and mastic compounds Cosmetics
Attributes	Advantages of BENTONE 38 in various systems:	
	Alkyd no hard settling, no sag, no syneresis in thixotropic paints, no flooding	Polyurethane higher film thicknesses, no settling no sag
	Epoxy Ester no settling or sag of the paint	Polyvinyl higher film thicknesses, no settling no sag
	Epoxy/Coal Tar thixotropy, more uniform coat surface	Silicon higher film thicknesses retards flow in baking cycles
	Polyacrylic no film cracking higher film thicknesses are possible	
	Polyester higher film thicknesses and film stability unpigmented top coats of good clarity	

**PHYSICO CHEMICAL PROPERTY OF THORADI VILLAGE SAMPLE OF
BHAVNAGAR DISTRICT**

Physical Tests		Chemical Analysis	
Gel Value	10.00%	SiO ₂	46.61
Swelling Index in ml.	12.0 ml	R ₂ O ₃	33.70
Moisture	9.77%	Fe ₂ O ₃	10.88
pH	10.1	Al ₂ O ₃	19.37
Specific gravity	2.43	TiO ₂	3.45
BEC meg/100 gms	71.42	CaO	4.80
Liquid limit	302.0	MgO	0.72
Exchangable Ca++ ions	0.33%	SO ₃	0.05
		P ₂ O ₅	0.03
		Na ₂ O	2.10
		K ₂ O	0.13
		LOI	10.61
		MnO	0.11
		Total	98.72

Source: Petrography & Mineral Laboratory, DGM, Govt. of Gujarat, Block No.15, Sector-10, Jivraj Mehta Bhavan, Gandhinagar-382 010 [Phone: 23282]

**PHYSICO CHEMICAL PROPERTY OF SARAN VILLAGE SAMPLE OF
KUTCH DISTRICT**

Physical Tests		Chemical Analysis	
Gel Value	9.9%	SiO ₂	53.91
Swelling index in ml.	27.0 ml	R ₂ O ₃	33.00
Moisture	12.64%	Fe ₂ O ₃	13.20
pH	8.95	Al ₂ O ₃	16.69
Specific gravity	2.51	TiO ₂	3.16
BEC meg/100 gms	82.32	CaO	1.07
Liquid limit	516	MgO	2.43
Exchangable Ca++ ions	0.50%	SO ₃	-
		P ₂ O ₅	-
		Na ₂ O	2.50
		K ₂ O	0.05
		LOI	6.491
		MnO	-
		Total	99.47

Source: Petrography & Mineral Laboratory, DGM, Govt. of Gujarat, Block No.15, Sector-10, Jivraj Mehta Bhavan, Gandhinagar-382 010 [Phone: 23282]

Attributes	BENTONE 500	
	Full and rapid dispersion using only moderate shear equipment	Controls misting
	Needs no chemical activator	Provides batch-to-batch reproducibility
	Efficient viscosity build, with moderate increase in tack	Can be postadded to inks under moderate shear
	Stable viscosity build- minimizes afterbodying and post-gelling problems	Is non-dusting
Chemical and Physical Data	Eliminates need for compound or pregel	Is non-hygroscopic
	Composition	organic derivative of a special smectite clay
	Colour	light cream
	Form	finely divided powder
	Particle Size(dispersed)	less than 1 micron
	Density (g/cm ³)	1.47
	Bulk Density (g/cm ³)	0.214

BENTONE SD-1

easy dispersible for systems containing aliphatic and other solvents of low to medium polarity

	BENTONE SD-1 rheological additive is an organic derivative of a montmorillonite clay. It is a very easily dispersible additive for systems containing primarily	aliphatic and other solvents of low to medium polarity. It can be added at any point in the paint manufacturing process.
Applications	Coating systems containing common aliphatic solvents eg.	
	Interior and exterior house paints Do-it-yourself paints Industrial finishes Primers, fillers, undercoats	Anti corrosive paints Roadmarking paints Wood stains
Attributes	BENTONE SD-1 rheological additive	
	is a cost effective replacement for conventional organoclay additives	produces rapid and full efficiency
	disperses very easily, even under low shear conditions	needs no chemical activator
	can be added at any point in the manufacturing process, even during letdown	offers formulating and production flexibility and improved plant efficiency
	eliminates the need for pregels	can be used for post correction
Chemical and Physical Data	Composition	organic derivative of a montmorillonite clay
	Colour	very light cream
	Form	finely divided powder
	Particle size (dispersed)	less than 1 micron
	Density	1.47(g/cm ³)

Chemical and Physical Data	Composition	organic derivative of a special magnesium montmorillonite
	Colour	Creamy white
	Form	finely divided powder
	Moisture	max.3%

BENTONE 128

for printing inks

	BENTONE 128 is a special organically modified smectite. This rheological additive is designed for use in nonpolar printing inks and organic solvent based inks and organic solvent based inks of intermediate polarity.	
Applications	Offset inks	UV curable inks
	Letterpress inks	Gravure printing inks
	News inks	Flexographic inks
Attributes	BENTONE 128	
	develops pseudoplastic flow properties	causes very little post gelling
	imparts particle suspension	prevents flooding and floating
	permits production of low tack inks at relatively high viscosity	can be used as a post additive to correct viscosity or consistency
	prevents excessive penetration of ink into substrate	permits precise control and reproduction of the desired flow properties
	reduces misting	
	is easily incorporable as a powder and needs no polar additive for activation	
Chemical And Physical Data	Composition	organic derivative of a special montmorillonite clay
	Colour	creamy white
	Form	finely divided powder

BENTONE 500

for printing inks

	BENTONE 500 additive is an easy to disperse organoclay rheological additive that is useful in offset and letterpress printing inks which are produced using only moderate levels of shear. This rheological additive requires neither the shear nor the chemical activation needed when using conventional organoclays. It is an efficient replacement for fumed silica and other gelling agents.	
	BENTONE 500 additive is most effective in printing inks containing aliphatic, aromatic or naphthenic oils and solvents. It is not normally suitable for systems containing high polarity, oxygenated solvents such as esters, ketones, and alcohols.	
Attributes	Lithographic inks including web offset, heatset, sheet fed offset and litho newsinks	
	Letterpress inks	

does not need pregelling
requires no chemical activator
provides high efficiency and reduces raw material cost

Improves batch to batch consistency
produces excellent rheological structure and coating properties typical of BENTONE rheological additives

Chemical and Physical Data	Composition	organic derivative of a smectite clay (hectorite)
	Colour	very light cream
	Form	finely divided powder
	Particle size(dispersed)	less than 1 micron
	Density	1.6 (g/cm ³)

BENTONE EW

for water-based systems

	BENTONE EW rheological additive is a highly beneficiated, easily dispersible smectite clay	
Applications	Emulsion paints Plaster type compounds Electrodeposition coatings Foundry paints Ceramic compounds Adhesives Corrosion inhibitive primers Other water based paint systems Cosmetics	Oil-in-water emulsions Paper coatings Polishes and cleaners Welding rods
Attributes	<p>BENTONE EW rheological additive is easily processed as a powder or pregel; increases the viscosity of aqueous systems and stabilises viscosity on ageing, at varying temperatures and mechanical influences;</p> <p>prevents settling, flooding and floating of pigments and extenders</p> <p>imparts good bath stability in electrodeposition coatings without impairing throwing power and anti corrosive protection</p> <p>has a positive effect of adhesion and permits the application of homogeneous films</p>	
Chemical and Physical Data	Composition	highly beneficiated smectite clay
	Colour	milky white soft powder
	Appearance	
	Form	
	Specific gravity	2.5 g/cm ³
	Moisture	6% \pm 2%
	pH	effective in the pH range 4 - 11

BENTONE LT

for water-based systems

	BENTONE LT rheological additive is a refined organo clay mineral specifically designed for use in emulsion paints and plaster type compounds	
Applications	Emulsion paints	Cosmetics
	Plaster type compounds	Polishes and cleaners
	Emulsions	Foundry paints
	Ceramic compounds	Textile finishes
	Adhesives	Waxes
Attributes	BENTONE LT rheological additive	
	is compatible with synthetic resin dispersions such as polyvinyl acetate, polyvinyl propionate, polyacrylics and their copolymers as well as with polar solvents like ethanol, glycerine and propylene glycol	allows the formulation of highly water resistant exterior and interior emulsion paints
	is compatible with wetting agents (most anionic and nonionic surfactants) and keeps colour pigments in uniform suspension, assuring colour uniformity through control of flooding and floating	improves water retention in plaster and other building materials
	reduces syneresis	improves recoatability
	at a pH between 3 and 11, generates good thixotropy without impairing levelling	has a positive effect on wash and scrub resistance
	extends open time upon application of emulsion paints long enough to achieve good brushability and surface uniformity	Increases economy of the total system, as the solids content can be reduced.
Chemical and Physical Data	Composition	organic derivative of a special smectite
	Colour	creamy white
	Form	finely divided soft powder
	Moisture	max. 7.5%
	pH of a 2% aqueous suspension	8.8 - 10.2

BIBLIOGRAPHY

- 01 Industrial Minerals, Sept. & Oct., 1962, Lower March, London.
- 02 Geological & Metallurgical Institute of India - Export Potentiality of Bentonite from India, Seminar proceeding 1974.
- 03 Bentonite Market Survey published by Indian Bureau of Mines, Nov. 80.
- 04 Bentonite in India - Qrtly. Journal - Geological Minerals & Met. Society of India - Vol. 19.
- 05 Traffic Review Report of 1989-90, Gujarat Maritime Board, Ahmedabad-16.
- 06 On the Origin, Classification & Review of Bhavnagar Bentonite, Mineral Wealth Vol. VI, No.1, 1969 publised by DGM, Government of Gujarat.
- 07 Gupte PK & BR Nijhawan, Bentonite Clays, National Metallurgical Lab., Council of Scientific & Industrial Research.
- 08 Prof. Ralph E Grim: Clay Minerology - Hewett, Ross and Shannon - Clay Work.
- 09 Keller WD, 1963 : Environmental Aspects of Clay Minerals - Journal of Sedimentary Petrology, Vol. 40 No.3, Sept. 1970.
- 10 Welcome to India's Industrial Paradise - Gujarat, published by INDEXTb Ahmedabad.



THE
OFFICE OF THE
ATTORNEY GENERAL
STATE OF NEW YORK
ALBANY

IN SENATE
JANUARY 11, 1901

REPORT
OF THE
COMMISSIONER OF
THE LAND OFFICE
FOR THE YEAR 1900