SUMMARY

* Ceramic units are concentrated in particular locations like Thangadh, Morbi, Surendranagar, Wankaner, Kadi, etc. Ahmedabad accounts for 49% of the value of output and 57% of fixed capital investment in the industry.

* Physico-chemical properties of ceramic minerals of Gujarat with proved reserves and grade are given for the utility purpose.

* China clay 63.00 Million Tonnes (MT), Fire clay 155.22 MT, Bentonite 105.00 MT, Dolomite 720.00 MT, Bauxite 97.00 MT reserves have been estimated in the State by the State Directorate of Geology & Mining, Govt. of Gujarat.

* State produced an average 6.80 lakh tonnes - Bauxite 1.50 lakh tonnes, Bentonite 0.2 lakh tonnes, China clay, 2.23 lakh tonnes, Fire clay 2.23 lakh tonnes, Plastic clay 0.11 lakh tonnes, Quartz 0.21 lakh tonnes, Silica sand 1.12 lakh tonnes during 1990-91.

* X-ray diffraction, thermal behaviour - DTA, infrared spectroscopy, electron microscopy work carried out in the Petrography and Mineral Chemical Laboratory of DGM confirmed the presence of mineral constituents.

* Projects on sanitarywares, glazed wall tiles, ceramic tower packing materials, ceramic unglazed vitreous tiles, stoneware crockery with oil fired ceramic fibre lined tunner kiln prepared by SISI can be established in a functional estate in Surendranagar district.
QUALITY CONTROL & SPECIFICATIONS

BIS has formulated and published vide IS : 2556 (Part - I ) 1974 the specifications of the sanitarywares. Following tests are carried out to control the quality standards of the sanitarywares:

1. Crazing
2. Water absorption
3. Chemical resistance
4. Modulus of Rapture
5. Resistance of staining and burning

COST OF PROJECT
1. Fixed Capital : [Amount in Rs]
   Land & Building
   Land - 4000 sq.m.@ Rs.150/sq.m. 6,00,000
   Machinery & work shed - 5000 sq.m.@Rs.2600/sq.m 13,00,000
   Kiln shed - 200 sq.m.@Rs.2600/sq.m. 6,50,000
   Raw material/finished goods godown - 200 sq.m.@Rs.2600/sq.m. 5,20,000
   Office/Laboratory etc. - 100 sq.m.@Rs.2600/sq.m. 2,60,000
   Boundry walls - L.S. 70,000
   Total Cost of Land & Building 28,00,000

2. Machinery & Equipment:

<table>
<thead>
<tr>
<th>Description</th>
<th>Qty.</th>
<th>Price (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Ball mills, size 1800 mm x 1800 mm with all accessories and 10 H.P. motor each</td>
<td>2</td>
<td>2,00,000</td>
</tr>
<tr>
<td>ii. Screw blunger, dia of impeller 500 mm Dimension of RCC tank - 2000 mm dia x 1900 mm depth with all accessories and 5 HP motor.</td>
<td>2</td>
<td>1,00,000</td>
</tr>
<tr>
<td>iii. Vibrating screen size 900 mm x 600 mm with all accessories and 2 H.P. Motor.</td>
<td>1</td>
<td>20,000</td>
</tr>
<tr>
<td>iv. Ball Mill 900 mm x 900 mm with all accessories and 10 HP motor</td>
<td>1</td>
<td>70,000</td>
</tr>
<tr>
<td>v. Agitator with all accessories and RCC tank and 5 HP motor each</td>
<td>2</td>
<td>80,000</td>
</tr>
<tr>
<td>vi. Slurry pump - 1000 litre and 5 HP motor</td>
<td>1</td>
<td>30,000</td>
</tr>
<tr>
<td>vii. Cemented store tank for glaze with stirror and 5 HP motor</td>
<td>1</td>
<td>20,000</td>
</tr>
<tr>
<td>viii. Magnetic separators permanent type</td>
<td>2</td>
<td>20,000</td>
</tr>
<tr>
<td>ix. Spray booths complete with air compressor, spray gun &amp; 2 HP motor each</td>
<td>4</td>
<td>40,000</td>
</tr>
<tr>
<td>x. Water pump set with storage tank and 5 HP motor</td>
<td>1</td>
<td>20,000</td>
</tr>
</tbody>
</table>

Total : 6,00,000
POTENTIALITIES OF CERAMIC PROJECTS
(Including Physico-Chemical Properties of Ceramic Minerals)

Compiled By

J.V. Bhatt
Senior Development Officer (Minerals)

INDEX

INDUSTRIAL EXTENSION BUREAU
(A Govt. of Gujarat Organization)
Nanalai Chambers
Ashram Road
Ahmedabad-380 009
(ii) Raw materials per month:

<table>
<thead>
<tr>
<th>Items</th>
<th>Qty</th>
<th>Rate</th>
<th>Price (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartz</td>
<td>20MT</td>
<td>Rs. 400/MT</td>
<td>8,000</td>
</tr>
<tr>
<td>Felspar</td>
<td>20MT</td>
<td>Rs. 500/MT</td>
<td>10,000</td>
</tr>
<tr>
<td>China clay</td>
<td>5MT</td>
<td>Rs 1500/MT</td>
<td>15,000</td>
</tr>
<tr>
<td>Ball clay/Fire clay</td>
<td>35MT</td>
<td>Rs. 600/MT</td>
<td>21,000</td>
</tr>
<tr>
<td>Plaster of Paris</td>
<td>5MT</td>
<td>Rs.1500/MT</td>
<td>7,500</td>
</tr>
<tr>
<td>Kiln furniture</td>
<td>L.S.</td>
<td></td>
<td>5,000</td>
</tr>
<tr>
<td>Glazing materials &amp; colours/chemicals</td>
<td>L.S.</td>
<td></td>
<td>8,00</td>
</tr>
<tr>
<td>Packaging materials</td>
<td>L.S.</td>
<td></td>
<td>6,000</td>
</tr>
<tr>
<td>LD Oil</td>
<td>21KL</td>
<td>Rs.4500/KL</td>
<td>94,500</td>
</tr>
</tbody>
</table>

Total cost of raw materials: 1,25,000

(iii) Utilities per month:

1. Power charges for machinery
   52 KWH x Rs.1.10 x 8 hours x 25 days = 11,440

2. Power charges for kiln
   12 KWH x Rs. 1.10 x 12 hours x 25 days = 3,960

Total = 15,400
Say = 15,000

(iv) Other contingent expenses (per month):

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postage &amp; Stationary.</td>
<td>200</td>
</tr>
<tr>
<td>Consumable stores.</td>
<td>1,000</td>
</tr>
<tr>
<td>Repairing &amp; Maintenance</td>
<td>2,000</td>
</tr>
<tr>
<td>Advertaisement &amp; Publicity</td>
<td>1,000</td>
</tr>
<tr>
<td>Misc. Expenditure</td>
<td>800</td>
</tr>
</tbody>
</table>

Total = 5,000

(v) Working Capital Requirement:

<table>
<thead>
<tr>
<th>Item</th>
<th>Time</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salary &amp; wages</td>
<td>1 Month</td>
<td>74,000</td>
</tr>
<tr>
<td>Raw Materials &amp; Fuel</td>
<td>3 Months</td>
<td>5,25,000</td>
</tr>
<tr>
<td>Utilities</td>
<td>2 Months</td>
<td>30,000</td>
</tr>
<tr>
<td>Other contingent expenses</td>
<td>1 Month</td>
<td>5,000</td>
</tr>
<tr>
<td>Bills receivables</td>
<td>1/2 Month</td>
<td>1,34,500</td>
</tr>
</tbody>
</table>

Total = 7,68,500
Say = 7,68,000

Total capital Investment:

(i) Fixed Capital: 57,00,000
(ii) Working capital: 7,68,000
Total = 64,68,000
# CONTENTS

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<th>Description</th>
<th>Page</th>
</tr>
</thead>
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<td><strong>Project Profile on</strong></td>
<td></td>
</tr>
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<td>1</td>
</tr>
<tr>
<td>ii.</td>
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<td>8</td>
</tr>
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<td>iii.</td>
<td>Stoneware Crockery</td>
<td>15</td>
</tr>
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<td>Calcined China Clay</td>
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<td>44</td>
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<tr>
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<td>51</td>
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<td><strong>Reserves of various Minerals of Gujarat</strong></td>
<td>55</td>
</tr>
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<td>3.</td>
<td><strong>Production of various Minerals of Gujarat</strong></td>
<td>56</td>
</tr>
<tr>
<td>4.</td>
<td><strong>Physico-Chemical Properties of</strong></td>
<td></td>
</tr>
<tr>
<td>i.</td>
<td>Attapulgite</td>
<td>57</td>
</tr>
<tr>
<td>ii.</td>
<td>Bauxite</td>
<td>59</td>
</tr>
<tr>
<td>iii.</td>
<td>Bentonite</td>
<td>61</td>
</tr>
<tr>
<td>iv.</td>
<td>Chalk</td>
<td>75</td>
</tr>
<tr>
<td>v.</td>
<td>China Clay</td>
<td>76</td>
</tr>
<tr>
<td>vi.</td>
<td>Dolomite</td>
<td>83</td>
</tr>
<tr>
<td>vii.</td>
<td>Fire Clay</td>
<td>85</td>
</tr>
<tr>
<td>viii.</td>
<td>Fluorite</td>
<td>89</td>
</tr>
<tr>
<td>ix.</td>
<td>Graphite</td>
<td>90</td>
</tr>
<tr>
<td>x.</td>
<td>Lignite</td>
<td>91</td>
</tr>
<tr>
<td>xi.</td>
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<td>93</td>
</tr>
<tr>
<td>xii.</td>
<td>Nepheline Syenite</td>
<td>96</td>
</tr>
<tr>
<td>xiii.</td>
<td>Plastic Clay</td>
<td>97</td>
</tr>
<tr>
<td>xiv.</td>
<td>Pyrohysite</td>
<td>99</td>
</tr>
<tr>
<td>xv.</td>
<td>Quartz</td>
<td>100</td>
</tr>
<tr>
<td>xvi.</td>
<td>Roofing Tiles</td>
<td>101</td>
</tr>
<tr>
<td>xvii.</td>
<td>Siderite</td>
<td>105</td>
</tr>
<tr>
<td>xviii.</td>
<td>Silica Sand</td>
<td>106</td>
</tr>
</tbody>
</table>
6. Jain Minerals
36, Kisagadh Koti
Jaipur Road
Ajmer (Rajasthan)
Quartz/Felspar/Ball clay

7. G.L.Mineral Supply Corporation
6/459 Serreffan Homalla
Beawer (Rajasthan)
-do-

8. Rajasthan Plaster & Industry
Outside Coga Gate
Bikaner (Rajasthan)
Plaster of Paris

9. Snow-white Industries
40 Mahendra Nagar
Rishikesh
Dehradun (U.P)
-do-

10. Ceramill Glaze & Ziroconium Co
Daultabad Road
Gurgoan (Haryana)
Zir Enlum

11. Ferro Coatings & Colurs Ltd
Post: Joka
24 Parganas
Calcutta (W.B)
Ceramic colours/glazes

ADDRESS OF KILN CONSULTANTS

1. Sharma Kiln Technology
206, Hare Krishne Complex
Opp. Kothawala Flat
Ashram Road
Ahmedabad - 380 006.

2. N.M. Ceramic Kiln
P.B. No.30
B-8 Ram Balram Appartment
Kalol - 382 721, Dist. Mehsana.

3. Associated Industrial Furnace
2/5 Sarai Julena, 1st Floor
Okhla Road, New Delhi- 110 065.

4. Unifire
16-12 Shakespere Sarani
4th Floor, Culcutta - 700 071.

5. Taksago Bhagat Cere Kiln (P) Ltd.
D- 828, New Friedented Colony
New Delhi -110 065.

6. Noble Enterprises
Umiya Shopping Centre
Nr. Bus Stand,
Limbdi - 363 421.
INTRODUCTION

The project profile envisages for the manufacture of sanitarywares i.e. wash basins, closets, urinals, sinks, etc. Sanitarywares belong to the body group of vitreous china. They have the property of resistance to weather action, crazing, chemical action, good strength and no water absorption. They are used in houses, educational and research institutions, hospitals, industries, hotels and restaurants, cinema halls and other public places.

MARKET POTENTIAL

Sanitarywares are used in houses, hospitals, industries, hotels, other public places etc. with the continued increase in population, the requirement of houses is increasing day by day, as shelter is the one of the basic needs of human beings next to food and clothes. Govt. of India has launched a plan to solve the problem of housing as a result of which number of houses are being constructed.

In the state of Gujarat, there are 4 units in large scale and about 110 units in SSI sector and the production capacity of these units is estimated 25,000 MT and 90,000 MT per annum respectively. In India, there are 15 units in large scale and 130 units in SSI sector and production capacity of these units is estimated 85,000 MT and 95,000MT per annum respectively.

In addition to housing tenaments, a large number of hotels, industries, market complex, other public buildings are being constructed and will be constructed in future to fulfil the needs of the increasing population, which increases the demand of sanitarywares.

Socio-economic change in society, increase in adult literacy, all round economic development in the country, for maintaining hygienic conditions have also increased the demand of the sanitarywares to a great extent. Further, the export potential to Arabain or African country has also increased the demand the sanitarywares.

Taking into consideration of the above factors, the demand is estimated at two lakhs tonnes of sanitarywares per annum in the coming next couple of years and is expected to increase at the rate of 20% every year. Hence there is a good scope for setting up some more new units for the manufacture of sanitarywares.

PRODUCTION TARGET PER ANNUM : Sanitarywares - 900 MT

BASIS AND PRESUMPTIONS

The project profile is based on the presumption of 8 hours working per day per shift for 25 days per month or 300 days per annum. However, the operation of kilns will be of continuous nature for each firing cycle. The cost of land, building, machinery, kiln, raw materials, labour etc. are estimated at the rate prevailing 1991-92, which obviously vary from time to time and place to place. Rejections in the end products is considered as 5%.

PROCESS OF MANUFACTURE

The raw materials like quartz, felspar and clays are ground with water in desired proportion in a ball mill and 0.3% soda ash and sodium silicate are mixed to form a good casting slip. The slip is sieved through 100-120 No mesh sieve. The articles are made by casting process by pouring the slip to the moulds of plaster of paris. The articles are finished dried and the glazed. The glazed articles are fired in kilns to the temperature of about 1200°C. The articles are taken out from the kiln when it is nearer to room temperature. The articles are sorted out and packed for selling.
INTRODUCTION

The project profile envisages the manufacture of glazed earthenware wall tiles used for the surface of walls where cleanliness is an important factor. Hospitals, Kitchens, Bathrooms, Chemical Laboratories are some of the important places where these glazed tiles are generally used. These tiles are made generally on sizes of 149 mm x 4.5 mm and 99 mm x 4 mm. These tiles may be manufactured in sizes other than above according to the agreement between the manufacturer and the purchaser. Commonly manufactured sizes are 108 mm x 108 mm x 5 mm; 152 mm x 152 mm x 5.5 mm; 200 mm x 200 mm x 6 mm; 200 mm x 150 mm x 6.5 mm and 200 mm x 200 mm x 7 mm. The top surface of the tiles is glazed either glossy or mat glazed in white and in various colours.

MARKET POTENTIAL

In the State of Gujarat, there are 6 units in large scale and 8 units in SSI sector engaged in the manufacture of glazed earthenware wall tiles. The production capacity of these units is estimated 16000 MT per annum. It is reported that these existing units do not have market problems at present and are sending their products to the other states also. Further, there is scope for exporting the product to Arabian and African countries.

As all round development activities are taking place in country, in result of which number of houses, offices, schools, colleges, hotels and other public buildings are being constructed in which ceramic tiles are used. The average standard of living has been improving steadily in India over past few years. Number of old houses are being modified by using these tiles. Further the population of India is increasing day by day and people are facing the problems of houses. The houses are the essential need of human being. To over come the problem of houses the Govt. of India has made so many plans. Along with these developments came an increasing demand for these tiles. The demand is expected to grow substantially at the rate of 20% per annum during the coming years.

PRODUCTION TARGET PER ANNUM

Glazed Earthenware wall Tiles - 1200 MT

BASIS AND PRESUMPTIONS

The project profile is based on the presumption of 8 hours working per day for 300 days in a year. The firing operation of the kiln is however to be carried out continuously. It is presumed that total losses of raw material during the process would be 20% and rejections in finished product would be 5%. The cost of land, building, machineries, kilns, raw materials, wages etc. are estimated after having contacted with concerned agencies and may vary from time to time and place to place depending upon various factors.

MANUFACTURING PROCESS

The raw materials required for the manufacture of glazed earthenware tiles ae ball clay, dolomite, willestonyte, talc and slate pencil powder. The raw materials in desired proportion are charged in Ball Mill/Blunger for fine grinding (120 mesh) with about 40% water. After grinding in the ball mill this material is discharged and passed through vibrating screen of 120 mesh and magnet
Electrification and installation charges  
@ 10% on the cost of machinery.  
Drying racks, working tables, etc.  
Laboratory equipments  
Office equipments  

Total cost of machinery & equipments  

3. Kiln & Dryers  
i. Shuttle kiln, fully fibre lined with two cars, with all accessories and automatic control system etc. including oil storage tank, etc.  
Car Dimensions  
Setting length - 2850 mm, Setting width - 1500 mm  
Setting height - 2500 mm, Setting volume - 10.5 m³  
ii. Chamber Dryer  
Size 10 m x 8 m with all accessories  

Total :  

Total Fixed Investment :  
Land  
Building  
Machinery & Equipments  
Kilns & Dryers  

Total :  

Salary and Wages Per Month :  
1. Personal (Wages per month)  

<table>
<thead>
<tr>
<th>Designation</th>
<th>Nos.</th>
<th>Salary/ Month (Rs.)</th>
<th>Total salary (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceramist</td>
<td>1</td>
<td>4000</td>
<td>4,000</td>
</tr>
<tr>
<td>Supervisors</td>
<td>4</td>
<td>2500</td>
<td>10,000</td>
</tr>
<tr>
<td>Accountant</td>
<td>1</td>
<td>1500</td>
<td>1,500</td>
</tr>
<tr>
<td>Clerk-cum-typist</td>
<td>2</td>
<td>1000</td>
<td>2,000</td>
</tr>
<tr>
<td>Skilled workers</td>
<td>15</td>
<td>1000</td>
<td>15,000</td>
</tr>
<tr>
<td>Semi-skilled workers</td>
<td>40</td>
<td>750</td>
<td>30,000</td>
</tr>
<tr>
<td>Watchman/Peon</td>
<td>2</td>
<td>750</td>
<td>1,500</td>
</tr>
</tbody>
</table>

Total : 64,000  
Perquisites @ 15% of total salary  
Say 74,000
<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>QTY</th>
<th>Rate (INR)</th>
<th>Amount (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Agitator with all accessories including cemented tank of size 6' dia x 6' deep</td>
<td>2</td>
<td>5</td>
<td>60,000</td>
</tr>
<tr>
<td>5</td>
<td>Funnel magnets</td>
<td>3</td>
<td>-</td>
<td>15,000</td>
</tr>
<tr>
<td>6</td>
<td>Diaphragm pump, strock 6&quot; suction - 2 1/2&quot;, Delivery - 2&quot; with all accessories</td>
<td>1</td>
<td>7.5</td>
<td>30,000</td>
</tr>
<tr>
<td>7</td>
<td>Filter press No.of plates 60 chamber dia 600 mm with all accessories</td>
<td>1</td>
<td>-</td>
<td>2,000,000</td>
</tr>
<tr>
<td></td>
<td><strong>Pressing section</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>1650 mm dia. dust pan mill with all accessories. Height of pan 200 mm Roller dia. 1000 mm x 250 mm face</td>
<td>1</td>
<td>7.5</td>
<td>1,80,000</td>
</tr>
<tr>
<td>9</td>
<td>Vibrating screen with all accessories size 4' x 2' for clay dust</td>
<td>1</td>
<td>2</td>
<td>20,000</td>
</tr>
<tr>
<td>10</td>
<td>Automatic tiles pressing capacity 40MT with all accessories. 18 stroke per minute</td>
<td>3</td>
<td>50</td>
<td>6,40,000</td>
</tr>
<tr>
<td>11</td>
<td>Fettling machine with all accessories</td>
<td>1</td>
<td>15</td>
<td>40,000</td>
</tr>
<tr>
<td>12</td>
<td>Dies - 149 mm x 149 mm x 4.5 mm 99 mm x 99 mm x 4 mm 200 mm x 150 mm x 6.3 mm</td>
<td>2 sets</td>
<td>-</td>
<td>1,50,000</td>
</tr>
<tr>
<td>13</td>
<td>Trolley</td>
<td>6</td>
<td>-</td>
<td>30,000</td>
</tr>
<tr>
<td>14</td>
<td>Conveyor system</td>
<td>1</td>
<td>3</td>
<td>50,000</td>
</tr>
<tr>
<td></td>
<td><strong>Glazing section</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Ball mill 1350 mm x 1200 mm with all accessories</td>
<td>1</td>
<td>10</td>
<td>70,000</td>
</tr>
<tr>
<td>16</td>
<td>Vibrating screen size 4' x 2' with all accessories</td>
<td>1</td>
<td>2</td>
<td>40,000</td>
</tr>
<tr>
<td>17</td>
<td>Permanent magnet</td>
<td>-</td>
<td></td>
<td>5,000</td>
</tr>
<tr>
<td>18</td>
<td>Cemented store tanks for glaze with stirrer</td>
<td>1</td>
<td>2</td>
<td>20,000</td>
</tr>
<tr>
<td>19</td>
<td>16’' long glaze line with all accessories</td>
<td>1</td>
<td>6</td>
<td>1,80,000</td>
</tr>
<tr>
<td>20</td>
<td>Selection line for finish tiles length 30' with all accessories</td>
<td>1</td>
<td>3</td>
<td>30,000</td>
</tr>
<tr>
<td>21</td>
<td>Water pump set</td>
<td>1</td>
<td>5</td>
<td>25,000</td>
</tr>
<tr>
<td>22</td>
<td>Misc. equipments</td>
<td>-</td>
<td></td>
<td>35,000</td>
</tr>
</tbody>
</table>

**Total:** 21,20,000
FINANCIAL ANALYSIS

1. Cost of production per annum:
   - Salary & Wages: 8,88,000
   - Raw materials: 21,00,000
   - Utilities: 1,80,000
   - Other contingent expenses: 60,000
   - Depreciation on building @ 5%: 1,40,000
   - Depreciation on machinery @ 10%: 1,90,000
   - Depreciation on Kilns & Dryers @ 15%: 2,10,000
   - Interest on fixed capital @ 15%: 8,55,000
   - Interest on working capital @ 20%: 1,53,600
   - Total cost of production: 46,76,600

2. Sales per annum:
   - Items
     - Sanitarywares
       - Qty: 855 MT
       - Rate: Rs.6500
       - Value (Rs): 55,57,500

3. Profitability Per annum:
   - Sales per annum: 55,57,500
   - Cost of production per annum: 46,76,600
   - Profit: 8,80,900
     - Percentage profit on investment: 13.6%
     - Percentage profit on sale: 15.8%
     - B.E.P: 64%

NAMES & ADDRESSES OF RAW MATERIALS SUPPLIERS

1. Eklera China Clay Works
   - Post Ekleri, Tal. Idar
   - Dist. Sabarkantha (Gujarat)
   - China clay

2. Swastik Industries
   - Shiv Krup Nagpur College Road
   - Bhuj Kutch - 370 001
   - China clay

3. Ashapura China Co
   - Near Rly. Station
   - Bhuj Kutch - 370 001
   - China clay

4. Hemang Pottery Works
   - Thangadhi
   - Dist. Surendranagar
   - Plaster fire clay

5. Muttani Minerals
   - Station Road, Thangadhi
   - Dist. Surendranagar
   - - do -
(ii) Raw materials per month:

<table>
<thead>
<tr>
<th>Items</th>
<th>Qty</th>
<th>Rate (Rs.)</th>
<th>Price (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball clay</td>
<td>60MT</td>
<td>700/MT</td>
<td>42,000</td>
</tr>
<tr>
<td>Dolomite</td>
<td>14MT</td>
<td>700/MT</td>
<td>9,000</td>
</tr>
<tr>
<td>Wallastonite</td>
<td>14MT</td>
<td>1500/MT</td>
<td>21,000</td>
</tr>
<tr>
<td>Talc</td>
<td>15MT</td>
<td>800/MT</td>
<td>12,000</td>
</tr>
<tr>
<td>Non-plastic burnt clay</td>
<td>17MT</td>
<td>300/MT</td>
<td>5,100</td>
</tr>
<tr>
<td>Frit</td>
<td>7MT</td>
<td>16000/MT</td>
<td>1,12,000</td>
</tr>
<tr>
<td>China Clay</td>
<td>1MT</td>
<td>2000/MT</td>
<td>2,000</td>
</tr>
<tr>
<td>Colours</td>
<td>L.S.</td>
<td></td>
<td>2,000</td>
</tr>
<tr>
<td>Kiln furniture</td>
<td>L.S.</td>
<td></td>
<td>25,000</td>
</tr>
<tr>
<td>Crans and deck slabs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Packaging materials</td>
<td>5000 Boxes</td>
<td>6/Box</td>
<td>30,000</td>
</tr>
<tr>
<td>LD Oil</td>
<td>30 KL</td>
<td>4500/KL</td>
<td>1,35,000</td>
</tr>
<tr>
<td><strong>Total cost of raw materials</strong></td>
<td></td>
<td></td>
<td><strong>3,95,000</strong></td>
</tr>
</tbody>
</table>

(iii) Utilities per month:

(1) Power charges for machinery 100 KWH x Rs.1.10 x 8 hours x 25 days = 22,000

(2) Power charges for kiln 23 KWH x Rs. 1.10 x 24 hours x 25 days = 15,180

Total = 37,180

Say 37,000

(iv) Other contingent expenses (per month):

Postage & Stationary. = 200

TA/DA = 3,000

Repairing & Maintenance = 3,000

Advertising & Publicity = 4,000

Misc. Expenditure = 2,800

Total = 13,000

(v) Working Capital Requirement:

Salary & wages = 1 Month = 70,000

Raw Materials & Fuel = 3 Months = 7,80,000

Fuel = 2 Months = 2,70,000

Power charges = 2 Months = 74,000

Misc. expenses = 1 Month = 13,000

Total = 12,07,000

**TOTAL COST OF PROJECT**

Land = 9,00,000

Building = 35,00,000

Machinery & Equipments = 23,50,000

Kilns & dryers = 23,00,000

Working capital = 12,07,000

Total = 1,02,57,000

12
NAMES AND ADDRESSES OF MACHINERY SUPPLIERS

1. Amic Industries (P) Ltd.
   86, D, Dr. Suresh Sirkar Road
   Calcutta - 700 014.

   8, Panchanantala New Road
   Balgharia
   Calcutta - 700 056.

3. Lokmanya Engg. Works
   26, Bharat Khand Cotton Mill Compound
   Naroda Road
   Ahmedabad - 380 016.

4. Jeevanlal Shivalal Panchal
   Opp. Old Civil Hospital
   Gheckanta Road
   Ahmedabad.

5. Modern Engg. & Fabricating Works
   Behind Kubeshwar Mahadev
   Saijpur, Ambawadi
   Ahmedabad.

   25 Swallow Lane
   Calcutta - 700 001.

7. Sabarwal Metal Industries
   9, Industrial Estate
   Kalapi Road
   Kanpur - 208 012.

8. Noble Enterprises
   Umeya Shopping Centre
   Nr. Bus Stand
   Limbdi - 363421.
### NAMES AND ADDRESSES OF SUPPLIERS OF MACHINERY

<table>
<thead>
<tr>
<th></th>
<th>Name</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Amic Industries (P) Ltd.</td>
<td>86, D, Dr. Suresh Sirkar Road, Calcutta - 700 014.</td>
</tr>
<tr>
<td>3</td>
<td>Lokmanyata Engg. Works</td>
<td>26, Bharat Khand Cotton Mill Compound, Naroda Road, Ahmedabad - 380 016.</td>
</tr>
<tr>
<td>4</td>
<td>Jeevanlal Shivlal Panchal</td>
<td>Opp. Old Civil Hospital, Gheekanta Road, Ahmedabad.</td>
</tr>
<tr>
<td>6</td>
<td>Keshav Engg. Works</td>
<td>25 Swallow Lane, Calcutta - 700 001.</td>
</tr>
<tr>
<td>7</td>
<td>Sabarwal Metal Industries</td>
<td>9, Industrial Estate, Kalapi Road, Kanpur - 208 012.</td>
</tr>
<tr>
<td>8</td>
<td>Noble Enterprises</td>
<td>Umeya Shopping Centre, Nr. Bus Stand, Limbdi - 363421.</td>
</tr>
</tbody>
</table>

### NAMES AND ADDRESSES OF THE RAW MATERIAL SUPPLIERS

<table>
<thead>
<tr>
<th></th>
<th>Name</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jain Minerals</td>
<td>36 Pashagalli Kothi, Jaipur Road, Ajmer (Rajasthan)</td>
</tr>
<tr>
<td>2</td>
<td>GC Minerals</td>
<td>6/459 Serreffan Mohalla, Beawar (Rajasthan)</td>
</tr>
<tr>
<td>3</td>
<td>Wolckel (P) Ltd</td>
<td>Nr Siroli Road 307 021, Rajasthan</td>
</tr>
<tr>
<td>4</td>
<td>Ferro Coatings &amp; Colour Ltd</td>
<td>Post Joka, 24 Parganas, Calcutta (W.B)</td>
</tr>
</tbody>
</table>
to remove the iron particles and collected in an agitator from where it is pumped to filter press for de-watering and to get in the form of cakes. The cakes are allowed to dry. The dried cakes are charged into dust pan for making the powder mixed with necessary blinder which is further passed through a vibrating screen. The tiles are made by charging the press dust to the automatic tile press. The pressed tiles are taken out and felted by felting machine. The tiles are loaded in to kiln for biscuit firing. The tiles are unloaded from the kiln and defective tiles are removed. The biscuit tiles are glazed on the top surface on the glaze line machine. The glazed tiles are again loaded into kiln for glost firing upto the temperature of 1050° C, when kiln is cooled, the tiles are taken out from the kiln and sorted out and packed for selling.

QUALITY CONTROL

BIS has formulated and published IS: 777-1988 "specification for glazed earthenware wall tiles". This IS covers the requirements for glazed earthenware wall tiles used for finishing the surface of wall where cleanliness is an important factor. The tiles must be free from all defects. Following are the quality control tests that are carried out on the tiles:

1. Defects
2. Dimensions and tolerances
3. Trueness of shape
4. Water absorption
5. Crazing
6. Impact resistance
7. Chemical resistance

Entrepreneurs are advised to refer IS - 777 : 1988 for more details.

COST OF PROJECT

Land - 6000 sq. m. @ Rs. 150/sq.m. 9,00,000

Building:
Manufacturing & Machinery shed 1000 sq.m. @ Rs.2600/sq.m 26,00,000
Godown for raw materials 200 sq.m. @ Rs.2000/sq.m 4,00,000
Office 100 sq.m. @ Rs.2000/sq.m 2,00,000
Boundry walls L.S. 3,00,000

Total : 35,00,000

2. Machinery & Equipment:

<table>
<thead>
<tr>
<th>S.No</th>
<th>Description</th>
<th>Nos.</th>
<th>HP required</th>
<th>Price (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slip House</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Ball mills, size 1800 mmx1800mm with all accessories and electric motor</td>
<td>2</td>
<td>10 each</td>
<td>2,00,000</td>
</tr>
<tr>
<td>2.</td>
<td>Screw blunger, Dia. of impeller -500 mm Dimension of RCC Tank - 2000 mm x 1900 mm depth RPM 250 - 300 capacity - 5000 litres.</td>
<td>1</td>
<td>5</td>
<td>60,000</td>
</tr>
<tr>
<td>3.</td>
<td>Vibrating screen size 600 mm x 900 mm with all accessories. Frequency of vibrating 3000 RPM Capacity 3000-4000 litre per hour.</td>
<td>1</td>
<td>2</td>
<td>40,000</td>
</tr>
</tbody>
</table>
IMPLEMENTATION SCHEDULE (PREMPTIONS)

<table>
<thead>
<tr>
<th></th>
<th>Activity</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Preparation of project report</td>
<td>30 days</td>
</tr>
<tr>
<td>2.</td>
<td>Selection of site</td>
<td>30 days</td>
</tr>
<tr>
<td>3.</td>
<td>Registration of SSI</td>
<td>5 days</td>
</tr>
<tr>
<td>4.</td>
<td>Availability of finance</td>
<td>45 days</td>
</tr>
<tr>
<td>5.</td>
<td>Construction of building</td>
<td>90 days</td>
</tr>
<tr>
<td>6.</td>
<td>Machinery procurement &amp; erection</td>
<td>90 days</td>
</tr>
<tr>
<td>7.</td>
<td>Raw material procurement</td>
<td>45 days</td>
</tr>
<tr>
<td>8.</td>
<td>Recruitment of labours</td>
<td>30 days</td>
</tr>
<tr>
<td>9.</td>
<td>Trial runs</td>
<td>15 days</td>
</tr>
</tbody>
</table>

If C.P.M. is drawn of above activities, the total period would be required about 180 days to implement the project, as many activities are to be completed simultaneously.

TECHNICAL ASPECTS

Process of Manufacture:

The raw materials like quartz, felspar, ball clay, fire clay etc. are charged in ball mill in desired proportion with 30-40% water and ground to the fineness of 100 -120 No. mesh. China clay and other soft clays are blunged in blunger with 30-40 water. The slurry from ball mill and blunger is mixed and passed through the sieve of 100 No mesh and then electromagnet in order to remove the iron particles from the slurry. Both slurries are kept and mixed properly in agitator tank. From agitator tank, it is passed through filter press for dewatering to make the form of cakes. These cakes are passed through de-airing pugmill to make the compact body. The round articles are made by this body on jigger and jolley. Other shapes are made by casting process. For casting first slip is made and poured into the moulds of plaster of paris. The articles are dried, finished, glazed, and fired at the temperature of 1250-1280°C. For firing tunnel kiln is proposed in this project profile. D.D. Kilns and shuttle kilns are also in practice. The articles taken out from the kiln are sorted and packed for selling.

Quality Specifications:

B.I.S. has formulated and published IS:11475-1985(Stonewares Dinnerwares) for carrying out the various tests for control the quality of the product.

Production Capacity per annum:

(a) Quantity - 600 M.T.
(b) Value - Rs. 54.15 lakhs.

Approximate power requirement: - 75 H.P.

Pollution Control:

This industry comes under "Red" Category. For the purposes of inspection for implementation of provisions of various statutes regarding control of pollution and protection of environment, it is proposed to visit a unit by the concerned authorities once in six month.

Energy Conservation needs:

This industry needs energy conservation in fuel as well as in electric. Ceramic fibred lined tunnel kiln proposed in the project profile conserves the fuel energy to 20-50%, when it is compared with conventional type D.D.Kiln.
Electriciation and installation charges @ 10
Office equipments

Total :

3. Kilns & Dryers
Shuttle Kilns
1. Size 2850 mm x 1500 mm x 2500 mm 1 No. 8,00,000
Burners 3 Nos. Ceramic fibre lined capacity 4.5 MT tiles for biscuit firing with all accessories and with fully automation control with 12 HP motors.
2. Car 2850 mm x 1500 mm x 2500 mm 1 No. 12,00,000
size (2 cars). Burners 6 Nos. Ceramic fibre lined capacity 4.5 MT tiles for glost firing with all accessories and with fully automation control and 18 HP motor.
3. Chamber dryer size 40’ x 40’ x 10’ 1 No. 3,00,000

Total:

Total Fixed Investment:
Land
Building
Machinery & Equipment
Kilns & dryers

Total:

Working Capital:
(1) Personal (Wages per month)

<table>
<thead>
<tr>
<th>Designation</th>
<th>Nos.</th>
<th>Salary/Month</th>
<th>Total salary (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manager cum Ceramist.</td>
<td>1</td>
<td>6000</td>
<td>6,000</td>
</tr>
<tr>
<td>Supervisors</td>
<td>2</td>
<td>3000</td>
<td>6,000</td>
</tr>
<tr>
<td>Accountant</td>
<td>1</td>
<td>1500</td>
<td>1,500</td>
</tr>
<tr>
<td>Clerk-cum-typist</td>
<td>2</td>
<td>1000</td>
<td>2,000</td>
</tr>
<tr>
<td>Skilled workers</td>
<td>10</td>
<td>1000</td>
<td>10,000</td>
</tr>
<tr>
<td>Unskilled workers</td>
<td>50</td>
<td>700</td>
<td>35,000</td>
</tr>
<tr>
<td>Peon</td>
<td>1</td>
<td>700</td>
<td>700</td>
</tr>
<tr>
<td>Watchman</td>
<td>2</td>
<td>700</td>
<td>1,400</td>
</tr>
</tbody>
</table>

Perquisites @ 15% of total salary

Total: 69,940
Say 70,000
3. **Kilns:**

Ceramic fibrelined push but tunnel kiln with control system, oil storage tank, combustion fan, hydraulic pusher etc.

Dimension
- Length: 2400 mm
- Setting width: 900 mm
- Setting height: 820 mm
- No. of burners: 4
- Power required: 10 H.P.
- Capacity: 2 M.T. per day.

4. **Pre-operative expenses:**

Total fixed capital (1+2+3+4) 50,000

5. **Working Capital:**

(i) Personal (Wages per month)

<table>
<thead>
<tr>
<th>Designation</th>
<th>Nos.</th>
<th>Salary/Month (Rs.)</th>
<th>Total salary (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manager cum Ceramist.</td>
<td>1</td>
<td>3500</td>
<td>3500</td>
</tr>
<tr>
<td>Supervisor</td>
<td>1</td>
<td>2500</td>
<td>2500</td>
</tr>
<tr>
<td>Accountant</td>
<td>1</td>
<td>2000</td>
<td>2000</td>
</tr>
<tr>
<td>Clerk-cum-typist</td>
<td>1</td>
<td>1500</td>
<td>1500</td>
</tr>
<tr>
<td>Skilled workers</td>
<td>15</td>
<td>1000</td>
<td>15,000</td>
</tr>
<tr>
<td>Semi-skilled workers</td>
<td>20</td>
<td>750</td>
<td>15,000</td>
</tr>
<tr>
<td>Peon</td>
<td>1</td>
<td>750</td>
<td>750</td>
</tr>
<tr>
<td>Watchman</td>
<td>2</td>
<td>750</td>
<td>1,500</td>
</tr>
</tbody>
</table>

Perquisites @ 15% of total salary 6,262

Say: 47,912

(ii) **Raw materials & Fuel per month:**

<table>
<thead>
<tr>
<th>Items</th>
<th>Ind./Imp.</th>
<th>Qty.</th>
<th>Rate (Rs.)</th>
<th>Price (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartz/Silica sand</td>
<td>Ind.</td>
<td>13MT</td>
<td>Rs.400/Mt</td>
<td>5,200</td>
</tr>
<tr>
<td>Felspar</td>
<td>Ind.</td>
<td>16MT</td>
<td>Rs.500/Mt</td>
<td>8,000</td>
</tr>
<tr>
<td>China clay</td>
<td>Ind.</td>
<td>10MT</td>
<td>Rs.1200/Mt</td>
<td>12,000</td>
</tr>
<tr>
<td>Ball clay</td>
<td>Ind.</td>
<td>5MT</td>
<td>Rs.500/Mt</td>
<td>2,500</td>
</tr>
<tr>
<td>Fire clay</td>
<td>Ind.</td>
<td>20MT</td>
<td>Rs.300/Mt</td>
<td>6,000</td>
</tr>
<tr>
<td>Marble/Calcite</td>
<td>Ind.</td>
<td>750/KG</td>
<td>Rs.2000/Mt</td>
<td>1,500</td>
</tr>
<tr>
<td>Zinc oxide</td>
<td>Ind.</td>
<td>100/KG</td>
<td>Rs.50/KG</td>
<td>5,000</td>
</tr>
<tr>
<td>Zirconium oxide</td>
<td>Ind.</td>
<td>700/KG</td>
<td>Rs.30/KG</td>
<td>21,000</td>
</tr>
<tr>
<td>Barium carbonate</td>
<td>Ind.</td>
<td>200/KG</td>
<td>Rs.20/KG</td>
<td>4,000</td>
</tr>
<tr>
<td>Colouring agents</td>
<td>Ind.</td>
<td>LS</td>
<td></td>
<td>2,800</td>
</tr>
<tr>
<td>Plaster of Paris</td>
<td>Ind.</td>
<td>2/Mt</td>
<td>Rs.2000/Mt</td>
<td>4,000</td>
</tr>
<tr>
<td>LDO (Fuel)</td>
<td>Ind.</td>
<td>18/KL</td>
<td>Rs.6500/KL</td>
<td>1,04,000</td>
</tr>
<tr>
<td>Kiln furniture</td>
<td>Ind.</td>
<td>LS</td>
<td></td>
<td>6,000</td>
</tr>
<tr>
<td>Packing material</td>
<td>Ind.</td>
<td>LS</td>
<td></td>
<td>3,000</td>
</tr>
</tbody>
</table>

Total cost of raw materials 1,85,000

18
FINANCIAL ANALYSIS

1. **Cost of production per annum:**

<table>
<thead>
<tr>
<th>Item</th>
<th>Value (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salary &amp; Wages</td>
<td>8,40,000</td>
</tr>
<tr>
<td>Raw materials</td>
<td>31,20,000</td>
</tr>
<tr>
<td>Fuel</td>
<td>16,20,000</td>
</tr>
<tr>
<td>Power charges</td>
<td>4,44,000</td>
</tr>
<tr>
<td>Other contingent expenses</td>
<td>1,56,000</td>
</tr>
<tr>
<td>Depreciation on building @ 5%</td>
<td>3,50,000</td>
</tr>
<tr>
<td>Depreciation on machinery @ 10%</td>
<td>2,35,000</td>
</tr>
<tr>
<td>Depreciation on Kilns &amp; Dryers @ 15%</td>
<td>3,45,000</td>
</tr>
<tr>
<td>Interest on fixed capital @ 15%</td>
<td>13,72,500</td>
</tr>
<tr>
<td>Interest on working capital @ 18%</td>
<td>2,17,260</td>
</tr>
</tbody>
</table>

   **Total cost of production:** 86,99,760
   **Say:** 87,00,000

2. **Sales per annum:**

<table>
<thead>
<tr>
<th>Item</th>
<th>Qty.</th>
<th>Rate</th>
<th>Value (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glazed Earthenware tiles</td>
<td>1140 MT</td>
<td>Rs.8500 per MT</td>
<td>96,90,000</td>
</tr>
</tbody>
</table>

3. **Profitability Per annum:**

<table>
<thead>
<tr>
<th>Item</th>
<th>Value (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales per annum</td>
<td>96,90,000</td>
</tr>
<tr>
<td>Cost of production per annum</td>
<td>87,00,000</td>
</tr>
<tr>
<td>Profit</td>
<td>9,90,000</td>
</tr>
<tr>
<td>Percentage profit on investment</td>
<td>9.6%</td>
</tr>
<tr>
<td>Percentage profit on sale</td>
<td>10.2%</td>
</tr>
<tr>
<td>B.E.P</td>
<td>72%</td>
</tr>
</tbody>
</table>

ADDRESS OF KILN CONSULTANTS

1 Sharma Kiln Technology
   206, Hare Krishna Complex
   Opp. Kothawala Flat
   Ashram Road
   Ahmedabad - 380 006.

2 N.M. Ceramic Kiln
   P.B. No.30
   B-8 Ram Balram Appartment
   Kalol - 382 721, Dist. Mehsana.

3 Associated Industrial Furnace
   2/5 Sarai Juliana, 1st Floor
   Okhla Road, New Delhi- 110 065.

4 Unifire
   16-12 Shakespere Sarani
   4th Floor, Culcutta - 700 071.

5 Taksago Bhagat Cere Kiln (P) Ltd.
   D- 828, New Friented Colony
   New Delhi - 110 065.

6 Noble Enterprises
   Umiya Shopping Centr
   Nr. Bus Stand,
   Limbdi - 363 421.
INTRODUCTION

At present Crockery Wares are being manufactured in earthenware, stonewares, vitreous china and bone chine. This project profile is prepared for the manufacture of Stoneware Crockery items. The main item under the group of Crockery are Cups, saucers, Plates, Bowls, tea sets, dinner sets etc. They are impermeable to most of the liquids and water absorption is less than 3%. They are bad conductor of heat. Ceramic Crockerywares have their own place in the field of kitchenware due to having some outstanding properties over to mellamine and steel wares, such as more hygenic, easily cleanable, heat resistance etc. The main uses of these items are in houses, Railway/Defence canteens, tea stalls, hotels and restaurants etc.

MARKET

Stoneware Crockery items are used in the kitchen of every houses, hotels, restaurents, tea stalls, railway canteens, defence canteens etc. In the state of Gujarat, about 80 SSI units are engaged in the manufacture of Stoneware Crockeries. The installed capacity of these units is estimated around 30000 MT per annum. It is reported that these units are not facing the problems of marketing. In the region (Gujarat State), supply of the product is greater than demand. Therefore, units of Gujarat State are supplying their products to the outside of the state mainly, Maharashtra, Andhrapradesh, Tamilnadu, Kerala and Karnataka. On the national level, demand of the product is greater than supply. This produchhas good scope in international market, mainly in Gulf and South African Countries. It is presumed that demand of this item is increasing with a growth rate of 15% per annum due to the increasing of population and development activities in the country.

BASIS & PRESUMPTIONS

(1) Efficiency and working hours considered for full capacity utilisation.
1. 80% (efficiency)
2. 8 working hours per day or 300 days in a year.
3. Operation of kiln will be of continuous nature

(2) Time required for achieving full/envisaged capacity utilisation.
6 months from the commencement of commercial production

(3) Labour wages
Skilled workers - Rs.40/day
Semi-skilled workers-Rs.30/day

(4) Interest rate for fixed capital working capital
18%
20%

(5) Margin money
30%

(6) Pay back period of the project
9 years

(7) Land rate
Rs.100/Sq.M.

(8) Building construction rate
Rs.2500/Sq.M.
2. Turn over per year:

<table>
<thead>
<tr>
<th>Items</th>
<th>Qty.</th>
<th>Rate</th>
<th>Value(Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stoneware Crockery items</td>
<td>600 MT</td>
<td>Rs.9000/Mt</td>
<td>54,00,000</td>
</tr>
<tr>
<td>Less rejections etc. @ 5%</td>
<td></td>
<td></td>
<td>2,70,000</td>
</tr>
</tbody>
</table>

Net turn over

51,30,000

3. Net profit per year (before income tax)

Rs. 51,30,000 - Rs. 46,46,000 = Rs. 4,84,000

4. Net profit ratio = \( \frac{484000 \times 100}{5130000} \) = 9.4%

5. Rate of return = \( \frac{484000 \times 100}{5391000} \) = 9%

6. Breakeven point:

i) Total Depreciation 4,64,000

ii) Total Interest 10,50,000

iii) 40% of salary & wages. 2,30,000

iv) 40% of utilities 1,03,000

v) 40% of other contingent 28,800

Say 18,82,400

Net profit

B.E.P. = \( \frac{1882400 \times 100}{1882400 + 484000} \) = 77%

4,84,000

NAMES & ADDRESSES OF MACHINERY SUPPLIERS

1. Amic Industries Pvt. Ltd
   80, D, Dr. Suresh Sircar Road
   Calcutta- 700 014

2. Modern Engg. & Fabricating Works
   Behind Kubeshwar Mahadev
   Naroda Road, Ahmedabad

3. Lokmanya Engg. work
   20, Bharat Khand Cotton Mills Compound
   Naroda Road
   Ahmedabad-380 010

4. Jivanlal Shivlal Panchal
   Opp: Old Civil Hospital
   Gheekanta Road
   Ahmedabad

5. Gidwaney Brothers
   73, Netaji Subhash Road
   P.B.No. 2346
   Calcutta-1

6. Saboo Engg. Works
   Kuchaman Road 341 509
   Rajasthan

7. Hindustan Engg. Company
   23/7 Gopallal Tagore Road
   Bon Hooghly
   Calcutta-700 035

   8, Panchanathala New Road
   Balgharia
   Calcutta- 700 056

9. Perfect Machine Tools Corporation
   1 Smith Road
   Madras-1

10. St. Vincent Industries
    Convent Road
    Calicut (Kerala)
1. **Fixed Capital:**

<table>
<thead>
<tr>
<th>Description</th>
<th>Ind/Qty</th>
<th>Price (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land &amp; Building</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land</td>
<td></td>
<td>3,00,000</td>
</tr>
<tr>
<td>Manufacturing &amp; Machinery shed</td>
<td></td>
<td>7,50,000</td>
</tr>
<tr>
<td>Kiln shed</td>
<td></td>
<td>3,75,000</td>
</tr>
<tr>
<td>Raw material shed</td>
<td></td>
<td>1,50,000</td>
</tr>
<tr>
<td>Finished goods godown</td>
<td></td>
<td>2,50,000</td>
</tr>
<tr>
<td>Office</td>
<td></td>
<td>1,25,000</td>
</tr>
<tr>
<td>Boundary walls</td>
<td></td>
<td>1,50,000</td>
</tr>
<tr>
<td><strong>Total Cost of Land &amp; Building</strong></td>
<td></td>
<td><strong>21,00,000</strong></td>
</tr>
</tbody>
</table>

2. **Machinery & Equipment:**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Description</th>
<th>Ind/Qty</th>
<th>Price (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ball mills, size 1800 mmx1800 mm with all accessories and 10 H.P. motor each</td>
<td></td>
<td>2,50,000</td>
</tr>
<tr>
<td>2</td>
<td>Ball mill size 900 mm x 900 mm with all accessories with 7.5 H.P. motor</td>
<td></td>
<td>40,000</td>
</tr>
<tr>
<td>3</td>
<td>Screw blunger, capacity 5000 litre, VAT (Hexagonal) 2.8 m x 1.8 m with 5 H.P. motor including cemented tank</td>
<td></td>
<td>1,00,000</td>
</tr>
<tr>
<td>4</td>
<td>Vibrating screen size 900 mm x 900 mm with all accessories and 1 H.P. Motor</td>
<td>Ind 2</td>
<td>20,000</td>
</tr>
<tr>
<td>5</td>
<td>Electromagnetic separators with rectifier</td>
<td>Ind 1</td>
<td>10,000</td>
</tr>
<tr>
<td>6</td>
<td>Agitator size 2.4 M x 1.8 M with 3 H.P. motor and cemented tank</td>
<td>Ind 1</td>
<td>40,000</td>
</tr>
<tr>
<td>7</td>
<td>Diaphragm pump, stroke 225 mm suction 75 mm with 7.5 H.P. motor</td>
<td>Ind 1</td>
<td>30,000</td>
</tr>
<tr>
<td>8</td>
<td>Filter press chamber dia 600 mm number of plates 50</td>
<td>Ind 1</td>
<td>1,00,000</td>
</tr>
<tr>
<td>9</td>
<td>De-airing pugmill with vacuum pump etc.</td>
<td>Ind 1</td>
<td>35,000</td>
</tr>
<tr>
<td>10</td>
<td>Disintegrator size 550 cm with all accessories and 7.5 H.P. motor</td>
<td>Ind 1</td>
<td>45,000</td>
</tr>
<tr>
<td>11</td>
<td>Jigger &amp; jolley with 5 HP electric motor</td>
<td>Ind 15</td>
<td>1,00,000</td>
</tr>
<tr>
<td>12</td>
<td>Saggar press power Operated with 5 HP motor</td>
<td>Ind 1</td>
<td>50,000</td>
</tr>
<tr>
<td>13</td>
<td>Water pump set with 2 H.P. motor</td>
<td>Ind 1</td>
<td>20,000</td>
</tr>
<tr>
<td>14</td>
<td>Pot mill, Pot No.6, Pot size 9&quot;x10&quot; with electric motor of 2 HP</td>
<td>Ind 1</td>
<td>1,00,000</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>8,50,000</strong></td>
</tr>
</tbody>
</table>

(b) Electrification and installation charges @ 10% on the cost of machinery. 85,000

c) Testing equipments. 30,000

d) Misc. Tools, dies, Trolleys etc. 50,000

e) Cost of office equipments. 25,000

**Total cost of machinery & equipments**: 10,10,000
11 Hindustan China Clay Works
   Papinacheri
   Kerala
   [China Clay]

13 Tahla Ram & Sons
   Rathkhna
   Bikaner (Rajasthan)
   [Ball Clay]

15 R.D. Manihar & Co
   Prithviraj Marg
   Bikaner (Rajasthan)
   [Ballclay/Felspar]

17 Multani Minerals
   Station Road
   Thangadh
   Dist. Surendranagar (Gujarat)
   [Fire Clay]

19 Ceramills Glaze & Zirconium Co
   Daulatabad Road
   Gurgaoan (Haryana)
   [Zirconium]

21 Ferro Coatings Coldurs Ltd
   Post Joka
   24 Paraganas, Calcutta - (WB)
   [Frits/glazes, colours]

23 Dudhan Industries
   12, Cement Road
   Dehradun (UP)
   [Plaster of paris]

12 Ami Ceramics
   Motipur, Himatnagar
   Gujarat
   [China Clay]

14 Sita Ram Rajkumar
   Inside Hemalton Ki Bari
   Bikaner (Rajasthan)
   [Ball Clay]

16 Shri Draupadi Devi Ball
   Clay Suppliers
   Post-Sri Kolaytji
   Bikaner - 334 001
   [Ball Clay]

18 Sompura Pran Shankar & Sons
   Thangadh
   Dist. Surendranagar (Gujarat)
   [Fire Clay]

20 Shahzips (P) Ltd
   55, Industrial Estate
   Nunhal, Agra
   [Frits/glazes]

22 Rajasthan Plasters & Inds.
   Outside Coga Gate
   Bikaner
   [Plaster of paris]

24 Snow-white Industries
   40, Mahendra Nagar
   Rishikesh
   Dehradun (UP)
   [Plaster of paris]
(iii) Utilities per month:
(1) Power charges for machinery 80 KWH x Rs. 1.10 x 8 Hrs. x 25 days = 13,200
(2) Power charges for kiln 14 KWH x Rs. 1.10 x 24 Hrs. x 25 days = 8,240
Total = 21,440
Say = 21,500
(iv) Other contingent Expenses (per month):
Postage & Stationary = 200
Consumable stores = 1,000
Repairing & Maintenance = 1,000
Advertising & Publicity = 2,000
Insurance etc. = 1,000
Misc. Expenditure = 800
Total = 6,000
(v) Total recurring expenditure per month:
Personnels. = 48,000
Raw Materials & Fuel. = 1,85,000
Utilities = 21,500
Other contingent expenses. = 6,000
Total = 2,60,500
(vi) Total working capital for 3 months:
Total capital Investment:
(i) Fixed Capital = 50,00,000
(ii) Working capital for 3 months. = 7,81,500
Total = 57,81,500

MACHINERY UTILISATION
Ball Mills - 100% (on the basis of 24 hours working)
Screw blunger - 100% - do -
Filter press - 80% - do -
Jigger Jolley - 80% (on the basis of 8 hours working on a day)
Tunnel kiln - 80% (on the basis on 24 hours working)

FINANCIAL ANALYSIS
1. Cost of production per year:
Total recurring cost = 31,20,000
Depreciation on building @ 5% = 90,000
Depreciation on machinery & equipment @ 10% = 1,04,000
Depreciation on kiln @ 15% = 2,70,000
Interest on fixed capital @ 18% = 9,00,000
Interest on working capital @ 20% = 1,50,000
Total cost of production = 46,46,000
The second stage, the hydroxylation change sees a structural change from kaolin to metakaolinite and the evolution of water. The reaction is endothermic, starting at 550°C - 650°C and is completed by 700°C - 800°C. This metakaolinite formed at this stage is readily identifiable by X-ray analysis.

\[
\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O} \rightarrow \text{Al}_2\text{O}_3 \cdot 2\text{SiO} \cdot 2\text{H}_2\text{O} \quad (14\% \text{ theoretically})
\]

**Kaolinite 500°C**

Metakaolinite

The third stage which involves the formation of a direct spinel followed by onset of mullite formation which causes the peak on differential thermal analysis at 1000°C - 1100°C.

\[
\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \rightarrow \text{Al}_2\text{O}_3 \cdot 1.5\text{SiO}_2 \cdot 0.5 \text{SiO}_2
\]

925°C  

Silicon spinel

\[
\text{Al}_2\text{O}_3 \cdot 1.5\text{SiO}_2 \rightarrow \text{Al}_2\text{O}_3 \cdot \text{SiO}_3 \cdot + 0.5 \text{SiO}_2
\]

1100°C  

1:1 mullite

The fourth and final stage above 1100°C sees the final transformation to mullite and the latter being either amorphous or crystalline silica (crystaobilite).

\[
\text{Al}_2\text{O}_3 \cdot \text{SiO}_2 \rightarrow \text{Al}_2\text{O}_3 \cdot 0.66\text{SiO}_2 \cdot + 0.33 \text{SiO}_2
\]

1400°C  

3:2 mullite

**PROJECT SIZE**

The project envisages to manufacture 15,000 tonnes per annum calcined china clay.

(Rs. in lakhs)

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost (Lakhs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land</td>
<td>80.00</td>
</tr>
<tr>
<td>Building</td>
<td>75.00</td>
</tr>
<tr>
<td>Plant &amp; Equipment</td>
<td>490.00</td>
</tr>
<tr>
<td>Working Capital</td>
<td>150.00</td>
</tr>
<tr>
<td><strong>Total Cost</strong></td>
<td><strong>795.00</strong></td>
</tr>
</tbody>
</table>

**RAW MATERIALS**

Raw China-clay exploited in Mamuara, Manfera, Bhachau, Goniasar villages in Kachchh district. Dhokawada of Santalpura taluka of Banaskantha district, Arasodia, Eklera of Sabarkantha district are available from the China-clay levigation plant owners. At present, 500 tonnes washed clay per day is available from existing plant owners. Raw & refined china-clay @ Rs.400 to Rs.500 and @ Rs.1200 to Rs.1500 can be procured. Captive mines can be procured in Kachchh, Banaskantha and Sabarkantha districts by filing mining lease or prospecting licence applications as per Mineral Concession Rules, 1989.

**QUALITY AND SPECIFICATIONS**

Calcined China-clay are used in PVC cables, mechanical rubber goods, elastomers, PVC, polyamide, plastic & rubber applications for specific properties given below:
11 Keshab Engg. Works
25, Swallow Lane
Calcutta-700 001

12 Jacea Traders
12, Gitanjali, 1st Floor
P.B.No.378
Bombay 400 005

13 Frigmeiras Engineers
Dalalal Towers, 9th Floor
No.903, Near new council Hall
Nariman Point, Bombay-1

14 Sabarwal Metal Industries
9, Industrial Estate
Kalapi Road
Kanpur 208 021 (UP)

TUNNEL KILN/SHUTTLE, KILN

15 Bengal-Lion (Industrial Furnace) Ltd
27-B, Camac Street
Calcutta-700 010

16 Teksago Bhagat Carakiln Pvt. Ltd
D-828, New Friends Colony
New Delhi - 110 005

17 Sharma Kiln Technol
206, Hare Krishna Complex
Opp. Kothawala Flat, Ashram Road
Ahmedabad- 380 006

18 Uni Fire
16-18, Shakespere Sarani, 4th Floor
Calcutta- 700 071

19 N.M. Ceramic Kiln
P.B.No. 30, B-8, Ram Balram Apartment
Kalol (Gujarat) - 382 721

NAMES & ADDRESS OF RAW MATERIAL SUPPLIERS

1 Golachar Pallawad Co
Opp. Rly. Station
Gandhinagar, Ajmer Road
Beawar (Rajasthan)
[Quartz/Felspar]

2 Jain Minerals
30 Kishangaaahl Koti
Jaiour Road
Ajmer (Rajasthan)
[Felspar/Ball clay]

3 Jotya Prakash Mining Works
4, Gupta Bali
Beawar- (Rajasthan)
[Felspar]

4 G.L. Minerals Supply Co
6/459, Srreftan Mohalla
Beawar- 305 901
[Felspar/Quartz]

5 Satya Prakash Mining Works
2, Gupta Gali
Beawar - 305 901
[Felspar]

6 Oriental Prospecting Co
1680/2, Opp. Desai pol, Khadia
Ahmedabad
[China Clay]

7 Ashwin & Co
Arsodia
Taluka - Idar
Sabarkantha - 383 430
[China clay]

8 Swastik China Clay Works
1102/1103, GIDC, Bhuj
Bhuj-Kutch-370 001
[China Clay]

9 Venkateswara Ceramics
Dhimadol
West Godavari District (A.P.)
[China Clay]

10 Bal Krishna Mineral Industries
Ramavaram
East Godavari District (A.P.)
[China Clay]
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Textile &amp; Paper coating</th>
<th>Requirement in percent for</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Rubber</td>
</tr>
<tr>
<td>1. Residue on 53 micron IS Steve</td>
<td>0.1 (max.)</td>
<td>1.9 (max.)</td>
</tr>
<tr>
<td>2. Particles larger than 10 microns in diameter</td>
<td>5.0 (max.)</td>
<td>7.0 (max.)</td>
</tr>
<tr>
<td>3. Particles smaller than 2 microns in diameter</td>
<td>62.0 (max.)</td>
<td>50.0 (max.)</td>
</tr>
<tr>
<td>4. Relative density at 27/27⁰Ca</td>
<td>2.5-2.9</td>
<td>-</td>
</tr>
<tr>
<td>5. Loss on drying</td>
<td>6.0 (max.)</td>
<td>2.9 (max.)</td>
</tr>
<tr>
<td>6. Loss on ignition</td>
<td>14.0 (max.)</td>
<td>14.0 (max.)</td>
</tr>
<tr>
<td>7. Matter soluble in water</td>
<td>-</td>
<td>0.5 (max.)</td>
</tr>
<tr>
<td>8. Matter soluble in HCl</td>
<td>2.5 (max.)</td>
<td>2.5 (max.)</td>
</tr>
<tr>
<td>9. CaO</td>
<td>-</td>
<td>0.007 (max.)</td>
</tr>
<tr>
<td>10. Al₂O₃</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>11. Fe₂O₃</td>
<td>0.7 (max.)</td>
<td>0.7 (max.)</td>
</tr>
<tr>
<td>12. MnO</td>
<td>-</td>
<td>0.013 (max.)</td>
</tr>
<tr>
<td>13. PH value of aqueous extract</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>14. Oil absorption</td>
<td>-</td>
<td>50 ml.per 100 gm(min)</td>
</tr>
<tr>
<td>15. Colour reflectance to blue light were length 3040A⁰</td>
<td>80.85</td>
<td>-</td>
</tr>
</tbody>
</table>
INTRODUCTION

Kaolin is one of the most versatile industrial minerals. It is chemically inert over a relatively wide pH range, is white in colour and has good covering power, when used as a pigment or extender. Kaolin is soft and non-abrasive and has a low conductivity of heat and electricity. Some uses of plastics require very rigid specifications including particle size, colour and brightness and viscosity whereas other uses require no specifications, for example in cement where the chemical composition is most important. The paper industry consumes the largest amount of kaolin where it is used both as a filler and as a coating material on the paper surface to improve the quality of printing.

MARKET POTENTIAL

China clay is mostly consumed in crockery, ceramic tiles, rubber, sanitaryware, insulators and paper industries. Some heat treated kaolin may be used for filling paper. Kaolin is used as coating clay. It imparts a smoother surface to the finished paper, improving its affinity for printing ink. Kaolin flows well under critical condition and manages to give a smooth and even film. Its platy structure lends itself particularly to the production of high class paper.

All coating grades of kaolin are water washed. Some heat treated kaolin may be used for filling paper where abrasion resistance is required. Paper coating requirement as per B.I.S.(505-1978) is as follows:

i) Residue on 53-0.1 (Max. micron IS sieve)
ii) Particles Larger 5.0 (Max.) than 10 micro in diameter
iii) Particles smaller 62.0 than 2 microns in max. diameter
iv) Relative -2.5 -2.9 density at 27/27° Ca
v) Loss on drying 6.0 (Max.)
vi) Loss on ignition - 14.0 (Max.)

vii) Matter soluble in HCl-2.5 (Max.)

CaO
Al₂O₃-0.7 (Max.)
Colour reflectance to 80.85
Blue light wave length 3040 Å

CALCINATION PROCESS

There are two basic methods of processing kaolin, a dry method or a wet process. The dry method is called air flotation which separates the clay from contaminants.

Calcination is a process to produce special grade products. Two different grades of calcined kaolins are produced depending on the treatment temperate calcination at temperature in range 650-700°C removes the structural hydroxyl groups and the escaping water vapour produces a bulky product with enhanced resiliency and opacity which are desirable attributes for paper coating applications.

Kaolin undergoes structural molecular changes when calcined. These changes occur in four distinct phases:

Absorbed water is removed in the first stage. This stage is complete at 150°C.
Pollution control:

This industry comes under "Red" category. For the purpose of inspection for implementation of the provisions of various statutes regarding control of pollution and protection of environment, it is proposed to visit a unit by the concerned authorities once in six month.

Energy Conservation:

This industry needs energy conservation in fuel as well as in electric. Ceramic kiln proposed in the project profile is latest modern kiln. When it is compared with...
<table>
<thead>
<tr>
<th>Principal Used</th>
<th>Specific Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. PVC cables</td>
<td>- Improve electrical properties</td>
</tr>
<tr>
<td>High voltage compounds</td>
<td></td>
</tr>
<tr>
<td>2. Low and medium voltage</td>
<td>- Low moisture content</td>
</tr>
<tr>
<td>power cable insulation</td>
<td>- Low water absorption</td>
</tr>
<tr>
<td>3. Mechanical Rubber Goods</td>
<td>- Good processability</td>
</tr>
<tr>
<td></td>
<td>- Low mill sticking</td>
</tr>
<tr>
<td></td>
<td>- Neutral PH</td>
</tr>
<tr>
<td></td>
<td>- Uniform cure rates</td>
</tr>
<tr>
<td>4. Elastomers</td>
<td>- Good resilience</td>
</tr>
<tr>
<td></td>
<td>- Low permanent set</td>
</tr>
<tr>
<td></td>
<td>- Good electrical properties</td>
</tr>
<tr>
<td>5. PVC</td>
<td>- Improve extrusion and calendering</td>
</tr>
<tr>
<td>6. Polyamide</td>
<td>- Improve heat distortion and reinforcing properties</td>
</tr>
<tr>
<td>7. Other Plastic/Rubber Applications</td>
<td>- Finest particlal size</td>
</tr>
<tr>
<td></td>
<td>- Significant increase in impact strength</td>
</tr>
<tr>
<td></td>
<td>- Improvement in tensile &amp; flexural modules</td>
</tr>
</tbody>
</table>

### Gradewise Physico-chemical Characteristics

<table>
<thead>
<tr>
<th>Grade</th>
<th>clay 20</th>
<th>clay 10</th>
<th>CL100</th>
<th>CL500</th>
<th>CLT100</th>
<th>CLT500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Lavigated</td>
<td>Lavigated</td>
<td>Calcined</td>
<td>Calcined</td>
<td>Calcined</td>
<td>Calcined</td>
</tr>
<tr>
<td></td>
<td>Air-float</td>
<td>Air-float</td>
<td>Mirco-nised</td>
<td>Mirco-nised</td>
<td>Mirco-nised</td>
<td>Mirco-nised</td>
</tr>
<tr>
<td></td>
<td>nised</td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Particle Size Distribution</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average M</td>
<td>3</td>
<td>1.5</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Topcut M</td>
<td>20</td>
<td>10</td>
<td>10</td>
<td>6</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Surface area M²/Gm</td>
<td>7.8</td>
<td>15.5</td>
<td>11.4</td>
<td>22.8</td>
<td>11.4</td>
<td>22.4</td>
</tr>
<tr>
<td>Physical Analysis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sp. Gravity (Gm/Litre)</td>
<td>2.58</td>
<td>2.58</td>
<td>2.63</td>
<td>2.63</td>
<td>2.63</td>
<td>2.63</td>
</tr>
<tr>
<td>Bulk Density (Gm/Litre)</td>
<td>680</td>
<td>550</td>
<td>600</td>
<td>520</td>
<td>610</td>
<td>530</td>
</tr>
<tr>
<td>Dry Brightness</td>
<td>86</td>
<td>86</td>
<td>88.90</td>
<td>88.90</td>
<td>88.90</td>
<td>88.90</td>
</tr>
<tr>
<td>Oil Absorption</td>
<td>42</td>
<td>55</td>
<td>65</td>
<td>72</td>
<td>46</td>
<td>52</td>
</tr>
<tr>
<td>PH(Sat.Soln.)</td>
<td>8.0</td>
<td>8.0</td>
<td>7.5</td>
<td>7.5</td>
<td>N.A</td>
<td>N.A</td>
</tr>
<tr>
<td>Moisture</td>
<td>0.5</td>
<td>0.5</td>
<td>0.2</td>
<td>0.2</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>(Max.)</td>
<td>(Max.)</td>
<td>(Max.)</td>
<td>(Max.)</td>
<td>(Max.)</td>
<td>(Max.)</td>
</tr>
<tr>
<td>Chemical Analysis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SiO₂</td>
<td>44.5</td>
<td>44.5</td>
<td>51.3</td>
<td>51.3</td>
<td>51.3</td>
<td>51.3</td>
</tr>
<tr>
<td>Al₂O₃</td>
<td>36.1</td>
<td>36.1</td>
<td>44.2</td>
<td>44.2</td>
<td>44.2</td>
<td>44.2</td>
</tr>
<tr>
<td>Mix Oxide Loss on Ignition</td>
<td>4.5</td>
<td>4.5</td>
<td>2.7</td>
<td>2.7</td>
<td>2.7</td>
<td>2.7</td>
</tr>
</tbody>
</table>

25
Items | Ind./Imp. | Qty. | Rate (Rs.) | Price (Rs.)
---|---|---|---|---
Colouring agent | Ind. | L.S | | 20,000
Fuel(L.D.O) | Ind. | 18K.L | Rs.8500/KL | 1,04,000
Kiln furniture | Ind. | L.S | | 15,300
Packaging material | Ind. | L.S | | 10,000
Total cost of raw materials | | | | 1,56,000
(iii) Utilities per month:
(1) Power charges for machinery 80 KWH x Rs.1.10 x 8 Hrs.x 25 days | | | | 13,200
(2) Power charges for kiln 14 KWH x Rs. 1.10 x 24 Hrs.x 25 days | | | | 8,240
Total | | | | 21,440
Say: | | | | 21,500
(iv) Other contingent expenses (per month):
Postage & Stationary | | | | 200
Consumable stores | | | | 1,000
Repairing & Maintenance | | | | 1,000
Advertaisement & Publicity | | | | 2,000
Insurance etc. | | | | 1,000
Misc. Expenditure | | | | 1,300
Total | | | | 6,500
(v) Total recurring expenditure per month:
Personnels | | | | 48,000
Raw Materials & Fuel | | | | 1,56,000
Utilities | | | | 21,500
Other contingent expenses. | | | | 6,500
Total | | | | 2,32,000
(vi) Total working capital for 3 months: | | | | 6,96,000
6. Total capital Investment:
(i) Fixed Capital | | | | 47,50,000
(ii) Working capital for 3 months. | | | | 6,96,000
Total | | | | 54,46,000

MACHINERY UTILISATION

- Ball Mills: 100% (on the basis of 24 hours working)
- Screw blunger: 100% (do -)
- Filter press: 80% (do -)
- Presses: 80% (on the basis of 8 hours working on a day)
- Pushbat tunnel kiln: 80% (on the basis on 24 hours working)
NAMES AND ADDRESSES OF KILN MANUFACTURERS

1. Andrew Hule & Co. Ltd
   (A Govt. of India Enterprises)
   Yule House, 8 Clive Row
   Calcutta-700 001

2. Bird & Co (Pvt) Ltd
   Chartered Bank Building
   Calcutta-700 001

3. Larsen & Toubro Ltd
   L&T House
   Ballard Estate, PO Box.278
   Bombay-400 038

4. Testeels Limited
   Navdeep Building
   Ashram Road, PB No.5, Navjivan
   Ahmedabad-380 014

5. Vulcan Engineers Pvt Ltd
   Mahalaxmi Chambers
   Bhulabhai Desai Road
   Bombay-400 026

NAMES & ADDRESSES OF RAW MATERIAL SUPPLIERS

1. Eklera Chinaclay Works
   8 Janpath Commercial Centre
   4th Floor, Opp Capital Comm. Centre
   Ashram Road
   Ahmedabad-380 009
   Phone: 443343

2. Amrapali & Co.
   289 New Cloth Market
   O/s Raipur Gate
   Ahmedabad-380 002
   Phone: 361253/365851
   Fax: 313175

3. Shri HD Patel
   HD Enterprises Pvt Ltd
   HD House, Silver Point
   New Station Road
   PO Bhuj-370 001
   Dist. Kachchh
   Phone: (02832) 21972
   Fax: (02832) 21937
5 Gidwaney Brothers
73, Netaji Subhash Road
P.B. No. 2346
Calcutta-1

7 Hindustan Engg. Company
23/7 Gopalall Tagore Road
Bon Hooghly
Calcutta-700 035

9 Perfect Machine Tools Corporation
1 Smith Road
Madras-1

11 Keshab Engg. Works
25, Swallow Lane
Calcutta-700 001

13 Frigmeiras Engineers
Dalalal Towers, 9th Floor
No. 903, Near New council Hall
Nariman Point, Bombay-1

TUNNEL KILN/SHUTTLE, KILN

15 Bengal-Lion (Industrial Furnace) Ltd
27-B, Camac Street
Calcutta-700 010

17 Sharma Kiln Technol
206, Hare Krishna Complex
Opp. Kothawala Flat, Ashram Road
Ahmedabad-380 006

19 N.M. Ceramic Kiln
P.B. No. 30, B-8, Ram Balram Apartment
Kalol (Gujarat) - 382 721

NAMES & ADDRESS OF RAW MATERIAL SUPPLIERS

1 Golachar Pallawad Co
Opp. Rly. Station
Gandhinagar, Ajmer Road
Beawar (Rajasthan)
[Quartz/Felspar]

3 Joyta Prakash Mining Works
4, Gupta Bali
Beawar- (Rajasthan)
[Felspar]

2 Jain Minerals
30 Kishangaual Koti
Jaiour Road
Ajmer (Rajasthan)
[Felspar/Ball clay]

4 G.L. Minerals Supply Co
6/459, Sreeffan Mohalla
Beawar- 305 901
[Felspar/Quartz]

6 Saboo Engg. Works
Kuchaman Road 341 509
Rajasthan

8 D.K. Engg. Works
8, Panchanathala New Road
Balgharia
Calcutta- 700 056

10 St. Vincent Industries
Convent Road
Calicut (Kerala)

12 Jacea Traders
12, Gitanjali, 1st Floor
P.B. No. 378
Bombay 400 005

14 Sabarwal Metal Industries
9, Industrial Estate
Kalapi Road
Kanpur 208 021 (UP)

16 Teksago Bhagat Carakiln Pvt. Ltd
D-828, New Friends Colony
New Delhi - 110 005

18 Uni Fire
16-18, Shakespere Sarani, 4th Floor
Calcutta- 700 071
13. Saggar press Hand Operated  Ind  1  30,000
14. Water pump set with 2 H.P. motor  Ind  1  20,000
Total  10,00,000

b) Electrification and installation charges  
   @ 10% on the cost of machinery  1,00,000

c) Testing equipments  30,000

d) Misc. Tools, dies, Trolleys etc  50,000

e) Cost of office equipments  20,000
Total cost of machinery & equipments  12,00,000

3. Kilns:
Ceramic fibrelined push but tunnel kiln
   with control system, oil storage tank, hydraulic pusher etc.
Dimension
   Length  - 2400 mm
   Setting width  - 900 mm
   Setting height  - 820 mm
   No. of burners  - 4
   Power required  - 10 H.P.
   Capacity  - 2 M.T. per day

4. Pre-operative expenses:
   Total fixed capital (1+2+3+4)  47,50,000

5. Working Capital:
(i) Personal (Wages per month)

<table>
<thead>
<tr>
<th>Designation</th>
<th>Nos.</th>
<th>Salary/Month (Rs.)</th>
<th>Total salary (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manager cum Ceramist</td>
<td>1</td>
<td>3500</td>
<td>3500</td>
</tr>
<tr>
<td>Supervisor</td>
<td>1</td>
<td>2500</td>
<td>2500</td>
</tr>
<tr>
<td>Accountant</td>
<td>1</td>
<td>2000</td>
<td>2000</td>
</tr>
<tr>
<td>Clerk-cum-typist</td>
<td>1</td>
<td>1500</td>
<td>1500</td>
</tr>
<tr>
<td>Skilled workers</td>
<td>15</td>
<td>1000</td>
<td>15,000</td>
</tr>
<tr>
<td>Semi-skilled workers</td>
<td>20</td>
<td>750</td>
<td>15,000</td>
</tr>
<tr>
<td>Peon</td>
<td>1</td>
<td>750</td>
<td>750</td>
</tr>
<tr>
<td>Watchman</td>
<td>2</td>
<td>750</td>
<td>1,500</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>41,750</td>
</tr>
<tr>
<td>Perquisites @ 15% of total salary</td>
<td></td>
<td></td>
<td>6,262</td>
</tr>
</tbody>
</table>
Say:                             |      |                    | 47,912            |

(ii) Raw materials & Fuel per month

<table>
<thead>
<tr>
<th>Items</th>
<th>Ind/Imp.</th>
<th>Qty.</th>
<th>Rate (Rs.)</th>
<th>Price (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartz</td>
<td>Ind.</td>
<td>10MT</td>
<td>Rs.400/MT</td>
<td>4,000</td>
</tr>
<tr>
<td>Felspar</td>
<td>Ind.</td>
<td>10MT</td>
<td>Rs.500/MT</td>
<td>8,000</td>
</tr>
<tr>
<td>China clay</td>
<td>Ind.</td>
<td>5MT</td>
<td>Rs.1200/MT</td>
<td>6,000</td>
</tr>
<tr>
<td>Ball clay</td>
<td>Ind.</td>
<td>5MT</td>
<td>Rs.500/MT</td>
<td>2,500</td>
</tr>
<tr>
<td>Fire clay</td>
<td>Ind.</td>
<td>10MT</td>
<td>Rs.300/MT</td>
<td>3,000</td>
</tr>
<tr>
<td>Vitrified clay</td>
<td>Ind.</td>
<td>5MT</td>
<td>Rs.200/MT</td>
<td>1,000</td>
</tr>
<tr>
<td>Lime Stone</td>
<td>Ind.</td>
<td>1MT</td>
<td>Rs.200/MT</td>
<td>200</td>
</tr>
</tbody>
</table>

31
INTRODUCTION

Ceramic tower packing materials come under the group of chemical stonewares and chemical porcelain. The main items are partition rings, intolos saddles, Berl saddles, Rachining rings, honeycombs etc. They are made in various sizes and shapes according to the requirement of customers. They are impermeable or most of the liquids and water absorption is less than 1%. They are resistant to acids, alkalies and other chemicals and gases. They are used in various types of chemical and petrochemical industries.

MARKET

Ceramic tower packing materials are used in chemical industries. They are used mainly in those industries which are engaged in the manufacture of organic chemicals, petrochemical, alkalies, acids etc. As Govt. of India has made the policy to promote the industry, in result of which number of industries are being set up in the state of Gujarat as well as in the country in which ceramic tower packing materials are used.

In the state of Gujarat there are about 4 units engaged in the manufacture of ceramic tower packing materials. The production capacity of these units is estimated about 1500 MT. per annum. It is reported that these units are not facing the problems in the marketing. In the state of Gujarat the main consumers of these items are Gujarat Heavy Chemicals Ltd. Hindustan organic chemicals, Deepak nitrate Ltd. I.P.C.L. etc. Due to the coming up of new units, the demand of these items is increasing day by day and expected growth rate is 15%. There is a good export potentialities of these items to Arabian and African countries.

Secondly they are replaced by new one between the period from one month to one year depending upon the various factors. Hence, there is a good scope for the setting up of few more units in the state of Gujarat.

BASIS & PRESUMPTIONS

1. Efficiency and working hours considered for full capacity utilisation (a) 75% (Efficiency)
   (b) 8 hrs working per day or 300 days in a year
   (c) Operation of Kiln will be of continuous nature for each firing cycle.

2. Time required for achieving full/envisaged capacity utilisation 6 months from the commencement of commercial production.

3. Labour wages
   Skilled workers - Rs.40/day
   Semi skilled workers - Rs.30/day

4. Interest rate - for Fixed Capital - 18%
   - for Working Capital - 20%

5. Margin Money - 30%

6. Pay back period of the project - 9 years

7. Land rate - Rs. 100/sq.M.

8. Building construction rate - Rs. 2500/sq.M.
FINANCIAL ANALYSIS

1. Cost of production per year:
   Total recurring cost: 27,84,000
   Depreciation on building @ 5%: 90,000
   Depreciation on machinery & equipment @ 10%: 1,20,000
   Depreciation on kiln @ 20%: 2,80,000
   Interest on fixed capital @ 18%: 8,55,000
   Interest on working capital @ 20%: 1,39,000
   Total cost of production: 42,68,000

2. Turn over per year:

<table>
<thead>
<tr>
<th>Items</th>
<th>Qty</th>
<th>Rate</th>
<th>Value (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceramic unglazed vitreous</td>
<td>600</td>
<td>Rs.8500/Mt</td>
<td>51,000.00</td>
</tr>
<tr>
<td>Tiles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less: Rejections etc. 5%</td>
<td></td>
<td></td>
<td>2,55,000</td>
</tr>
<tr>
<td>Net turn over</td>
<td></td>
<td></td>
<td>48,45,000</td>
</tr>
</tbody>
</table>

3. Net profit per year (before income tax)
   Rs. 48,45,000 - Rs. 42,68,000 = Rs. 5,77,000

4. Net profit ratio
   = \( \frac{577000 \times 100}{4845000} \) = 12%

5. Rate of return
   = \( \frac{577000 \times 100}{5446000} \) = 10.6%

6. Breakeven point
   i) Total Depreciation: 4,90,000
   ii) Total Interest: 9,94,000
   iii) 40% of salary & wages: 2,30,000
   iv) 40% of utilities: 1,03,000
   v) 40% of other contingent: 31,000
   Say: 18,48,800

   B.E.P. = \( \frac{1849000 \times 100}{1849000 + 577000} \) = 76%

NAMES & ADDRESSES OF MACHINERY SUPPLIERS

1. Amic Industries Pvt. Ltd
   80, D. Dr. Suresh Sircar Road
   Calcutta- 700 014

2. Modern Engg. & Fabricating Works
   Behind Kubeshwar Mahadev
   Naroda Road, Ahmedabad

3. Lokmanyaa Engg. work
   20, Bharat Khand Cotton Mills Compound
   Naroda Road
   Ahmedabad-380 010

4. Jivanlal Shivlal Panchal
   Opp: Old Civil Hospital
   Gheekanta Road
   Ahmedabad
Energy conservation needs:

This industry needs energy conservation in fuel as well as in electric Ceramic fibre lined shuttle kiln proposed in the project profile, conserves the fuel energy to 20-40% when it is compared with conventional type D.D.Kiln.

FINANCIAL ASPECTS

Fixed capital :

1. **Land & Building:**
   - Land: 3000 sq.m. @ Rs. 100/sq.m. = Rs. 300,000
   - Machinery shed: 300 sq.m. @ Rs. 2500/sq.m. = Rs. 750,000
   - Kiln shed: 150 sq.m. @ Rs. 2500/sq.m. = Rs. 375,000
   - Raw materials shed: 100 sq.m. @ Rs. 1500/sq.m. = Rs. 150,000
   - Finished goods godown: 100 sq.m. @ Rs. 2500/sq.m. = Rs. 250,000
   - Office: 100 sq.m. @ Rs. 2500/sq.m. = Rs. 250,000
   - Boundary wall etc.: 1,25,000

   **Total Cost of land & Building:** 22,00,000

2. **Machinery & Equipment:**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Description</th>
<th>Ind/Imp.</th>
<th>Qty.</th>
<th>Price (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>Production unit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Ball mills, size 1800 mmx1800mm with all accessories and 10 H.P. motor each</td>
<td>Ind.</td>
<td>2</td>
<td>2,50,000</td>
</tr>
<tr>
<td>2.</td>
<td>Ball mill size 900 mm x 900 mm with all accessories with 7.5 H.P. motor</td>
<td>Ind.</td>
<td>1</td>
<td>40,000</td>
</tr>
<tr>
<td>3.</td>
<td>Screw blunger, capacity 5000 litre, vat (Hexagonal) 2.8 m x 1.8 m with 5 H.P.</td>
<td>Ind.</td>
<td>1</td>
<td>60,000</td>
</tr>
<tr>
<td></td>
<td>motor including cemented Tank.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Vibrating screen size 900 mm x 600 mm with all 1 H.P. Motor.</td>
<td>Ind.</td>
<td>2</td>
<td>20,000</td>
</tr>
<tr>
<td>5.</td>
<td>Electromagnetic separators with rectifier 200 volts A.C.</td>
<td>Ind.</td>
<td>1</td>
<td>10,000</td>
</tr>
<tr>
<td>6.</td>
<td>Agitator size 2.4 M x 1.8 M with 3 H.P. motor</td>
<td>Ind.</td>
<td>1</td>
<td>40,000</td>
</tr>
<tr>
<td>7.</td>
<td>Diaphragm pump, stroke 225 mm suction 75 mm with 7.5 H.P. motor</td>
<td>Ind.</td>
<td>1</td>
<td>30,000</td>
</tr>
<tr>
<td>8.</td>
<td>Filter press chamber dia 600 mm number of plates 50</td>
<td>Ind.</td>
<td>1</td>
<td>1,00,000</td>
</tr>
<tr>
<td>9.</td>
<td>Disintegrator size 550 cm with all accessories and 7.5 H.P. motor each</td>
<td>Ind.</td>
<td>1</td>
<td>80,000</td>
</tr>
<tr>
<td>10.</td>
<td>Granules making machine with 2 H.P. motor</td>
<td>Ind.</td>
<td>1</td>
<td>20,000</td>
</tr>
<tr>
<td>11.</td>
<td>Toggle press, hand operated</td>
<td>Ind.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Saggar press Hand Operated</td>
<td>Ind.</td>
<td>1</td>
<td>30,000</td>
</tr>
<tr>
<td>13.</td>
<td>Water pump set with 2 H.P. motor</td>
<td>Ind.</td>
<td>1</td>
<td>20,000</td>
</tr>
</tbody>
</table>

**Total:** 10,00,000
5 Satya Prakash Mining Works
2, Gupta Gali
Beawar - 305 901
[Felspar]

6 Oriental Prospecting Co
1680/2, Opp. Desai pol, Khadia
Ahmedabad
[China Clay]

7 Ashwin & Co
Arsodia
Taluka - Idar
Sabarkantha - 383 430
[China Clay]

8 Swastik China Clay Works
1102/1103, GIDC, Bhuj
Bhuj-Kutch-370 001
[China Clay]

9 Venkateswara Ceramics
Dhimadol
West Godavari District (A.P.)
[China Clay]

10 Bal Krishna Mineral Industries
Ramavaram
East Godavari District (A.P.)
[China Clay]

11 Hindustan China Clay Works
Papinacheri
Kerala
[China Clay]

12 Ami Ceramics
Motipur, Himatnagar
Gujarat
[China Clay]

13 Tahla Ram & Sons
Rathkhna
Bikaner (Rajasthan)
[Ball Clay]

14 Sita Ram Rajkumar
Inside Hemalton Ki Bari
Bikaner (Rajasthan)
[Ball Clay]

15 R.D. Manihar & Co
Prithviraj Marg
Bikaner (Rajasthan)
[Ballclay/Felspar]

16 Shri Draupadi Devi Ball
Clay Suppliers
Post-Sri Kolaytji
Bikaner - 334 001
[Ball Clay]

17 Multani Minerals
Station Road
Thangadh
Dist. Surendranagar (Gujarat)
[Fire Clay]

18 Sompura Pran Shankar & Sons
Thangadh
Dist. Surendranagar (Gujarat)
[Fire Clay]

19 Ceramills Glaze & Zirconium Co
Daulatabad Road
Gurgaoan (Haryana)
[Zirconium]

20 Shahzips (P) Ltd
55, Industrial Estate
Nunhal, Agra
[Frits/glazes]

21 Ferro Coatings Coldurs Ltd
Post Joka
24 Paraganas, Calcutta - (WB)
[Frits/glazes, colours]

22 Rajasthan Plasters & Inds.
Outside Coga Gate
Bikaner
[Plaster of paris]

23 Dudhan Industries
12, Cement Road
Dehradun (UP)
[Plaster of paris]

24 Snow-white Industries
40, Mahendra Nagar
Rishikesh
Dehradun (UP)
[Plaster of paris]
(iii) Utilities per month:

Power charges for machinery
60 KWH x Rs.1.10 x 8 hours x 25 days \[13,200\]
Power charges for kiln
14 KHW x Rs.1.10 x 12 hours x 25 days \[4,120\]
Total \[17,320\]
Say \[17,500\]

(iv) Other Contingent expenses (per month):

Postage and stationery \[300\]
Consumable stores \[2,000\]
Repairing and maintenance \[4,000\]
Advertisement publicity \[1,000\]
Insurance etc. \[2,000\]
Misc. expenditure \[1,200\]
Total \[10,500\]

(v) Total recurring expenditure per month

Personnel \[53,000\]
Raw material \[2,34,000\]
Utilities \[17,500\]
Other contingent expenses \[10,500\]
Total \[3,15,000\]

(vi) Total working capital for 3 months \[9,45,000\]

6. Total Capital Investment:

(i) Fixed capital \[47,00,000\]
(ii) Working capital for 3 months \[9,45,000\]
Total \[56,45,000\]

MACHINERY UTILISATION

Ball Mills - 100% (on the basis of 24 hours working in a day)
Screw blunge - 100% -do-
Filter press - 100% -do-
Toggle press - 80% (on the basis of 8 working hours in a day)
Shuttle kiln - 100% (on the basis of 24 working hours till particular firing cycle is completed)

Note: Capacity utilisation of the unit depends on the capacity of shuttle kiln.
IMPLEMENTATION SCHEDULE (Presumptions)

1. Time required for preparation of project report - 30 days
2. Selection of site. - 30 days
3. Registration of SSI (Temporary) - 5 days
4. Availability of finance - 45 days
5. Construction of building - 90 days
6. Machinery Procurement & Erection - 90 days
7. Raw Materials procurement - 30 days
8. Recruitment of Labour - 30 days
9. Trial runs - 15 days

If C.P.M Chart is drawn of above activities, the total time would be taken about 180 days to implement the project as many activities may be completed simultaneously.

TECHNICAL ASPECTS

Process of Manufacture:
The raw materials like quartz, felspar, ball clay, plastic fire clay with 30 - 40% water are ground in ball mill to fineness of 100 - 120 No. mesh in desired proportion. China clay and other soft clays with 30 - 40% water are blunged in blunger. The slurry from ball mill and blunger is passed through the sieve 120 No. mesh and then electromagnet in order to remove the iron particles. Both slurries are mixed properly in agitator tank. The slurry from agitator tank is passed through filter press for dewatering to make the form of cakes. The cakes are dried and powdered in a disintegrator. Dry broken articles are also used up with this body. The powder is mixed with water (about 6%) and oil about 3% in powder and made into such consistency that when a handful of them is pressed, the powder forms a lump but does not wet the hand. The oil is made up from: Thin oil, or crude petrol - 4 parts, and thick oil linseed or castor oil 1/2 to 1 part. The prepared mass is again passed through a centrifugal disintegrator where any lump formed during mixing is broken and make the form of granules. The mass is them pressed into shapes in a piller press/toggle press fitted with dies of required shapes. The articles are dried and finished. The articles are glazed if required and then fired at the temperature of 1280°C in shuttle kiln. D.D. Kiln and Tunnel kiln are also in practice. The articles taken out from the kiln are sorted and packed for selling.

Quality specification:
IS: 7087-1979 B.I.S. has formulated and published IS-7087-1979 for carrying out the various tests for control of the quality of the product.

Production capacity per annum:

a) Quantity - 900 MT
b) Value - Rs. 6075000

Approximate power requirement: 75 H.P.

Pollution Control:
This industry come under "Red" Category. For the purposes of inspection for implementation of the provisions of various statutes regarding control of pollution and protection of environment, it is proposed to visit a unit by the concerned authorities once in six month.
5 Gidwaney Brothers  
73, Netaji Subhash Road  
P.B.No. 2346  
Calcutta-1  

6 Saboo Engg. Works  
Kuchaman Road 341 509  
Rajasthan  

7 Hindustan Engg. Company  
23/7 Gopallal Tagore Road  
Bon Hoogly  
Calcutta-700 035  

8 D.K. Engg. Works  
8, Panchanathala New Road  
Balgharia  
Calcutta- 700 056  

9 Perfect Machine Tools Corporation  
1 Smith Road  
Madras-1  

10 St. Vincant Industries  
Convent Road  
Calicut (Kerala)  

11 Keshab Engg. Works  
25, Swallow Lane  
Calcutta-700 001  

12 Jacee Traders  
12, Gitanjali, 1st Floor  
P.B.No.378  
Bombay 400 005  

13 Frigimeiras Engineers  
Dalamal Towers, 9th Floor  
No.903, Near New council Hall  
Nariman Point, Bombay-1  

14 Sabarwal Metal Industries  
9, Industrial Estate  
Kalapi Road  
Kanpur 208 021 (UP)  

TUNNEL KILN/SHUTTLE, KILN  

15 Bengal-Lion (Industrial Furnace) Ltd  
27-B, Camac Street  
Calcutta-700 010  

16 Teksago Bhagat Carakiln Pvt. Ltd  
D-828, New Friends Colony  
New Delhi - 110 005  

17 Sharma Kiln Technol  
206, Hare Krishna Complex  
Opp. Kothawala Flat, Ashram Road  
Ahmedabad- 380 006  

18 Uni Fire  
16-18, Shakespere Sarani, 4th Floor  
Calcutta- 700 071  

19 N.M. Ceramic Kiln  
P.B.No. 30, B-8, Ram Balram Apartment  
Kalol (Gujarat) - 382 721  

NAMES & ADDRESS OF RAW MATERIAL SUPPLIERS  

1 Golachar Pallawad Co  
Opp. Rly. Station  
Gandhinagar, Ajmer Road  
Beawar (Rajasthan)  
[Quartz/Felspar]  

2 Jain Minerals  
30 Kishangahaal Koti  
Jaipur Road  
Ajmer (Rajasthan)  
[Felspar/Ball clay]  

3 Jotya Prakash Mining Works  
4, Gupta Bali  
Beawar- (Rajasthan)  
[Felspar]  

4 G.L. Minerals Supply Co  
6/459, Srefffan Mohalla  
Beawar- 305 901  
[Felspar/Quartz]
b) Electrification and installation charges
@ 10% on the cost of machinery 1,00,000

c) Testing equipments 30,000
d) Misc. Tools, dies, Trolleys etc. 50,000
e) Cost of office equipments 20,000

Total cost of machinery & equipments 12,00,000

3. Kilns:
Ceramic Fibre lined shuttle kiln with two cars, control system oil storage Tank, and two extra cars.
Car dimension
Setting length - 2850 mm
Setting width - 1500 mm
Setting height - 2500 mm
No. of Burners - 6 Nos.
H.P. required - 16
Capacity - 4 to 5 MT per cycle

4. Pre-operative expenses :
50,000
Total Fixed Capital (1+2+3+4) 47,00,000

5. Working Capital:

(i) Personal (Wages per month)

<table>
<thead>
<tr>
<th>Designation</th>
<th>Nos.</th>
<th>Salary/Month(Rs.)</th>
<th>Total salary (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manager cum Ceramist</td>
<td>1</td>
<td>3500</td>
<td>3,500</td>
</tr>
<tr>
<td>Supervisor</td>
<td>1</td>
<td>2500</td>
<td>2,500</td>
</tr>
<tr>
<td>Accountant</td>
<td>1</td>
<td>2000</td>
<td>2,000</td>
</tr>
<tr>
<td>Clerk-cum-typist</td>
<td>1</td>
<td>1500</td>
<td>1,500</td>
</tr>
<tr>
<td>Skilled workers</td>
<td>15</td>
<td>1000</td>
<td>15,000</td>
</tr>
<tr>
<td>Semi-skilled workers</td>
<td>20</td>
<td>750</td>
<td>19,500</td>
</tr>
<tr>
<td>Peon</td>
<td>1</td>
<td>750</td>
<td>750</td>
</tr>
<tr>
<td>Watchman</td>
<td>2</td>
<td>750</td>
<td>1,500</td>
</tr>
</tbody>
</table>

Perquisites @ 15% of total salary 6,937
Total 53,187
Say 53,000

(ii) Raw materials & Fuel per month

<table>
<thead>
<tr>
<th>Items</th>
<th>Ind/Imp.</th>
<th>Qty.</th>
<th>Rate (Rs.)</th>
<th>Price (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartz/silica sand</td>
<td>Ind.</td>
<td>20MT</td>
<td>400/Mt</td>
<td>8,000</td>
</tr>
<tr>
<td>Felspar</td>
<td>Ind.</td>
<td>25MT</td>
<td>500/Mt</td>
<td>12,500</td>
</tr>
<tr>
<td>China clay</td>
<td>Ind.</td>
<td>20MT</td>
<td>1200/Mt</td>
<td>24,000</td>
</tr>
<tr>
<td>Ball clay/Fire clay</td>
<td>Ind.</td>
<td>30MT</td>
<td>500/Mt</td>
<td>15,000</td>
</tr>
<tr>
<td>Glazing materials</td>
<td>Ind.</td>
<td>2MT</td>
<td>600/Mt</td>
<td>12,000</td>
</tr>
<tr>
<td>LDO (fuel)</td>
<td>Ind.</td>
<td>23ML</td>
<td>6500/ML</td>
<td>1,49,000</td>
</tr>
<tr>
<td>Kiln furniture</td>
<td>Ind.</td>
<td>LS</td>
<td></td>
<td>4,000</td>
</tr>
<tr>
<td>Packing materials</td>
<td>Ind.</td>
<td>LS</td>
<td></td>
<td>9,000</td>
</tr>
</tbody>
</table>

Total cost of raw materials 2,34,000
INTRODUCTION

Crockeryware is most prominent household products which are marketed as per technical specification like Earthenware, Stoneware porcelain.

Bone China is a most sophisticated fine product which requires proper technology in the manufacturing process. Hard porcelain and soft porcelain were earlier produced successfully even on commercial basis. A special variety of porcelain was first introduced in England in 1794 by using tricalcium phosphate as the most fundamental raw material. Great interests was expressed in USA early this century. The important of the use of bone ash as a major constituent in the ceramic body produced a sophisticated ware known as 'Bone China'. Like porcelain, Bone China is a vitrified body having short firing range of biscuit firing. A proper control is the main parameter in Bone Chianware preparation.

Stoneware crockery is the general crockery in India for most of the manufacturers to fulfill the demand of the people. Earthenware crockery which was known as common man's crockery has now disappeared. Poreclain is somehow technically specified wares.

MARKET POTENTIAL

In India crockery units having significant growth in organised as well as SSI sector. In SSI sector, maximum growth has been observed which can fulfill common man's demand. At Khunja (UP), lot of small scale units are producing crockeryware. There are about 600-630 small scale units in UP. Next to UP higher concentration has been observed in Gujarart.

For Gujarart, at Ahmedabad, Thangadh and Himatnagar various crockery units producing stoneware crockeries. There are about 190 small scale units manufacturing crockeryware in Gujarart. After Gujarart, some small scale units are found in Haryana (about 30 units).

As regards to manufacturing capacity, "Hitkari Pottery" of UP producing 60-70 MT monthly production of Bone China. Previously Bansal Pottery was only unit manufacturing Bone Chine in large scale. But, due to various problems the unit is not in a stage now to manufacture this. M/s Crown Ceramics Ltd, Alware in Rajasthan is the only unit mainly manufacturing Bone China. In India, there are about 7-8 units manufacturing Bone Chinaware. The lack in the production of Bone China is due to skilled labour, proper supervision, sophisticated machineries and availability of raw materials, etc. Cost effectiveness is also one of the factor. Maintenance of quality is the prime factor for Bone China crockery. It is luxury household item particularly for rich people and some upper class people. But due to increasing trend and popularity of the items it has become useful in common man's devise also. So there is much demand of the item roughly estimated 10,000 MTs valued about Rs.55-60 crores per annum by the next five years. Besides, it has good export potential.

MANUFACTURING PROCESS

Bone China is a vitufied body best known for translucency. The body composition of Bone China is as follows:

<table>
<thead>
<tr>
<th>Material</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bone ash</td>
<td>45-50%</td>
</tr>
<tr>
<td>China clay</td>
<td>25-30%</td>
</tr>
<tr>
<td>Felspar</td>
<td>25-30%</td>
</tr>
<tr>
<td>Ball clay</td>
<td>5-5%</td>
</tr>
</tbody>
</table>
FINANCIAL ANALYSIS

1. Cost of production (per year)
   Total recurring cost                          37,80,000
   Depreciation on building @ 5%                95,000
   Depreciation on machinery & equipment @ 10%  1,20,000
   Depreciation on kiln @ 20%                   2,50,000
   Interest on fixed capital @ 18%              8,40,000
   Interest on working capital @ 20%            1,90,000
   Total cost of production                     52,81,000

2. Turn over (per year)
<table>
<thead>
<tr>
<th>Items</th>
<th>Qty.</th>
<th>Rate</th>
<th>Value (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceramic tower packing materials</td>
<td>900 MT</td>
<td>Rs.7500/MT</td>
<td>67,50,000</td>
</tr>
<tr>
<td>Less: Rejection 10%</td>
<td></td>
<td></td>
<td>6,75,000</td>
</tr>
<tr>
<td>Net turn over</td>
<td></td>
<td></td>
<td>60,75,000</td>
</tr>
</tbody>
</table>

3. Net profit per year (before income tax)
   Rs. 60,75,000 - Rs. 52,81,000 = Rs. 7,94,000

4. Net profit ratio
   \[ \frac{7,94,000 \times 100}{6075000} = 13\% \]

5. Rate of return
   \[ \frac{7,94,000 \times 100}{5645000} = 14\% \]

6. Break-even Point
   (i) Fixed cost
      a) Total depreciation                        4,67,000
      b) Total interest                           10,36,000
      c) 10% of salary                            2,54,400
      d) 40% of other contingent expenses         45,600
      e) 40% of utilities                         1,08,000
      Total                                      19,11,000
   (ii) Net profit per year
        \[ \frac{19,11,000 \times 100}{27,05,000} = 70.6\% \]

NAMES & ADDRESSES OF MACHINERY SUPPLIERS

1. Amic Industries Pvt. Ltd
   80, D, Dr. Suresh Sircar Road
   Calcutta- 700 014

2. Modern Engg. & Fabricating Works
   Behind Kubeshwar Mahadev
   Naroda Road, Ahmedabad

3. Lokmanya Engg. work
   20, Bharat Khand Cotton Mills Compound
   Naroda Road
   Ahmedabad-380 010

4. Jivanlal Shivlal Panchal
   Opp: Old Civil Hospital
   Gheekanta Road
   Ahmedabad
When reviewed over electromicroscope anothite layer is visible. In Bone China body 45% B-trialcium phosphate, 25% anorthite and 30% glass gives a very good homogenous structure producing sufficient strength and translucency. The translucency is the prime objective of the Bone Chinawares. Mixture of bone ash, felspar and China clay increases translucency due to higher glossy phase. Addition of ball clay should be very limited as it decreases translucency. Translucency is increased by glazzy phase. Fluxing materials is to be added considering on the maturing temperature. Drying and firing shinnase are high for which there is high rejecting manufacturing stage. So all the possible efforts to be needed for man's less rejecting by adopting suitable composition and mode of manufacturing techniques.

RAW MATERIALS

Bone Ash:

It is fundamental constituent in manufacturing Bone Chinaware. Bone ash is prepared from calcined bone. Cattle bones are specially preferred as it is free from iron. The processing of bone is very important. First the bones are crushed, washed and subjected to heat treatment which residual organic matters are removed. With increasing temperature crystal growth occur. Over the temperature range 900°C to 1000°C the crystal size is changed. It is noticed that too rapid a calcination may cause residual carbonaceous matter, which is difficult to remove. High oxidising atmosphere during calcination is preferred.

The calcined bones are finally ground with water in ball mill. Bone ash constituents some plasticity due to finer grain size and organic matter. If the bones are not properly calcined defects like scratches, shirnkage, etc. developes. The such ground material is passed over sieves and magnets. To increase the workability of the body the material is aged for about some days where chemical reaction occurs.

After ageing the bone is dried to a moisture contents of 10-15%. The drying of the bone in kiln preferred to remove air from the ground ash.

China Clay:

China clay used in the manufacture of Bone China requires proper washing before use. White burning China clay is preferred. After purification, silica content and Al2O3 content ratio should be 45-47% and 35-38% and Fe2O3 contents. As less as possible, sometimes 3-5% ball clay is incorporated in the body composition.

Felspar:

It is a flux. It is an isneous mineral containing alumino silicate of Na K or Ca. Felspar is used for introducing nearly insoluble alkalies. Felspar is used in the body and glazes.

LOCATION

The plant can be located in Mehsana, Ahmedabad or in Kachchh districts. Ideal location will be in Bachau taluka of Kachchh district.

COST OF PROJECT

The project envisage to manufacture 150 MT Bone Chinaware crockery with an investment of Rs.1.10 crores.
5 Satya Prakash Mining Works
   2, Gupta Gali
   Beawar - 305 901
   [Felspar]

7 Ashwin & Co
   Arsodia
   Taluka - Idar
   Sabarkantha - 383 430
   [China clay]

9 Venkateswara Ceramics
   Dhimadal
   West Godavari District (A.P.)
   [China Clay]

11 Hindustan China Clay Works
   Papinacheri
   Kerala
   [China Clay]

13 Tahla Ram & Sons
   Rathkhna
   Bikaner (Rajasthan)
   [Ball Clay]

15 R.D. Manihar & Co
   Prithvraj Marg
   Bikaner (Rajasthan)
   [Ballclay/Felspar]

17 Multani Minerals
   Station Road
   Thangadh
   Dist. Surendranagar (Gujarat)
   [Fire Clay]

19 Ceramills Glaze & Zirconium Co
   Daulatabad Road
   Gurgoon (Haryana)
   [Zirconium]

21 Ferro Coatings Coldurs Ltd
   Post Joka
   24 Paraganas, Calcutta - (WB)
   [Frits/glazes, colours]

23 Dudhan Industries
   12, Cement Road
   Dehradun (UP)
   [Plaster of paris]

6 Oriental Prospecting Co
   1680/2, Opp. Desai pol, Khadia
   Ahmedabad
   [China Clay]

8 Swastik China Clay Works
   1102/1103, GIDC, Bhuj
   Bhuj-Kutch-370 001
   [China Clay]

10 Bal Krishna Mineral Industries
   Ramavaram
   East Godavari District (A.P.)
   [China Clay]

12 Ami Ceramics
   Motipur, Himatnagar
   Gujarat
   [China Clay]

14 Sita Ram Rajkumar
   Inside Hemalton Ki Bari
   Bikaner (Rajasthan)
   [Ball Clay]

16 Shri Draupadi Devi Ball
   Clay Suppliers
   Post-Sri Kolaytji
   Bikaner - 334 001
   [Ball Clay]

18 Sompura Pran Shankar & Sons
   Thangadh
   Dist. Surendranagar (Gujarat)
   [Fire Clay]

20 Shahzips (P) Ltd
   55, Industrial Estate
   Nunhal, Agra
   [Frits/glazes]

22 Rajasthan Plasters & Inds.
   Outside Coga Gate
   Bikaner
   [Plaster of paris]

24 Snow-white Industries
   40, Mahendra Nagar
   Rishikesh
   Dehradun (UP)
   [Plaster of paris]
The raw materials bone ash, China clay, ball clay and felspar are proportionately weighed and ground in ball mill in wet condition. Afterwards the slurry is passed through a screen and magnets to a blunger. Then it is passed to filter press for dewatering and passed through a deairing pug mill. the material thus obtained is used for shaping.

**Shaping:**

The method of shaping consists of plastic making slip casting dry pressing. Flatwares are generally made by digesting cups and simple hollow ware shaping is done by sollying. Roller making has improved the quality of surface. Now-a-days automatic disser sollcy is used for maximum output and uniform thickness. The hollow wares like tea pots, milk pots, sugar pots and oval shaped dinner sets are made by slip casting process in plaster mould. The latest method of shaping bone china flatwares are by isostatic pressing.

**Finishing and Drying:**

The finishing operation is same as normal procedure in general crockeryware. Seams are removed by knife carefully sponging for finishing is necessary.

For drying mangle drier is preferred. As far as drying is concerned, the importance of slow and especially even drying cannot be over stressed. Dobbies is another type of dryer incorporated hot airjets are most widely used for bone china.

**Biscuit Firing:**

The biscuit temperature of bone china lies between 1250°C-1300°C. The firing temperature is very critical. Underfiring leaves open pores and cannot bring translucency. Overfiring cause blistering bioating and distortion.

Biscuits firing done in intermittent shuttle kiln or continuous tunnel kiln. The setting of wares in the kiln each pieces must be individually supported and even plate must be placed in a tray with alumina powder and impressed in the correct shape. After biscuiting the ware are stored for glazing.

**Glazing & Gloss Firing:**

Bone Chinaware is glazed with lead borsilicate frit with small percentage of white burning China clay which will act as a suspending agent for the glaze. Colourless transparent glaze is used. Glaze is to be applied on the biscuitwares by dipping or spraying. The maximum firing temperature of glaze for Bone China will be around 1050-2100°C. Bone China glaze will be much more fluid at the maximum temperature than hard porcelain. Glaze firing is done at the temperature much lower than biscuiting. Gloss firing is done either in shuttle kiln turnnel kiln, thickness of glass maintains the fundamental factor to avoid defects like blibs or rolling.

**Decoration:**

On glaze decoration creates good attraction on Bone Chinawares specially at 700-750°C. Decoration is carried out by transfer hand painting and liquid gold decoration.

**Constitution, Microstructure & Conditions:**

Bone acts as glux but when added excess acts as a refractory. The fluxing action will continue only at 1 to 10. It has been observed that first sometime from bone reads with China clay to form anorthite, remaining line of bone product B-tricalcium phosphate, lastly P2O5 reactes with other materials form glass.
Add: perquisites @ 30% of pay

<table>
<thead>
<tr>
<th></th>
<th>Qty.</th>
<th>Rate (Rs.)</th>
<th>Amount (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bone ash</td>
<td>9 T</td>
<td>25000/T</td>
<td>2,25,000</td>
</tr>
<tr>
<td>2. Felspar powder</td>
<td>7 T</td>
<td>700/T</td>
<td>4,900</td>
</tr>
<tr>
<td>3. China clay</td>
<td>10 T</td>
<td>1500/T</td>
<td>15,000</td>
</tr>
<tr>
<td>4. Plastic clay</td>
<td>0.5 T</td>
<td>800/T</td>
<td>400</td>
</tr>
<tr>
<td>5. Calcite powder</td>
<td>200 Kg</td>
<td>2/Kg</td>
<td>400</td>
</tr>
<tr>
<td>6. Borax</td>
<td>1 T</td>
<td>50/Kg</td>
<td>50,000</td>
</tr>
<tr>
<td>7. Quartz powder</td>
<td>1 T</td>
<td>700/T</td>
<td>700</td>
</tr>
<tr>
<td>8. White lead</td>
<td>0.5 T</td>
<td>50/UG</td>
<td>400</td>
</tr>
<tr>
<td>9. Plastic pans</td>
<td>3 T</td>
<td>1500/T</td>
<td>4,500</td>
</tr>
<tr>
<td>10. Kiln furniture</td>
<td>LS</td>
<td>-</td>
<td>20,000</td>
</tr>
<tr>
<td>11. Chemicals</td>
<td>LS</td>
<td>-</td>
<td>20,000</td>
</tr>
<tr>
<td>12. Transfer/Decoration</td>
<td>LS</td>
<td>-</td>
<td>10,000</td>
</tr>
<tr>
<td>13. Packing materials</td>
<td>LS</td>
<td>-</td>
<td>20,000</td>
</tr>
<tr>
<td>14. Light diesel oil</td>
<td>30 KL</td>
<td>6000/KL</td>
<td>1,80,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>5,75,900</strong></td>
</tr>
<tr>
<td><strong>Say</strong></td>
<td></td>
<td></td>
<td><strong>5,76,000</strong></td>
</tr>
</tbody>
</table>

Other expenditure:

1. Power charges for machineries: 65KWH
2. Power charges for both kilns: 100 M
3. Power charges for decoration kiln: 80 M

**Total** 75,000

Contingent expenditure per month:

1. Postage & stationery
2. Consumable stores
3. Water
4. Repairs and maintenance
5. Travelling expenses
6. Advertisement/publicity
7. Insurance
8. Other Misc.

**Total** 32,000
### Land and Building:
- Land: 7000 sq.m. @ Rs.60/sq.m. = Rs.420,000
- Built up area: 2000 sq.m. @ Rs.1500/sq.m. = Rs.300,000
- **Total** = Rs.34,20,000

### Machineries & Equipment:

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Description</th>
<th>Nos.</th>
<th>Cost (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Ball mill size 6’x41/2’ with 10 HP motor &amp; accessories</td>
<td>2</td>
<td>2,00,000</td>
</tr>
<tr>
<td>2.</td>
<td>Ball mill size 3’x3’ with 7.5 HP motor and accessories</td>
<td>2</td>
<td>80,000</td>
</tr>
<tr>
<td>3.</td>
<td>Agitator double fan with 5 HP motor and accessories</td>
<td>1</td>
<td>35,000</td>
</tr>
<tr>
<td>4.</td>
<td>Screw blunger with 5 HP motor and accessories</td>
<td>2</td>
<td>36,000</td>
</tr>
<tr>
<td>5.</td>
<td>Vibroshifter - 1 HP</td>
<td>2</td>
<td>25,000</td>
</tr>
<tr>
<td>6.</td>
<td>Magnets</td>
<td>3</td>
<td>9,000</td>
</tr>
<tr>
<td>7.</td>
<td>Diaphragm pump stone 6” section</td>
<td>1</td>
<td>32,000</td>
</tr>
<tr>
<td>8.</td>
<td>Filter press. 24 plates. Chamber dia 600 mm with all accessories</td>
<td>1</td>
<td>56,000</td>
</tr>
<tr>
<td>9.</td>
<td>Deairing pug mill with vacuum pump motor - 5 HP and accessories</td>
<td>1</td>
<td>45,000</td>
</tr>
<tr>
<td>10.</td>
<td>Jigser trolley including 4 HP motor</td>
<td>8</td>
<td>40,000</td>
</tr>
<tr>
<td>11.</td>
<td>Potmill or racer mill including spot size each 4-5 us capacity with 1 HP motor and accessories</td>
<td>1</td>
<td>8,000</td>
</tr>
<tr>
<td></td>
<td>Electric and installation charges</td>
<td></td>
<td>55,000</td>
</tr>
<tr>
<td></td>
<td>Office equipments</td>
<td></td>
<td>25,500</td>
</tr>
<tr>
<td></td>
<td>Benches, trolleys, recls, spray gum compressor with motor</td>
<td></td>
<td>1,25,000</td>
</tr>
</tbody>
</table>

**Total** = Rs.7,71,500  
**Say** = Rs.7,72,000

### Kiln & Dryers:

1. Push bat turner, length 85’ width 8’, height 10’  
   Capacity 1 ton fine crockery item per day including burner, cooling fan, hydraulic pusher, power 20KW.
   - Nos. 2  
   - Cost (Rs.) 30,00,000

2. Frit making furnace  
   - Nos. 1  
   - Cost (Rs.) 1,00,000

3. Electrical kiln for decoration  
   - Nos. 1  
   - Cost (Rs.) 1,00,000

4. Mangle drier  
   - Nos. 2  
   - Cost (Rs.) 2,25,000

**Total** = Rs.39,25,000  
**Say** = Rs.40,00,000

### Salaries & Wages per month:

<table>
<thead>
<tr>
<th>Designation</th>
<th>Nos.</th>
<th>Pay(Rs.)</th>
<th>Amount (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manager(Technical)</td>
<td>1</td>
<td>6,000</td>
<td>6,000</td>
</tr>
<tr>
<td>Administrative Officer</td>
<td>1</td>
<td>3,000</td>
<td>3,000</td>
</tr>
<tr>
<td>Supervisors</td>
<td>7</td>
<td>2,000</td>
<td>14,000</td>
</tr>
<tr>
<td>Moulder</td>
<td>1</td>
<td>2,500</td>
<td>2,500</td>
</tr>
<tr>
<td>Accountant</td>
<td>1</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>Clerk-cum-typist</td>
<td>2</td>
<td>1,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Skilled workers</td>
<td>25</td>
<td>1,000</td>
<td>25,000</td>
</tr>
<tr>
<td>Unskilled workers</td>
<td>30</td>
<td>750</td>
<td>22,500</td>
</tr>
<tr>
<td>Watchmen</td>
<td>3</td>
<td>1,500</td>
<td>4,500</td>
</tr>
<tr>
<td>Peon</td>
<td>1</td>
<td>500</td>
<td>500</td>
</tr>
</tbody>
</table>

**Total** = Rs.81,000
## Working Capital Requirement:

<table>
<thead>
<tr>
<th>Description</th>
<th>Months</th>
<th>Amount (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Salaries &amp; wages</td>
<td>1</td>
<td>81,000</td>
</tr>
<tr>
<td>2. Raw materials</td>
<td>3</td>
<td>17,28,000</td>
</tr>
<tr>
<td>3. Utilities</td>
<td>1</td>
<td>75,000</td>
</tr>
<tr>
<td>4. Contingencies</td>
<td>1</td>
<td>32,000</td>
</tr>
<tr>
<td>5. Work in progress</td>
<td>1/2</td>
<td>1,50,000</td>
</tr>
<tr>
<td>6. Finished goods in stock and received</td>
<td>1</td>
<td>6,00,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>26,66,000</strong></td>
</tr>
<tr>
<td><strong>Say</strong></td>
<td></td>
<td><strong>27,00,000</strong></td>
</tr>
</tbody>
</table>

## Total investments:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Land and building</td>
<td>34,00,000</td>
</tr>
<tr>
<td>2. Machineries &amp; equipment</td>
<td>7,72,000</td>
</tr>
<tr>
<td>3. Kilns and driers</td>
<td>40,00,000</td>
</tr>
<tr>
<td>4. Working capital</td>
<td><strong>27,00,000</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,08,72,000</strong></td>
</tr>
<tr>
<td><strong>Say</strong></td>
<td><strong>1,10,00,000</strong></td>
</tr>
</tbody>
</table>

## Cost of Production per annum:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Salaries &amp; wages</td>
<td>9,72,000</td>
</tr>
<tr>
<td>2. Raw materials</td>
<td>69,12,000</td>
</tr>
<tr>
<td>3. Utilities</td>
<td>9,00,000</td>
</tr>
<tr>
<td>4. Other contingencies</td>
<td>3,84,000</td>
</tr>
<tr>
<td>5. Depreciation on building @ 20% p.a.</td>
<td>1,50,000</td>
</tr>
<tr>
<td>6. Depreciation on machinery</td>
<td>77,000</td>
</tr>
<tr>
<td>7. Depreciation on kilns @ 10% p.a.</td>
<td>4,00,000</td>
</tr>
<tr>
<td>8. Interest on total investment @ 15% p.a.</td>
<td>7,33,333</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,05,28,533</strong></td>
</tr>
<tr>
<td><strong>Say</strong></td>
<td><strong>1,06,00,000</strong></td>
</tr>
</tbody>
</table>

## Total Sales per annum & Profitability:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bone China: 150 T @ Rs.1 lakh/T</td>
<td>1,50,00,000</td>
</tr>
<tr>
<td>Cost of production per annum</td>
<td>1,06,00,000</td>
</tr>
<tr>
<td><strong>Profit</strong></td>
<td><strong>44,00,000</strong></td>
</tr>
</tbody>
</table>

Percentage profit on sales: 34%  
Percentage profit on investments: 25%
INTRODUCTION

Gujarat has potential of 65.3 million tonnes of China Clay contributing share of about 9.2% and ranking fifth in the field of production. Districts of Sabarkantha, Mehsana and Kachchh are richly endowed with good quality of China Clay. The total reserves in Sabarkantha, Mehsana districts are 62 million tonnes and 2 million tonnes respectively. The production of processed clay is 6700 metric tonnes in the State. Potential locations for beneficiation with modern techniques should be in Sabarkantha district. The adopted methods of mining and beneficiation of China clay are primitive, as compared to the techniques adopted in England, Czechoslovakia and USA. The methods that may render our clays a considerable improvement in quality and bring down the cost of production are available from M/s Mozley Ltd., England.

In paper, kaolin is used as a filler and for coating. As a filler, it is used to fill the interstices of the paper fibres. Kaolin is less expensive than paper pulp and, therefore, effectively lower paper production costs. Kaolin has advantages as high glass, brighteners and low viscosity at high solids contents. Existing units may improve the quality of processed kaolin.

MARKET POTENTIAL

Kaolin is used as coating clay. It imports a smoother surface to the finished paper, improving its affinity for printing ink. Kaolin flows well under critical condition and manages to give a smooth and even film. Its platy structure lends itself particularly to the production of high glass paper.

All coating grades of Kaolin are water washed. Some heat treated kaolin may be used for filling paper where abrasion resistance is required. Paper coating requirement as per BIS (505-1978) is as follows:

(i) Residue on 53 Micron IS sieve - 0.1 (Max.)
(ii) Particles larger than 10 Microns in diameter - 5.0 (Max.)
(iii) Particles smaller than 2 Microns in Max. diameter - 62.0
(iv) Relative density at 27/27°Ca - 2.5 - 2.9
(v) Loss on drying - 6.0 (Max.)
(vi) Loss on ignition - 14.0 (Max.)
(vii) Matter soluble in HCl - 2.5 (Max.)

CaO -
Al₂O₃ -
Fe₂O₃ - 0.7 (Max.)
Colour reflectance to blue light - 80.85
wave length 3040 Å

MANUFACTURING PROCESS

Kaolin refining process rely on particlesize separation. Mined raw china clay is crushed by stationery raw crusher. Crushed kaolin may be dispersed in soft water to turn into slurry. With the application of hydrocyclone separation, it is possible to produce paper coating grade clay. In this process, traditional methods of processing such as centrifuging, air floating have proved no longer good. The mozley 10 mm hydrocyclone is a high performed small diameter unit offering 50 cut points in the 2 to 5 micron size range. The hydrocyclone, which is injection moulded in polyurethane for good abrasion resistance or PVDF for corrosive applications is fitted in multiples of 60 numbers.
Break even point:

Fixed Cost:
1. 40% of salary & wages 3,88,000
2. 40% of utilities 3,60,000
3. 40% of other expenses 1,53,000
4. Depreciation on building 1,50,000
5. Depreciation on machinery 77,200
6. Depreciation on kiln 4,00,000
7. Interest 7,33,333

Total Say
23,62,933 23,63,000

B.E.P

Fixed cost per annum x 100 = 35%
fixed cost per annum + profit per annum

GOVERNMENT POLICIES & PROCEDURES
1. Certificate from Gujarat Pollution Control Board.
2. Industrial Entrepreneurs Memorandum to be filled to Industry Department, Govt. of India, New Delhi.
3. For the production of bone ash, air pollution control equipments are essential.

MACHINERY SUPPLIERS

Kiln Erectors:
1. M/s Sharma Kiln Tech Ltd
   Sharda Complex
   Opp. Kothawala Flat, Ashram Road
   Ahmedabad-380 006

Ceramic Machinery Suppliers:
1. M/s NM Ceramic Kiln Ltd
   P.B. No.30
   B-6 Ram Balram Apartments
   Kalol - 382 721
2. M/s Dayal Machinery Works
   Dariyapur Gate
   Ahmedabad - 380 001
3. M/s Lokmany Engg. Works
   26 Bharat Khand Cotton Mill Compound
   Naroda Road
   Ahmedabad
PLANT & MACHINERY

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Description</th>
<th>Qty.(Nos)</th>
<th>Price (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Blunger (3.04 mtrs. dia)</td>
<td>1</td>
<td>25,000</td>
</tr>
<tr>
<td>2.</td>
<td>Agitator (5.22/3.48 mtrs)</td>
<td>3</td>
<td>60,000</td>
</tr>
<tr>
<td>3.</td>
<td>One Mozley, Hydrocyclone system consisting of two Nos.of Mozley C1030C Assemblies.</td>
<td>60 Nos.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Two-way inline feed distributor with Trash screen.</td>
<td>hydrocyclones assemblies</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>One Feed pressure gauge.</td>
<td>2 Nos.</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>1 Mtr. long overflow &amp; underflow pipes at the system discharge point.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Slurry pumps</td>
<td>2,00,000</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Miscellaneous</td>
<td>1,00,000</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Buell drier</td>
<td>20,00,000</td>
<td></td>
</tr>
</tbody>
</table>

Captive Mines:
The project involves captive mines of china clay of 10 hectares area with 50 tonnes per day output from the mines.

GOVERNMENT POLICY

1. China clay captive mines can be procured from the State Government as per Mineral Concession Amended Rules, 1988 by filing lease applications to the State Government in prescribed forms.

2. Erection of Hydrocyclone assemblies can be done by the firm as per proposal.

3. Before installation of above assemblies, it is advisable to test slurry. In the laboratory, model of the company or pilot model can be erected first.

TECHNOLOGY SUPPLIER & ERECTOR

1. Richart Mozley Ltd
   Cardrew, Redruth
   Cornwall - TR 15, ISS England
   Tel: (0209) 211081
   Tlx: 45735 Mozely G
   Fax: (0209) 211081

Firm can erect hydrocyclone assemblies after testing slurry in their laboratory.

RISK FACTOR

1. Procurement of captive mines from the State Government will depend upon passing of Mine Plan by IBM, Government of India.

2. Prospected china clay pockets are mostly in the private land, so potential land have to be purchased from the owners.
Mozley high performance 10 mm hydrocyclones each fitted with ceramic lined Vortex finers (3.2 mm) & SPiGOTS (1.5 mm) system will have two-way in-line feed distributor with trash screen. One feed pressure gauge. One meter long overflow and underflow pipes at system discharge points. The individual hydrocyclones screw together in two sections allowing easy replacement of one without disturbing the remainder 10 mm hydrocyclones are a low cost alternative to centrifuges. They offer lower power consumption, more consistent product quality and considerably easier maintenance.

All operated from single feed pump. Desired 30,000 litre slurry with 100 PSI pressure is feed to the assemblies. Hydrocyclone system underflow will separate coating clay slurry which will be dried in a buell drier. Dried clay can be packed in 50 kg. paper bag in packing section.

**RAW MATERIAL**

Gujarat produces 6% of total china clay of the country. An average 5 lakh tonnes of raw china clay is exploited. Plant can procure its plant feed of 30,00,000 litres slurry from the captive mines. Captive mines can be procured in the Sabarkantha, Mehsana districts. Visnagar, Vijapur area is a clay zone in Mehsana district. Kot, Ransipur, Arsodia, Eklera, Kadoli Davad are potential villages for captive mines. In case of Banaskantha, Aluvas, Dhokanwada of Santalpur taluka is good area for captive purposes.

**SUGGESTED LOCATION**

Plant can be erected in subsidy area of Mehsana and Sabarkantha district. Ideal location will be Himatnagar in Sabarkantha district, Bhachau in Kachh district.

**COST OF PROJECT**

The project envisage to operate at an inlet pressure of 100 PSI. The required throughout will be of the order of 30 M$^3$/hr. Plant will treat 3,00,000 litres per day on 10 hrs. operating day basis, involving Rs. 5.0 crores with 20 tonnes per day refined capacity.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>[Rs. in crores]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td>Land</td>
<td>0.02</td>
</tr>
<tr>
<td>2)</td>
<td>Plant &amp; Machinery</td>
<td>2.00</td>
</tr>
<tr>
<td>3)</td>
<td>Capital Money</td>
<td>0.80</td>
</tr>
<tr>
<td>4)</td>
<td>Captive Mechanised Mines</td>
<td>2.00</td>
</tr>
<tr>
<td></td>
<td>(with mining machinery)</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>4.82</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Say</strong></td>
<td><strong>5.00</strong></td>
</tr>
</tbody>
</table>
## RESERVES OF VARIOUS MINERALS OF GUJARAT

[In Million Tonnes]

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Name of Mineral</th>
<th>Reserves</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Attapulgite</td>
<td>N.E</td>
</tr>
<tr>
<td>2</td>
<td>Base Metal (Pb, Cu, Zn)</td>
<td>8.50</td>
</tr>
<tr>
<td>3</td>
<td>Bauxite</td>
<td>97.00</td>
</tr>
<tr>
<td>4</td>
<td>Bentonite</td>
<td>105.00</td>
</tr>
<tr>
<td>5</td>
<td>Chalk</td>
<td>57.90</td>
</tr>
<tr>
<td>6</td>
<td>China clay</td>
<td>63.00</td>
</tr>
<tr>
<td>7</td>
<td>Coal</td>
<td>3.00</td>
</tr>
<tr>
<td>8</td>
<td>Dolomite</td>
<td>720.00</td>
</tr>
<tr>
<td>9</td>
<td>Fire clay</td>
<td>155.22</td>
</tr>
<tr>
<td>10</td>
<td>Fluorite</td>
<td>11.00</td>
</tr>
<tr>
<td>11</td>
<td>Graphite</td>
<td>2.06</td>
</tr>
<tr>
<td>12</td>
<td>Gypsum</td>
<td>5.85</td>
</tr>
<tr>
<td>13</td>
<td>Lignite</td>
<td>700.00</td>
</tr>
<tr>
<td>14</td>
<td>Limestone</td>
<td>11,500.00</td>
</tr>
<tr>
<td>15</td>
<td>Marble</td>
<td>46.50</td>
</tr>
<tr>
<td>16</td>
<td>Nepheline syenite</td>
<td>14.00</td>
</tr>
<tr>
<td>17</td>
<td>Plastic clay</td>
<td>N.E</td>
</tr>
<tr>
<td>18</td>
<td>Pyrolusite (Manganese ore)</td>
<td>2.50</td>
</tr>
<tr>
<td>19</td>
<td>Quartz</td>
<td>4.00</td>
</tr>
<tr>
<td>20</td>
<td>Roofing tiles clay</td>
<td>N.E</td>
</tr>
<tr>
<td>21</td>
<td>Siderite</td>
<td>4.60</td>
</tr>
<tr>
<td>22</td>
<td>Silica sand</td>
<td>N.E</td>
</tr>
</tbody>
</table>

N.E = Not Estimated
3. Recovery of paper coating clay as per BIS standard depends on the genesis of china clay deposit. If the particle size of kaolin is uniform, recovery will be good.

4. Soft water requirement for preparing slurry per day will be 50,000 litres per day with high pressure pump.

**PRICE TARIFF OF THE MOZLEY MODELS**

<table>
<thead>
<tr>
<th></th>
<th>C-1010 (Pound) (A)</th>
<th>C-1030 (Pound) (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex-works UK Price</td>
<td>434.70</td>
<td>6,035.12</td>
</tr>
<tr>
<td>CIF Bombay charges</td>
<td>160.00</td>
<td>276.00</td>
</tr>
<tr>
<td></td>
<td><strong>594.70</strong></td>
<td><strong>6,311.12</strong></td>
</tr>
</tbody>
</table>

10 MM hydrocyclones

<table>
<thead>
<tr>
<th>1' hydrocyclones</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Pounds)</td>
</tr>
<tr>
<td>A. Price of system (Ex works UK)</td>
</tr>
<tr>
<td>B. CIF charges</td>
</tr>
<tr>
<td>C. System commissioning charges</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

+ Import Duty @ 20%.
## ATTAPULGITE

<table>
<thead>
<tr>
<th>Location</th>
<th>Muldhar Vallabhipur Bhavnagar (1)</th>
<th>Panvi Vallabhipur Bhavnagar (2)</th>
<th>Polarpur Dhandhuka Ahmedabad (3)</th>
<th>Patna Vallabhipur Bhavnagar (4)</th>
<th>Lunadhra Vallabhipur Bhavnagar (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SiO₂</td>
<td>21.80</td>
<td>53.43</td>
<td>45.42</td>
<td>54.46</td>
<td>19.18</td>
</tr>
<tr>
<td>Al₂O₃</td>
<td>6.03</td>
<td>10.37</td>
<td>10.09</td>
<td>5.83</td>
<td>3.44</td>
</tr>
<tr>
<td>Fe₂O₃</td>
<td>3.76</td>
<td>6.20</td>
<td>6.40</td>
<td>4.64</td>
<td>2.24</td>
</tr>
<tr>
<td>TiO₂</td>
<td>0.47</td>
<td>-</td>
<td>-</td>
<td>0.83</td>
<td>0.47</td>
</tr>
<tr>
<td>CaO</td>
<td>21.67</td>
<td>2.38</td>
<td>7.55</td>
<td>3.30</td>
<td>23.81</td>
</tr>
<tr>
<td>MgO</td>
<td>13.30</td>
<td>11.16</td>
<td>12.83</td>
<td>14.69</td>
<td>15.84</td>
</tr>
<tr>
<td>P₂O₅</td>
<td>0.01</td>
<td>0.03</td>
<td>0.01</td>
<td>Ab</td>
<td>-</td>
</tr>
<tr>
<td>SO₃</td>
<td>Ab</td>
<td>0.03</td>
<td>0.01</td>
<td>Ab</td>
<td>Nil</td>
</tr>
<tr>
<td>Na₂O</td>
<td>0.43</td>
<td>0.28</td>
<td>0.38</td>
<td>0.48</td>
<td>0.18</td>
</tr>
<tr>
<td>K₂O</td>
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<tr>
<td>L.O.I</td>
<td>32.43</td>
<td>15.58</td>
<td>17.28</td>
<td>15.58</td>
<td>33.96</td>
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</tbody>
</table>

## CHEMICAL COMPOSITION:

### PHYSICAL PROPERTIES:

- **Moisture at 105°C**
  - Muldhar: 4.60
  - Panvi: 8.34
  - Polarpur: 8.55
  - Patna: 7.63
  - Lunadhra: 3.77

- **Specific gravity**
  - Muldhar: 2.48
  - Panvi: 2.21
  - Polarpur: 2.28
  - Patna: 2.05
  - Lunadhra: 2.21

- **Liquid limit**
  - Muldhar: -
  - Panvi: -
  - Polarpur: -
  - Patna: -
  - Lunadhra: -

- **pH 30°C**
  - Muldhar: 10.65
  - Panvi: 9.05
  - Polarpur: 9.80
  - Patna: 8.40
  - Lunadhra: 10.10

- **Gel value**
  - Muldhar: 10.00
  - Panvi: 11.00
  - Polarpur: 10.00
  - Patna: 10.00
  - Lunadhra: 9.00

- **Swelling index**
  - Muldhar: 10.00
  - Panvi: 12.00
  - Polarpur: 18.00
  - Patna: 7.50
  - Lunadhra: 9.00

- **Base exchange cap. Meq/100 gm.**
  - Muldhar: 18.04
  - Panvi: 20.15
  - Polarpur: 37.61
  - Patna: 3.28
  - Lunadhra: 15.84

- **Viscosity 600 RPM**
  - Muldhar: -
  - Panvi: -
  - Polarpur: -
  - Patna: -
  - Lunadhra: -

- **Exchangeable Ca⁺⁺ ion**
  - Muldhar: 0.12
  - Panvi: 0.15
  - Polarpur: 0.28
  - Patna: 0.08
  - Lunadhra: 0.15
### PRODUCTION OF VARIOUS MINERALS OF GUJARAT

[Quantity in Tonnes]

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<td>1.</td>
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<td>2.</td>
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<td>Chalk</td>
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<td>5.</td>
<td>China clay</td>
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<td>6.</td>
<td>Dolomite</td>
<td>4,23,363</td>
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<td>7.</td>
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<td>8.</td>
<td>Fluorite</td>
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<td>Graphite</td>
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<td>Plastic clay</td>
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<td>Pyrolusite ore</td>
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<td>(Manganese ore)</td>
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<td>15.</td>
<td>Quartz</td>
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<td>(Pipe clay)</td>
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<td>18.</td>
<td>Silica sand</td>
<td>1,37,756</td>
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N.P = No Production

* Provisions
### Bauxite

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<td>Jamkham-bhaliya</td>
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<td>Ajad-Tapu</td>
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<td>Ajad-Tapu</td>
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<td>D-9</td>
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<td>Jamnagar</td>
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<tr>
<td>D-14</td>
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#### CHEMICAL COMPOSITION:

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<th>Ref.No.</th>
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<tr>
<td>SIO2</td>
<td>M-118/1-A</td>
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<td>M/67/1C</td>
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<td>JBS M/30</td>
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<td>JSM-M 33</td>
<td>Jamnagar</td>
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<table>
<thead>
<tr>
<th>Constituents (%)</th>
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<tbody>
<tr>
<td>SiO2</td>
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<td>Fe2O3</td>
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<td>2.80</td>
<td>4.17</td>
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<td>Al2O3</td>
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<td></td>
<td>3.63</td>
<td>Tr</td>
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<tr>
<td></td>
<td>1.01</td>
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<tr>
<td>MgO</td>
<td>Tr</td>
<td>Tr</td>
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<td>Tr</td>
<td>Tr</td>
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<tr>
<td>L.O.I.</td>
<td>32.02</td>
<td>30.57</td>
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<td>30.05</td>
<td>30.26</td>
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<td></td>
<td>28.00</td>
<td>99.95</td>
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Total: 98.96 98.80 99.29 100.00 99.95
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<th>(1)</th>
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<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
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<tbody>
<tr>
<td><strong>MINERAL COMPOSITION (X-ray diffraction):</strong></td>
<td>The sample contains Dolomite and impurities of Calcite.</td>
<td>The sample contains Attapulgite and impurities of Dolomite &amp; Calcite.</td>
<td>The sample contains mainly Attapulgite and impurities of Dolomite &amp; Calcite.</td>
<td>The sample contains Dolomite is associated with Attapulgite. It also contains Quartz &amp; Calcite as impurities.</td>
</tr>
<tr>
<td><strong>THERMAL BEHAVIOR - DTA:</strong></td>
<td>Endothermic peak at 125°C, 245°C (Sh), 770°C, 830°C</td>
<td>Exothermic peak at 450°C</td>
<td>Exothermic peak at 125°C, 245°C, 450°C, 755°C</td>
<td>Endothermic peak at 125°C, 240°C, 450°C, 700°C, 755°C, 830°C</td>
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<tr>
<td></td>
<td>Exothermic peak abroad at 850°C</td>
<td>Exothermic peak abroad &amp; small at 850°C</td>
<td>Exothermic peak abroad &amp; small at 850°C, peak temp. suggest that the sample contains Attapulgite.</td>
<td>Exothermic peak at 850°C, peak temp. suggest that the sample contains Attapulgite &amp; small quantity of Calcite.</td>
</tr>
<tr>
<td><strong>INFRARED SPECTROSCOPY:</strong></td>
<td>Sample contains Attapulgite and impurities of Calcite &amp; Quartz.</td>
<td>Sample contains Attapulgite and impurities of Calcite &amp; Quartz.</td>
<td>Sample contains Attapulgite and impurities of Calcite &amp; Quartz.</td>
<td>Sample contains Attapulgite and impurities of Calcite &amp; Quartz.</td>
</tr>
<tr>
<td><strong>ELECTRON MICROSCOPY:</strong></td>
<td>Clay sample was examined at 1400 magnification. Electron micrograph showed well formed needles with sharp edges perfect parallel growth and particles are bound to aggregates shows the presence of Attapulgite.</td>
<td>N.D.</td>
<td>Clay sample was examined at 5250 magnification. Electron micrograph showed well formed needle with sharp edges, perfect parallel growth and particles are bound to aggregate shows the presence of Attapulgite.</td>
<td>Clay sample was examined at 11000 magnification. Electron micrograph showed the fibrous structure shows the presence of Attapulgite.</td>
</tr>
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58
<table>
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<tr>
<th>Ref. No.</th>
<th>VGM-11 Budhel</th>
<th>VGM-16 Thordi</th>
<th>VGM-17 Thordi</th>
<th>VGM-23 Thordi</th>
<th>VGM-24 Thordi</th>
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<tbody>
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<td>Location:</td>
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<td>Bhavnagar</td>
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**CHEMICAL COMPOSITION:**

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<th>Constituents (%)</th>
<th>VGM-11</th>
<th>VGM-16</th>
<th>VGM-17</th>
<th>VGM-23</th>
<th>VGM-24</th>
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<tr>
<td>SiO2</td>
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<td>Fe2O3</td>
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<td>3.95</td>
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<tr>
<td>CaO</td>
<td>3.30</td>
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<td>MgO</td>
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<td>P2O5</td>
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**PHYSICAL PROPERTIES:**

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<th>VGM-17</th>
<th>VGM-23</th>
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<td>Moisture at 105°C</td>
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<td>9.77</td>
<td>9.45</td>
<td>8.35</td>
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<td>9.70</td>
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<td>9.00</td>
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<td>Swelling index</td>
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<td>12.00</td>
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<td>Base exchange cap. meq/100 gm.</td>
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**CHEMICAL COMPOSITION:**

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<th>SiO₂</th>
<th>Al₂O₃</th>
<th>Fe₂O₃</th>
<th>TiO₂</th>
<th>CaO</th>
<th>MgO</th>
<th>P₂O₅</th>
<th>SO₃</th>
<th>MnO</th>
<th>Na₂O</th>
<th>K₂O</th>
<th>L.O.I</th>
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**CHEMICAL COMPOSITION:**

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<th>Constituents (%)</th>
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<th>TiO₂</th>
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<th>MgO</th>
<th>P₂O₅</th>
<th>SO₃</th>
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<th>Na₂O</th>
<th>K₂O</th>
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<td>0.58</td>
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<th>(5)</th>
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<tbody>
<tr>
<td>MINERAL COMPOSITION (x-ray Diffraction):</td>
<td>The sample contains mainly Kaolinite, Montmorillonite &amp; Quartz.</td>
<td>The sample contains mainly Montmorillonite, Kaolinite and little quantity of Hematite &amp; Rutile.</td>
<td>The sample contains mainly Natrojarosite, Montmorillonite &amp; Kaolinite.</td>
<td>The sample contains mainly Quartz, Montmorillonite &amp; Kaolinite.</td>
</tr>
<tr>
<td>THERMAL BEHAVIOR - DTA:</td>
<td>Endothermic peak at 120°C, 530°C, 700°C</td>
<td>Large Endothermic peak at 120°C, 510°C</td>
<td>Large Endothermic peak at 120°C, 610°C No clear exothermic peak.</td>
<td>Medium Endotherm at 115°C, 285°C, 510°C.</td>
</tr>
<tr>
<td></td>
<td>exothermic hump at 955°C</td>
<td>Exothermic peak at 900°C.</td>
<td>The peaks are characteristic of Montmorillonite.</td>
<td>slight exothermic hump at 950°C sample contains Montmorillonite &amp; small amount of Geothite &amp; Kaolinite.</td>
</tr>
<tr>
<td>Sample contains Montmorillonite and small amount of Calcite &amp; Kaolinite.</td>
<td>Sample contains Montmorillonite and Calcite.</td>
<td>N.D</td>
<td>N.D</td>
<td></td>
</tr>
<tr>
<td>INFRARED SPECTROSCOPY:</td>
<td>Sample mainly contains Montmorillonite, Kaolinite, Silica and Rutile are present as impurities.</td>
<td>Sample contains mainly soil Montmorillonite, Kaolinite &amp; Quartz are present as impurities.</td>
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<tr>
<td>ELECTRON MICROSCOPY:</td>
<td>The sample was examined at 2400, 3100, 000 magnification. The electron micrograph showed very thin lamellae of different sizes. These lamellae confirm the presence of montmorillonite.</td>
<td>The sample was examined at 4000, 11000, 14000 &amp; 18000 magnification. The electron micrograph showed very thin lamellae of different sizes. These lamellae confirm the presence of montmorillonite.</td>
<td>The sample was examined at 2400, 11000 &amp; 14000 magnification. The electron micrograph showed thin platy particles without characteristic features and it also showed feather like appearance confirming the presence of mixture of soil, Montmorillonite and Montronite.</td>
<td>The sample was examined at 2400, 3100, 5000 magnification. The electron micrograph showed thin platy particles without characteristic features and it also showed feather like appearance confirming the presence of mixture of soil, Montmorillonite and Montronite.</td>
</tr>
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<tr>
<td>CHEMICAL COMPOSITION :</td>
<td>Constituents (%)</td>
<td>Constituents (%)</td>
<td>Constituents (%)</td>
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<tr>
<td>SiO2</td>
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<td>Al2O3</td>
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<td>22.97</td>
<td>18.97</td>
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<tr>
<td>Fe2O3</td>
<td>9.72</td>
<td>11.04</td>
<td>10.88</td>
<td>26.56</td>
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<tr>
<td>TiO3</td>
<td>2.15</td>
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<td>CaO</td>
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<tr>
<td>MgO</td>
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<td>2.38</td>
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<td>1.57</td>
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<tr>
<td>P2O5</td>
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<td>0.02</td>
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<tr>
<td>SO3</td>
<td>Ab</td>
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<td>Ab</td>
<td>Ab</td>
</tr>
<tr>
<td>Na2O</td>
<td>2.10</td>
<td>1.05</td>
<td>1.25</td>
<td>1.23</td>
</tr>
<tr>
<td>K2O</td>
<td>0.68</td>
<td>0.38</td>
<td>0.68</td>
<td>0.23</td>
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</table>

PHYSICAL PROPERTIES :

<p>| Moisture at 105°C | 11.25 | 9.63 | 10.06 | 10.52 | 9.74 |
| Specific gravity | 2.39 | 2.45 | 2.46 | 2.35 | 2.25 |
| Liquid limit | 539.40 | 357.00 | 373.00 | 394.00 | 568.75 |
| pH 30°C | 10.00 | 9.40 | 10.00 | 9.45 | 10.00 |
| Gel value | 14.00 | 10.00 | 10.00 | 5.00 | 6.00 |
| Swelling index | 30.00 | 32.00 | 23.00 | 24.00 | 30.00 |
| Base exchange | 85.26 | 72.28 | 73.32 | 67.34 | 70.20 |
| cap.meq/100 gm. | | | | | |
| Viscosity (a) 600 RPM | 17.50 | 6.50 | 11.00 | - | 37.00 |
| (b) 300 RPM | 11.00 | 3.50 | 7.00 | - | 27.50 |
| Filter loss ml. | 23.00 | 23.00 | 29.00 | - | 22.00 |</p>
<table>
<thead>
<tr>
<th>MINERAL COMPOSITION (x-ray Diffraction):</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The sample contains mainly Montmorillonite, Quartz &amp; Anatase.</td>
<td>The sample contains mainly Montmorillonite, Kaolinite, Quartz, little quantity of Calcite and Hematite.</td>
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<table>
<thead>
<tr>
<th>THERMAL BEHAVIOR - DTA :</th>
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<tbody>
<tr>
<td>Endothermic 130°C, 175°C</td>
<td>125°C, 515°C</td>
</tr>
<tr>
<td>500°C, Exothermic hump at 900°C</td>
<td>910°C. Sample contains Montmorillonite.</td>
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<table>
<thead>
<tr>
<th>INFRARED SPECTROSCOPY :</th>
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<tbody>
<tr>
<td>Sample mainly contains Montmorillonite.</td>
<td>Sample contains mainly Montmorillonite.</td>
</tr>
<tr>
<td>Kaolinite, Silica, Rutile and Calcite are present as impurities.</td>
<td>Silica, Rutile and Calcite are present as impurities.</td>
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<table>
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<tr>
<th>ELECTRON MICROSCOPY :</th>
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<tbody>
<tr>
<td>The sample was examined at 1400 &amp; 5000 magnification. \ The electron micrograph showed very thin lamellae of different sizes, which confirms the presence of montmorillonite.</td>
<td>The sample was examined at 1800, 4000 &amp; 18000 magnification. \ The electron micrograph showed very thin lamellae of different sizes, which confirms the presence of montmorillonite.</td>
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64
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**CHEMICAL COMPOSITION:**

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<td>Fe2O3</td>
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<td>TiO2</td>
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<td>CaO</td>
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<td>1.07</td>
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<tr>
<td>MgO</td>
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<td>2.43</td>
<td>3.33</td>
<td>2.15</td>
<td>2.12</td>
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<td>P2O5</td>
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<td>N.D.</td>
<td>N.D.</td>
<td>N.D.</td>
<td>N.D.</td>
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**PHYSICAL PROPERTIES:**

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<td>Moisture at 105°C</td>
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<td>593.00</td>
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<td>8.95</td>
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<tr>
<td>Gel value(%)</td>
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<td>99.00</td>
<td>86.00</td>
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<td>Viscosity</td>
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<td>(a) 600 RPM</td>
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<td>149.00</td>
<td>42.00</td>
<td>176.00</td>
<td>152.00</td>
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<td>(b) 300 RPM</td>
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<td>141.00</td>
<td>45.00</td>
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<td>139.00</td>
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<td>Filter loss ml.</td>
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<tr>
<td><strong>MINERAL COMPOSITION (x-ray Diffraction):</strong></td>
<td></td>
<td></td>
<td><strong>The sample contains mainly Montmorillonite confirmed by glycol treatment.</strong></td>
<td><strong>The sample contains mainly Montmorillonite confirmed by glycol treatment.</strong></td>
<td></td>
</tr>
<tr>
<td>The sample contains mainly Montmorillonite confirmed by glycol treatment.</td>
<td>The sample contains mainly Montmorillonite confirmed by glycol treatment.</td>
<td>It contains Cancite as associated mineral.</td>
<td>It contains Quartz and Anatase as associated mineral.</td>
<td>The sample contains mainly Montmorillonite confirmed by glycol treatment.</td>
<td></td>
</tr>
<tr>
<td><strong>THERMAL BEHAVIOR - DTA:</strong></td>
<td>Endothermic peak 145°C, 520°C.</td>
<td>Endothermic peak 145°C, 520°C.</td>
<td>Endothermic peak 140°C &amp; 525°C.</td>
<td>Exothermic peak 950°C.</td>
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<tr>
<td>Exothermic peak 950°C.</td>
<td>Sample contains Montmorillonite.</td>
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<td></td>
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<tr>
<td><strong>INFRARED SPECTROSCOPY:</strong></td>
<td>Sample contains Montmorillonite. Quartz &amp; Attapulgite are present as associated mineral.</td>
<td>Sample contains Montmorillonite. Quartz &amp; Attapulgite are present as associated mineral.</td>
<td>Sample contains mainly Montmorillonite. Quartz &amp; Attapulgite are present as associated mineral.</td>
<td>Sample contains mainly Montmorillonite.</td>
<td></td>
</tr>
<tr>
<td>Sample mainly contains Montmorillonite. Quartz &amp; Attapulgite are present as associated mineral.</td>
<td>Sample contains mainly Montmorillonite. Quartz &amp; Attapulgite are present as associated mineral.</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ELECTRON MICROSCOPY:</strong></td>
<td>The sample was examined at 26500,12500 &amp; 10750 magnification. The electron micrograph showed thin platy lamellae particles which shows presence of montmorillonite.</td>
<td>The sample was examined at 6000,10000, &amp; 27500 magnification. The electron micrograph showed very thin lamellae of different sizes, which shows the presence of Montmorillonite.</td>
<td>The sample was examined at 16250 &amp; 94500 magnification. The electron micrograph showed very thin irregular lamellae of different sizes and particles. Cleavage plane with pseudo hexagonal particle shows the presence of mixture of Montmorillonite and Kaolinite.</td>
<td>The sample was examined at 1650 &amp; 10000. The electron micrographs showed very thin irregular lamellae of different sizes, which shows the presence of Montmorillonite.</td>
<td></td>
</tr>
<tr>
<td>The sample was examined at 10000,26500 &amp; 6000 magnification. The electron micrograph showed very thin lamellae of different sizes, which shows the presence of Montmorillonite.</td>
<td>The sample was examined at 6000,10000, &amp; 27500 magnification. The electron micrograph showed very thin lamellae of different sizes, which shows the presence of Montmorillonite.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The sample was examined at 16250 &amp; 94500 magnification. The electron micrograph showed very thin irregular lamellae of different sizes and particles. Cleavage plane with pseudo hexagonal particle shows the presence of mixture of Montmorillonite and Kaolinite.</td>
<td>The sample was examined at 1650 &amp; 10000. The electron micrographs showed very thin irregular lamellae of different sizes, which shows the presence of Montmorillonite.</td>
<td></td>
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<tr>
<td>Location</td>
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<td>Derol</td>
<td>Tajpuri</td>
<td>Pathari</td>
<td>Kapadvanj</td>
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<td>Kapadvanj</td>
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<td>Sabarkantha</td>
<td>Sabarkantha</td>
<td>Bulsar</td>
<td>Kapadvanj</td>
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</table>

**CHEMICAL COMPOSITION:**

<table>
<thead>
<tr>
<th>Constituents (%)</th>
<th>SiO2</th>
<th>Al2O3</th>
<th>Fe2O3</th>
<th>TiO3</th>
<th>CaO</th>
<th>MgO</th>
<th>P2O5</th>
<th>SO3</th>
<th>Na2O</th>
<th>K2O</th>
<th>LOI</th>
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<tbody>
<tr>
<td></td>
<td>65.19</td>
<td>57.12</td>
<td>57.62</td>
<td>36.30</td>
<td>54.64</td>
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**PHYSICAL PROPERTIES:**

- Moisture at 105°C: [14.21, 12.62, 5.38, 13.22]
- Specific gravity: [2.65, 2.70, 2.93, 2.82]
- Liquid limit: [195.50, -, - , 89.00]
- pH 30°C: [9.00, 9.20, 8.80, 9.70]
- Gel value(%): [50.00, 10.00, 13.00, 14.00]
- Swelling index: [18.00, 10.00, 13.00, 14.00]
- Base exchange: [47.04, -, - , 23.03]

cap. meq/100 gm.
MINERAL COMPOSITION (x-ray Diffraction):
The sample contains mainly Quartz and accessory minerals are Montmorillonite, Kaolinite, and Anatase.
The sample contains mainly Quartz & accessory minerals are Montmorillonite, Kaolinite, Anatase and Calcite.
The sample contains mainly Quartz & accessory minerals are Kaolinite, Calcite and Montmorillonite.

THERMAL BEHAVIOR - DTA:

Endothermic peak at 110°C, 520°C, 570°C. Broad Exothermic peak at 940°C.
Sample contains disordered Kaolinite and small amount of Montmorillonite and Quartz.

Endothermic peak at 115°C, 510°C, 570°C. Exothermic peak at 900°C.
Sample contains Montmorillonite & Quartz.

Endothermic peak at 125°C, 510°C, 580°C. Exothermic peak at 900°C.
Sample contains Montmorillonite & Quartz.

Endothermic peak at 100°C, 320°C, 525°C, 565°C. Exothermic peak at 930°C.
Sample contains disordered Kaolinite & some amount of Gibbsite and Quartz.

Endothermic peak at 120°C, 300°C, 500°C, 570°C, 750°C. Exothermic peak.
No clear peak is observed. Sample contains Montmorillonite, Quartz, Calcite and Goethite.
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**CHEMICAL COMPOSITION:**

**Constituents (%)**

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**CHEMICAL COMPOSITION:**

**Constituents (%)**

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*Constituents (%)*

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**CHEMICAL COMPOSITION:**
Constituents (%)

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**PHYSICAL PROPERTIES:**

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**CHEMICAL COMPOSITION:**

**Constituents (%)**

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**PHYSICAL PROPERTIES:**

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**CHEMICAL COMPOSITION:**

**Constituents:**

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<th>TiO2</th>
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<th>MgO</th>
<th>P2O5</th>
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Amreli China Clay:

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<td>1.</td>
<td>Raw colour &amp; impurities</td>
<td>Dull white</td>
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<tr>
<td>2.</td>
<td>Slaking nature</td>
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</tr>
<tr>
<td>3.</td>
<td>Levigated colour</td>
<td>-</td>
</tr>
<tr>
<td>4.</td>
<td>Plasticity by hand feel</td>
<td>Fair</td>
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<tr>
<td>5.</td>
<td>% water of plasticity (dry basis)</td>
<td>45.26</td>
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<td>6.</td>
<td>Dry shrinkage at 110°C</td>
<td>4.00</td>
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<tr>
<td>7.</td>
<td>Fired properties at 1250°C</td>
<td>Light cream colour. No cracks, but many brown specks are available.</td>
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<tr>
<td>i.</td>
<td>Fired colour</td>
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<tr>
<td>ii.</td>
<td>Total shrinkage</td>
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<td>iii.</td>
<td>Vitrification</td>
<td>Fair</td>
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<tr>
<td>8.</td>
<td>Fired properties at 1400°C</td>
<td>Sunshine colour, many cracks are developed like spider web but match due to vitrification.</td>
</tr>
<tr>
<td>i.</td>
<td>Fired colour</td>
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<tr>
<td>ii.</td>
<td>Total shrinkage</td>
<td>22.00</td>
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<td>iii.</td>
<td>Vitrification</td>
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Mineralogical Composition (X-ray diffraction):
Sample contains mainly Kaolinite and accessory mineral is Anatase.

Thermal Behaviour - DTA:
Endothermic 530°C sharp. Exothermic peak at 970°C. Sample contains Kaolinite.
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<tr>
<td>(1)</td>
<td>Raw colour &amp; impurities</td>
<td>White, fairly hard lumps, black particles are visible.</td>
<td>White, fairly hard lumps. Many small black particles are visible.</td>
<td>Salmon pink.</td>
<td>White</td>
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<td>Plasticity by hand feel</td>
<td>(Moderate to fair)</td>
<td>(Moderate to fair)</td>
<td>(Moderate to fair)</td>
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<td>(8.3)</td>
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### Mehsana China Clay:

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<td>Pale white with grey grit particles.</td>
<td>Pale white with grey grit.</td>
<td>Pale white with grey grit and felspathic impurities.</td>
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<td>Fair</td>
<td>Fair to quick</td>
<td>Quick</td>
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<td>3</td>
<td>Levigated colour</td>
<td>Yellowish white</td>
<td>Pale white</td>
<td>Pinkish white</td>
</tr>
<tr>
<td>4</td>
<td>Plasticity by hand feel</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>5</td>
<td>% water of plasticity (dry basis)</td>
<td>39.21</td>
<td>33.27</td>
<td>33.74</td>
</tr>
<tr>
<td>6</td>
<td>Dry shrinkage at 1100°C(%)</td>
<td>6.00</td>
<td>5.00</td>
<td>5.01</td>
</tr>
<tr>
<td>7</td>
<td>Fired properties at 1250°C</td>
<td>White with brown specks.</td>
<td>White</td>
<td>Pale white with small brown patches</td>
</tr>
<tr>
<td>7.1</td>
<td>Fired colour</td>
<td>White</td>
<td>White</td>
<td>Pale white with full of brown patches.</td>
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<tr>
<td>7.2</td>
<td>Total shrinkage (%)</td>
<td>16.00</td>
<td>11.00</td>
<td>12.00</td>
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<tr>
<td>7.3</td>
<td>Vitrification</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>8</td>
<td>Fired properties at 1450°C</td>
<td>Buff white</td>
<td>White</td>
<td>Pale with full of brown patches.</td>
</tr>
<tr>
<td>8.1</td>
<td>Fired colour</td>
<td>Buff white</td>
<td>White</td>
<td>Pale with full of brown patches.</td>
</tr>
<tr>
<td>8.2</td>
<td>Total shrinkages</td>
<td>17.00</td>
<td>14.00</td>
<td>19.00</td>
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<td>8.3</td>
<td>Vitrification</td>
<td>Fair</td>
<td>None</td>
<td>Slight</td>
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9. Chemical analysis:

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<thead>
<tr>
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<tbody>
<tr>
<td>SiO2</td>
<td>46.34</td>
<td>50.34</td>
<td>48.85</td>
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<tr>
<td>Al2O3</td>
<td>32.64</td>
<td>34.52</td>
<td>30.01</td>
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<tr>
<td>Fe2O3</td>
<td>1.12</td>
<td>1.00</td>
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<tr>
<td>TiO2</td>
<td>1.04</td>
<td>0.50</td>
<td>0.80</td>
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<tr>
<td>CaO</td>
<td>4.18</td>
<td>0.77</td>
<td>0.32</td>
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<tr>
<td>MgO</td>
<td>0.31</td>
<td>Tr</td>
<td>1.66</td>
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<tr>
<td>Na2O</td>
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<td>0.38</td>
<td>-</td>
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<td>K2O</td>
<td>0.36</td>
<td>0.20</td>
<td>0.24</td>
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<tr>
<td>L.O.I</td>
<td>14.26</td>
<td>11.78</td>
<td>13.90</td>
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10. DTA Endothermic

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Peak temp.</td>
<td>98°C</td>
<td>65°C</td>
<td>75°C</td>
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<tr>
<td>Exothermic</td>
<td>560°C</td>
<td>580°C</td>
<td>565°C</td>
</tr>
<tr>
<td>peak</td>
<td>180°C</td>
<td>225°C</td>
<td>175°C</td>
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<tr>
<td></td>
<td>992°C</td>
<td>1005°C</td>
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11. Dominant mineral

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<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Kaolinite with</td>
<td>Kaolinite</td>
<td>Kaolinite</td>
</tr>
<tr>
<td>Halloysite</td>
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12. Impurities

<p>| |</p>
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<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Properties</th>
<th>Kadoli</th>
<th>Kot</th>
<th>Ransipur</th>
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<tbody>
<tr>
<td>2</td>
<td>Raw colour &amp; impurities</td>
<td>Yellowish white salt contains sand material.</td>
<td>Pale white.</td>
<td>Pale white.</td>
</tr>
<tr>
<td>3</td>
<td>Slaking nature</td>
<td>Quick</td>
<td>-</td>
<td>White (slightly pinkish).</td>
</tr>
<tr>
<td>4</td>
<td>Levigated colour</td>
<td>Pale white.</td>
<td>Yellowish white.</td>
<td>Good</td>
</tr>
<tr>
<td>5</td>
<td>Plasticity by hand feel</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>6</td>
<td>% water of plasticity</td>
<td>35.79</td>
<td>38.90</td>
<td>43.25</td>
</tr>
<tr>
<td>7</td>
<td>Dry shrinkage at 110°C(%)</td>
<td>5.00</td>
<td>6.00</td>
<td>7.00</td>
</tr>
<tr>
<td>7.1</td>
<td>Fired properties at 1250°C</td>
<td>Pale white rarely very small brown patches, some cracks.</td>
<td>White</td>
<td>White</td>
</tr>
<tr>
<td>7.2</td>
<td>Total shrinkage (%)</td>
<td>18.00</td>
<td>13.00</td>
<td>13.50</td>
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<tr>
<td>7.3</td>
<td>Vitrification</td>
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<td>None</td>
<td>None</td>
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</table>
8. Fired properties at 1450°C:

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<tbody>
<tr>
<td>8.1</td>
<td>Fired colour</td>
<td>Greyish white with brown patches. Cracks developed.</td>
<td>Buff white with some brown patches.</td>
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<tr>
<td>8.2</td>
<td>Total shrinkages</td>
<td>19.00</td>
<td>15.00</td>
</tr>
<tr>
<td>8.3</td>
<td>Vitrification</td>
<td>Fair</td>
<td>Fair</td>
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9. Chemical analysis:

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>SiO₂</td>
<td>47.25</td>
<td>48.32</td>
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<tr>
<td>Al₂O₃</td>
<td>36.43</td>
<td>31.22</td>
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<tr>
<td>Fe₂O₃</td>
<td>0.94</td>
<td>1.10</td>
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<tr>
<td>TiO₂</td>
<td>0.48</td>
<td>0.32</td>
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<tr>
<td>CaO</td>
<td>0.56</td>
<td>4.63</td>
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<tr>
<td>MgO</td>
<td>0.03</td>
<td>Tr</td>
</tr>
<tr>
<td>Na₂O</td>
<td>0.22</td>
<td>0.18</td>
</tr>
<tr>
<td>K₂O</td>
<td>0.23</td>
<td>0.24</td>
</tr>
<tr>
<td>L.O.I</td>
<td>13.95</td>
<td>14.05</td>
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10. DTA Endothermic

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<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Peak temp.</td>
<td>70°C</td>
<td>90°C</td>
</tr>
<tr>
<td>Exothermic peak</td>
<td>570°C</td>
<td>565°C</td>
</tr>
<tr>
<td>Exothermic peak</td>
<td>240°C</td>
<td>1000°C</td>
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11. Dominant mineral

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<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Kaolinite with Halloysite</td>
<td>Kaolinite Halloysite</td>
<td>Kaolinite Halloysite</td>
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12. Impurities

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Calcite, Quarts Albite</td>
<td>Calcite, Quarts Albite</td>
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Surendranagar China Clay:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Properties</th>
<th>Bavli</th>
<th>Kankavati</th>
<th>Khod</th>
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<tbody>
<tr>
<td>1</td>
<td>Raw colour &amp; impurities</td>
<td>Fairly hard white lumps.</td>
<td>Fairly hard white brittle lumps.</td>
<td>Moderately hard brittle white &amp; pale white lumps.</td>
</tr>
<tr>
<td>2</td>
<td>Slaking nature</td>
<td>Fair</td>
<td>Moderate</td>
<td>Moderate to fair</td>
</tr>
<tr>
<td>3</td>
<td>pH</td>
<td>8.35</td>
<td>8.50</td>
<td>8.30</td>
</tr>
<tr>
<td>4</td>
<td>BEC Meq/100 gm</td>
<td>6.57</td>
<td>3.55</td>
<td>3.03</td>
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<tr>
<td>5</td>
<td>Whiteness</td>
<td>69</td>
<td>75</td>
<td>70</td>
</tr>
<tr>
<td>6</td>
<td>Plasticity by hand feel</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>7</td>
<td>Water of plasticity % (Dry basis)</td>
<td>26.93</td>
<td>24.22</td>
<td>25.87</td>
</tr>
<tr>
<td>8</td>
<td>Dry shrinkage at 110°C(%)</td>
<td>5.00</td>
<td>3.00</td>
<td>5.00</td>
</tr>
<tr>
<td>9</td>
<td>Atterberg number</td>
<td>25</td>
<td>16</td>
<td>19</td>
</tr>
<tr>
<td>10</td>
<td>Grit content retained on 45 micron sieve %</td>
<td>4.90</td>
<td>29.64</td>
<td>19.80</td>
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11. Fired properties at 1250°C:

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<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>11.1 Fired colour</td>
<td>Pale white with small brown specks.</td>
<td>White with small brown specks.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>11.2 Total shrinkage (%)</td>
<td>9.00</td>
<td>7.00</td>
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<tr>
<td>11.3 Vitrification</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>11.4 Water absorption %</td>
<td>11.09</td>
<td>15.11</td>
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<td>12. Fired properties at 1400°C :</td>
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<tr>
<td>12.1 Fired colour</td>
<td>Beige</td>
<td>Yellow with brown small specks.</td>
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<tr>
<td>12.2 Total shrinkages</td>
<td>13.00</td>
<td>10.50</td>
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<td>12.3 Vitrification</td>
<td>High</td>
<td>Fair</td>
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<tr>
<td>12.4 Water absorption %</td>
<td>2.16</td>
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<tr>
<td>13. Chemical analysis % :</td>
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<tr>
<td>SiO2</td>
<td>60.75</td>
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<td>Al2O3</td>
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<td>Fe2O3</td>
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<td>0.88</td>
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<tr>
<td>TiO2</td>
<td>1.41</td>
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<tr>
<td>CaO</td>
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<td>0.13</td>
</tr>
<tr>
<td>MgO</td>
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<td>0.03</td>
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<tr>
<td>Na2O</td>
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<td>0.53</td>
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<tr>
<td>K2O</td>
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<tr>
<td>L.O.I</td>
<td>9.11</td>
<td>7.43</td>
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<td>14. Rational analysis % :</td>
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<td>Kaolinite</td>
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<td>Muscovite</td>
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<td>Albite</td>
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<td>Hematite</td>
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<td>Rutile</td>
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<td>1.40</td>
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<td>Calcite</td>
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<td>Magnesite</td>
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<tr>
<td>Free quartz</td>
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<td>15. Particle size analysis % undersize in microns :</td>
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<td>5-8</td>
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81
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<td>42.20</td>
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<tr>
<td>16. DTA Endothermic peak temp.</td>
<td>530°C</td>
<td>528°C</td>
<td>538°C</td>
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</tr>
<tr>
<td>Exothermic peak</td>
<td>980°C</td>
<td>985°C</td>
<td>982°C</td>
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</tr>
<tr>
<td>17. Dominant mineral</td>
<td>Kaolinite</td>
<td>Kaolinite</td>
<td>Kaolinite</td>
<td></td>
</tr>
<tr>
<td>18. Impurities</td>
<td>Quartz</td>
<td>Quartz</td>
<td>Quartz</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Muscovite</td>
<td>Muscovite &amp; Pyrophyllite</td>
<td>Muscovite &amp; Pyrophyllite</td>
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### DOLOMITE

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<th>SPN/PRP (90-91)/69</th>
<th>SPN/PRP (90-91)/72</th>
<th>SPN/PRP (90-91)/76</th>
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<td>Rangasar</td>
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<td></td>
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<td>Okhamandal</td>
<td>Okhamandal</td>
<td>Bhavnagar</td>
</tr>
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<td>Jamnagar</td>
<td>Jamnagar</td>
<td>Jamnagar</td>
<td>Bhavnagar</td>
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#### CHEMICAL COMPOSITION:

**Constituents (%):**

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<td>SiO2</td>
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<td>TiO2</td>
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<td>Okhamandal</td>
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#### CHEMICAL COMPOSITION:

**Constituents (%):**

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<td>Chathawala</td>
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<td>Jadiyan</td>
<td>Chhotaudepur</td>
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<td>Vadodara</td>
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**CHEMICAL COMPOSITION:**

**Constituents (%):**

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**Comparison of Fire Clays from Rajkot District:**

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<th>Makansar</th>
<th>Sartanpur</th>
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<td></td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
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<tr>
<td>1.</td>
<td>Raw colour &amp; appearance</td>
<td>Grey hard lumps with carbonaceous matter.</td>
<td>Pinkish white</td>
<td>Buff white with pinkish tinge.</td>
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<tr>
<td>2.</td>
<td>Slaking nature</td>
<td>Fair</td>
<td>Slor</td>
<td>Slow</td>
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<tr>
<td>3.</td>
<td>pH</td>
<td>8.30</td>
<td>9.40</td>
<td>8.00</td>
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<td>4.</td>
<td>BEC Meq/100 gm</td>
<td>8.84</td>
<td>N.D</td>
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<td>5.</td>
<td>Residue on 150 BS Mesh</td>
<td>6.31</td>
<td>21.80</td>
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<td>Plasticity by hand feel</td>
<td>Fair</td>
<td>Moderate</td>
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<td>7.</td>
<td>Atterberg’s Number</td>
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<td>8.</td>
<td>Water of plasticity</td>
<td>27.08</td>
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<td>% (Dry basis)</td>
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<td>9.</td>
<td>Dry shrinkage at 1100°C (%)</td>
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<td>7.00</td>
<td>7.00</td>
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<td>10.</td>
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<tr>
<td>10.1</td>
<td>Fired colour</td>
<td>Pale white with small brown specks.</td>
<td>White with light small brown specks.</td>
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<td>Total shrinkage (%)</td>
<td>10.00</td>
<td>10.00</td>
<td>9.00</td>
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<tr>
<td>10.3</td>
<td>Vitrification</td>
<td>None</td>
<td>None</td>
<td>None</td>
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<td>10.4</td>
<td>Water absorption %</td>
<td>13.05</td>
<td>13.74</td>
<td>16.04</td>
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<td>11.</td>
<td>Fired properties at 1400°C :</td>
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<tr>
<td>11.1</td>
<td>Fired colour</td>
<td>Pale white with small brown specks.</td>
<td>Brownish yellow with small brown specks.</td>
<td>Yellowish white with brown specks.</td>
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<td>Vitrification</td>
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<td>None</td>
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12. Chemical analysis %:

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<th>Fe2O3</th>
<th>TiO2</th>
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<th>MgO</th>
<th>SO3</th>
<th>Na2O</th>
<th>K2O</th>
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<td>57.80</td>
<td>63.73</td>
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<td>21.75</td>
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<td>1.37</td>
<td>1.56</td>
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Comparison of Fire Clays from Sabarkantha District:

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<th>Pedhamli</th>
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<td>(5)</td>
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<tr>
<td>1.</td>
<td>Raw colour &amp; appearance</td>
<td>Mixture of brownish pink, and yellowish white hard lumps alongwith small micaceous particles.</td>
<td>Light buff red lumps with micaceous particles.</td>
<td>Dark red lumps.</td>
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<td>Slaking nature</td>
<td>Non slaking</td>
<td>Non slaking</td>
<td>Non slaking</td>
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<tr>
<td>3.</td>
<td>pH</td>
<td>8.40</td>
<td>6.50</td>
<td>6.80</td>
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<td>BEC Meq/100 gm</td>
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<td>ND</td>
<td>ND</td>
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<td>5.</td>
<td>Plasticity by hand feel</td>
<td>Low</td>
<td>Poor</td>
<td>Poor</td>
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<td>Water of plasticity % (Dry basis)</td>
<td>29.22</td>
<td>24.13</td>
<td>23.00</td>
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<td>8.</td>
<td>Dry shrinkage at 110°C (%)</td>
<td>5.50</td>
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<td>4.36</td>
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### Fired properties at 1250°C:

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<td>9.</td>
<td>9.1</td>
<td>Pale to cream white.</td>
<td>Dull white.</td>
<td>Pale white.</td>
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<td>Total shrinkage (%)</td>
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<td>None</td>
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### Fired properties at 1300°C:

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<td>10.</td>
<td>10.1</td>
<td>Light yellowish brown with grey tinge.</td>
<td>Creamish white.</td>
<td>Buff white.</td>
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### Chemical analysis %:

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<td>CaO</td>
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<td>SO3</td>
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<td>ND</td>
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<td>Na2O</td>
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### P.C.E

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<td>12.</td>
<td>P.C.E</td>
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<td>Between Orton Cone 26-27</td>
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### Comparison of Fire Clays from Surendranagar District:

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<td>Moderate</td>
<td>Slow to non-slaking.</td>
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<td>7.70</td>
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<td>24.99</td>
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<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
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<td>6.</td>
<td>Plasticity by hand feel</td>
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<td>Fair</td>
<td>Fair</td>
<td>Moderate to fair.</td>
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<td>16</td>
<td>13</td>
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<tr>
<td>8.</td>
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<td>27.57</td>
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<td>% (Dry basis)</td>
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<td>9.</td>
<td>Dry shrinkage at 110°C(%)</td>
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<td>8.00</td>
<td>8.00</td>
<td>7.00</td>
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<td>10.</td>
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<td>8.00</td>
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<tr>
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<td>11.1 Fired colour</td>
<td>Light white with yellow tinge with brown specks.</td>
<td>Yellow with grey patches.</td>
<td>N.D</td>
<td>Yellowish white with brown specks.</td>
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<td>15.00</td>
<td>N.D</td>
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### CHEMICAL COMPOSITION:

**Constituents (%)**:

- **SiO2**: 41.30, 37.60, 32.36, 37.47, 36.04
- **Al2O3**: 3.74, 3.59, 1.60, 1.19, 5.91
- **Fe2O3**: 5.52, 5.68, 6.20, 6.36, 5.44
- **TiO2**: 12.99, 13.74, 13.15, 11.27, 11.42
- **CaO**: 27.20, 30.27, 33.06, 32.43, 27.76
- **MgO**: 2.11, 1.82, 1.46, 0.73, 3.56
- **P2O5**: Tr, Tr, Nil, Nil, Tr
- **O ≡ F**: 5.46, 5.77, 5.77, 4.96, 4.80
- **Na2O**: ND, ND, ND, ND, ND
- **K2O**: ND, ND, ND, ND, ND
- **L.O.I**: 12.12, 12.61, 15.01, 13.87, 15.35
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# LIGNITE

**Statement showing details of Lignite deposits of Gujarat State consists of Area, Reserves, Quality (Proximate Analysis)**

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<th>Bhavnagar Lignite Deposits</th>
<th>Surat Lignite Deposits</th>
<th>Jhagadia Lignite Deposits</th>
<th>Panandhro Lignite Deposits</th>
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<td>Mangrol</td>
<td>Jhagadia</td>
<td>Lakhpat</td>
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<td>Vastan and around 45 kms.</td>
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**Proximate Analysis (%)**:
- **Moisture**: 21.55, 18.30, 32.50, 35.40
- **Ash**: 26.40, 13.40, 12.50, 8.10
- **Volatile matter**: 35.79, 38.90, 33.10, 30.43
- **Fixed carbon**: 17.97, 30.20, 21.80, 22.25
- **Calorific value (K.Cal/Kg)**: 4072, 4587, 3700, 4187
- **Sulphur**: 1.34 to 6.00, 0.22 to 2.00, -2.5 to 5.4

**Ultimate analysis**:
- **Carbon**: 29.45-6.7, 50.36, -61.28
- **Hydrogen**: 2.62-3.55, 0.03, -4.87
- **Sulphur**: 4.00-6.57, 0.36, -2.05
- **Nitrogen**: 0.39-0.60, 0.78, -0.91

**Ash analysis**:
- **SiO2**: 5.76-5.74, 10.27-46.96, -16.26
- **Fe2O3**: 5.04-2.50, 5.36-20.32, -37.9
- **Al2O3**: 3.37-37.58, 9.42-30.60, -12.2
- **CaO**: 0.54-20.69, 5.83-26.75, -11.0
- **TiO2**: 0.38-8.25, 0.64-3.15, -
- **SO3**: 0.29-26.80, 1.89-24.02, -11.4
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<th>Akrimota Lignite deposits</th>
<th>Umarsar Lignite deposits</th>
<th>Matanmadh Lefri Lignite deposits</th>
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**Proximate Analysis (%)**:

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## LIMESTONE

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### CHEMICAL COMPOSITION:

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**Constituents (%) :**

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**CHEMICAL COMPOSITION:**

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# NEPHELINE SYENITE

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**CHEMICAL COMPOSITION:**

**Constituents (%)**:

- **SiO₂** 58.10 58.20 59.14 57.33 71.16
- **Al₂O₃** 21.68 18.74 20.40 19.48 13.85
- **Fe₂O₃** 6.00 5.68 5.52 6.88 3.52
- **TiO₂** 0.47 0.28 0.50 0.50 0.42
- **CaO** 0.75 2.62 2.41 2.56 1.42
- **MgO** 0.10 0.39 0.23 0.34 0.14
- **P₂O₅** 0.01 0.03 0.18 0.13 0.06
- **SO₃** Ab Ab Ab Ab Ab
- **MnO** Nd 0.02 0.10 0.11 0.05
- **Na₂O** 6.25 6.50 5.50 5.13 3.00
- **K₂O** 6.00 6.00 5.75 5.00 4.25
- **L.O.I** 0.40 1.59 0.32 1.14 1.54
## Comparative Study of Plastic Clay of Gujarat with Bikaner Clay:

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**CHEMICAL COMPOSITION**

**Constituents (%)**:  

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CHEMICAL COMPOSITION

**Constituents (%) :**

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<th>Fe₂O₃</th>
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<th>CaO</th>
<th>MgO</th>
<th>P₂O₅</th>
<th>SO₃</th>
<th>Na₂O</th>
<th>K₂O</th>
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## ROOFING TILES CLAY

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### Chemical Composition

#### Constituents (%)

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<td>6.52</td>
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### Physical Properties

1. **Colour**
   - Lab/87-88: Red
   - Lab/87-88: Light red
   - Lab/87-88: Red

2. **Plasticity by hand feel**
   - Lab/87-88: Fair
   - Lab/87-88: Fair
   - Lab/87-88: Fair

3. **Water of plasticity %**
   - Lab/87-88: 26.27
   - Lab/87-88: 27.98
   - Lab/87-88: 24.98

4. **Dry linear shrinkage at 105°C**
   - Lab/87-88: 5.0
   - Lab/87-88: 5.0
   - Lab/87-88: -

5. **Liquid limit**
   - Lab/87-88: 34.90
   - Lab/87-88: 39.20
   - Lab/87-88: 35.45

6. **Atterberg’s Number**
   - Lab/87-88: 20
   - Lab/87-88: 22
   - Lab/87-88: 17

7. **BEC Meq/100 gm**
   - Lab/87-88: 4.05
   - Lab/87-88: 4.30
   - Lab/87-88: 3.50

8. **Fired properties at 900°C**
   - Lab/87-88: Red colour. No cracks or specks are visible.
   - Lab/87-88: Red colour. No cracks or specks are visible.
   - Lab/87-88: Red colour. No cracks or specks are visible.

9. **Fired properties at 1250°C**
   - Lab/87-88: Red colour. No cracks or specks are visible.
   - Lab/87-88: Red colour. No cracks or specks are visible.
   - Lab/87-88: Red colour. No cracks or specks are visible.

10. **Vitrification**
    - Lab/87-88: None
        - Lab/87-88: None
        - Lab/87-88: None

### Additional Information

- **Fired linear shrinkage %**
  - Lab/87-88: 5.0
  - Lab/87-88: 6.0
  - Lab/87-88: 4.5

- **Water absorption %**
  - Lab/87-88: 19.34
  - Lab/87-88: 18.53
  - Lab/87-88: 19.42

- **Vitrification**
  - Lab/87-88: None
  - Lab/87-88: None
  - Lab/87-88: None
### Mineralological Composition (x-ray diffraction)

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<td>Sample contains mainly kaolinite, quartz and hematite. Little</td>
<td>Sample contains mainly kaolinite, quartz and hematite. Little</td>
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### Infrared Spectroscopy

|                  | Sample contains kaolinite, quartz, calcite & hematite.              | Sample contains kaolinite, quartz, calcite & hematite.              | Sample contains kaolinite, quartz, calcite & hematite.              |

### Petrographic Study

|                  | Ferruginous clay.                                                   | Ferruginous cherty clay.                                            | Impure fire clay.                                                   |

| Ref. No.         | KRK Rao (89-90)                                                     | KRK Rao (89-90)                                                     | BSD/87-88 BSD-3                                                     | BSD/87-88 BSD-6                                                      |
| Location         | Sahebpur Himatnagar Sabarkantha                                    | Bhimpura Vijapur Mehsana                                          | Ged Prantij Sabarkantha                                            | Ged Prantij Sabarkantha                                             |

### Chemical Composition

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### Physical Properties

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Chemical Composition

Constituents (%) :

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<td>13.66</td>
<td>11.42</td>
<td>11.51</td>
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**Physical Properties**

1. Colour
   - Deep buff.
   - Leaf brown.
   - Light grey.
   - Near light grey.

2. Plasticity by hand feel
   - Good
   - Fair to good
   - Good
   - Good

3. Water of plasticity %
   - 42.76
   - 38.08
   - 42.66
   - 42.33

4. Dry linear shrinkage at 105°C(%)
   - 6.00
   - 4.5
   - 9.0
   - 9.0

5. Liquid limit
   - -
   - -
   - -
   - -

6. Atterberg’s Number
   - -
   - -
   - -
   - -

7. pH
   - 7.10
   - 7.25
   - 4.25
   - 4.20

8. BEC Meq/1100 gm
   - -
   - -
   - 13.02
   - 17.03

9. Fired properties at 900°C

9.1 Fired colour & visual exam.
   - Red colour.
   - Red colour.
   - Near middle stone colour.
   - Near salmon pink colour.
   - Some cracks have developed. No specks are visible.
   - No cracks or specks are visible.
   - No cracks or specks are visible.
   - No cracks or specks are visible.

9.2 Fired linear shrinkage %
   - 11.0
   - 7.00
   - 11.00
   - 11.00

9.3 Water absorption %
   - 30.67
   - 27.86
   - 22.86
   - 22.02

9.4 Vitrification
   - None
   - None
   - None
   - None

10. Fired properties at 1050°C

9.1 Fired colour & visual exam.
   - -
   - -
   - Near light stone. No cracks or specks are visible. Test pieces are slightly bent.
   - Near deep buff colour. No specks are visible. Some cracks are visible.

9.2 Fired linear shrinkage %
   - -
   - -
   - 21.50
   - 21.00

9.3 Water absorption %
   - -
   - -
   - 1.17
   - 1.07

9.4 Vitrification
   - -
   - -
   - Fair
   - Fair

*Note:* These clays can be used for roofing tiles after combination with other clay and other appropriate material as per requirement.
## SIDERITE

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### CHEMICAL COMPOSITION:

**Constituents (%)**:

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**CHEMICAL COMPOSITION**

Constituents (%):

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