# Utilization of clay washery waste of Bageshpura, (Karnataka) India

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**Abstract**

The waste from clay washery plant at Bageshpura (Karnataka) is an excellent source for various grades of silica sands. On an average, more than 60% of the waste is recoverable in the size range of 1.003 mm to 0.177 mm, and after magnetic separation it conforms to the industrial specifications of silica sand for manufacture of various types of glasses.

## Introduction

Bageshpura is a station on Arsikere-Mysore railway line. Here, clay derived from the weathering of Precambrian gneisses is mined and processed in a washing plant situated about a kilometre away from the station. The washery waste serves as a source of silica sand, whose industrial potential is investigated in the present study.

## Determination of silt and clay content

Three samples, each weighing 500 gm, were taken for determination of silt and clay content in the waste. The individual samples were put in separate glass beakers and agitated with two litres of water. After a lapse of 30 seconds of settling time, the upper 10 cm thick layer of supernatent portion was carefully siphoned out and rejected. This procedure was repeated till the supernatent portion remained absolutely clear and devoid of any clay. Finally, the remainder of the sample was dried at 105°C for 24 hours, cooled and weighed. The results obtained are given in Table I, which shows the silt and clay content in the waste is about 4% by weight.

TABLE I

SILT AND CLAY CONTENT IN THE WASTE

| Sample No. | Initial Weight of sample | Weight of washed and dried sample | Weight per cent of silt and clay | Average silt and clay content as weight per cent of waste |
|---|---|---|---|---|
| 1 | 500 g | 481 g | 3.80 | |
| 2 | 500 g | 473 g | 5.40 | 4.07 |
| 3 | 500 g | 485 g | 3.00 | |

## Size analysis of clay-washed samples

The three samples used for determination of silt and clay content were mixed and subsequently coned and quartered to give 1422 gm of samples for size analysis. Remainder was kept for reference. The clay-washed sample was analysed in a column consisting of six sieves of 2.057, 1.003, 0.500, 0.251, 0.177 and 0.124 mm average width of aperture respectively. The actual sieving was done for 15 minutes on a Rotap sieve shaker and the separated fractions were carefully weighed. The results of sieve analysis are given in Table II.

TABLE II

RESULTS OF SIEVE ANALYSIS OF CLAY-WASHED SAMPLE

| Serial Number | Grain size (mm) | Weight of separated fraction | Weight per cent |
|---|---|---|---|
| 1 | > 2.057 | 140 g | 9.85 |
| 2 | 2.057 to 1.003 | 140 g | 9.85 |
| 3 | 1.003 to 0.500 | 320 g | 22.53 |
| 4 | 0.500 to 0.251 | 430 g | 30.28 |
| 5 | 0.251 to 0.177 | 200 g | 14.08 |
| 6 | 0.177 to 0.124 | 70 g | 4.92 |
| 7 | < 0.124 | 120 g | 8.45 |
| Total | | 1420 g | 99.96 |
| Loss during sieving | | 2 g | |

From the results of sieve analysis it can be seen that more than 66% of waste material lies between 1.003 mm to 0.177 mm grain size range.

### Mineralogical composition

Each fraction obtained by sieve analysis was studied for its mineralogical composition with the sole intention of ascertaining the nature of impurities associated with quartz in the waste. Calcite with iron coating, limonite, chlorite, sericite and clay are common impurities. Rock fragments, serpentine and asbestos are present in the size fraction greater than 1.003 mm.

### Magnetic separation of impurities

In order to separate mineral impurities associated with quartz, the various sieve fractions were subjected to magnetic separation on Frantz's Isodynamic Separator. The beneficiated samples were again examined for impurities. Except for clay, all other mineral impurities were removed. The beneficiated sample analysed $SiO_2$ 99.20%, $Al_2O_3$ 0.50%, $CaO + MgO$ 0.21%, total iron 0.04%, alkalies were in traces, titanium and chromium were absent.

It was noted that the alumina content was solely due to the clay impurity which failed to respond to the washing and magnetic separation.

### Results

Grain size and the chemical composition of the beneficiated sand obtained from Bageshpura clay-washery waste has been compared with the various industrial specifications for silica sands in Table III. The specifications are based upon the size and chemical composition of the sand required for different industrial practices (Krishnaswamy, 1972).

TABLE III

VARIOUS INDUSTRIAL SPECIFICATIONS FOR SILICA SAND

| | Size in mm | $SiO_2$% | $Al_2O_3$% | Total Fe% | CaO+ MgO % |
|---|---|---|---|---|---|
| Steel casting sand | 0.152 to 0.104 | 90.00 | 06.00 to 10.00 (Fire clay) | — | — |
| Foundry sand | 0.152 to 0.104 | 97.00 | 3.00 (Fire clay) | — | — |
| Fire brick sand | 0.152 | 98.00 | 0.60 | 0.40 | 0.20 |
| Glass sand | 0.853 to 0.152 | 98.00 to 98.80 | 0.10 to 0.50 | 0.02 to 0.075 | 0.10 to 0.50 |
| Beneficiated Bageshpura sand | 1.003 to 0.177 | 99.20 | 0.50 | 0.04 | 0.21 |

From the above, it can be seen that Bageshpura quartz sands conform to the specifications of glass industry.

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