# Characterisitics Examination of Bentonite Mortar with Replacement of Cement

**K. Anitha, T.P. Meikandaan, M. HemaPriya**

***Abstract:*** ***The experimental investigation on alternate concrete from aged volcanic ash or hydrated aluminium silicate was done by partially replacing bentonite with OPC. Bentonites consist of the fundamental elements of cement like silica, magnesium and calcium. The total assets of bentonite in the country are about 531 million tons bulk of the resource in Tamil Nadu.The partial replacement of bentonite with cement leads to reduction of cement content in concrete mix and furthermore decreases the transfer and contamination issues. Cylinders and cubes were casted and tested for the 7th, 14th and 28th days respectively.10, 20, 30, 40 and 50% replacement of bentonite with cement are done. Slump test are also done to study the workability characteristics of replacement concrete according to Indian standards. Finally the estimation was computed for all the partial replacement of concrete samples of bentonite according to percentage of mix.***

***Keywords – Volcanic ash, Slump test, Aluminium Silicate.***

## I. INTRODUCTION

Concrete is the most broadly utilized man-made construction material available on the world. Its popularity as a construction material is due to its economy, durability, insulation property, thermal property, ability to be mould in to desired shapes and its beauty[1]-[4]. Concrete is defined as the combination of the coarse aggregate, fine aggregate and binding material such as cement or lime with convenient prescribed quantity of water. Here cement is the important component because, cement is binding materialThe carbon-di-oxide emanations go about as a quiet executioner in nature as different structures. In this background, the quest for less expensive substitute to OPC is a needful one. Bentonite is basically high plastic dirt containing at the very least 85% earth mineral. There are two kinds of bentonite in particular, growing sort or sodium bentonite and non-expanding type or calcium bentonite. The business significance of bentonite depends more on its physic-compound properties instead of its substance structure[5]-[8]. Magnificent versatility and lubricity, high dry-holding quality, high shear and compressive quality, low penetrability and low compressibility make bentonite significant.

### A. Propoerties of Bentonite

Bentonite is basically profoundly plastic clay containing at the very least 85% earth mineral, montmorillonite. There are two kinds of bentonites. To be specific, growing sort (or) sodium bentonite and non-expanding type (or) calcium bentonite.Some of the basic properties of this bentonite are tabulated below.

| Type | Non-Swelling Bentonite (Calcium) |
|---|---|
| Specific gravity | 3.60 |
| Bulk density (g/cc) | 0.60 |

**Table – 1 Properties of Bentonite**

| S. no | Chemical name | Results(%) |
|---|---|---|
| 1. | Manganese (Mn) | 0.022 |
| 2. | Calcium (Ca) | 0.197 |
| 3. | Potassium (k) | 0.486 |
| 4. | Phosphorus (P) | 0.136 |
| 5. | Titanium (Ti) | 1.803 |
| 6. | Iron (Fe) | 4.759 |
| 7. | Silica (Si) | 16.210 |
| 8. | Aluminum (Al) | 5.752 |

**Table – 2 Chemical compositions of Bentonite**

## II. EXPERIMENTAL RESULTS

### A. Object of Testing

For normal concrete, fine aggregates and cement were weighed and blended altogether; the ,coarse aggregate was then added and blended in with the above mentioned samples. The necessary measure of water was added and blended completely to get a uniform solid mass, and finally concrete is compacted by hand compaction according to Indian Standards techniques[9]-[11]. For setting up the cylinder and cube concrete samples, steel moulds of standard size were utilized. The fresh concrete was then poured into the respective moulds with utmost care and proper compaction should be done. After 24 hours all moulds should be de moulded and kept for curing. Then according to IS 456:2000 code all samples were tested on 7th,14th and 28th day. The following samples were casted with bentonite replaced concrete sample

1. 18 No's of cube sample size 150mm x 150mm x 150mm were casted utilizing M20 grade concrete. Concrete samples with ordinary Portland cement
2. were utilized for the study of compressive strength of bentonite replaced concrete sample.

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3. 6 Nos. of cylinder concrete sample of size 150mm x 300mm were casted for the study of split tensile strength test of bentonite replaced concrete sample

4. OPC was replaced with bentonite powder at 10%, 20%, 30%, 40% and 50%.

**Figure – 1 Sample Specimens**

## III. RESULT AND DISCUSSION

Various properties of concrete incorporating bentonite at various replacement levels with fine aggregate levels were studied; results were compared and checked for compressive strength, of bentonite mix with ordinary mix. Test results were compared and shown in below table 3[12]-[13]

| Normal concrete M20 | | | With Bentonite (30 % added) | | | With Bentonite (30 % added) 7 days | | | With Bentonite (30 % added) 14 days | | | With Bentonite (30 % added) 28 days | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 14 | 28 | 7 | 14 | 28 | 50 °c | 75 °c | 100 °c | 50 °c | 75 °c | 100 °c | 50 °c | 75 °c | 100 °c |
| 4.38 | 17.19 | 21.94 | 13.91 | 17.12 | 22.87 | 14.42 | 14.12 | 13.97 | 16.75 | 16.42 | 16.05 | 14.38 | 17.19 | 21.94 |

**Table 3 – Comparison of compression strength for M20 Concrete**

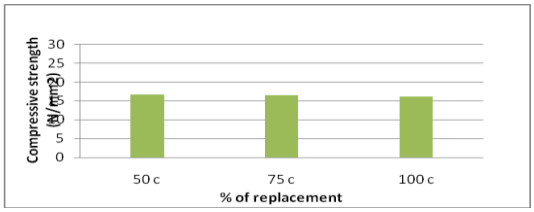


**Figure – 2 Compressive Strength Results**

## IV. CONCLUSION

Based on the limited experimental investigation on the compressive and split tensile strength of concrete, the following observations are made regarding the resistance of partially replaced bentonite powder. From the experimental study, replacement of cement with bentonite powder at 30% gives maximum strength and it is most economical one compared to normal concrete. Utilization of cement is reduced while using bentonite powder. Environmental effects due to the cement manufacturing are reduced through this project[30]-[34]. The mixture of Cement and bentonite is extremely versatile material and make an immense contribution to construction processes such as cut-off walls, permeation grouting, jet grouting, borehole sealing etc. The compression strength increases for added 30% bentonite, compare to nominal concrete 7, 14, & 28 days. The compression strength decreases for added 30% Bentonite concrete cube at 500 C, 750 C, & 1000 C.

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