Abstract

The present paper represents the result of an experimental study handled with developed colloidal grout material. These experimental study found the difference of strength of normal proportional base concrete and colloidal concrete by using mixer. All grout types were prepared with the same water/cement ratio. Mixer which makes the colloidal grout is of 1200 watt. Hence it revolves around 500-550 rpm and makes grout colloidal. While in other side grout made by hand mixing procedure but found not effective as colloidal. The result showed that colloidal grout which is made by mixer has more compressive strength as compare to traditional hand mixing procedure. All the strength test of colgrout and simple grout exhibited till 3 days and 7 days of curing time. Compressive strength obtained by the colgrout by using mixer was found 82 KN/m², 10.9KN/m² for 3 and 7 days of curing period respectively. And compressive strength obtain by hand mixing grout was found 56KN/m², 78KN/m² for 3 and 7 days of curing period respectively.

Key Words: Colgrout, Compressive Strength, Colcrete Mixer, Curing and Grout

1. Introduction

This section presents the introductory contents related to the subject of Seminar. Firstly, it discusses the basics and then its various details.

1.1 General

Colgrout is colloidal grout is mortar mix grout whose solid particles are in a fixed suspension. Colcrete is nothing but the Colloidal Concrete. Colloidal concrete means concrete that is mix of aggregates and colloidal grout.

In other words we can say concrete whose aggregate is bound by colloidal grout. Colloidal concrete is differ from ordinary concrete in many significant ways.

The solution consists of Portland cement, sand, water and cement hydration (Al-Adili et al. 2015). A mobile injection binds or strengthens the soil to prevent water entering or any damage after excavation.

In its initial phase of flow it exhibit great density and adhesiveness. Due to this tough and sticky consistency allow for a longer working period for the mixture to flow effectively into a desire placement location. The formula also provides a much greater degree of self compression and compacting during the curing phase.

It is used mainly to improve soil, for example, walls of curtain dam using the methods of jet grinding to repair the crack of stone walls or for pre-installed concrete mixtures.

The main characteristic of colgrout is bleeding, setting time, strength, and viscosity.

With the name of colgrout we also used mixer called as paint mixer to the mix the grout that means we perform experiment for preparation of grout and colgrout by using mixer which having the power of 1200 watt and 500-550 rpm hence it mix grout and make it as a colloidal grout (colgrout)

That mixer gives well mix concrete and grout as compare to traditional hand mix.

A colgrout is one that satisfies the requirement of durability and durability, and at the same time is impermeable, especially suitable for keeping water in the Indian environment.

2. Literature Survey

Yuo et al studied that the compressive strength of the colloidal solution decreased after 7 days due to the cracking of the surface due to self-lowering of shrinkage as a result of evaporation of water.

Lam et al. Studied the strong effect of SF and FA with different ratios w/c. According to their findings, 15% SF and 25% FA substitution significantly increased the compressive strength in the solution at the end of the 28 days.

Tang et al. (2005) investigated the effects of bentonite, ash and respiratory zone on bleeding using the Taguchi method, and found that silica distillate is the most effective supplement among these supplements to reduce bleeding.
Shanag provided 26% strength, increasing 15% of pozzolan and 15% of SF after 28 days. It was established that the compressive strength of concrete without CΦ is lower than the compressive strength of concrete SF for mixtures with the ratio w / c 0,35.

In 1992, as Kriszek, and others. and Liao and softed. carried out experimental studies using a solution with a mixture of thin cement and sodium silicate, found that the compression force increased due to the cured solution

According to the requirements of the standard IS 269: 1989, the specification for ordinary Portland cement of grade 33 is given by: - ordinary portland cement, portland cement, slag cement, Portland Putsolon cement and sulphated cement used for the operation of colorine masonry in dams. A on IS 2116: 1980 The specification for sand for masonry mortars is used.

3. Theoretical Aspect

This section presents the introductory contents related to the subject of Seminar. Firstly, it discusses the basics and then the different possible systems.

1.1 About of Mixer

Paint mixer consists of a high torque motor with a robust gear box, with electronically variable continuously variable speed. So that different speeds and power output can be selected for different viscosity materials, due to this speed control. There is no splashing of the fluid

It also use for mixing putty, cement & concrete

This machine as shown in fig. 1 having power of 1200w/120v/50hz ,height of machine blade is 550 mm also its speed is 580 rpm hence it mixes the concrete mix faster.

![Fig. 1 : Mixer used](image)

Method of Operation

First of all we have to mix the cement, aggregate, fly ash, water, sand in certain proportion in any container then tend paint mixer in that mix and start the machine by giving it electric supply, Computes amounts and weights of water ,and other contained required from standard formula, and pours the specified amounts water into mix .Starts mixer and allows it to run for prescribed time to attain better mix and then after stop machine .

3.2 Characteristics of Grout Mixture

There are four main characteristics for a grout mixture including bleeding, setting time, strength, and viscosity. The main characteristics for cement-based grouts by which the efficiency of a grout is examined can be mentioned as follow (Azadi et al., 2017)

- Bleeding: The appearance of water on the surface of grout after it has consolidated is known as bleeding. It is the form of segregation in which the layer of water migrates to the surface of grout during the initial stage of cement hydration process.

- Initial setting time: Setting is the stiffening of the cement paste after water is mixed. The time at which cement paste loses its plasticity is called as initial setting time or the time when the cement water paste attains a certain degree of hardness. For OPC, it should not be less than 30 minutes. Rapid setting time is often desirable when injection is under water table so that the grout will set before being excessively diluted or washed away.

- Compressive strength: It is the capacity of material or structure to withstand loads tending to reduce its size. It is the resistance of a material to breaking under compression. This test is performed to know how much compressive load a material can bear or resist. In some grouting projects, however, especially those in connection with water control, strength is not of much importance.

3.3 Priority of Grout Characteristics

It is important to note that the priority of importance between the above-mentioned characteristics is first belonged to bleeding, second to setting time, third to strength i.e. compressive strength, and finally to viscosity. The reason for this fact is that one may build a grout mixture with noticeable strength but not acceptable bleeding or setting time. Therefore, apart from the high strength, the grout mixture cannot be considered. Besides, there are some projects with only purpose of sealing. (Azadi et al., 2017)

4. Material and Methodology

This section presents the material needed for the experiment and process to perform the experiment. From the research papers study, the effects of many admixtures on grout through the researcher's experimental study are discussed below.

4.1 Materials used in the experiment:

1.1 Material

- cement - ordinary portland cement, portland cement, slag, portland
The cement of Pozzolon and Supersulphated cement used to work with paintbrushes, dams and other massive structures must meet the requirements of IP: 269-1976, IC: 455, IP: 1489-1976 and IP: 6909, respectively. Special cements can also be defined for use in the dam.

- **Mineral mixture:** Fly Ash
- **Water:** water used for mixing the solution, and also for washing the stone and the treatment masonry must meet the requirements of IC 456.
- **Sand:** Sand should comply with IS 2116: 1965 and IS 383: 1970 standards.

### 4.2 When mixer is used to create grout

#### Preparation of Grouting Mixture using mixer:

The color solution consists of cement, sand, water and other approved impurities mixed in proportions that can be determined by weight. The proportions of the materials entering the solution should be based on laboratory studies. The moisture content of the sand should be taken into account in proportion to the mixture. The subtlety of the sand should be from 2.6 to 3.0. Posolanical material can also be mixed, the solution is mixed in a large container.

![Fig. 2: Preparation of Grouting Mixture using mixer](image)

The minimum mixing time is usually indicated as follows:

Mixing of cement and water as shown in the fig. no. 3 in the first container - 30 to 50 seconds. Mixing of cement slurry and sands in a container - from 80 to 100 seconds. The total time for a single mixture of colostrum solution - from 100 to 130 seconds.

#### 4.3 When mixer is not used to create grout

Preparation of Grouting Mixture by Hand mix: The color solution consists of cement, sand, water and other approved impurities mixed in proportions that can be determined by weight. The proportions of the materials entering the solution should be based on laboratory studies. The moisture content of the sand should be taken into account in proportion to the mixture. The subtlety of the sand should be from 2.6 to 3.0. Posolanical material can also be mixed, the solution is mixed in a large container. The mixer is not used to mix the blended mixture. Preparation of the mixture using traditional hand mixing.

![Figure 3- Preparation of Grouting Mixture using Hand mixing method](image)

### 1.1 Methodology

The grout was prepared as shown in the fig. no. 4 by using mineral admixture i.e. Fly Ash (FA) in 34% by the weight of cement and adding water in it with W/C ratio of 0.4. Those prepared grouting mixtures were filled in mould of 150mmx150mmx150mm and put it for 24 hours in mould for drying, then was taken out from mould after 24 hours and put them for curing. With three different types of grouting mixtures and three different curing times i.e. 3 days, 7 days and 28 days compressive strength of grouting mixtures were determined.

There is ratio of 1:2:4 of Cement, Sand, Aggregate is used For 250 g of cement, 500 g of sand of size 2.36 mm, 1 kg of aggregate of size 6 mm is used to create single mould of grout and water contained is taken as 12% in it.
5. Testing

Compressive strength test was performed in this study. Their description is as follows.

5.1 Compressive Strength Test

150mmx150mmx150mm cubic specimens were cast for each grout mixtures type and compressive strength tests were conducted using these specimens. A digital compression testing machine was used for compressive strength testing. The load was constantly applied without shock until failure and the load present on the grout cube at the time of failure was noted down. That load was considered as the compressive strength of that grouting mixture cube. Compressive strength grouting mixtures for 3 days, 7 days and 28 days were taken.

6. Testing Results

6.1 Testing Results of Grout:

The test specimens of compressive strength were tested after 3, 7, 28 days of curing times.

Compressive Strength results of both grouts i.e. using mixer and hand mix method were found with the help of Digital Compression Testing Machine. Results are in the table below.

Table 1

| Sr. No. | Grout  | Compressive Strength in N/m² |
|---------|-------|-----------------------------|
|         |       | 3 days curing | Average | 7 days curing | Average | 28 days curing | Average |
| 1.      | Using mixer | 8.1          | 8.2     | 9.8           | 10.9    | 14.5           |
|         |        | 8.4          | 10.9    | 15.2          | 14.7    |
| 2.      | Hand mixing | 5.0         | 5.6     | 8.2           | 7.78    | 9.6            | 10.1    |
|         |        | 5.6          | 7.2     | 10.2          |
|         |        | 6.2          | 7.9     | 10.1          |

6.2 Testing Results of cement test

Table 2

| Sr. No | Time min | Initial Reading | Final Reading | Sett. Of Needle | Penetration mm |
|--------|----------|-----------------|---------------|-----------------|----------------|
| 1      | 10       | 46              | 8             | 37              |                |
| 2      | 20       | 46              | 10            | 36              | 35             |
| 3      | 30       | 46              | 11            | 34              |                |
| 4      | 40       | 46              | 12            | 33              |                |

6.3 Testing results of sand

Table 3

| Sr. No | % Water | Height (h1) | Height (h2) | % Bulking |
|--------|---------|-------------|-------------|----------|
| 1      | 4       | 12.9        | 13.9        | 7.75     |
| 2      | 6       | 11.9        | 13.9        | 16.80    |
| 3      | 10      | 11.7        | 13.9        | 18.83    |

7. Discussion and Conclusion

- In hand mixing the does not proper give proper mix because it contains pores in it
- In use of paint mixer gives a proper mix because it does not contains pore in it
- Hence The compressive strength obtained by the grout mixture prepared by using mixer having more strength as compare to mixed by hand mixing method.
- We can conclude that the mineral admixtures can be used for high-strength and low cost grout in tunneling applications. In addition, the use of waste materials can contribute to the resolution of environmental problems
- Also by preparing colgrout we also conclude that it is much durable and strengthening as compare to other grouts and concrete hence it is beneficial for water retaining structures

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