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Study of Concrete by Using Bacteria and Flyash

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ABSTRACT: In this project we have studied about bacterial concrete. Crack formation in concrete are common in concrete structure. The cracks reduces the strength and durability of the concrete structure. And repairing of cracks are very expensive now a days. Therefore self-healing concrete is very necessary to repair those cracks in concrete.

KEYWORDS: Bacterial concrete, Conventional concrete, Self-healing concrete, Bacillus Subtilies, Compressive strength, Split tensile strength, Flexural strength, and Water absorption.

I. INTRODUCTION

1.1 Overview

Concrete is one of the major component in construction industry and it is easily available.It is convenient to cast the concrete. Concrete has high compressive strength and low tensile strength due to this it fails in tension. Repairing of these cracks is very essential but difficult and also time consuming process .Bacterial concrete is also known as self-healing concrete , it secrets lime when it gets activated which heals the cracks in concrete. When water enters through the cracks, it reacts with bacteria to form a calcium carbonate precipitate, which they makes a free concrete. Bacteria concrete is better than normal conventional concrete. This reduces the cost of repairing of concrete and time consumption for that.

1.2 BACTERIAL CONCRETE

Bacterial concrete is also known as self-healing concrete. Bacteria are classified in so many types such as Bacillus globigii, Bacillus natto, etc. but the most widely used bacteria is Bacteria Subtilies which are commonly used in construction, etc. The original named of bacteria is Vibrosubtilies in 1835 but this bacteria is renamed Bacillus Subtilies in 1872. The characteristics of bacillus subtilies having a gram positive, rod shaped structure and aerobic, spore forming microorganism. Bacillus subtilies are also used in concrete blocks to heal the cracks in concrete or self-healing concrete.When cracks form in concrete,the bacteria removes the cracks from concrete by calcium carbonate precipitation.Calcium carbonate are relatively dense and can block the cracks. That's why bacterial concrete is better than normal conventional concrete.

1.3 Types Of Bacteria Used In Concrete:

Various types of bacteria which are used in construction purposes are as follows:

- Bacillus Subtilies
- Bacillus Cohni
- Bacillus Pseudofirms
- Escherichia Coli
- Bacillus Halodurans

1.4 Advantages Of Bacterial Concrete:

1. Bacterial concrete are harmless to human life.
2. The expected time over of concrete structure is 200 years.
3. In bacterial concrete it increases the compressive strength and flexural strength of concrete as compared to normal conventional concrete.
4. The maintenance cost of bacterial concrete is very low.
5. In bacterial concrete the water absorption is very lower than normal conventional concrete.
6. It repairs cracks without any external aide.
7. It also improves the durability of concrete as compared to normal conventional concrete.
8. Fly ash gives good work ability, durability in a concrete.

1.5 MATERIALS

1. **CEMENT:** Cement is a material which is widely used in construction purposes.Cement is mainly depend upon following factors such as Shrinkage Ratio, Fineness of cement, Work Ability of cement, etc. In this paper we are using Ordinary Portland Cement (OPC).There was only one grade of Ordinary Portland Cement which is governed by IS 269-

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1967.The Ordinary Portland Cement are mainly classified into three grades such as 33 grade, 43 grade, 53 grade. This grades are depend upon the strength of the cement. If the 28 days strength is not less than 33 N/mm^2 is called 33 grade cement .If the strength is not less than 43 N/mm^2, is called 43 grade cement. If the strength is not less than 53 N/mm^2, it is called as 53 grade of cement.

2. **FINE AGGREGATE:** The most essential ingredient in concrete is fine aggregate, they are consists a crushed stone or natural sand. Fine aggregates are naturally available. The crushed stone and natural sand consists a particles that are ¼" or smaller. If we select the fine aggregate on the basis of grading zone, abrasion, absorption, and surface moisture then the mixture of concrete gets become stronger and cheaper and more durable. It also effect the significant impact on the shrinkage of the concrete, hardening properties in the quality of fine aggregates.

3. **COARSEAGGREGATE:** Coarse aggregate is one of the most important and widely used building material in construction world.Coarse aggregate are used in various projects such as railway tracks, buildings, etc. Therefore coarse aggregate is important part in construction field. Shape of coarse aggregates are mainly classified in three types such as round, irregular shape, angular. The aggregate which will get retained on the 4.75mm sieve or the aggregate which have size more than 4.75mm are known as coarse aggregate.

4. **FLY ASH:** Fly ash is a fine grey powder having a diameter from 0.5 to 300 micro meter. The main components which are present in fly ash is Silicon dioxide, Aluminum oxide, Ferric oxide and oxacalcium. Fly ash is a heterogenous material and it is also known as coal combustion residuals (CCR). It is genrated in steam generating plant. Fly ash used in various construction projects because it gives us increasing lifespan and improve the durability of concrete roads.

5. **WATER:** Water is one of the most plentiful and important ingredient in concrete. Because it has an ability to dissolve the other substances. While mixing the concrete,the water should be clean and free from organic materials, etc. If the harmful impurities are present in water then we will not get requires result. Generally normal water is used for construction. Therefore clean and clear water is quite suitable for construction work.

II. METHODOLOGY

The following steps are involve for producing a Bacterial Concrete. The steps are classified in two parts:

1) Preparation of test specimens.
2) Preparation of conventional concrete.

A. Preparation of test specimens:

In this study around 24 specimenwere casted. 12 cubes of size are 150*150*150mm. Here we use M50 grade of mix ratio 1:0.82:2.5:0.45. The rate of bacillus subtilis is 10ml,20ml,30ml were added. The materials which are used in this specimens are Ordinary Portland Cement of 53 grade, coarse aggregate of 20mmsize, water which are specify in IS 456:2000 were used to prepare a concrete mixture ,fine aggregate passing through 4.75mm sieve. Depending on the qualities of ingredients the quantities of fly ash were added like 30%, 40%, 50%. After concrete were prepared the specimens were casted for 24 hours and dried specimens were then cured for 7 days, 14 days, and 28days. By compression testing machine the compressive test was performed and flexural strength was conducted by flexural strength testing machine. The test were carried as per Indian Standards.

B. Preparation of conventional concrete:

While preparing bacterial concrete cubes we also prepared for conventional concrete in parallel way. We prepared the normal conventional concrete cubes just to see the different result between bacterial concrete and normal conventional concrete. Preparation of cubes is similar to bacterial concrete but the little difference is we are not adding bacteria in normal conventional concrete. These are some of the steps while preparing the normal conventional concrete specimens: Mix the cement, sand aggregate, coarse aggregate manually. For mixing add some water in it. After that place the mold and fill it in three layers. Using tamping rod,compact each layer with 25 strokes and smoothen it with a trowel. At the end we can see that we will get better result of bacteria concrete as compared to normal conventional concrete.

III. FUTURE SCOPE

1. It can be reduce the more cost of bacterial concrete.
2. It require the limitations of study through the bacillus subtilies bacteria.
3. Minimum works should be done or the long time which can be effect the bacteria on human life.
4. The aircraft runway bridges and dams constructions should be done to reduces the highly maintenance cost.
5. The bacterial concrete should be done in residential building of hospital, hotels and it also constructed the road.
6. Investigations should be done to study the strength of material, strength of durability, shear strength, tensile strength to form bacterial concrete with fly ash.
7. The cracks can be prevent in concrete which can be used in large scale to constructed with increasing durability.

IV. RESULT

1. We are expecting higher compressive strength and flexural strength in bacteria concrete as compared to normal conventional concrete.
2. By using fly ash in bacterial concrete is also increases impermeability and thereby increase the compressive strength of concrete.
3. It is also observed that by adding bacteria in concrete it will significantly increase in tensile strength.
4. And by increase in tensile strength it also observed that bacterial concrete showed more strength than normal conventional concrete.

V. CONCLUSIONS

1. When we introduce bacteria in concrete the compressive strength of bacterial concrete start increasing as compared to normal conventional concrete.
2. By adding fly ash in concrete we will get higher compressive strength in bacterial concrete.
3. By using water absorption test we conclude that we will got better result in bacterial concrete as compared to normal conventional concrete.
4. Due to presence of bacteria in concrete it improves the durability and strength of concrete.
5. By mechanism of bacteria, we can clearly notice that we will get higher strength in concrete by increasing the about of bacterial concrete.

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