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Review Paper on Strength Analysis of different grades of concrete by using bacterial.

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ABSTRACT: Civil Engineering Is Branch Of Engineering Which Deals With Design,Construction And Maintenance Of Structures. Through this project we had studied as well as analyzed the strength of different grades of concrete with the adding sum admixtures/bacterias Into concrete to increase the strength of concrete.We had also studied about bacterias used in concrete for making concrete self healing or for increase the strength of concrete.

Moto of this project is to analyse the strength of different grades of concrete by adding sum bacterias .

KEYWORDS: Self healing,bacterias,

I. INTRODUCTION

Cement concrete is usually construction material as it takes high compressive load and it is used for the for the development of infrastructure of country. Concrete is posses the property of brittleness and subjected to cracks under the tensile as well as shear stresses. cracks under sustained loading, freezing thaw action and shrinkage leads to cracks in concrete. Due to the cracks, water and gases can easily enter inside the concrete and comes in contact with reinforcement provided and leads to corrosion of reinforcement bars. Which decreases the strength as well as durability of concrete. therefore its suitable mechanism for repairing of concrete. Repairing of cracks formed in concrete structures is time consuming process and expensive . Old method of cracks repairing involves impregnation of cracks with application of cement mortar, epoxy based fillers as well as chemical grouting. But in these conventional process hadrised the chance of thermal expansion as well as environmental issues. new concept is by incorporating self healing mechanism which is seen in nature of concrete elements. A recently new technique is used with the help of Microbiologically Induced Calcite or Calcium Carbonate (CaCO3) Precipitation (MICP) based on concept of bio-mineralization. By addition of the bacteria in concrete, it produces calcium carbonate crystals which stop the micro cracks and pores in the concrete.

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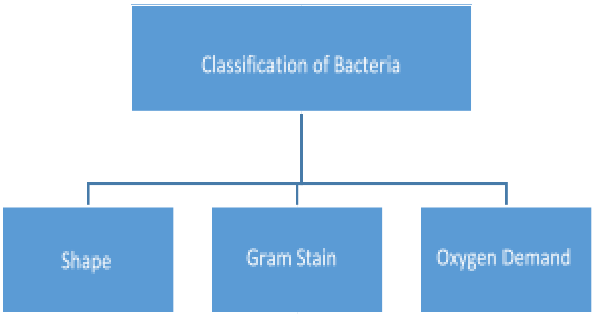


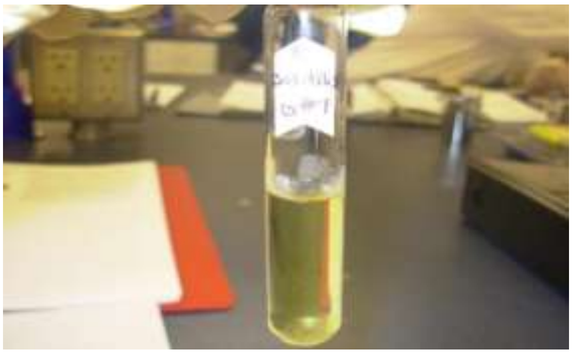
Various Forms Of Bacterias Used In Concrete:

- **Bacillus Subtilis**
- **Bacillus Sphaericus**
- **Bacillus pasteurii**
- **Escherichia coli**

Bacillus subtilis:

Bacillus subtilis is an Gram-positive bacteria, rod-shaped as well as catalase-positive. It was named Vibrio subtilis by Christian Gottfried Ehrenberg and afterwards renamed Bacillus subtilis by Ferdinand Cohn in 1872 (subtilis being the Latin for 'fine'). B. subtilis cells are typically rod-shaped, and are about 4-10 micro meters long and 0.25–1.0 mm in diameter, with a cell volume of about 4.6 at stationary phaseAs with other members of the genus Bacillus, it can form an endospore, to survive extreme environmental conditions of temperature and desiccation.subtilis is a facultative anaerobeand had been considered as an obligate aerobe until 1998. B. subtilis is heavily flagellated, which gives it the ability to move quickly in liquids. B. subtilis has proved amenable to genetic manipulation, and has been adopted in high percentage as a model organism for laboratorical studies, specially of sporulation, which is a simple example of cellular differentiation. In terms of popularity as a laboratory model organism, subtilis is often considered as the Gram-positive equivalent of Escherichia coli, an extensively studied Gram negative bacterium

1)Bacillus subtilis is also called as the grass bacillus.
2)It is a common soil bacterium.
3)Bacillus subtilis is a model laboratory bacterium,
4)which can produce calcite precipitates on suitable media supplemented with a calcium source.
5)Bacillus subtilis is used to induce CaCO3 precipitation at a faster rate.



Bacillus Subtilis

II. LITERATURE SURVEY

Bacterial Concrete

PawarBhagyashri, Magdum Archana, Bhosale Megh, Pol Sayali

When the loads is applied on any structures cracks inconcrete are formed which allow water and other chemicals toenter thus making it vulnerable which leads to unwanted corrosion of the steel reinforcement and deterioration of concrete structure. For these project we use M25 grade of concrete because of its superior properties. As mentioned above in cases like this where there is a formation of cracks there is an acute need of Self-healing concrete to achieve this weadded BACILLUS SUBTILLUS which is a GRAM POSITIVE bacterium to the mixture. Along with this bacteria concrete mixture we use chemical compound CALCIUM LACTATE ($C_6H_{10}CaO_6$) which is used to activate the healing procedure.

Bacterial Concrete- A Sustainable Solution for sustainable development

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Shubham Ajay Puranik, Siddharth Jain, G. Sritam, SayaliSandbhor

Cracks formed in concrete are inescapable and are one of the major reasons for the weaknesses of concrete. Majorly water with other components penetrate by these cracks results in corrosion thereby reduce the strength of concrete directly hamperdits life. The objective of present research work is to promote sustainable development and to identify sustainable materials for treating cracks formed in concrete. Various researches have shown positive results by adding calcite precipitating bacteria in concrete, also known as bacterial concrete or self-healing concrete. Various researches have shown positive results by adding calcite precipitating bacteria in concrete, also known as bacterial concrete or self-healing concrete. This research is dedicated to check the suitability of mixing these self-healing calcite depositing bacteria with concrete in order to increase the compressive strength of concrete, reduce its permeability and seepage of water by bio-mineralization process. Substantial increase in strength is observed in concrete specimens when casted with bacterial solution. The study has devised methods or ways to test the effect of use of bacteria in concrete. Results have been compared with conventional concrete. Biological modifications of construction materials are the need of the hour for strength improvement and long term sustainability. The study propose a promising sustainable repairing method for concrete.

Bacterial Concrete as a Sustainable Building Material?

Elz˙bietaStanaszek-Tomal

The selection of construction materials plays an important role while designing a building to definition of sustainable development. the most commonly used construction materials is concrete. Its production cause a high energy burden on the environment. Concrete is susceptible to external factors. As a result, cracks formed in the material. Achieve its durability with the assumptions of sustainable construction means, there is a need to use an environmental friendly and effective technique of alternative crack remedial into the damaged material. Bacterial concrete reduces costs in terms of detection of damage and maintenance of concrete structures, thus ensure a safety lifetime of the structure. Bacterial concrete improve its durability. However, it is not currently used on big scale . Many research units try to reduce production costs through various methods; however, bacterial concrete can be an effective response to sustainability.

Exploratory Research using Bacteria (Bacillus Subtilis) as a Self-Healing Concrete:

A Basis for Strengthening Infrastructure in the Philippine Setting

Lagazo, Magil A., Noriesta, Carla Pamela D., Montecalvo, Marlou A., Roselle P. Alviar-Adviser

This study demonstrates that the utilization of microorganisms-Bacillus Subtlis is productive for development a tough framework and put forth a concentrated effort mending concrete as strategy for break control to upgrade administration life in solid structure. In this paper, the system Microbiologically Induced Calcite Precipitation (MICP) is embraced. It is the utilization of Bacillus Subtilis alongside its nutrients which is the

Sodium Bicarbonate (NaHCo3), Ammonium Carbonate (NH4Cl), Calcium Chloride Dehydrate (CaCl2), and nutrient broth. The mixing proporton used is 1:2 ½: 5:0.45 along with 30 ml liquid form of Bacillus Subtilis with the cell concentration of 105 cells/ml. The strength of concrete mix is evaluated by conducting test on 150mm x 150mm x 150mm cube for compressive strength test, 6in x 12in cylindrical mold for split tensile strength test, 21in x 6in x 6in rectangular beams for flexural strength text and 3in x 6in for water absorption test, 3 specimens each test. All specimen utilized for recuperating is 4in x 2in x 2in which is deliberately broken. The investigation demonstrates that there is a noteworthy increment in the quality of cement added with bacteria or bacterial concrete contrasted with conventional concrete and in this manner calcium carbonate precipitation is obvious following 3-4 weeks in small scale splits.

III.METHODOLOGY

The methodology of the work starts from the study of preparation of material which is to be used for casting A total of 24 concrete block were tested . All the specimens are then cured in water for 7 days and 14 days 28 days before testing.. Specimen preparation for compressive strength test was performed with the help of cube steel moulds of size 0.15x0.15x0.15mm. The specimens were cast in three layers; each layer being tamped with 25 strokes of the tamping rod spread uniformly over the cross section of the mould. The top of each mould was smoothened and leveled and the outside surfaces cleaned. The moulds and their contents were kept in the curing room at temperature and relative humidity 90% for 24hours. De-molding of the cubes took place after 24hours and the specimens were transferred into water bath in the curing room. Compressive strength was determined at curing age 7 &14 days 28 days. The compressive strength was determined using compression machine.

A mix of M15 and M20 designed using locally available materials. Ordinary Portland cement of 53 grade with standard consistency of 30%. Fine aggregate confirming to IS: 3831970 with 2.42 specific gravity and coarse aggregate of 20 mm size, 0.55% water absorption and specific gravity of 2.78 used for preparation of concrete specimens. Microorganism of Bacillus subtilis is cultured and is added to the water during mixing of concrete in three different concentrations like 15ml, 30ml and 45ml.

M15 and M20 grade mix design is used for the specimens.

IV.MIX DESIGN

Size of Mould: 0.15 X 0.15 X 0.15m^3

Grades of Concrete: M15 (1:2:4) & M20 (1:1.5:3)

Density of Cement: 1440 kg/m^3

Density of fine aggregate: 1600 kg/m^3

Density of Coarse aggregate: 1800 kg/m^3

Dry volume: 1.54

Volume of Block: 0.15 x 0.15 x 0.15

= 0.003375m^3

Total Volume of Block: Volume of block x Dry volume

= 0.003375 x 1.54

=**0.0051975m^3**

Mix design for M15 grade concrete:

Proportion of M15 grade concrete: 1:2:4

Water cement ratio: 0.4

Volume of cement:

= (volume of block/sum of mix proportion) x density of cement x one part of cement.

= (0.0051975/7) x 1440 x 1

= **1.0692 kg**

Volume of fine aggregate:

= (volume of block/sum of mix proportion) **x** density of fine aggregate **x** proportion of fine aggregate.

= (0.0051975/7) x 1600 x 2

= 2.376 kg

Volume of coarse aggregate:

= (volume of block/sum of mix proportion) **x** density of coarse aggregate **x** proportion of coarse aggregate.

= (0.0051975/7) x 1800 x 4

= **5.346 kg**

Mix design for M20 grade concrete:

Proportion of M20 grade concrete: 1:1.5:3

Water cement ratio: 0.45

Volume of cement:

= (volume of block/sum of mix proportion) x density of cement x one part of cement.

= (0.0051975/5.5) x 1440 x 1

= **1.360 kg**

Volume of fine aggregate:

= (volume of block/sum of mix proportion) x density of fine aggregate x proportion of fine aggregate.

= (0.0051975/5.5) x 1600 x 1.5

= **2.268 kg**

Volume of coarse aggregate:

= (volume of block/sum of mix proportion) x density of coarse aggregate x proportion of coarse aggregate.

= (0.0051975/5.5) x 1800 x 3

= **5.103 kg**

V.EXPERIMENTAL PROCEDURE

Preparation of 24 concete cubes in which 12 concrete cubes of M15 grade and remaining 12 concrete cubes of M20 grade.

For M15 Grade concrete cube:

1.Prepared M15 grade concrete.
2.After preparation of concrete, prepared a concrete cube by the procedure.
3.Added 15ml,30ml,45ml of bacterial specimen for each cube.
4.Total no of cubes- 12 in which,
5.Normal concrete cube- 4
6.Bacterial concrete cube- 8
7.Kept all cubes in a curing tank for curing.
8.After the curing period of 7 days taken one sample of each type for compressive strength test.
9.Conduct the compressive strength test by the procedure.
10.Same was done for curing period of 14 days and 28 days

For M20 Grade concrete cube:

1.Prepared M20 grade concrete.
2.After preparation of concrete, prepared a concrete cube by the procedure (refer-5.2.3)
3.Added 15ml,30ml,45ml of bacterial specimen for each cube.
4.Total no of cubes- 12 in which,
5.Normal concrete cube- 4
6.Bacterial concrete cube- 8
7.Kept all cubes in a curing tank for curing.
8.After the curing period of 7 days taken one sampl of each type for compressive strength test.
9.Conducted the compressive strength test by the procedure
10.Same was done for curing period of 14 days and 28 days

•Then analysed the compressive strength of both grades of bacterial concrete cubes.

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VI.APPLICATIONS

From enhancement in durability of cementious materials to improvement in sand properties, from repair of limestone monuments, sealing of concrete cracks to highly durable bricks, microbial concrete has been successful in one and all.

1.This new technology can provide ways for low cost and durable roads.

2.High strength buildings with more bearing capacity.

3.Long lasting river bank.

4.Erosion prevention of loose sands.

5.Low cost durable housing.

VII.ADVANTAGES & DISADVANTAGES

Advantages of Bacterial Concrete:

1.It helps in crack remediation.

2.Better resistance towards freeze-thaw attack reduction.

3.Improvement in compressive strength of concrete.

4.Reduction in permeability of concrete.

5.Reduction in corrosion of reinforced concrete.

6.This could be particularly useful in earthquake zones where hundreds of buildings have to be flattened because there is currently no easy way of repairing the cracks and make them structurally sound.

7.Fills the crack in an efficient period of time so that the life period of a concrete structure can be expected over 200 years.

8.Prevents the use of cement in future used as a maintenance structure by drilling and grouting process so in this way less use of cement can be seen.

9.As we know more of cement content more will be carbon dioxide gases released causing global warming effecting the ozone layer. By using this bacteria the structure does not need to be repaired except for the less cases and so results in less use of cement.

10.Bacillus bacteria are harmless to human life and hence it can be used effectively.

Disadvantages of Bacterial Concrete:

1.Cost of bacterial concrete is double than conventional concrete.

2.Growth of bacteria is not good in any atmosphere and media.

3.The clay pellets holding the self-healing agent comprise 20% of the volume of the concrete. This may become a shear zone or fault zone in the concrete.

4.Design of mix concrete with bacteria here is not available any IS code or other code.

5.Investigation of calcite precipitate is costly.

VI.CONCLUSION

Through various reviews ,literature survey its observed that after the addition of bacteria into concrete, there is change intoproperties of concrete which leads to make concrete self healed.

Compressive quality was impressively expanded as the period of solid increments.

Durability of bacterial concrete is more than normal concrete.

The bacterial concrete has less weight and strength loss than the Ordinary Portland cement concrete without microorganism.

Bacterial specimen is not easily available in local market.

Bacterial concrete is costly to prepare as compare to normal concrete, but it is economical as looking towards strength.

Bacterial concrete has the ability of the cracks remediation.

Bacteria reduces permeability of concrete.

Bacillus bacteria are harmless to human life and hence it can be used effectively.

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