International Journal of Advances in Engineering and Management (IJAEM)
Volume 5, Issue 4 April 2023, pp: 1866-1869 www.ijaem.net ISSN: 2395-5252

Investigation of Self healinng contract By Using Bacteria (Escherichia Coli) As a Crack Healing Agent

Mustak Ahamed.A 1, Dr.M.Manikandan 2
1Research scholar,Civil Engineering Dept.,MGR Educational and Research Institute.,Chennai,india 2Associate Professor,Civil Engineering Dept.Dr.MGR Educational and research Institute.,Chennai,india

Date of Submission: 20-04-2023 Date of Acceptance: 30-04-2023

ABSTRACT
The rate of degradation of concrete structures around the world is occurring at an alarming rate, presenting daily challenges to engineers around the world. This includes damage to bridges, buildings, parking lots, environmental facilities and other structures. Unfortunately, repair costs can be prohibitive. Microcracks and porosity are very common problems in concrete structures because the material is very permeable, allowing water and other aggressive fluids to penetrate, causing performance degradation. Recent research in the field of biotechnology shows the potential of biomimetic materials to develop less toxic solutions. Calcium carbonate is one of the best-known minerals produced by bacteria through a process called bio cementation or microbe-induced calcite precipitation (MICP). The aerobic soil bacterium Escherichia coli was incorporated into the concrete at different cell concentrations with mixing water. Index Terms: Calcium Carbonate, E. coli, Cement, Fine Aggregate, Coarse Aggregate, Water, Self-Replenishing

I. INTRODUCTION

Purpose of Entry:

Due to the relatively low tensile strength, cracking of concrete is a common occurrence. The durability of concrete is affected by these cracks as they provide convenient pathways for the transport of liquids and gases that may contain hazardous substances. If micro cracks develop and reach the reinforcement, not only is the concrete itself is attacked, but the reinforcement is also corroded. Therefore, it is important to control the width of the crack and to heal the crack as quickly as possible. As the costs associated with the maintenance and repair of concrete structures are often high, this research focuses on the development of self-healing concretes. Selfhealing of cracks in concrete will help extend the life of concrete structures and make the material not only more durable, but more durable.

Scope of the project:

Concrete is one of the most commonly used building materials. However, it is one of the main producers of carbon dioxide (CO2), which directly contributes to the destruction of our environment. Cracks of all sizes form in all concrete structures that require sealing for the life of the structure. Many researchers have attempted to improve concrete for a longer life, among other things.

Introduction of Bacterial Concrete: Modern (lime-based) concrete, revolutionary then and now, has a short life due to cracks that shorten the life of a particular structure. many researchers have attempted to improve concrete for a longer life, among other things.

Definition of self-healing
A self-healing material is described as a material capable of returning to its original state.The concept of self-healing concrete (SHC) occurring (self-generating) over time has been noted for over 20 years.

Materials:
Ordinary Portland cement (grade 53) calibrated fine aggregate.
Coarse aggregate. Water. Bacteria = Escherichia coli Calcium carbonate

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II. METHODOLOGY:

MIX PROPORTON

CEM ENT	FINE AGGREGATE	COARS E AGGREGATE	WATER	BACT ERIA
502.7 Kg/m3	482.32Kg /m3	1172.67K g/m3	186Li t/m3	10 ml
1	0.96	2.33	0.37	10ml

BACTERIA (E. coli)

E. coli is an obligate aerobic bacterium used as a larvicide for mosquito control. It forms terminal spherical orbits. Bacillus sphaericus is a Gram-positive bacterium with rod-shaped cells forming a chain - smooth-margined medium-sized colonies. And the rod cells.Gram-variable,

megaspore-forming rods, <0.9 Î¼m in diameter. Directory - active. Lecithin negative. Does not attack sugar.Growth temperature range: 37 o Optimum temperature - 35-37 o

The ability of bacterial concrete to repair cracks

Attention must be paid not only to the closing of cracks (blocking the path of penetration of water and ions), but also to the recovery of chemical properties. Cracks in concrete samples subjected to various loading scenarios will be studied before and after curing. For this, immersion and SEM techniques will be applied. (Electronique scanning microscope).On the other hand, microorganisms such as bacteria, bacteria, algae, lichens, yeasts, fungi and mosses etc. It is ubiquitous and omnipotent and is responsible for metabolism leading to microbial deposition of a protective layer of CaCO3. Yes, this process has the effect of restoring the cohesion of the particles of the mineral building material and prevents further deterioration of the stone. Demonstrate the positive effect of microbial CaCO3 precipitation. Increased porosity in concrete leads to increased capillary water absorption, increased gas permeability and higher carbonation rates, high chloride ion migration and frost damage -thaw.

Hand Mixing

The hand mixer is suitable for small concrete projects. Hand mixing should be done on an impermeable concrete or brick floor large enough to hold a bag of cement. The measured amounts of coarse and fine aggregates are distributed in alternating layers. Pour the cement over it and stir dry with a spatula, swirling the mixture until the color is uniform.Spread this homogeneous mixture to a thickness of about 20 cm.

Continue this operation until a very homogeneous and homogeneous concrete is obtained. In particular, it should be noted that the water is not poured, but simply poured out. A small amount of water should be added at the end of mixing to achieve the desired consistency. At this point, even a small amount of water can make a difference.The bacterial culture medium is then sprinkled over the concrete mix.

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CURING

Concrete gains strength through the hydration of cement particles. The hydration of cement is not a momentary action, but a long-lasting process. Curing can also be described as keeping the concrete moist and warm enough for the hydration of the cement to continue. More broadly, it can be described as the process of maintaining a satisfactory moisture content and an appropriate temperature in concrete for a period of time immediately after placement, so that hydration of the cement can proceed. continue until the desired properties develop sufficiently to meet the requirements. service requirements.The cast cubes and cylinders were soaked in water tanks for 3, 7, 14 and 28 days, respectively.

WORKABILITYOFCONCRETE

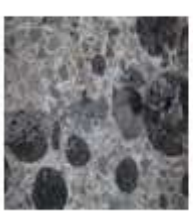
Workability is the useful amount of internal work required to produce complete compaction of concrete. It depends, workability is the useful amount of internal work required to produce complete compaction of concrete. It depends,

1. Total type
2. Classification of coarse and fine aggregates
3. Amount of cement slurry
4. Consistency of cement slurry

SLUMP TEST

Slump testing is the most commonly used method for measuring the consistency of concrete and can be used in laboratories or labs for engineering work. This is not an appropriate method for very wet or very dry concrete. It can be conveniently used as a control test and as an indication of concrete consistency between batches. The deformation reveals the segregation properties of the concrete. The thickness of the metal plate used for the mould should not be less than 1.6 mm. To compact the concrete, steel tamping bars with a diameter of 16 mm and a length of 0.6 m and bales are used. The mould is then filled in four layers, each layer taking up approximately 1/4 of the mould. Each layer is struck 25 times by the strike rod to ensure the strikes are evenly distributed across the cross section. Once the top layer has rotted, level the concrete with trowels and pushers. Immediately remove the formwork from the concrete by slowly and carefully lifting the formwork vertically. This can cause the concrete to sag. This settlement is known as concrete slump. Sag value = 90 mm

III. RESULT:



IV. CONCLUSION:

Based on the experimental investigation, cube specimens were cast for control mix as well as mixes substituted with dosage of Escherichia coliBacteria varying from 0.6%, 0.7%, 0.8%, 0.9%, 1.0% to obtain optimum percentage of concrete mix which is having more compressive strength. After obtaining optimum mix other specimens were cast for control mix and optimum concrete mix. From the experimental investigation the following conclusions were made:

- The cube compressive strength is 5.77% more than control mix concrete when 0.8% of Escherichia coli bacteria by volume of concrete has been added.
- The split tensile strength is 1.31% more than control mix concrete when 0.8% of Escherichia coli.bacteria by volume of concrete has been added.
- SEM results shows that the presence of CaCO3 after the healing process is more than control mix when 0.8% of Escherichia colibacteria by volume of concrete has been added.
- We conclude that Escherichia coli bacteria had an influence on compressive strength, split tensile strength, before and after healing on Concrete.

- Further studies may be continued in future to know the influence of other self- healing agents like silica gel, ceramic tubes, polyurethane, and sulfoaluminate on various characteristics of concrete

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