IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 5, May 2022
Impact Factor: 6.252

Self-Healing Concrete

P. V. Kapure[1], R. B Vetal[2], P. S. Panduche[3], S. D. Waghmode[4], R. B. Kokani[5]
M.E in Structure, Department of Civil Engineering[1]
Diploma Student, Department of Civil Engineering[2,3,4,5]
AISSMS Polytechnic, Pune, Maharashtra, India
pvk127@gmail.com, vetalrohit449@gmail.com, priyankapanduche@gmail.com,
surajwaghmode71@gmail.com, riyakokani35@gmail.com

Abstract: *Self-healing concrete is mostly defined as the ability of concrete to repair its cracks autonomously. It is also called self- repairing concrete. Cracks in concrete are a common phenomenon due to its relatively low tensile strength. If micro cracks grow and reach the reinforcement, not only the concrete itself maybe attacked, but also the reinforcement steel bars will be corroded. Therefore, it is important to control the crack width and to heal the cracks as soon as possible. Self-healing of cracks in concrete would contribute to a longer service life of concrete structures and would make the material not only more durable but also more sustainable..*

Keywords: Bio-concrete, Self-healing, Self repairing Concrete, Service Life

I. INTRODUCTION

Even though concretes are widely used as a construction material, cracks in concretes are unavoidable. Treatments for the cracks are a very expensive procedure. Also on par with the occurrence of crack properties of concrete such as durability, permeability and strength of the concrete structure will get diminished. Hence water will eventually get in contact with the reinforcement structures and the corrosion of those structures will occur. By the introduction of bacteria that produce calcium carbonate into the concrete mixture, the cracks can be avoided with the self-healing mechanism. Once the bacteria is introduced these self-healing concrete will produce calcium carbonate crystal that blocks the cracks. Microbial induced calcium carbonate precipitation (MICP) is an interdisciplinary field of study combining microbiology, engineering, and chemistry (Van Tittel boom & De Belie, 2013).A bacterium that is selected for the process should be stable and survive at a high alkaline environment that is usually in the pH of 10 or above. However, several mechanisms such as usage of polyurethane can enhance the survivability of microbes at higher pH. Bacteria of Bacillus strain are renowned to have a high stability at a high alkaline environment. Because they form viable endospores in harsh conditions and become activated once spores get in to contact with water and other nutrients. Once the concrete starts cracking it will also reduce the highly alkaline pH into lesser range of 10-11.5.Several pieces of research have used different strains of bacteria in the Bacillus family such as Bacillus scohnii, Bacillus pasteurii, Bacillus lintus, and Bacillus subtilis etc. Once the Ca 2+ in the process of demineralization negatively charged bacterial cell wall will draw cations fromthe environment. Ca 2 + will eventually get deposited on their cell surface. These Ca 2+ionssubsequently react with the CO32−ions, leading to the precipitation of CaCO3. Bacterial cell surface serves as a nucleation site. Carbonate is produced extracellularly through autotrophicand heterotrophic metabolic pathways. In the Autotrophic pathway in the presence of carbondioxide, microbes convert it to carbonate through non-methy lotrophicmethanogenesis, oxygenic photosynthesis, and anoxygenic photosynthesis. Whereas in heterogenic pathway calcium carbonate crystals precipitate as a result of their growth in different natural habitats. Bacillus species follow the heterotrophic pathway.

1.1 AIMS & OBJECTIVES

- To repair the cracks without having expenses due to maintenance.
- To improve healing process of Concrete.
- To solve the problem of our society.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 5, May 2022
Impact Factor: 6.252

1.2 PARAMETERS

- Study research paper from the people who did this work.
- Do experiments by using bacteria.
- Add correct reinforcements for making of self-healing concrete.

II. LITERATURE REVIEW

[1] C. Chetan Kumar "Self-Healing Concrete" 1H.O.D, Department of Civil Engineering, SWIET, Ajmer Rajasthan., India 2Assistant Professor, Department of Civil Engineering, SWIET, The study reviewed about different types of bacteria that can be used for remedying cracks in concrete. Bacteria repair the cracks in concrete by producing the calcium carbonate crystal which block the cracks and repair it. Following result that bacteria improves the property of conventional concrete such as increase in 13.75% strength increased in 3 days, 14.28% in 7 days and 18.35% in 28 days. This paper gives the ideas and methods for designing the self-healing concrete.

[2] W. Wei Wang1, Tieyi Zhong1, Xiaoxue Wang1 and Zhenyu He "Self-Healing Concrete" From School of Civil Engineering, Beijing Jiaotong University, Beijing, 100044, China * TieyiZhong'sThis study is sponsored by the Science & Technology Research Development Project of China Railway (Grant No.2012G013-G, Grant No.2007G030). The crack treatment of concrete structures is a research hotspot and has caused long-term problems for the development of the engineering community. At present, the research on self-healing concrete technology at home and abroad has been carried out in a variety of ways, and good progress has been made in different research directions, but most of the research is in a state of theoretical feasibility and laboratory feasibility. There are few proposals for projects that can make use of a large amount of self-healing concrete.

[3] S. SalmabanuLuhar "Self-Healing Concrete" Research Scholar, Malaviya National Institute of Technology, Jaipur 2 U.G. Student, Civil Engineering Department, Jaipur.Many researchers done their work on the self-healing nature of concrete and they had found the following result that bacteria improves the property of conventional concrete such as increase in 13.75% strength increased in 3 days, 14.28% in 7 days and 18.35% in 28 days. The development of calcium carbonate crystal Decreases the water permeability by decreasing the width of cracks from 0.5 mm to 0.35 mm. Compressive strength was increases by 30.76% in 3 days, 46.15% in 7 days and 32.21% in 28 days and in mathematical modal it was found that the bacterial concrete shows the better value of stress and strain as compared to controlled concrete for the high strength grade of concrete.

III. PROPOSED METHODOLOGY

Study the qualities of bacteria to add in concrete. Experiment it with adding soil into concrete and check its healing process. Make cube molds to check its compressive strength, by adding right proportion of cement, aggregate and water. After that we will check whether this concrete is useful to our society so that our project will have some worth to make.

IV. CONCLUSION

This paper gives the methods for designing self-healing concrete. Introducing the bacteria within the concrete performs extremely useful it improves the attribute of the concrete, which is higher than the conventional concrete. The study reviewed about different types of bacteria that can be used for remedying cracks in concrete. Bacteria repair the cracks in concrete by producing the calcium carbonate crystal which block the cracks and repair it. Many researchers done their work on the self-healing nature of concrete and they had found the following result that bacteria improves the property of conventional concrete such as increase in 13.75% strength increased in 3 days, 14.28% in 7 days and 18.35% in 28 days. As we all know that the repairing and maintenance are costly by the conventional methods than the self-healing concrete. So we have to improve and use these methods for the betterment of concrete structures. This paper gives the ideas and methods for designing the self-healing concrete.

Through the above literature review we came to know about the problem of cracks in all the buildings. So to reduce the number of accidents and maintenance charge of our walls we will make sure to make a self-healing concrete workable.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 5, May 2022
Impact Factor: 6.252

V. RESULT

Self-healing nature of concrete and they had found the following result that bacteria improves the property of conventional concrete such as increase in 13.75% strength increased in 3 days, 14.28% in 7 days and 18.35% in 28 days.

VI. ACKNOWLEDGMENT

All India Shree Shivaji Memorial Society Polytechnic wishes to acknowledge Michael Shell and other contributors for developing and maintaining the IEEE LaTeX style files which have been used in the preparation of this template.

REFERENCES

[1]. C. Chetan Kumar "Self-Healing Concrete" 1H.O.D, Department of Civil Engineering, SWIET, Ajmer Rajasthan., India 2Assistant Professor, Department of Civil Engineering, SWIET, http://ijariie.com/AdminUploadPdf/A_REVIEW_PAPER_ON_SELF_HEALING_CONCRETE_ijariie11282.pdf

[2]. W. Wei Wang1, Tieyi Zhong1, Xiaoxue Wang1 and Zhenyu He "Self-Healing Concrete" From School of Civil Engineering, Beijing Jiaotong University, Beijing, 100044, China. Tiey Zhong'shttps://www.researchgate.net/publication/303172092_A_review_paper_on_self_healing_concrete

[3]. S. SalmabanuLuhar"Self-Healing Concrete" Research Scholar, Malaviya National Institute of Technology, Jaipur 2 U.G. Student, Civil Engineering Department, Jaipur. https://www.researchgate.net/publication/330502803_Review_on_Self-Healing_Concrete_with_Bacillus_subtilis