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A Review Paper on Self Healing Concrete

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Abstract: *Crack formation is very common phenomenon in concrete structure which allows the water and different type of chemical into the concrete through the cracks and decreases their durability, strength and which also affect the reinforcement when it comes in contact with water, CO2 and other chemicals. For repairing the cracks developed in the concrete, it requires regular maintenance and special type of treatment which will be very expansive. So, to overcome from this problem autonomous self-healing mechanism is introduced in the concrete which helps to repair the cracks by producing calcium carbonate crystals which block the micro cracks and pores in the concrete. The selection of the bacteria was according to their survival in the alkaline environment such as B. pasteurii, Bacillus subtilis and B. spharicus which are mainly used for the experiments by different researchers for their study. The condition of growth is different for different types of bacteria. For the growth, bacteria were put in a medium containing different chemical at a particular temperature and for a particular time period. Bactria improves the structural properties such as tensile strength, water permeability, durability and compressive strength of the normal concrete which was found by the performing different type of experiment on too many specimens had varying sizes used by different researchers for their study of bacterial concrete in comparison with the conventional concrete and from the experiment it was also found that use of light weight aggregate along with bacteria helps in self healing property of concrete. For gaining the best result a mathematical model was also introduced to study the stress-strain behavior of bacteria which was used to improve the strength of concrete.*

Keywords: Bacteria, Bacillus pasteurii, Concrete, Bacillus sphaericus

I. INTRODUCTION

Concrete is very good material to resist the compressive load to a limit but if the load applied on the concrete is more than their limit of resisting load, it causes the strength reduction of concrete by producing the cracks in the concrete and the treatment of the cracks in very expensive. Some of the property like durability, permeability ad strength of the concrete structure is also decreases. Due to increase in the permeability of the concrete the water easily pass through the concrete and come in the contact with the reinforcement of the concrete structure and after some time corrosion start due to this strength of the concrete structure will decreases so it will be necessary to repair the cracks [1]. By introduce the bacteria in concrete it producing calcium carbonate crystals which block the micro cracks and pores in the concrete [2]. In concrete micro cracks are always avoided but to some extent they are responsible to their failure in strength. The selection of the bacteria is depend on the survive capability of bacteria in the alkaline environment. Most of the microorganisms die in an environment with pH value of 10 or above [3]. Strains of the bacteria genus Bacillus will be found to succeed in high alkaline environment. The bacteria survive in the high alkaline environment that formed spores comparable to the plant seeds. The spores are of very thick wall and they activated when concrete start cracking and water transude into the structure. The pH of the highly alkaline concrete lowers to the values in the range 10 to 11.5 where the bacterial spores become activated. There many bacteria other then Bacillus which are survive in the alkaline environment shown in Table 1 [4].

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II. MATERIAL AND METHODS

2.1. Size of Cracks in Concrete

According to the analysis and study by different authors, that the cracks healed by autogenously healing was observed in various sizes such as0.05 mm to 0.87 mm [11], 5 to 10µm [12-13], 100µm [14], 200µm [15], 205µm [15] and 300µm [17].

2.2. Condition of Microorganism and Its Growth

Sookie S. Bang et al., was used *B. Pasteurii*ATCC 11859 for his study of bacterial concrete. Stock culture of *B. pasteurii*were maintained in ATCC 1832 medium containing 10 g trypcase, 5 g yeast extract 4.5 g tricine. 5 g of (NH4)2SO4, 2 g glutamic acid and 10 g urea liter-1, pH 8.6, which were filter-sterilized. For solid medium, a final concentration of 1.6% agar autoclaved separately was added later. Growth conditions of broth cultures for calcite precipitation in Urea-CaCl2 medium. All cultures were grown at 30°C [18].

II. CONCLUSION

Introducing the bacteria into the concrete makes it very beneficial it improves the property of the concrete which is more than the conventional 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. 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

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