Masters Desertion Showcase
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Department: Civil Engineering

Programme: Masters in Engineering
Specialization: Structural Engineering

1	**Title of the Thesis** Response of Self-Healing PVA Fibre Reinforced Cementitious Composites for Serviceability
2	**Abstract** Concrete structures often suffer from cracking that leads to much earlier deterioration than designed service life. To prevent such deterioration, regular inspection of cracks in concrete structures and their repair are usually carried out by means of some kind of human intervention. On the other hand, there are certain bacteria which can use to heal such cracks before their adverse effect. Such concrete having these bacteria are known as self-healing concrete. Generally, structural elements in marine environment become more susceptible to crack and consequently corrosion due to harsh environment occurs. Therefore, there is a need of cementitious material which can arrest the opening of crack and also heal it before penetration of deleterious substance up to rebar. The current study aims to investigate the effectiveness of healing in cementitious composite through microorganisms such as Bacillus Subtilis. These microorganisms will be encapsulated in an innovative carrier compound towards the healing with the polyvinyl alcohol (PVA) fibres to maintain the small sizes of cracks at the service state to have better efficiency of the self-healing material. Total 12 mix were examined in which bacillus subtilis was used 0.75 and 1.5% by mass of binder. The bacteria were added in the encapsulation form to keep them immobilise during mixing and testing until crack is not formed. PVA fibres of 0.5, 1 and 1.5% by volume of mix has been used. The compressive strength, flexural strength and load versus crack mouth opening displacement (Load-CMOD) are observed during testing. Beams of 100×100×500 mm having notch at the bottom face at mid span were subjected to third-point loading to observe the effect on the stiffness, peak load and post-peak response in the presence of bacteria and PVA fibres before and after healing. The crack width before and after healing was also observed to check the response of bacteria for healing cracks. Based on the results, it was found that compressive strength is slightly decreased with the addition of bacteria but PVA fibres addition suppress this loss of strength. The flexural strength is found to be increasing with bacteria and PVA fibres and it was observed that stiffness and load carrying capacity was significantly recovered after healing of composites in the presence of bacteria. The crack width more than 0.3 mm was found to be healed in the presence of bacteria and PVA fibres
3	**Impact on Sustainability of Urban Regions or SDG-11 "Sustainable Cities and Communities"** Based on the acquired results of the whole research, one could infer that, utilization of selfhealing PVA fibre reinforced composite would play its role in enhancing the durability and life span of the structural elements. Conclusively, the cycle of building, repairing, demolition and re-building, that adversely affect the environment would be significantly reduced. Furthermore, production of cement causes production of CO2 into the environment, so reduction in the aforementioned cycle would also help in developing green environment that meets the target 11.7. In addition, such type of self-repairing technique will ultimately vanish the repairing cost. Although it might have a little greater initial cost but development of such type of self-healing composite may reduce the other costs that would be beneficial for least developed countries, hence meet the target 11.c.
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