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Experimental Investigation on Hydrophobic Treatment of Cement Concrete with Organosilane Based Compound

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ABSTRACT

Concrete is the most widely used construction material owing to its good strength, mouldability, and robustness. However, its durability has always been a cause of concern arising, mainly due to the fact that concrete is highly porous, microcracked, and hydrophilic in nature, making water ingress into it unavoidable. Water ingress is the primary cause of all major durability-related issues in concrete, such as freezing and thawing, reinforcement corrosion, carbonation, efflorescence, etc. It is thus evident that to prevent deterioration and thereby increase durability and service life of concrete structures, water ingress into it must be minimized. This can be accomplished by a number of methods, out of which hydrophobic treatment of concrete is nowadays becoming popular. Surface Hydrophobic Treatment and Integral/Bulk Hydrophobic Treatment are two main ways to induce water repellency in concrete. In this work, the efficacy of integrally incorporating a silane product into concrete and providing a surface treatment using the same product on the mechanical, durability, and physical properties have been studied. The integral modification did not yield satisfactory results in the case of waterproofing the composites with the Water Contact Angle values lying below 90˚ in the hydrophilic range. Whereas, the surface treatment reported a successful hydrophobic modification reporting a Water Contact Angle value as high as 157.1˚. The Water Contact Angle values for all surface-modified samples were over 150˚, which lies in the superhydrophobic category, along with the composites exhibiting a self-cleaning behavior with very little effect on the compressive and tensile strength.

Keywords: **Hydrophobic, Porous, Silane, Durability, Concrete.**

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1. INTRODUCTION

Concrete faces multiple issues that threaten the serviceability of the structure, durability being one such major issue. High porosity, hydrophilic nature, and the presence of microcracks and fractures facilitate water penetration into the concrete. Water penetration is the reason behind all major durability-related issues in concrete [1, 2]. It might weaken or even negate the protection offered by concrete to the reinforcing bars. Corrosion, freeze-thaw cycles and penetration of harmful ions and substances not only corrode the steel bars but also may react with cement paste and give rise to unwanted deleterious products; all result from water penetration into the concrete [3-5]. All these issues can be negated if water penetration into the concrete can be prevented or reduced. There are various methods that can be used to reduce water penetration into the concrete, out of which the hydrophobic modification methods are continually becoming popular [6-8]. Hydrophobic treatments alter the concrete characteristics from hydrophilic to hydrophobic, lowering