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A Study on Self-Healing Concrete Using Crystalline Admixture

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ABSTRACT

Concrete is the most widely used construction material due to its excellent compressive strength and durability. However, it is vulnerable to cracking caused by shrinkage, loading, temperature variation, and environmental exposure. Cracks allow aggressive agents such as water, chloride ions, and carbon dioxide to penetrate the concrete, reducing service life and requiring expensive maintenance.

Self-healing concrete technology aims to repair cracks autonomously without human intervention. Crystalline admixture (CA) is one of the most promising autogenous healing techniques. It contains hydrophilic chemicals that react with unhydrated cement particles and water to form insoluble needle-shaped crystals that block pores and cracks up to 2 mm in width.

In this study, self-healing concrete mixed with Penetron Admix, a crystalline waterproofing product, is compared with conventional M20 grade concrete. The experimental investigation includes material testing, mix proportioning, mechanical strength evaluation, crack creation, healing exposure and crack monitoring over time.

Results show that crystalline admixture-based concrete demonstrates superior crack sealing, reduced permeability, and improved compressive strength due to continued hydration reactions. Cracks healed within 10–21 days under moisture exposure, proving its suitability for durable infrastructure.

Keywords

Self-healing concrete, crystalline admixture, crack sealing, Penetron Admix, durability, permeability reduction.

1. INTRODUCTION

Concrete infrastructure around the world suffers from deterioration due to crack formation.
Manual repair is costly, time-consuming and often temporary. The concept of self-healing
concrete addresses these problems by enhancing resilience and prolonging service life with minimal maintenance.

Problems due to cracks

Loss of durability and load-carrying capacity Water seepage in buildings

Corrosion of reinforcement

Increased chemical attack (chlorides, sulphates)

Crystalline admixtures (CA) are an internal healing agent. When water enters cracks, CA reacts with cement hydration by-products forming insoluble crystals that:

Block microcracks Reduce permeability

Restore durability properties

Because water is essential for activation, this technique is especially effective in underground, marine, and water retaining structures.

2. LITERATURE REVIEW

) (Only summarized here — Full detailed reference list provided at the end) Author

Findings

Neville (2005)

Crack formation and permeability reduce structural performance. Sisomphon et al. (2012)

CA enhances autogenous healing in moist environments. Snoeck C De Belie (2015)

Self-healing reduces repair cost and improves durability. Ahn et al. (2016)

Crystal growth fills micro-cracks up to 0.4 mm. Ahmad et al. (2018)

Strength + water tightness improved significantly using CA. Penetron International (2019)

Crack-sealing capacity up to 0.5–2 mm.

Most studies conclude that crystalline admixture-based healing is practical and cost-effective for real structures.

✳ Part-2 (Objectives, Methodology, Materials C Mix Design) will be sent next. This keeps formatting perfect and avoids message limits.

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