

عنوان مقاله:

A Review of Biomineralization as Solution for Roads and Infrastructures Concrete Sustainability

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خلاصه مقاله:

Concrete cracks in roads and infrastructure are ubiquitous due to environmental factors, fatigue, and material degradation. Applying bacteria with self-healing capabilities in concrete matrices is proposed as a solution. These bacteria, activated by water and oxygen ingress, produce calcium carbonate through biomineralization. They are improving structural integrity while reducing the adverse effects of chemical and water infiltration. The quantity of Bacillus bacteria to be added to the concrete mixture is an integral part of the standardization of the self-healing mechanism. $1.5 - 1.8$ cells/mL of spores experienced improvement in mechanical properties and self-healing efficiency. Various Bacillus strains, such as Bacillus sphaericus, Bacillus subtilis, and Bacillus megaterium, are typically utilized in self-healing. The by-product of biomineralization, calcium carbonate, is an autonomous crack and pore sealer, which can be evaluated via SEM, XRD, and XDS. The study highlights the testing methodologies used to examine calcite deposition. Also, it reiterates the importance of urease activity evaluation before bacterial propagation to confirm the occurrence of the biomineralization process. Moreover, the article reiterates the bacteria's history, origin, and pathogenicity, bridging the gap concerning bacteria propagation safety and the need for industry-accepted standards and certification procedures. The transition from laboratory experiments to large-scale implementation is advocated to demonstrate bacterial concrete's sustainability and economic feasibility for broader industry adoption. Finally, bacteria concrete is a ground-breaking approach that unites construction and biology for long-term sustainable transportation materials and construction. Doi: 10.28991/CEJ-2024-01-008-020 Full Text: PDF

کلمات کلیدی:

.Transportation Materials; Self-Healing Concrete; Biomineralization; Infrastructure Sustainability

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