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Mimicking Oyster Reefs to Generate Cements with Enhanced Performance

A new class of biomimetic cement, inspired by oyster adhesive, substantially increases material adhesion and compressive strength for high-performance, sustainable mortars, concrete, and specialty sealants.

Researchers at Purdue University have developed a new class of biomimetic polymer-modified cements (PMCs) inspired by the unique adhesive used by oysters to construct reef structures. For this novel cement, unlike traditional Portland cement which is energy-intensive to produce and weak in tension or conventional PMCs that often compromise compressive strength, its biomimetic approach yields a superior material. The material surpasses commercial masonry sealant benchmarks and, when added to a commercial mortar mix, substantially increases both adhesion and compressive strength. This innovation provides a promising and potentially more sustainable alternative to conventional cement materials.

Technology Validation:

The methacrylate polymers performed well when phosphates were added, with p(MePhos-MeAc-MeNaAc) having the highest adhesion of 5 Â± 2 MPa (or 4.6 Â± 1.7 MPa). Elmer's Glue-All achieved a bonding of 1.1 Â± 0.3 MPa, and Loctite Super Glue was 4.9 Â± 0.5 MPa for these conditions. These results show that the phosphate-functionalized, sodium-containing methacrylate polymer p(MePhos-MeAc-MeNaAc) had nearly similar strength to the commercial counterparts.

Advantages:

-Enhanced performance in adhesion and compressive strength

-Sustainable approach

Applications:

-High-performance mortars and concrete

-Specialty adhesives and sealants

Technology ID

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Category

Chemicals & Advanced Materials/Coatings, Adhesives & Sealants

Materials Science & Nanotechnology/Biomedical & Bioinspired Materials

Buildings, Infrastructure, & Construction/Infrastructure Modeling & Digital Twins

Authors

Mitchell Meger

Collin Scott

Jonathan James Wilker

Further information

Aaron Taggart

adtaggart@prf.org

View online

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