CERIS Civil Engineering Research and Innovation for Sustainability

HO.R.M.AS – Self-Healing Processes in Recycled Concrete and Mortar using Bio-Polymers

Summary

Quest for sustainable and respectful solutions for environment is, nowadays, a basic goal for developed countries. Transverse challenges like the reduction of raw materials and natural resources, improving and assuring its performance and optimizing its efficiency, plot the basic axis for the near-future behaviour in the construction sector. In recent years this need is linked with the concept known as "circular economy".

In this evolutive threshold a new concept for healing is emerging strongly, based in the preventive treatment of incipient cracks which can appear in constructive elements, not only news but existing. The self-healing of construction cement-based materials represents a valuable and novel good, due its natural capacity to fix damage when it occurs. The present proposal finds the experience with capable biomaterials which can act as healing promoters in constructive elements and also be compatible with the existing cement-base. As admixture promoter of self-healing, this study proposes the use of polymers from biomass waste obtained in biodiesel (glycerol) industries. This sludge is subjected to a different chemist process to obtain an exo-polymer, namely, a polymeric external cellular substance that can be added to different types of materials as an improver of its durability.

The starting hypothesis is that an eco-efficient cement-based material made from recycled mixed-type aggregates (ceramic mix + concrete + natural aggregates) can be obtained, to save natural resources and raw materials and to reduce the harmful effects of the spill of waste in the environment, and which also has characteristics of self-healing or repair through the use of biopolymers obtained from a residual sludge from the production of biodiesel. The bio-product has two possibilities of application: as a treatment on the external surface of the material once formed and hardened or as a bio-cementant addition during the process of fresh mixing, in bioformulation. Both possibilities would be studied during the development of the works, if granted.

The research group has a strong international and multidisciplinary character: biologists, chemists and engineers from the Universities Nova of Lisbon (Portugal) and León (Spain) have joined forces to apply for the HO.R.M.AS project (HOrmigones . Reciclados . Morteros . Auto-Sanado) based on the previous studies that we have been able to carry out at the end of last year 2016 and that we are excited about this 2017 call of the Ministry of Economy and Competitiveness.

Figure 1. a) Water penetration under pressure test; b) penetration depth in a recycled concrete specimen with treated surface with a bioproduct produced based on mixed microbial cultures from pinewood waste [Serrano-González et al., 2021 - https://doi.org/10.3390/ma14216545].

Project Reference

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Leading Institution

ULe – Universidad de Leon (Spain)

Partners

FCT NOVA – NOVA School of Science and Technology (Portugal)

CERIS Principal Investigator

Paulina Faria
(paulina.faria@fct.unl.pt)

CERIS Research Team

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147 620.00€

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Project Website

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