Non-axenic biomasses as bacterial self-healing agents in cementitious mortar

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Microbially induced calcium carbonate precipitation (MICP) is one of the main pathways to achieve biological self-healing in concrete structures. It has been a popular research topic due to its repeated crack closure and water permeability reduction abilities. However, the cost of the application, which is around 40€/m^3 of concrete, has been the limiting factor for industrial adaptation. Since most of the studies are focusing on axenic culture usage, their production and encapsulation cost results in an expensive method.

As a solution, this study evaluates readily available low-cost non-axenic (mixed cultures) as possible bio-additives which can execute self-healing through MICP. Biomasses from residual side streams such as paper industry and agricultural plants were added to the mortar as healing agents. Compressive and flexural strength, workability, crack closure and capillary absorption capacity of the specimens were chosen as main parameters and the efficiency of the biomasses was determined respectively. Results showed that two out of four biomasses achieved above 70% crack sealing without adverse effects on strength and workability. Thus, non-axenic biomass usage could be a cost-effective option to achieve bacterial self-healing.

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