Lichen growth on concrete elements for sustainable facade design

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The potential use of a new type of green façade based on the growth of lichens on a concrete substrate is investigated. Lichens are unique life forms characterized by a symbiotic relationship between a fungus and an alga, drawing all its nutrients from the air and the rain.

The strategy was to use limestone and calcined clay in the mix design. The replacement of 35% of the cement by a blend of limestone and calcined clay reduces the level of CO₂ emissions significantly compared to ordinary concrete with comparable mechanical performances. The use of this blend presents an additional advantage for this context, by allowing a faster carbonation which reduces the pH of the material and therefore facilitates the colonization and growth of lichens. A series of concrete tiles were casted using different mix designs and surface treatments to assess their efficiency as a substrate for lichen growth while their water exchange properties at different relative humidity were tested.

The experiments showed that the substrate provided a more suitable substrate for the seeding and the transplantation of the lichen Xanthoria parietina compared to a reference ordinary Portland cement concrete. However, it showed a higher permeability, impairing the micro-climatic environment on the surface.