**Bio Ceramic**

**Moss-grafted clay tiles for green roofs, Barcelona, Spain**

**Main author**

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**Project data**

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**Summary and appraisal by the jury**

This materials research project from Barcelona, Spain describes an experiment that explores the bio-receptivity of ceramics, taking advantage of the porosity of the material that allows it to retain water and using natural fibers as complementary elements to benefit other properties. Botanical species like moss have the capacity to grow on particular surfaces with high concentration of moisture and acceptable levels of acidity. Ceramics, like roof tiles, become suitable places for the reproduction of these organisms, enhancing the material performance in terms of thermal and acoustic parameters – and furthermore photosynthetic organisms also improve air quality and alleviate urban heat island effects.

The jury commends the research objectives of the experiment – an investigation into the material properties of “bio-ceramics”. Particularly promising is the improved characteristics of mineral matter when combined with an organic substance. The investigation offers the grounds for a potentially new understanding of materials in construction, combining natural and fabricated elements.

**Sustainability concept**

The project aims to explore the bio-receptivity of ceramics taking advantage of the material’s porosity that allows it to retain water and using natural fibers as complementary elements to benefit other properties. Moss gametophytes have no vascular system to transport water through the plant, or waterproofing systems to prevent tissue water from evaporating. They must therefore have a damp environment in which to grow and a surrounding of liquid water to reproduce. Since mosses are autotrophic they require enough sunlight to conduct photosynthesis. Shade tolerance varies by species, just as it does with higher plants.

In most regions, mosses grow chiefly in areas of dampness and shade, such as woodlands and at the edges of streams. But, they can grow anywhere in cool damp cloudy climates, and some species are adapted to sunny seasonally dry habitats such as alpine rocks or stabilized sand dunes. Since the moss lifecycle can take a couple of months to stabilize, a method of mixing different components in order to accelerate growth is used.

In order to analyze the bio-receptivity of the Bio Ceramic, the NIR and NDVI technologies were used to detect first evidence of living moss in the ceramics. This helped determine which samples are most suitable for growing the photosynthetic organism in controlled conditions. A multiple moisture sensor using an Arduino MEGA controller was developed that is capable of reading data from ten different regions inside the clay. This measurement helped to more accurately determine water retention capacity and absorption time.

After the testing, it can be concluded that moss can grow in a ceramic environment provided with high levels of humidity, good sun and shade parameters, creating the possibility of harvesting these components. While the moss provides high levels of humidity due to its capacity to hold water to survive, this will generate a temperature buffer. Moisture will be retained by the three layers in the clay making a natural exchange cycle from the moss to the medium and vice versa. At the same time, the levels of density can be tested as a sound buffer creating a sustainable passive system.

**Further authors**

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