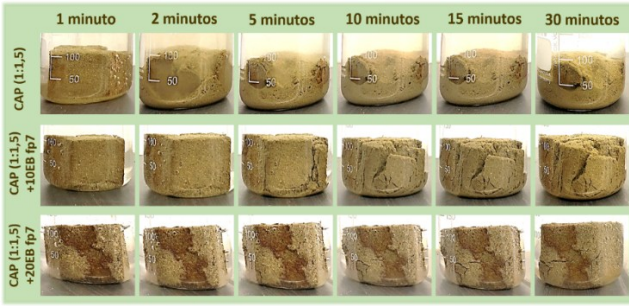
Biostabilization of earth mortars with cow dung

Summary

Cow dung is a material used for thousands of years by humanity as a stabilising addition in earth building, including in Brazilian vernacular architecture. Even though this material has been little investigated scientifically. In the present research, the effects caused to earth mortars, produced with a tropical Brazilian earth and two Mediterranean Portuguese ones, by the addition of cow dung in different proportions (5% to 40%) and under different conditions of use (fresh, dry, fermented, in nature or ground) were investigated. The influence of the cow's diet (pasture and grain ration feed) on the effects caused, and the potential for recycling the mortar with this bioaddition was also evaluated. The biostabilized mortars were evaluated for shrinkage, bulk density, thermal conductivity, mechanical resistance, adhesion, durability in relation to the action of water, essential for external coating, and hygroscopicity, very important for internal coating. For this evaluation, the German technical standard DIN 18947 was mainly used. The results showed that the fresher the cow dung, the greater the durability of the mortar in contact with water, the mechanical resistance and the adhesion to the masonry. The cow's diet and the use of dry dung (composted), whole (in nature) or ground, do not make a significant difference in the effects caused on earth mortars. Fermenting the mortar for 72 hours increases masonry adhesion and durability in contact with water. The optimal proportion (by volume) for adding cow dung depends on the application: 10% produces mortars that are more mechanically resistant and with more adhesion; 40% produces mortars that are more resistant to contact with water; and 20% is a balanced proportion with wide application. The addition of cow dung definitely makes the coatings: more thermally insulating and especially resistant to the action of water; with greater adhesion to adobe and ceramic brick masonry; with reduced shrinkage, which prevents the appearance of cracks, and increases mechanical resistance by compression, but mainly by flexion. It was observed that the granulometry and mineralogical composition of the earth also influence the effects caused by the addition of cow dung, with the effects caused in the tropical earth mortar being more expressive. The mortar with the addition of cow dung was recycled and presented superior performance to the mortar without the addition of cow dung, but inferior to the "original" mortar, with results still classifiable by the parameters of the DIN standard. Mortars were also formulated and evaluated with different volumetric additions of sand, and with the addition of vegetable fibres and air lime. Compared to these additions, cow dung showed superior results in all tests. The results obtained and the effects presented by the different additions of cow dung demonstrated the potential of using natural materials and microbiological additions to the detriment of conventional binding materials such as lime, obtained through very polluting processes, from extraction, processing, logistics and disposal at the end of the life cycle. Therefore, until technological innovations based on the use of natural and biodegradable materials are stimulated, building will be hostage to materials that contribute to the destruction of the planet. This study also highlights that cow dung is a vernacular solution that demonstrates the magnitude of ancestral and traditional empirical knowledge, from which there is much to learn and respect.

Keywords

Clay plasters, eco-efficient mortars, biocementation, exopolysaccharides, bioconstruction, agroecology.



Prismatic and rendering specimens (left) and samples immersed in water: on the bottom right is possible to see how the cow dung additions improved the water resistance of clay mortars.

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