Embedding Biomaterials into Mortars for Enhancement of Some Physical-Mechanical Properties [†]

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The history portrays the identity of a culture, of people and various civilizations, which has been preserved by specific images, paintings and buildings over time. In order to carry history forward, but also to preserve the traditional values, cultural heritage reconsolidation is required.

In the last few years, biomaterials have gathered attention due to their good compatibility with different materials, and also due to their great potential for applications in various fields. In addition, the low processing costs, availability and the possibility to be used as additives for cement are the advantages that make these materials suitable for preparation of mortars. The aim of the study is to investigate the behavior of biomaterials in combination with sand and white cement for the obtaining of mortars.

The biomaterials used in this study consist of: alginate (Sigma-Aldrich, low viscosity), chitosan (commercial) and starch (commercial). The mortars were prepared as cubic samples (30 × 30 × 30 mm), according to SR EN 12390-1 standard [1]. In order to characterize the obtained materials, the following tests were performed: determination of mechanical properties with compressive strength using a digital Schmidt hammer, determination of the freezing-thawing resistance according to SR 3518 standard [2], colorimetric analysis using an instrument from Konica Minolta (CR-410 model) under illuminant C and 2 degree standard observer conditions for the calculation of whiteness index [3], and spectral analysis using Attenuated Total Reflection-Fourier Transform Infrared (ATR-FTIR) technique.

The whiteness indices showed the lowest values for sand with white cement and alginate; all materials exhibited a slightly yellow tint (according to the b^* parameter) due to the presence of sand in mortars. The infrared spectra showed the presence of sand as major component in the final products, and the white cement as secondary constituent. The lowest value of compressive strength was obtained for alginate as an additive, while chitosan and starch showed a slightly better mechanical resistance.

Some biomaterials could be successfully used to improve the mechanical properties of mortars. Infrared spectra analysis was strongly influenced by the sand and white cement materials, which were used in larger quantities than alginate, chitosan and starch. Determination of the freezing-thawing resistance showed promising results for mortars prepared with chitosan and starch. A small improvement of the mechanical resistance, determined by compressive strength, was

observed for the samples with chitosan and starch, while the lowest resistance was obtained when using alginate as an additive.

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