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Innovative method and apparatus for the deep cleaning of soluble salts from mortars and lithic materials

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Porous materials (e.g. plasters, mortars, concrete, and the like) used in the building industry or in artworks fail to develop, after their genesis, salts such as nitrates, carbonates (e.g. potassium carbonate, magnesium carbonate, calcium carbonate), chlorides (e.g. sodium chloride) and/or others, which are a concurrent cause of material deterioration phenomena. In the case of ancient or cultural heritage buildings, severe damage to structures and works of art, such as fresco paintings are possible.
In general, in situ alteration pattern in mortars and frescoes by crystallization of soluble salts from solutions is caused by capillar rise or circulation in damp walls. Older buildings can be more subject to capillary rise of ion-rich waters, which, as water evaporates, create salt crystals inside the walls. If this pattern reveals overwhelming upon other environmental decay factors, the extraction of salts is the first restoration to recover the artpiece after the preliminary assessment and mitigation of the causes of soaking.
A new method and apparatus, patented by University of Genoa [1] improves the quality and durability of decontamination by soluble salts, compared with conventional application of sepiolite or cellulose wraps.
The conventional application of cellulose or sepiolite requires casting a more or less thick layer of wrap on the mortar, soaking with distilled water, and waiting until dry. The soluble salts result trapped within the wrap.
A set of artificial samples reproducing the stratigraphy of frescoes was contaminated with saline solution of known concentration. The higher quality of the extraction was demonstrated by trapping the salts within layers of Japanese paper juxtaposed to the mortar; the extraction with the dedicated apparatus was operated in a significantly shorter time than with wraps (some hours vs. several days). Two cycles of about 15 minutes are effective in the deep cleaning from contaminant salts. The decontamination was demonstrated by conducibility tests on the juxtaposed Japanese paper.
In addition, after the conventional treatment, a considerable amount of soluble salts was further extracted demonstrating that traditional wraps operate just a shallow cleaning, and soluble salts are liable to emerge later as efflorescence affecting the conservation after restoration.
The optimum cleaning was obtained by finishing the innovative extraction with sepiolite/cellulose wraps.
As a whole, the novel method and apparatus enhance the time for restoration and the final quality before consolidation and protection.

[1] “Apparatus and method for treating porous materials” – M. Ferretti, L. Gaggero, G. Torrielli, PCT/IB2015/055129 (2015)