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Portable hyperspectral device as a valuable tool for the detection of protective agents applied on hystorical buildings

S. Vettori (1), E. Pecchioni (2), M. Camaiti (3), F. Garfagnoli (2), M. Benvenuti (2), P. Costagliola (2), and S. Moretti (2)

(1) Department of Construction and Restoration, University of Florence, Italy, (2) Department of Earth Sciences, University of Florence, Italy, (3) CNR ICVBC, Institute for Conservation and Promotion of Cultural Heritage, Florence, Italy

In the recent past, a wide range of protective products (in most cases, synthetic polymers) have been applied to the surfaces of ancient buildings/artefacts to preserve them from alteration [1]. The lack of a detailed mapping of the permanence and efficacy of these treatments, in particular when applied on large surfaces such as building facades, may be particularly noxious when new restoration treatments are needed and the best choice of restoration protocols has to be taken.
The presence of protective compounds on stone surfaces may be detected in laboratory by relatively simple diagnostic tests, which, however, normally require invasive (or micro-invasive) sampling methodologies and are time-consuming, thus limiting their use only to a restricted number of samples and sampling sites. On the contrary, hyperspectral sensors are rapid, non-invasive and non-destructive tools capable of analyzing different materials on the basis of their different patterns of absorption at specific wavelengths, and so particularly suitable for the field of cultural heritage [2,3]. In addition, they can be successfully used to discriminate between inorganic (i.e. rocks and minerals) and organic compounds, as well as to acquire, in short times, many spectra and compositional maps at relatively low costs.
In this study we analyzed a number of stone samples (Carrara Marble and biogenic calcarenites – "Lecce Stone" and "Maastricht Stone"-) after treatment of their surfaces with synthetic polymers (synthetic wax, acrylic, perfluorinated and silicon based polymers) of common use in conservation-restoration practice. The hyperspectral device used for this purpose was ASD FieldSpec FR Pro spectroradiometer, a portable, high-resolution instrument designed to acquire Visible and Near-Infrared (VNIR: 350–1000 nm) and Short-Wave Infrared (SWIR: 1000–2500 nm) punctual reflectance spectra with a rapid data collection time (about 0.1 s for each spectrum). The reflectance spectra so far obtained in the laboratory experiments indicate that this hyperspectral technique is able to distinguish the different protective agents and, therefore, may be used to monitor the conservation treatments employed for the stone surfaces of historic materials.

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