Mid-infrared hyperspectral imaging of painting materials

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A novel hyperspectral imaging system (HI90, Bruker Optics), working in the mid-infrared range (1300–900 cm^{-1}) and recently developed for the remote identification and mapping of hazardous compounds, has been here applied for investigating painting surfaces. A painting by Alberto Burri, namely Sestante 10 (1982), has been investigated through the HI90 system, imaging the distribution of inorganic materials and binding media constituting the artworks. In order to validate the results obtainable by the imaging system previous tests on laboratory models were performed. Yellow, white and blue pigments painted with different binders (namely, egg, alkyd, acrylic and vinyl) were investigated by the HI90 highlighting the strengths of the device. Afterwards, the polychrome painting Sestante 10 was investigated in situ revealing the distribution of different extenders (kaolin, $BaSO_4$, $CaSO_4$) mixed with the various silica-based pigments and two different binders (acrylic and vinyl). The brightness temperature spectra collected by the HI90 system have been also compared with reflection point infrared spectra acquired by the conventional portable FTIR spectrophotometer R-Alpha (Bruker Optics) highlighting the good spectral quality of hypercube data produced by the new imaging system. This comparison also allowed evaluation of the spectral response and assignment from the reduced spectral range available by the HI90 imaging (1300–900 cm^{-1}), validating the reliability of the obtained chemical images. This study clearly highlights the high potential of the new hyperspectral imaging system and opens up new perspectives in the current scientific interest devoted to the application of mapping and imaging methods for the study of painting surfaces.