Calcium hydroxide nanoparticles from solvothermal reaction for the deacidification of degraded waterlogged wood

Giovanna Poggi[1]*, Nicola Toccafondi[1], David Chelazzi[1], Patrizia Canton[2], Rodorico Giorgi[1], Piero Baglioni[1]

[1]*Department of Chemistry & CSGI, University of Florence, Via della Lastruccia 3, 50019 Sesto Fiorentino, Florence, Italy*

[2]*Department of Physical Chemistry and CSGI, University of Venice Ca' Foscari, 30170 Venezia, Italy*

**poggi@csgi.unifi.it*

The preservation of the Swedish warship Vasa represents a unique and challenging conservation case study. Since its salvage, a combination of sulfuric acid and iron ions inside the wood has been corroding the hemicellulose and cellulose matrices jeopardizing the preservation of the shipwreck [1-3]. Past deacidification treatments displayed poor penetration inside the wood matrix with limited efficacy [4-6]. Alkaline earth metal hydroxide nanoparticles have proved efficient for pHN controlled deacidification to inhibit both the metalN catalyzed oxidation and the acidN catalyzed hydrolysis of cellulose and hemicellulose [7]. In order to improve on the available treatments and make the conservation of larger objects possible, stable and highly concentrated calcium hydroxide nanoparticle dispersions in alcohols were synthesized via a solvothermal reaction, which has also the advantage to be upscalable to industrial level. Nanoparticle dispersions were characterized using Attenuated Total Reflectance Fourier Transform Infrared Spectroscopy (ATR-FTIR), X-Ray Powder Diffraction (XRPD), High Resolution Transmission Electron Microscopy (HR-TEM), Selected Area Electron Diffraction (SAED), Dynamic Light Scattering (DLS), surface area analysis (BET), and turbidimetry. The efficacy of these nanoparticle dispersions was tested on samples from the Vasa shipwreck using a mild vacuum treatment. Deacidification was assessed by pH determination and Differential Thermal Gravimetric (DTG) measurements, showing that these dispersions represent a very promising tool for the conservation of objects such as statues or decorations of waterlogged and archeological relicts whose preservation is still a challenging issue [8].

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