THE APPLICATION OF IONIC NANOPARTICLES IN THE CONSERVATION OF ARCHAELOGICAL WOOD

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ABSTRACT

A major cause of the degradation of heritage and museum objects is attack by acid. Examples include the attack by acids caused by atmospheric pollution or acidic species generated from within the artefact. In the case of cellulose based materials, paper and wood, acid causes hydrolysis of the polymer and a loss of mechanical strength. Manuscripts written with iron-gall ink, from the 12th to the 20th centuries the most common writing ink, have posed a particular conservation problem. The colour forming ingredients are the product of a reaction between gallic acid, from tannins, and iron ions from iron (II) sulfate, which meant that the ink was often contaminated with acid. Similar problems have been encountered in waterlogged wooden ships, such as the *Vasa* and the *Mary Rose*, where the timbers are being degraded by sulfuric acid and reactions catalysed by iron. Amongst marine archaeologists, this is termed 'the sulfur problem'. Recently[1-4], the impregnation of artefacts with alkaline earth hydroxides or carbonates has been proposed as alkaline reservoirs to neutralise acids.

We have focused on the use of strontium carbonate nanoparticles (20-30 nm) to develop treatments for the *Mary Rose* and its associated wooden artefacts. This material has the advantage of being a target for synchrotron studies[3] and the product on reaction with sulfuric acid has a very low solubility in water. In addition, synchrotron X-ray absorption (XAS) studies[3] indicate that the nanoparticles react with reduce organosulfur compounds in the wood. In this contribution, we will concentrate on the reactions of strontium carbonate nanoparticles directly with known components of the timbers; these include the reduced organosulfur compounds (e.g. cysteine, cystine, and methionine) and the polyethylene glycol (PEG) which is used to give mechanical stability timbers. The analysis of the reaction products was determined by XAS measurements and mass spectrometric techniques. We will report the nature of these products and the possible kinetics of the associated chemical reactions.

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References:

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