Investigation of the natural plant extract *Emblica officinalis* for chloride release from βFeOOH

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Controlling post-excavation corrosion of chloride (Cl^-) infested archaeological iron presents a major storage problem for museum professionals. This corrosion is stimulated by Cl^- containing corrosion products, such as akaganeite (βFeOOH), whose hygroscopicity and mobile surface adsorbed Cl^- corrode iron at low relative humidity (RH) [1]. Renewed interest in inhibitors to control corrosion of archaeological iron has centred on low toxicity eco-friendly compounds. Recent study suggests that the extract of *Emblica officinalis* (Indian gooseberry) has inhibitive properties for iron[2]. This is attributed to the high level of the strongly hydrolysable gallic ($C_6H_2(OH)_3COOH$) acid in *E. officinalis* extract dissolving βFeOOH to produce Fe^{2+}, which it complexes to form magnetite (Fe_3O_4) covered in iron gallate. This transformation releases Cl^- ions from βFeOOH into solution, thereby removing electrolyte ions that drive iron corrosion and interfere with the effectiveness of many inhibitors. Simply cold washing βFeOOH removes most of its Cl^- and significantly slows its ability to corrode iron at high RH[3]. The study reported here examines quantitatively the impact of washing βFeOOH with various aqueous concentrations of *E. officinalis*, over differing time periods, to assess the ability of βFeOOH to corrode iron. βFeOOH transformation was investigated using FTIR and Micro-Raman spectroscopy.

βFeOOH was cold washed with selected aqueous concentrations of *E. officinalis* juice for various time periods and dried. Controls involved washing βFeOOH solely in water. Washed βFeOOH samples were individually mixed with Fe powder and sealed into their own dedicated reaction vessel containing silica gel conditioned to 80% RH and an oxygen sensor, which recorded oxygen concentration via light projected through the vessel wall. Oxygen depletion was used to represent Fe corrosion rate. Results revealed the impact of *E. officinalis* on the corrosion of iron by βFeOOH, offering insight for optimising concentration and wash time.

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3. **Watkinson D., Emmerson N. and Seifert J. (2016)** Matching display relative humidity to corrosion rate: Quantitative evidence for marine cast iron cannon balls. In *Metal 2016* Proceedings of the Interim Meeting of the ICOM-CC Metals Working Group, September 26th-30th, 2016, New Dehli India, Eds. Menon, R., Chemello, C. and Pandya, A. 195-202 ICOM-CC