

Innovative chemical approaches for the nanofunctionalization of hydroxyapatite scaffold: antibacterial effect, osteo-inductive capabilities and cytotoxicity investigation

Salvatore Petralia¹, Giovanna Calabrese², Domenico Franco², Claudia Fabbi³, Lucia Forte³, Salvatore Guglielmino², Francesco Traina^{4,5} and Sabrina Conoci^{2,6}

¹ Department of Drug Science Department, University of Catania, Catania, Italy

² ChiBioFarAm Department, University of Messina, Messina, Italy;

³ Fin-Ceramica Faenza, 48018 Faenza (RA), Italy

⁴ IRCCS Istituto Ortopedico Rizzoli, Bologna

⁵ Biomorf Department, University of Messina, Messina, Italy;

⁶ Distretto Tecnologico Micro e Nano Sistemi Sicilia, Catania, Italy

Abstract

We report a new chemical approach for the functionalization of hydroxyapatite scaffold with nanostructured metal materials. This method exploits a photochemical synthesis to allow the direct Silver nanoparticles formation at scaffold surface. The nanofunctionalized surface scaffold was investigated by SEM, EDX and TEM techniques.

Microscopics and spectroscopic investigations show Ag NPs spherical shaped with a mean diameter of about 20 nm exhibiting the typical plasmon absorption band with maximum at 420 nm.

The antibacterial properties were tested against two bacterial strains, *Escherichia coli* and *Staphylococcus aureus*. The results show excellent antibacterial properties achieving up to 99% and 100% reduction of colonies for both bacteria cultures after 24 h of incubation and 100% of reduction after 48 h of incubation. The cytotoxicity and osteo-inductive were also investigated. The observed cytotoxicity can be probable ascribed to the oxidative stress by ROS.