ABSTRACT SUBMISSION

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Development of a hybrid baicalein-hydroxyapatite coating with antibacterial properties

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ABSTRACT

With ageing of population, the number of joint arthroplasties is constantly increasing; with for instance more than 100 000 total hip replacements each year in France [1]. Unfortunately, about 10 % of them are revision arthoplasties due to implant failure [2], caused by two major reasons: the lack of osseointegration and the development of infections. Currently, the strategy to avoid infections is the use of systemic antibiotic prophylaxis. An alternative promising way to avoid its overuse is to use the implant as a support for the antimicrobial activity, which may offer advantages such as decrease in the side-effects of the treatments and the possibility of higher dosages near the affected site thereby improving efficiency and reducing the treatment duration [3]. Titanium alloy is widely used as material for body implant for its biocompatibility; nevertheless, it cannot induce bone regeneration. In order to combine osseoconduction and local drug delivery, implants can be coated with a calcium phosphate layer, and more particularly hydroxyapatite, known to improve the osseointegration of implants [4].

The goal of this work was to develop a hybrid coating on titanium alloy Ti6Al4V associating a layer of biomimetic hydroxyapatite and a natural antibiotic molecule, baicailein. Known to be active against multi-resistant bacteria, baicalein is a flavonoid extracted from the root of the plant *Scutellariabaicalensis* that has long been used in traditional Chinese medicine [5]. Hydroxyapatite coating was synthesized by immersion of the metal in a mineralizing solution called Simulated Body Fluid (SBF), whose ionic composition is similar to blood plasma, at physiological pH and temperature [6]. Hybrid materials were obtained either in a one-pot synthesis with incorporation of baicalein in SBF, or in a two steps process consisting in the adsorption of baicalein at the surface of a pre-formed hydroxyapatite layer. Their morphology was studied by scanning electron microscopy, and their compostion by X ray photoelectron spectroscopy and both Raman and InfraRed spectroscopies. Finally, the antimicrobial activity of hybrid material was tested against *Staphylococcus epidermidis*, a bacterial strain encountered in post-surgery infections. For purpose of comparison and understanding, a study of the molecular interaction between calcium and baicalein in solution was also performed.

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