ISGC 2022

N°169 / OC
TOPIC(s) : Polymers or composites / Biomass conversion

Nanoparticles embedded silk fibroin scaffolds for biomedical and environmental applications

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PURPOSE OF THE ABSTRACT

Bionanocomposites prepared from natural polymers are materials that are attracting growing interest in many applications, particularly in the biomedical field. They combine properties of biopolymers (biodegradability, biocompatibility and mechanical properties in some cases) and the various properties of nanoparticles (NP).
We have developed a method for the preparation of several types of silk bionanocomposites incorporating NPs in order to evaluate them in biomedical applications. Indeed, fibroin, the main protein extracted from Bombix mori silk allows the preparation of many types of biomaterials that can incorporate NPs: sponges, electro-woven fabrics, hydrogels, aerogels, 3D printed objects, ...[1]. However, the shaping of this very sensitive protein in the presence of nanoparticles remains a real challenge and few studies evaluate the influence of NPs on the structure of materials. A methodology based on the control of the silk/NP interface has been developed to obtain various bionancomposites incorporating gold, silver and iron oxide NPs [2]. A thorough characterization of silk hydrogels, including in situ measurements (during gel formation) and ex situ analysis (once the gel is formed) was conducted and the study of the properties of these new objects has been carried out in the context of several specific applications: biomedical applications such as antibacterial application, tissue engineering, imaging but also environmental applications such as depollution.

FIGURES

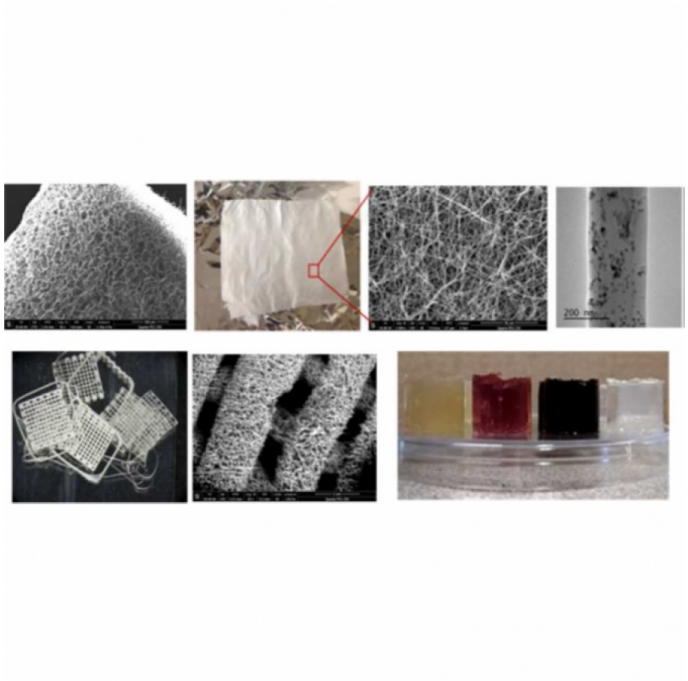

FIGURE 1

Exemple of nanoparticles embedded silk fibroin scaffolds

Silk Nanofoam, electrospun fibroin Mats (SEM and TEM), 3D printed Silk scaffol with SEM, silk hydrogel containing silver, gol and iron oxide particles

FIGURE 2

KEYWORDS

silk | nanoparticle | biomedical applications | depollution

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