

Synthesis and characterization of hybrid cellulose-silica aerogels reinforced with collagen to be used as scaffolds in biomedical applications

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Cellulose-silica aerogels are fascinating materials featuring high porosity, low density and biocompatible properties that can be useful in many biomedical applications. However, their lack of sufficient mechanical stability makes them inappropriate for some purposes. In our effort to produce more durable and stronger aerogels and to improve their absorption capacity, hydrolysed collagen was used as a reinforcing agent. Collagen and cellulose were integrated into silica networks by means of the sol-gel process and then dried in supercritical conditions using CO_2. Different amounts of cellulose and collagen were employed, and $Ca(NO_3)_2 \cdot 4H_2O$ and KH_2PO_4 were added to induce the production of hydroxyapatite. Structural characterization tests (uniaxial compression, BET method, TGA curves, FTIR analyses, and SEM) conducted on the collagen-cellulose-silica aerogels showed that their compressive properties greatly exceed those of plain cellulose aerogels, and that, unlike the latter, the former exhibited elastomeric behaviour. Their absorption capacity properties were also measured by immersing them in simulated body fluid (SBF). Results proved that the stable structure and effective swelling of cellulose aerogels improved significantly by the use of collagen (swelling ratio from 80 to 96 %). Finally, the bioactivity of scaffolds was evaluated by examining the formation of a biologically active carbonate apatite layer on its surface after immersion in SBF. These promising results led us to carry out cell adhesion/attachment tests, which revealed the presence of osteoblast cells on the scaffolds' surface. We can conclude that the prepared cellulose/silica aerogels may be used as tissue engineering scaffolds.

Biography

Dr. María del Mar Mesa graduated in Chemistry and completed her doctorate in Chemical Engineering at the University of Cádiz (Spain) in 1998. She then applied for a posdoctoral position at the University of Geneva. Having lectured in the Department of Chemical Engineering and Food Technologies at the University of Cádiz for several years, Dr. Mesa took the position of assistant professor in 2004. Her research activity has primarily focused on bioprocess engineering, and is currently working on the design and preparation of polymeric scaffolds with potential applications in tissue engineering using sol-gel techniques.

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