A NEW HYBRID HYDROGEL FOR POTENTIAL APPLICATIONS AS BIOINK

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ABSTRACT

Tissue Engineering is a multidisciplinary research field that combines engineering, biology, medicine, and materials science. One of the most challenging health issues is the loss of hard tissue or the failure of an organ due to a disease, injury, or surgery. This is where the innovation and contribution of tissue engineering [1] lies in the development of functional biomaterials for the treatment of damaged tissue. Thus, the main goal of this study was to optimize the synthesis of a biocompatible, bioactive, and biodegradable new hybrid hydrogel based on gelatin methacrylate (GelMA).[2,3] In details, the comparison of the pure GelMA with the new hybrid hydrogel (GAB) derived from the combination of GelMA with a silver-doped bioactive glass (Ag-BG) at a molecular level was performed, and a composite bioink produced by mixing GelMA and Ag-BG nanoparticles (Ag-BGNPs) was developed. Subsequently, the three types of hydrogels were subjected to characterization where their structural, morphological, and elemental characteristics were identified. Moreover, their rheological properties, printability, and stability were studied via an extrusion method and biodegradation tests, and protocols, [4,5] assessing their cytotoxicity and antibacterial activity, were performed. It is concluded that it is particularly critical to maintain the desired temperature throughout the process and to ensure a neutral pH, for a successful synthesis. The morphological and elemental homogeneity of the synthesized biomaterials was confirmed. Rheological characteristics were recorded and the inverse relationship between viscosity and temperature was established. Furthermore, the printability of the systems was observed, and the optimum printing parameters were identified. Finally, tracking of their degradation profile was attained by immersion in DMEM for up to 28 days, which is considered sufficient for triggering new tissue regeneration, while cell survival and the antibacterial activity of the developed systems were evaluated.[5] The new hybrid hydrogel is considered an advanced biomaterial [6] with improved properties due to the reduction of intermolecular extrusion stresses resulting in enhanced cell viability and proliferation.

KEYWORDS: bioactive glass, gelatin methacrylate, hybrid hydrogels, bioprinting

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