

Área: FIS

Gold Nanoparticle-Functionalized Chitosan and Gellan Gum Hydrogels: Synthesis, Characterization, and Comparative Evaluation

^{1*}Gustavo R. Vadique (PG), ^{1,2}Elton G. Bonafé (PQ), ^{2,3}Alessandro F. Martins (PQ), ^{1,2}Rafael B. Samulewski (PQ), ^{1,2}Johny P. Monteiro (PQ)

gustavo.2019@alunos.utfpr.edu.br^{1*}; johnnymonteiro@gmail.com^{1,2}

¹Programa de Pós-Graduação em Ciência e Engenharia de Materiais, UTFPR-AP; ²Laboratório de Materiais, Macromoléculas e Compósitos- LAMMAC, UTFPR-AP; ³Pittsburgh State University, Pittsburgh, Kansas 66762, Estados Unidos

Palavras-Chave: *Hydrogels, Chitosan, Gellan Gum, Gold Nanoparticles, Mechanical Properties, Biomedical Applications*

Highlights

Hydrogels retain high water content and exhibit excellent biocompatibility.
Comparative study reveals distinct behaviors of chitosan vs. gellan gum matrices.
AuNP-functionalized hydrogels show potential for tissue engineering and scaffold systems for cell growth.
Synthesized hydrogels characterized by UV-Vis, SEM, and mechanical testing.

Resumo/Abstract

Hydrogels are three-dimensional polymeric systems widely used in biomedical applications due to their high water retention capacity, biocompatibility, and ease of functionalization. The incorporation of gold nanoparticles (AuNPs) into these matrices has been explored as a strategy to enhance their mechanical, thermal, and functional properties. However, comparative studies involving different polymeric matrices remain scarce, particularly for chitosan (CS) and gellan gum (GG), which exhibit distinct biocompatibility and bioactivity profiles. In this work, hydrogels were prepared from two different polymeric matrices: chitosan and gellan gum. Gold nanoparticles (AuNPs) were chemically synthesized and subsequently incorporated into the matrices at different proportions. The resulting materials were then characterized using various techniques. UV-Vis spectroscopy was employed to evaluate the presence and incorporation of AuNPs in CS solutions, showing an increase in absorption signals with higher nanoparticle concentrations and characteristic peaks of gold nanoparticles between 510 and 550 nm. Scanning electron microscopy (SEM), performed in collaboration with the Londrina laboratory, revealed significant porosity in the hydrogel structures. Mechanical tests demonstrated a slight change in resistance, associated with the Young's modulus, after the addition of nanoparticles. Swelling tests and TGA characterization were also performed, which also showed slight alterations upon nanoparticle incorporation. In conclusion, both chitosan and gellan gum are promising matrices for the incorporation of AuNPs, showing great potential for biomedical applications such as tissue engineering and scaffold systems for cell growth.

Agradecimentos/Acknowledgments

Os autores agradecem ao Capes pela bolsa concedida, à Universidade Tecnológica Federal do Paraná (UTFPR) pelo apoio do Laboratório de Materiais, Macromoléculas e Compósitos (LAMMAC) e dos Laboratórios Multiusuários LAMAP (Campus Apucarana) e LABMULTI (Campus Londrina) pelo suporte.