

Synthesis and Investigation of Biological Activity of a Magnetic Nanobiocomposite Based on Functionalized Graphene Oxide Nanosheets by Casein, Zn-Al LDH, and Alginate Hydrogel

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Due to the increasing prevalence of diseases and their effects, the field of biomedicine, especially tissue engineering and wound healing, is a rapidly growing area of research [1-3]. Researchers are adopting new strategies to promote wound healing, and nanomaterials are playing an increasingly important role in these efforts [4-5]. Regarding this, we fabricated a novel nanobiocomposite using graphene oxide (GO), casein, LDH (Zn-Al), sodium alginate, and Fe₃O₄ magnetic nanoparticles. The GO was synthesized by a modified Hammer's method, and then its surface was covalently functionalized with casein protein. The functionalized GO was then combined with the as-synthesized LDH (Zn-Al). The composite was then conjugated with alginate hydrogel via the gelation process. Finally, the nanobiocomposite was magnetized by in-situ magnetization. The nanobiocomposite (GO/CS/LDH/Alg/Fe₃O₄) was fully characterized using several techniques, including FT-IR, FE-SEM, EDX, XRD, TGA, and VSM. The cell viability method, hemolysis, and anti-biofilm assays were performed to explore the biological capability of the nanobiocomposite. The results of the MTT assay showed that the viability percentages of HuO2 cells treated with the nanobiocomposite after 24, 48, and 72 hours of incubation were 93.08%, 91.64%, and 91.19%, respectively. The hemolytic effect of the nanobiocomposite was 3.84%. The measured bacterial growth inhibition percentages of *E. coli* and *S. aureus* bacteria in the presence of the nanobiocomposite were 52.18% and 55.72%, respectively. Overall, the results of this study demonstrate that the novel nanobiocomposite has good biocompatibility and antibacterial and anticancer activity. It is a promising candidate for use in tissue engineering applications.

Keywords: Graphene oxide, Alginate, Nanoparticles, Layered double hydroxide, Biomaterial.

References

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