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PROCEEDINGS ABSTRACT

A novel polyethylene glycol / graphene oxide composite as a nanocarrier of methylprednisolone: synthesis and physicochemical characterization

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A popular corticosteroid with strong anti-inflammatory and immune suppressive qualities, methylprednisolone (MP), has a comparatively low cellular absorption and a restricted water solubility that limit its therapeutic efficacy and require a greater dosage, thereby raising the possibility of unfavourable systemic side effects. Therefore, it is crucial to create a drug delivery system that can enhance MP's solubility, stability and targeted distribution; carrier-based nanocarriers have been shown to overcome these restrictions. Because of its enormous surface area, its abundance of oxygen-containing functional groups, and its exceptional aptitude for drug adsorption through pi–pi stacking and hydrogen bonding interactions, graphene oxide (GO) has garnered great attention amongst nanomaterials. GO is a flexible platform for medication-loading and delivery applications. The PEGylation (or surface functionalization with polyethylene glycol; PEG) has been used in order to enhance the stability, dispersibility, and biocompatibility of nanomaterials for various medical applications. We herein report the development of a PEGylated GO nanoparticle as a novel nanocarrier system for the transportation of MP and the enhancement of its delivery. A solution blending method was used in order to synthesize the nanocomposite *via* the dispersion of GO, first ultrasonically in the deionized water and then through the functionalization of its surface so as to improve its stability and compatibility. PEG was then added with constant stirring in order to encourage the interaction between GO and PEG. The mixture was purified using ultracentrifugation so as to remove any unbounded components and to produce stable GO–PEG nanoparticles. MP was loaded onto the PEGylated GO nanocarrier through an adsorption procedure under carefully regulated heating and stirring conditions. Multiple binding sites were made possible by the GO's vast surface area and functional groups, which allow the drug molecules on the nanocarrier matrix to interact effectively. Several approaches were employed in order to clarify the nanocomposite's physicochemical properties and to verify that the GO was successfully functionalized with PEG. In order to detect the interaction between the carrier and the loaded medication (MP), we employed Fourier transform infrared (FTIR) spectroscopy. The structural features and crystalline properties of the developed nanomaterial were examined using X-ray diffraction (XRD) analysis, while energy dispersive spectroscopy (EDS) was used in order to ascertain the elemental composition of the produced nanocomposite. Furthermore, scanning electron microscopy (SEM) revealed details about the surface shape and particle size distribution of the produced nanoparticles. In brief, the GO–PEG nanocomposite was successfully formed, and MP was found to be ef-

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fectively loaded on it. Successful surface functionalization was confirmed through FTIR, displaying distinctive absorption bands related to GO and peaks linked to PEG, as well as interactions between the MP and the GO–PEG matrix. The undertaken XRD analysis revealed structural changes indicative of the creation of a stable structure. Good dispersion was demonstrated by the obtained SEM micrographs, with the latter revealing nanoscale sheets-like structures with comparatively homogeneous shapes. EDS demonstrated a successful drug integration into the GO-based carrier. Our findings suggest that the PEGylated GO could serve as a promising nanocarrier for MP administration due to its advantageous properties and drug-carrier interactions.

Keywords

drug delivery system; graphene oxide; methylprednisolone; PEG; PEGylated graphene oxide

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Conflicts of interest statement

None to declare.

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