GADOLINIUM NANOPARTICLE-EMBEDDED HYDROGELS: EXPLORING NEUTRON RADIATION INTERACTIONS FOR ADVANCED MEDICAL THERAPY

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Gadolinium is renowned for its exceptionally high cross-section for thermal neutrons [1]. This study delves into the synthesis and comprehensive physico-chemical characterization of gadolinium nanoparticles. These nanoparticles are subsequently incorporated into a hydrogel matrix as a carrier to investigate their interaction with neutron sources derived from an AmBe reactor. The synthesis process involves precise control over nanoparticle size and morphology to optimize their neutron capture efficiency.

Physico-chemical characterization encompasses structural analysis using techniques such as X-ray diffraction (XRD) and scanning electron microscopy (SEM) coupled to an Oxford Instruments Xplore microanalysis for elemental composition and surface properties examination along with Raman spectroscopy.

The gadolinium nanoparticle-hydrogel nanocomposite is evaluated for its neutron capture capabilities using neutron activation analysis (NAA) and neutron spectroscopy (BDS). The hydrogel serves a dual role: it functions as a carrier for the nanoparticles and provides a biocompatible environment suitable for potential medical applications [2].

This research aims to advance the understanding of gadolinium nanoparticle behavior under neutron irradiation conditions, laying the groundwork for future developments in neutron radiotherapy. The findings contribute to the ongoing exploration of gadolinium-based materials for their potential to enhance therapeutic outcomes in medical neutron irradiation.

Key words: *Gadolinium nanoparticles, Hydrogel, Radiotherapy, Neutron Radiation.*

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