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Navigating The Duality of Silver Nanocomposites: Antimicrobial Promise Versus Cytotoxic Risks

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ABSTRACT

Silver nanocomposites (Ag-NCs) have garnered significant attention in recent years owing to their exceptional antimicrobial properties, which make them promising candidates for various biomedical applications. However, concerns regarding their potential toxicity and cellular compatibility persist. This review offers a comprehensive overview of the current status of Ag-NCs, covering their synthesis, characterization, and biological interactions. It examines the effects of Ag-NCs on cellular responses, including cytotoxicity, genotoxicity, and oxidative stress, alongside their potential applications in healthcare systems. The review also underscores the key factors influencing cellular compatibility, such as the size, shape, concentration, and surface chemistry of Ag-NCs. Furthermore, it identifies existing knowledge gaps and suggests future research directions to facilitate the safe and effective utilization of Ag-NCs in biomedical contexts. The literature search was performed using Google Scholar, Web of Science (WoS), and Scopus-indexed repositories. The objective of this review is to advance a comprehensive understanding of the complex interplay between Ag-NCs and biological systems, thereby supporting the development of Ag-NC-based biomaterials with optimal cellular compatibility.

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