

# Synthesis and Characterization of Metal-Based Nanocomposites for Multifunctional Biotechnological Applications

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**Abstract:** *The synthesis, characterisation, and many biological uses of metal complexes and nanocomposites made from a wide range of biopolymeric ligands are thoroughly examined in this review study. Because of their biocompatibility, biodegradability, and functional diversity, these ligands—which include chitosan, 2-hydroxybenzaldehyde, and 4-aminopyridine imine, among others—have demonstrated extraordinary promise. In addition to highlighting sophisticated characterization methods including spectroscopy, microscopy, thermal analysis, and X-ray diffraction, the study explores a variety of synthetic procedures, including conventional and green synthesis approaches. The study discusses the wide range of biological properties that these compounds display, including antibacterial, antioxidant, anticancer, enzyme inhibition, and drug delivery applications. This review attempts to give researchers in medicinal chemistry, materials science, biotechnology, and related disciplines useful insights by summarizing recent work and highlighting important issues and future prospects.*

**Keywords:** Metal Complexes, Nanocomposites, Synthesis, Characterization, Biological Application