

TUTORIAL REVIEW

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Greener nanobiopolymers and nanoencapsulation: environmental implications and future prospectsShikha Gulati,^a Anoushka Amar,^a Lakshita Chhabra,^a Riya Katiyar,^a Meenakshi,^a Tanu Sahu^a and Rajender S. Varma^b

To minimize the consumption of nonrenewable resources and ensure environmental sustainability, there ought to be greater utilization of abundant and renewable greener nanobiopolymers, particularly those derived from various plants and microbes. This article discusses the various types, origins, and synthesis methods of biopolymers, including those that come from natural resources and microorganisms, with a focus on their properties in nanoformat; the most common and recently researched nanobiopolymers have been deliberated. In addition, discussion on various synthesis steps and structural characterization of green polymeric materials such as cellulose, chitin, and lignin is also incorporated. A comprehensive discussion of greener nanobiopolymers with illustrative examples has been presented for the last five years comprising their diverse types and topologies including the environmental improvements realized via the deployment of nanoencapsulation, especially the applications of polymer nanoencapsulated materials in wastewater and soil treatment. The emphasis on the use of greener nanobiopolymers for sustainable environmental remediation is specifically highlighted for the decontamination of soil, water, and air with the main objective being to offer an overview of their adaptability embracing nanotechnology. This effort could stimulate additional research in their deployment in practical environmental applications.

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Environmental pollution remains a pressing global issue, posing significant risks to ecosystems and human health. Addressing this challenge is crucial for ensuring a sustainable future. Our review, "Modernizing Environmental Cleanup: Harnessing Greener Nanobiopolymers for a Sustainable Tomorrow," explores innovative, eco-friendly nanobiopolymers as advanced solutions for remediation. These materials offer efficient, non-toxic alternatives to conventional methods, significantly reducing environmental impact. By leveraging cutting-edge technology, our work aligns with the United Nations Sustainable Development Goals