Commentary
Volume 14:04, 2024

Journal of Bioprocessing & Biotechniques

ISSN: 2155-9821 Open Access

New Insights into Regulating the Form, Size and Composition in the Biosynthesis of Inorganic Nanoparticles

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Introduction

The biosynthesis of inorganic Nanoparticles (NPs) presents a sustainable and eco-friendly alternative to traditional synthesis methods. This article offers a fresh perspective on how the form, size and composition of inorganic NPs can be precisely regulated through biosynthesis. We delve into the mechanisms underlying this process, highlighting the roles of microorganisms, enzymes and biomolecules. Additionally, we explore the diverse applications of these bio-synthesized NPs in fields such as medicine, catalysis and environmental remediation. Inorganic nanoparticles are distinguished by their unique physical and chemical properties, which differ significantly from their bulk counterparts. Traditional synthesis methods often involve harsh chemicals and elevated temperatures, raising environmental concerns. In contrast, biosynthesis employs biological systems such as microorganisms, enzymes and biomolecules to control and optimize NP production, offering a more sustainable approach. This article emphasizes how biological systems can influence the nucleation, growth and stabilization of inorganic NPs. Microorganisms like bacteria, fungi and algae are instrumental in this process, as they secrete enzymes and biomolecules that serve as reducing agents, capping agents, or templates for NP formation. Enzymes such as nitrate reductase and alkaline phosphatase facilitate the reduction of metal ions to create NPs. Additionally, biomolecules including proteins, polysaccharides and lipids interact with metal ions to modulate their size, shape and composition, thereby tailoring the properties of the resulting nanoparticles [1-3].

Description

The form and dimensions of inorganic Nanoparticles (NPs) can be precisely controlled through various mechanisms in biosynthesis. For instance, factors such as reactant concentration, pH and temperature of the reaction medium significantly influence the size and shape of the NPs. Microorganisms contribute to shaping NPs by secreting biomolecules that selectively bind to specific crystal faces, resulting in distinct geometric shapes like rods, cubes, or triangles. The chemical composition and surface properties of inorganic NPs can also be regulated during biosynthesis. Microorganisms can selectively accumulate metal ions from their environment and incorporate these ions into the NPs as they form. This process can be fine-tuned by adjusting the growth conditions of the microorganisms, such as nutrient availability and the presence of other ions in the medium. Bio-synthesized inorganic NPs exhibit considerable potential in various fields. In medicine, they serve as drug delivery vehicles, imaging agents, or therapeutic agents due to their unique properties and biocompatibility. In catalysis, these NPs act as catalysts in reactions such as hydrogenation, oxidation and carbon-carbon bond formation. In environmental remediation, they are used to remove pollutants from water and soil and to detect environmental contaminants [4,5].

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Received: 02 July, 2024, Manuscript No. jbpbt-24-143763; **Editor Assigned**: 04 July, 2024, PreQC No. P-143763; **Reviewed**: 16 July, 2024, QC No. Q-143763; **Revised**: 22 July, 2024, Manuscript No. R-143763; **Published**: 30 July, 2024, DOI: 10.37421/2155-9821.2024.14.631

Conclusion

In conclusion, biosynthesis of inorganic Nanoparticles (NPs) presents a promising method for precisely regulating their form, size and composition. By leveraging biological systems-such as microorganisms, enzymes and biomolecules-the synthesis process can be tailored to produce NPs with specific properties suitable for a range of applications. Continued research in this field holds the potential to develop novel nanomaterials with enhanced properties and functionalities, advancing various industries and applications.

Acknowledgement

None.

Conflict of Interest

There is no conflict of interest by author.

References

1. Kapoore, Rahul Vijay, Gloria Padmaperuma, Supattra Maneein and Seetharaman Vaidyanathan. "Co-culturing microbial consortia: A pproaches for applications in biomanufacturing and bioprocessing." *Crit Rev Biotechnol* 42 (2022): 46-72.
2. Dunbar, Sherry A and James W. Jacobson. "Quantitative, multiplexed detection of *Salmonella* and other pathogens by Luminex® xMAP™ suspension array." *Methods Mol Biol* 22(2007): 1-19.
3. Lee, Sang Gui, Jae Hwan Goo, Hee Gon Kim and Jeong-Il Oh, et al. "Optimization of methanol biosynthesis from methane using *Methylosinus trichosporium* ob3b." *Biotechnol Lett* 26 (2004): 947-950.
4. Ducey, Thomas F., Brent Page, Thomas Usgaard and Monica K. Borucki, et al. "A single-nucleotide-polymorphism-based multilocus genotyping assay for subtyping lineage I isolates of listeria monocytogenes." *Appl Environ Microbiol* 73 (2007): 133-147.
5. Nair, Lakshana G., Komal Agrawal and Pradeep Verma. "An insight into the principles of lignocellulosic biomass-based zero-waste biorefineries: A green leap towards imperishable energy-based future." *Biotechnol Genet Eng Rev* 38 (2022): 288-338.

How to cite this article: Hee, Soo. "New Insights into Regulating the Form, Size and Composition in the Biosynthesis of Inorganic Nanoparticles." *J Bioprocess Biotech* 14 (2024): 631.