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Commentary

Biosynthesized Silver Nanoparticles (AgNPs): Melanoidin Decolorization in the Bacterial Extracellular Supernatant

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Abstract

The goal of the current study was to use biosynthesized silver nanoparticles (AgNPs) to decolorize synthetic melanoidins using bacterial extract in an immobilized state. Bacillus sp. BAC1 was used to biosynthesize silver nanoparticles employing an extracellular approach. UV-Visible spectroscopic spectroscopy was used to analyze silver nanoparticles of brown hue that were produced through biosynthesis. The spherical shape and smooth surface morphology of the nanoparticles were further characterized using Transmission electron microscopy (TEM), Scanning electron microscopy (SEM), Energy dispersive X-ray spectroscopy (EDX), Fourier transform infrared spectroscopy (FT-IR), and Atomic force microscopic (AFM) analysis. Under typical circumstances, the amount of melanoidin decolorization in the bacterial extracellular supernatant was greater than 65% (in 12 hours). In comparison, biosynthesized AgNPs demonstrated 82% clearance under comparable circumstances. The maximal amount of melanoidin removal from the cell free extract immobilized with manufactured AgNPs was 92% in 12 hours; this highlights the usefulness of Nano-coupled biomaterial immobilization as a method for speedy melanoidin decolorization (Sadighi A et al., 2013).

INTRODUCTION

Molasses spentwash is a dark-brown coloured effluent produced by sugarcane-based enterprises that has high levels of the biopolymer melanoidin, heavy metals, sulphate, phenolics, solids, BOD, and COD. A naturally occurring pigment called melanoidin is produced via the maillard reaction between amino and carbonyl groups of chemical compounds. Water pollution issues arise in aquatic habitats as a result of the discharge of melanoidin-based effluent since less sunshine and photosynthetic activity are occurring. Additionally, colourful waste wash pollutes soil by lowering pH and preventing growth and seed germination. The decolorization of colourful effluent containing melanoidin has been researched using a variety of physical-chemical processes, including photolysis, photocatalytic degradation, flocculation, membrane filtration, ultrafiltration, mineral sorbents, and advanced oxidation. But microbiological decolorization employing bacteria, fungus, and yeast is regarded as environmentally friendly and has the ability to mineralize finished materials (Junejo Y et al., 2014).

The primary restrictions are the rising cost to the point of impracticality, carbon dioxide, volatile acids, and the residual biomass content. The use of immobilization technology offers an alternative to using free cells in the degrading process to address these issues. Different immobilization techniques are used today to speed up the decolorization process. The use of microbiological source in conjunction with nanoparticle immobilization to increase degradation is a recent development in this field (Krutyakov YA et al., 2008).

Due to their increased surface area, high catalytic efficiency, mass transfer effect, efficient enzyme storage, and high surface reaction activity, a variety of nanoparticles can be used as catalysts in the waste water treatment process thanks to nanotechnology. It has been discovered that adding nanoparticles as a supplement to biodegradation

affects the microbial population and, consequently, the pace of biodegradation (Kalimuthu K et al., 2008).

Similar to this, the technique of removing colour has been successful when nanoparticles with enzyme immobilization technology are used. The use of silver nanoparticles in numerous industries, including the bio-medical, pharmaceutical, cosmetic, electronics, energy sector, dye effluent treatment, and other environmental remediation advances, has been extensively documented in papers. AgNPs have excellent chemical stability, strong thermal and electrical conductivity, catalytic activity, and nonlinear optical properties. Therefore, the goal of the current study was to combine the benefits of biologically generated silver nanoparticles with the immobilization method to create a quick method for synthetic melanoidin decolorization (Mukhopadhyay A et al., 2013).

CONCLUSION

The goal of the current work was to investigate the possibility of a fast melanoidin decolorization system assisted by nanomaterials. Significant melanoidin decolorization can be seen in the bacterial extracellular supernatant and silver nanoparticles. Additionally, the supernatant immobilized with AgNPs displayed increased decolorization activity, confirming the existence of a second catalytic process in the breakdown of melanoidin. Additionally, it suggests that the extracellular supernatant's physico-chemical characteristics are altered by the Nano catalyst, causing the decolorization process to occur. However, further research needs to be done on several findings, such as the type of enzyme responsible for melanoidin decolorization, the properties of immobilized nanoparticles, and free crude extract. The aforementioned information leads to the conclusion that the use of nanoparticles with microbial sources may improve the effectiveness of melanoidin Nano bioremediation in the treatment of molasses spent wash.

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