Honey Mediated Green Synthesis of Silver Nanoparticles to Combat Against Pathogenic Bacteria

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ABSTRACT

Introduction: Honey, known for its complex composition of sugars, enzymes, and phytochemicals, is being utilized in the synthesis of silver nanoparticles[3]. These nanoparticles have remarkable properties, particularly in medicine, electronics, and environmental applications. Traditional methods of creating nanoparticles often involve harmful chemicals and energy-intensive processes, raising environmental and health concerns[1]. The focus on honey-based synthesis arises from its potential to address these issues. Honey's unique blend of natural compounds has the ability to reduce silver ions and control the size and shape of the resulting nanoparticles. This process is primarily facilitated by sugars like glucose and fructose, acting as reducing agents when they interact with silver ions in a solution containing silver nitrate. Furthermore, honey's organic acids and phytochemicals play a crucial role in stabilizing the nanoparticles, ensuring their biocompatibility and functionality. Compared to other methods reliant on microorganisms, using honey for nanoparticle synthesis offers several advantages. It's faster, doesn't require the meticulous cultivation of microorganisms, and simplifies the separation of nanoparticles from biological agents[2,4]. This eco-friendly approach aligns well with sustainable practices and holds promise across diverse fields such as biomedicine, catalysis, and materials science.

The significance of this honey-assisted synthesis lies in its potential to revolutionize nanoparticle production, paving the way for sustainable, biocompatible, and versatile applications across multiple industries.

Objectives:

1. Exploration of various ratios, times, pH levels, and temperatures to optimize the synthesis of silver nanoparticles.
2. Characterize synthesized AgNPs with different techniques to emphasize the potential applications of silver nanoparticles in the medical field as potent antimicrobial agents.

Methodology: Honey was procured from an online source. Milli-Q water was utilized in the preparation process. Various concentrations of $AgNO_3$ solutions (2.5, 5, and 7.5 mM) with different dilutions of Honey were used. Detection and characterization of the silver nanoparticles (AgNPs) was conducted by obtaining UV-visible absorption spectra within the wavelength range of 300 to 700 nm.

Conclusion/Results: In conclusion, the process outlined in the experimentation involving the synthesis of silver nanoparticles through the green synthesis method using honey as a reducing and stabilizing agent, coupled with varying concentrations of silver nitrate, presents a promising avenue for potential applications in biomedical and antimicrobial fields. The identified optimum conditions, including the ratio of honey to silver nitrate, pH, temperature, and duration of synthesis, exhibited successful formation of silver nanoparticles, as evidenced by the observed peaks in the UV-Vis spectrophotometer. Further characterization using SEM, FTIR, and assessment of antimicrobial activity provided additional insights into the properties of these nanoparticles. The outcomes of this study hold significant prospects for the

development of silver nanoparticles as potent antimicrobial agents, contributing to advancements in pharmaceutical and medical sectors.

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REFERENCES

1. Ijaz, Irfan, et al. “Detail Review on Chemical, Physical and Green Synthesis, Classification, Characterizations and Applications of Nanoparticles.” Green Chemistry Letters and Reviews, vol. 13, no. 3, 2 July 2020, pp. 223–245, https://doi.org/10.1080/17518253.2020.1802517.
2. Balasooriya, Eranga Roshan, et al. “Honey Mediated Green Synthesis of Nanoparticles: New Era of Safe Nanotechnology.” Journal of Nanomaterials, vol. 2017, 2017, pp. 1–10, https://doi.org/10.1155/2017/5919836. Accessed 19 Apr. 2020.
3. Patel RR, Singh SK, Singh M. Green synthesis of silver nanoparticles: methods, biological applications, delivery and toxicity. Materials Advances. 2023;4(8):1831-49.
   Matar G, Akyuz G, Kaymazlar E, Andaç M. An investigation of green synthesis of silver nanoparticles using Turkish honey against pathogenic bacterial strains. Biointerface Research in Applied Chemistry. 2023;13(2).