

A Comparative Evaluation of Antibacterial activity of Silver and Gold Nanoparticles Synthesized using a Poly(amic) acid

Abstract

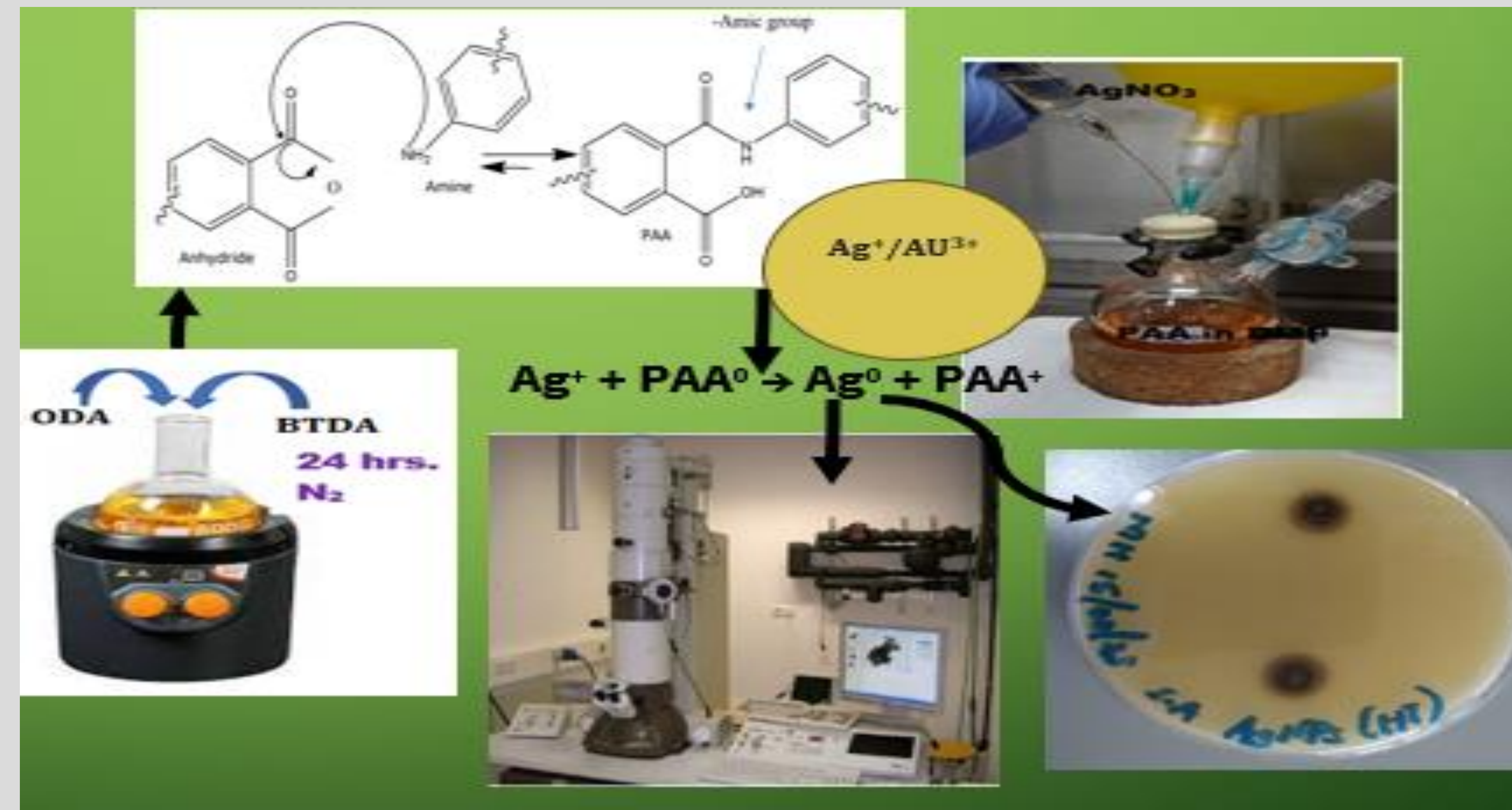
Water is the most abundant natural resource covering about 70 percent of the earth's total surface. The supply of clean and safe water for domestic use, however, remains the most important scientific and technological challenge facing the globe today. Pollution as a result of human organic waste, generates a large volume of waste water containing deadly microbes including *Escherichia coli* (*E. coli*) and *Streptococcus aureus* (*S. Aureus*) has been cited as the major cause of water pollution and contamination. To realize the Sustainable Development Goal (SDG) number 6, sustainable and environmentally friendly approaches for waste water treatment and remediation is therefore critical. Recently, Nanotechnology has been widely investigated as efficient and effective pathway for waste water treatment and remediation. Both silver (Ag) and gold (Au) nanoparticles (NPs) have shown activity against *Escherichia coli* and *staphylococcus aureus*, but the degree of activity is not yet clear. This study intended to compare the antibacterial activities of synthesized AgNPs, AuNPs and Ag/AuNPs blends against *E. coli* and *S. aureus*. Synthesized AgNPs, AuNPs and Ag/AuNPs blends were characterized by UV-Visible spectroscopy, cyclic voltammetry and SEM analysis. SEM showed that AgNPs, AuNPs and Ag/AuNP blend were aggregated, spherically shaped and dispersed throughout the matrix of the polymer. Ag/AuNP blends synthesized under ambient temperature showed an excellent antimicrobial efficacy against *E. coli* and *S. aureus* compared to AgNPs, AuNPs and Ag/AuNPs synthesized under ambient temperature or 70°C. However, we recommend further investigations to understand the potential risks of the application.

Introduction

- Rapid depletion of the world's basic life-supporting resources presents a critical crisis¹
- About 26% of the global population lack access to safe drinking water²
- SDG-6 seeks to achieve universal and equitable access to safe and affordable drinking water for all³.
- Nanotechnology application in water treatment is a fast-growing technology⁴.
- AgNPs and AuNPs are known for antimicrobial activity but information is insufficient on their degree of antimicrobial activity⁵.
- In this research, we intended to compare the antibacterial activities of synthesized AgNPs, AuNPs, and Ag/AuNPs blends against *E. coli* and *S. aureus*.

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Methodology



Discussion

- The yellow viscous liquid indicated PAA formation.
- The PAA was an effective reducing agent while also stabilizing the nanoparticles, hence providing excellent control against agglomeration⁶
- The UV-Vis spectra in the region of 425 nm (Fig. 1 a) and 533 nm (Fig 1 b) confirmed synthesis of AgNPs and AuNPs respectively⁶.
- The shift in the plasmon resonance absorption to longer wavelengths explains Significant difference in the size, morphology and distribution of the nanoparticles⁷
- Room temperature produced smaller, more spherical and dispersed nanoparticles.
- The Ag/AuNPs synthesised at room temperature showed the greatest antibacterial inhibition with an average zone diameter of for *S.A* and *E. Coli* respectively. 25.5 and 27.5

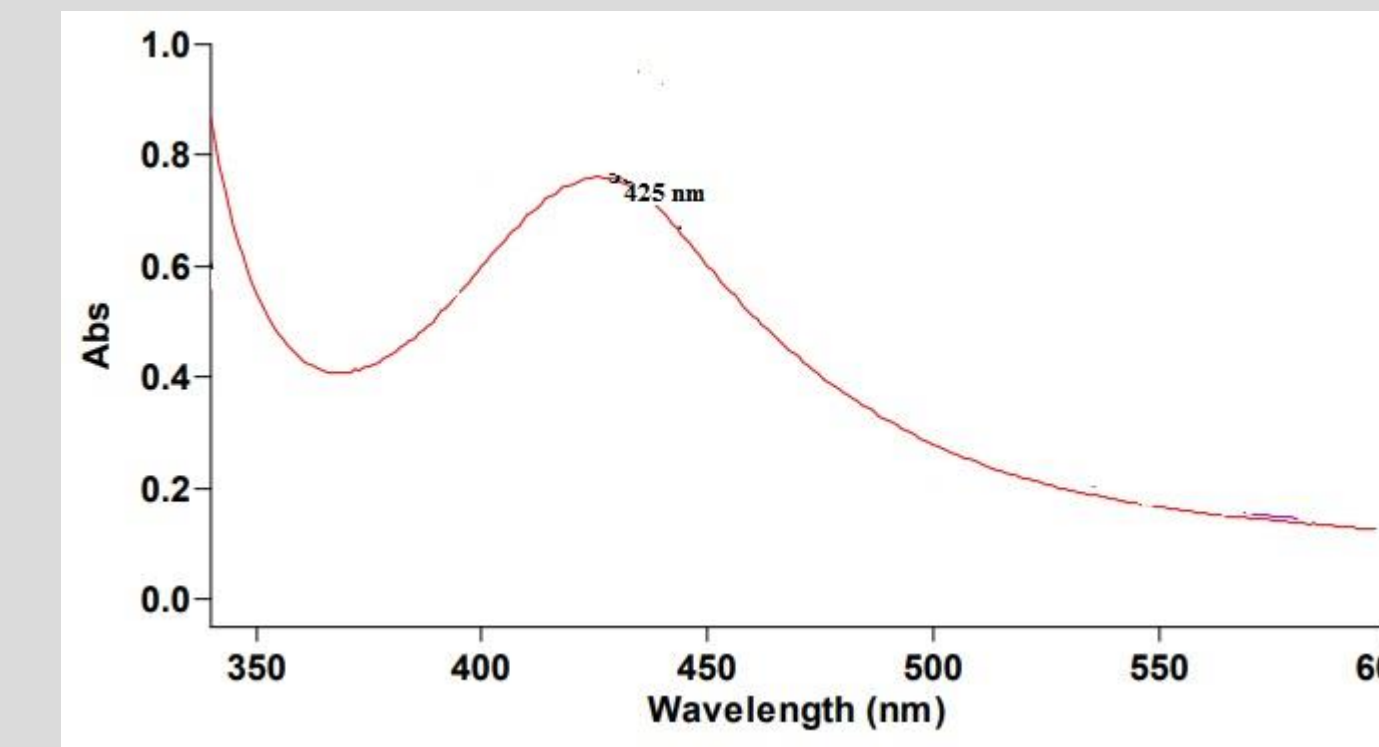


Figure 1a. UV/Vis for AgNPs

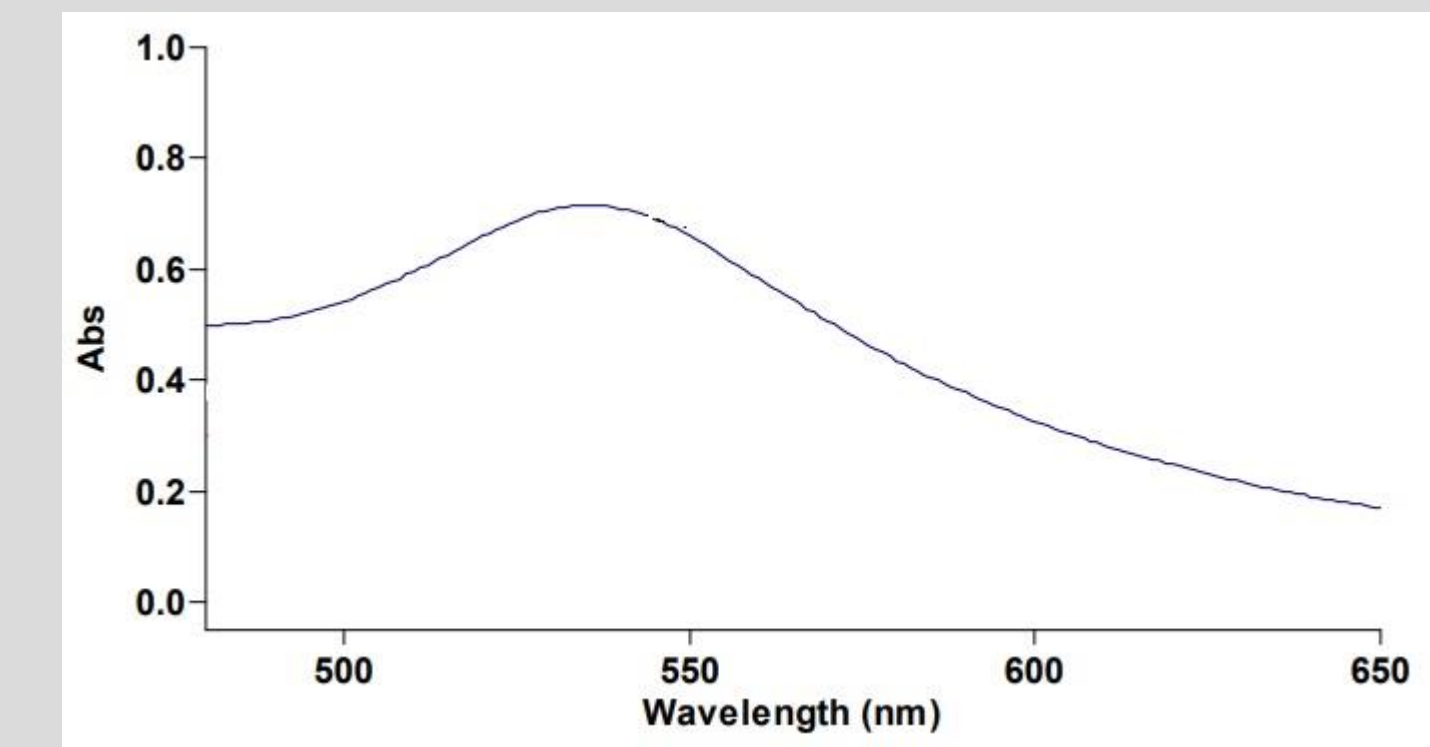


Figure 1b. UV/Vis for AuNPs



Conclusion

- AgNPs, AuNPs and Ag/AuNPs blend were successfully synthesized and stabilized by the PAA at room and 70°C.
- Room temperature produced smaller particles which had better antibacterial activity than those synthesized under 70°C.
- Blend of Ag/AuNPs gave better activity than the positive control.

Reference

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