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Application Of Silver Nanoparticles Biosynthesized Using Secondary Metabolites Of Acid-Tolerant Bacteria Isolated From Osun State Gold Mining Field, Southwest Nigeria

Ajani, T. F.[1,2]., Adebayo-Tayo, B. C.[2], Alao, S. O.[2]., Ogunwale, J. O.[1] & Akinde, S. B.[1]
[1]Department of Microbiology, Osun State University, Osogbo, Osun State, Nigeria
[2]Department of Microbiology, Faculty of Science, University of Ibadan, Ibadan, Nigeria
Email: temitope.ajani@uniosun.edu.ng

ABSTRACT

Acidic mine drainage (AMD) refers to effluent from abandoned mines containing a variety of microorganisms and dissolved metals in concentration greater than what is found in natural water bodies. In this study, water samples were collected aseptically from five different points of gold mining site in Oke - Ipa, Atakunmosa West Local Government, Osun State, Nigeria, and then transferred immediately to the laboratory for standard physicochemical and microbiological analyses. Secondary metabolites produced from the isolated bacteria used to biosynthesize silver nanoparticles (AgNP), with the best two producers identified molecularly, and the biosynthesized AgNP nanoparticles applied for the purification of the acidic mine drainage water. The results of the analyses of the mine drainage sampled points ranged from: 25.7 – 26.7°C for temperature; 5.88 – 6.75 for pH; 0.04 – 0.07 (ppt) for salinity; 94.9 – 365.2 (NTU) for turbidity; 0.09 – 0.13 (µS/cm) for conductivity; 5.1 – 8.7 mg/L for Dissolved Oxygen; 163 – 468 mg/L for BOD_5; 13,950.02 – 16, 857.66 mg/L for COD; and 5.9 x 10^6 – 9.2 x 10^6 CFU/mL for bacterial count. Seven (7) distinct bacterial colonies obtained and used to biosynthesize AgNPs showed surface plasmon resonance bands ranging from 360 – 570 nm, and molecular identification of the best two AgNP producers closely related to *Serratia* sp. (97.7%) and *Enterobacter cloacae* (98.5%). The biosynthesized AgNPs percentage purification of water from the sampled points of the gold mining site ranged from: 3.7 – 22.4% for pH; 4.29 – 84.60% for salinity; 14.98 – 71.82% for turbidity; 15.32 – 85.71% for conductivity; 1.12 – 46.90 % for BOD_5; 2.56 – 81.44 % for Dissolved Oxygen; and 15.72 – 92.59% for bacterial load. This investigation revealed secondary metabolites biosynthesized AgNPs with high purification potential for acid mine drainage.

Keywords: Acidic Mine Drainage, Physicochemical; Microbiological; Secondary Metabolites; Silver Nanoparticles; Purification

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