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Harnessing the Generation of Ferromagnetic and Silver Nanostructures from Tropical Aquatic Microbial Nanofactories

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Abstract : Iron based ferromagnetic nanoparticles (IONP) and silver nanostructures (AgNP) have found a wide range of application in antimicrobial therapy, cell targeting, and environmental applications. As such, the design of well-defined monodisperse IONPs and AgNPs have become an essential tool in nanotechnology. Fabrication of these nanostructures using conventional methods is not environmentally conducive and weigh heavily on energy and outlays. Selected microorganisms possess the innate ability to reduce metallic ions in colloidal aqueous solution to generate nanoparticles. Hence, harnessing this potential is a way forward in constructing microbial nano-factories, capable of churning out high yields of well-defined IONP's and AgNP's with physicochemical characteristics on par with the best synthetically produced nanostructures. In this paper, we report the isolation and characterization of bacterial strains isolated from the tropical marine and freshwater ecosystems of Malaysia that demonstrated facile and rapid generation of ferromagnetic nanoparticles and silver nanostructures when precursors such as $FeCl_3.6H_2O$ and $AgNO_3$ were added to the cell-free bacterial lysate in colloidal solution. Characterization of these nanoparticles was carried out using FESEM, UV Spectrophotometer, XRD, DLS and FTIR. This aerobic bioprocess was carried out at ambient temperature and humidity and has the potential to be developed for environmental friendly, cost effective large scale production of IONP's. A preliminary bioprocess study on the harvesting time, incubation temperature and pH was also carried out to determine pertinent abiotic parameters contributing to the optimal production of these nanostructures.

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