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Extracellular Synthesis of Iron Oxide NPs by Using Several Bacteria Genera Isolated from Oil Contaminated Sites in Basrah Governorate

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ABSTRACT

Nanotechnology is a developing field of research that focuses on manipulating the structure of matter at the atomic and molecular level. Twenty-two bacterial isolates were isolated from five contaminant sites of wastewater, sludge, and soil in Basrah Governorate. The isolates were identified by 16S rRNA gene sequencing analysis. The isolated bacteria was investigated to reduce nitrate and screen for production of iron oxide nanoparticles (IONPs) by determining the weight of yield for each isolate, and measuring the absorbance by using UV-Vis spectrophotometer. The results of genetic identification showed that bacterial isolates belonged to the genera of *Alishewanella*, *Stutzerimonas*, *Mixta*, *Pantoea*, *Leclercia*, *Citrobacter*, *Bacillus*, *Franconibacter*, *Enterobacter*, *Shigella*, *Lysinibacillus*, *Halotalea*, and *Enterobacteriaceae*. Depending on the 16S rDNA gene sequences, the phylogenetic tree was built to show the evolutionary relationships between the isolated bacteria. Nine new strains were recorded in the GenBank. All bacterial isolates were positive to nitrate reduction test and the color of the medium changed from pale yellow to brown or reddish brown indicating the reduction of iron salt FeCl3.6H2O to IONPs, moreover the range of absorbance was between 342–457nm. The weight of IONPs synthesis ranged from 0.02 to 0.702g/ l. *Alishewanella jeotgali* KCTC 22429, *Leclercia adecarboxylata* strain V894, and *Lysinibacillus boronitolerans* strain Mix24 achieved the highest rate of production of IONPs 0.702, 0.5 and 0.46g/ l, respectively. The abundance of diverse bacteria suggests that they possess an inherent ability to function as viable bio factories in the creation of nanoparticles.

INTRODUCTION

The petroleum refinery effluents are generated as a result of the crude oil processing. It consists of hazardous substances, including heavy metals, polycyclic aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH) **(Almutairi, 2024)**. The conditions such as high pressure, high temperatures, high salt content, and little water activity in oil field reservoirs, prevent many bacteria to survive there **(Pannekens *et al.*, 2019)**. Several significant bacterial species were isolated and identified in oil-contaminated soil that have the ability to biodegrade petroleum. These species include *Vibrio Xanthomonas*, *Bacillus* sp., *Aeromonas* sp., *Acinetobacter* sp.,