Microbial Synthesis and Characterization of Iron Nanoparticles from *Escherichia Coli*

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Abstract

Nanotechnology is one of the developing areas with wide applications and iron (Fe) is a very common and easily accessible option for manufacturing nanoparticles (NPs). Iron nanoparticles (FeNPs) can be produced through physical, chemical, or biological processes. Therefore, the objective of this study was to synthesize iron nanoparticles by *Escherichia coli.* The state of microorganisms and their morphological characteristics were investigated prior to the synthesis of nanoparticles. *Escherichia coli* bacterium (ATCC 25922) was selected for synthesized FeNPs using extra cellular method. *Escherichia coli* was cultured and incubated on a shaking water bath and on an orbital shaker at room temperature to identify the suitable way for the growth of *Escherichia coli*. The biomass of *Escherichia coli* was harvested and centrifuged. Then, the pellet was collected for the further reaction to the synthesis of nanoparticles. The Ferric Chloride ($FeCl_{3)}$ solution of different concentration was used for synthesized iron nanoparticles. Nanoparticle formation was confirmed by UV- visible spectroscopy, Fourier-Transform Infrared Spectroscopy (FTIR), and Scanning Electron Microscopy (SEM) analysis methods. According to the results, the UV spectrum of FeNPs synthesized by *Escherichia coli* exhibited broad absorption peaks between 220 and 250 nm; the interaction of extracts with the nanoparticle was explained by FTIR spectroscopy. Accordingly, scanning the FeNP sample between the range of 1000 and 4000 cm^{-1} was used to get FTIR spectra for FeNPs produced by *Escherichia coli*, and (SEM) examination of iron nanoparticles revealed the presence of the FeNPs. Extracellular enzymes in microorganisms have the ability to reduce metallic ions on their surfaces and the synthesis of iron nanoparticles using *E.coli* plays a vital role in the reduction of metal ions in the microbial synthesis method.

Keywords: *Iron nanoparticles, Ferric Chloride, Ultraviolet-Visible Spectroscopy, Fourier- Transform Infrared Spectroscopy, Scanning Electron Microscopy*