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Simulation and experimental study on magnetic separation of Au loaded biomass from wastewater

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ABSTRACT

Magnetotactic bacterium has the characteristics of both magnetotaxis and adsorbing the precious metal ions, which makes it possible to recycle the precious metal from wastewater in the combination of high gradient magnetic separation. Nickel wires were used as media which producing gradient magnetic field to separate the magnetotactic bacteria (MTB) which had adsorbed Au(III) with high gradient magnetic field from wastewater. The magnetic separation model including the material balance equation and the separation rate equation were developed to describe this process. The movement process of metal loaded bacteria in magnetic field was investigated both experimentally and theoretically. The magnetic separator developed by our research team used for separating Au loaded biomass showed high separation efficiency, with nearly 100% biomass removed at the magnetic intensity of 1200 GS in 100 min. Experimental and simulation results all showed that the trapped bacteria were deposited in multi-layers, implying the ability of multi-layer trapping for the wires. Simulation mode was in good agreement with experiments results, which meant it could be used in the future research of MTB magnetic process.

Keywords: Kinetics; Bio-magnetic separation; Simulation ; High Gradient Magnetic Separation; Gold; Magnetotactic bacterium

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