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Citrus Fruit Waste as a Nano-Factory for Super Paramagnetic Iron Oxide Nanoparticles: Decorator and Enhancer for Microbial Desulfurization Efficiency

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Abstract

The readily available and costless mandarin (*Citrus reticulata*) peels were applied for one-pot synthesis of crystalline, highly stable spherical shaped super paramagnetic iron oxide nanoparticles (SPION) with 11.58 nm average size and 51.12 emu/g magnetic saturation. Such green and non-toxic biofunctionalized SPION was used to decorate and magnetize the selective desulfurizing *Rhodococcus erythropolis* HN2. That recorded 24.97emu/g at the optimum SPION/biomass ratio of 0.9 g/g. The magnetized HN2 found to be characterized by higher tolerance and BDS efficiency for relatively increased oil feed concentrations relative to non-magnetized HN2. Besides; the ease of separation by applying an external magnetic field, longer life time, higher storage and operational stability, magnetized HN2 was found to be effectively reused for six successive times without losing much of its activity. In a 120 h mild operating biphasic batch BDS process (30% v/v oil/water), magnetized HN2 removed 96% of the 690 mg/L total sulfur content in a hydrodesulfurized diesel oil without affecting its fuel content.

Keywords: Phytogenesis; Super paramagnetic iron oxide nanoparticles; Waste citrus fruit debris; Bacteria magnetization; Hydrodesulfurized diesel oil biodesulfurization