The efficiency of a novel bioreactor employing bacteria and chitosan-coated magnetic nanoparticles

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Abstract:

Heavy metals like lead, copper, nickel, and arsenic, which are known to have toxic effects at very low concentrations, have a tendency to bioaccumulate and end up as permanent additions to the environment. The objective of the present work was to investigate the efficiency of a combination of bacteria and chitosan-coated magnetic nanoparticles (CMNPs) in removing heavy metals from industrial effluents. To perform the study, we constructed a novel two-stage reactor containing bacteria and CMNPs, using a design theoretically calculated using Aspen *HYSYS 7.2 process-modeling software*. The strain of bacteria used was isolated from various samples of wastewater and identified using colony-forming assay. The bioreactor was tested with both synthetic and industrial effluents containing nickel. Optimal conditions in the bioreactor for both synthetic and industrial effluents were determined for retention time (20–60 min), pH level (0.5–9), CMNP dosage (0.09–1g L^{-1}), and initial metal ion concentration (50–500 mg L^{-1}). Maximum removal rates for synthetic and industrial effluents of 83% and 92.1% were obtained.

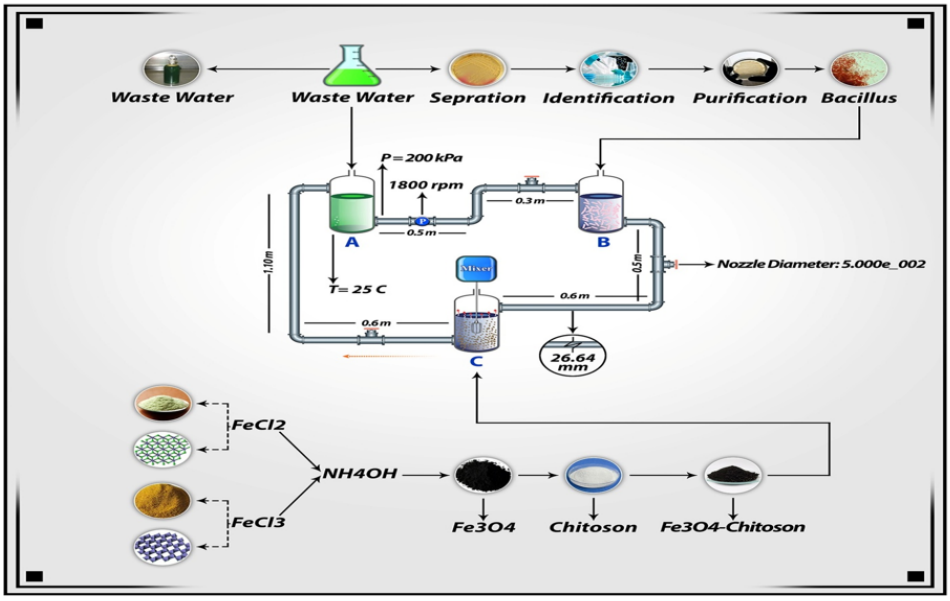

Figure 1. Schematic of the design of bioreactor for the removal industrial effluent