IMMOBILIZATION OF ARSENIC CONTAMINATION USING MICROBIALLY INDUCED CARBONATE PRECIPITATION (MICP) WITH UREOLYTIC BACTERIA FROM MANGROVE SITE IN TELUK BUO, PADANG

FINAL PROJECT

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ABSTRACT

Microbially Induced Carbonate Precipitation (MICP) was applied to mangrove soil and water to evaluate its potential for immobilizing arsenic (As) in contaminated soil. Ureolytic bacteria were isolated from mangrove samples collected in Teluk Buo, Padang. Arsenic was introduced as arsenic trioxide (As_2O_3), a toxic and soluble trivalent arsenic (As(III)). To optimize the biocementation process, tolerance and biomineralization tests were performed, measuring optical density, pH, urease activity, specific urease activity, and $CaCO_3$ mass. The tolerance test evaluated bacterial survival and enzyme activity at different arsenic concentrations and incubation times. The findings demonstrated that bacteria originating from soil exhibited greater resistance to arsenic than bacteria originating from water. Under arsenic exposure, soil isolates exhibited higher urease activity and produced more $CaCO_3$ precipitates, whereas water isolates experienced a sharper decline in enzyme activity and precipitation efficiency. The highest levels of bacterial survival, enzyme activity, and $CaCO_3$ precipitation were obtained at an arsenic concentration of 0.0058 g/L, which was ideal for immobilizing bacteria. The study's final observation period, 48 hours, showed a continuous increase in $CaCO_3$ precipitation. Arsenic was immobilized through co-precipitation, becoming entrapped within $CaCO_3$ crystals and thereby reducing its mobility in soil. These findings demonstrated that indigenous ureolytic bacteria could effectively immobilize arsenic through the MICP process and provided a promising sustainable approach for remediating arsenic-contaminated environments.

Keywords: Arsenic, Biocementation, Immobilization, MICP, Ureolytic Bacteria.