# REMEDIATION CATALYSES OF AMD BY INDIGENOUS MICROORGANISMS DURING CHEMICAL TREATMENT

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The barium carbonate-dispersed alkaline subtrate (BDAS) system was created as an ecofreindly solution to treat Acid Mine Drainge (AMD). This chemical system is composed of 3 stages: 1) an aereation system, 2) BDAS reactors and 3) decanters. The removal efficiency of heavy metals and sulfate by the system has been proved in different mining sites around South Africa. Such efficiency could be boosted as a consequence of the activity of indigenous microorganisms that inhabit AMD and thrive in each component of the system. In order to understand which microorganisms proliferate in each step and what is their contribution in the system, a metagenomic and geochemical investigation was undertaken. The AMD (pH 3.5) contained Fe (55.7 mg/L), Ca (130mg/L), and $SO_4$ (700 mg/L) as major compounds. SEM-EDS analysis suggested that biofilm formation promoted the nucleation of poorly crystalline Fe–Al neoformed minerals during aereation process (stage 1). Predominant bacterial genera such as *Acidiphilum, Acidocella and gallionella* could be involved in the oxidation and removal of approx. 95% of Fe. The drastic increase of pH to 7-8 and microaerophilic conditions in BDAS reactor (stage 2) promoted a bacterial consortium of facultative *Azospirillum, Geobacter, Desulfovibrio* and cyanobacterial species. Barium carbonate dissociation promoted the precipitation of sulphate (as $BaSO_4$) and calcium (as $CaCO_3$), while the microbial consortium catalyzed the carbonatation process. This process persisted in the decanters (stage 3), which induced the nucleation of Mg/Na/$CaCO_3$ minerals in the microbial biofilm. SEM-EDS analysis suggested the syntrophic interaction between microbial species and intracellular biomineralization of $CaCO_3$. The IR analysis showed the activity of bacterial carboxyl and phosphate groups which could induce the nucleation of carbonate minerals. This study confirm the pivotal role that indigenous bacteria consortium plays in heavy metals and salts removal in a chemical treatment.