MONITORING OF SULFATE REDUCING BACTERIA IMMOBILIZED IN BIOCHAR FOR THE TREATMENT OF ACID MINE DRAINAGE (AMD)

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Resumo:

Coal is the non-renewable fuel in greater abundance on the globe, responsible for much of the world's energy consumption. One of the main impacts generated by the exploitation of coal is acid mine drainage (AMD). AMD usually occurs when the mineral of interest in mining operations is associated with pyritic sulfides and iron, whose source materials, under the influence of biotic and abiotic components, cause acidification of water resources releasing potentially toxic elements in the affected ecosystems. This scenario affects the use and occupation of the land, even after ceased the mining activities. Currently, traditional methods for the mitigation and control of AMD involve procedures that have incipient results or low efficiency. In this context, this study employed innovative methodology, based on biochar and sulfate-reducing bacteria (BRS), to mitigate the acidity and the presence of contaminants in AMD waters in the coal-mining region of Criciúma, Santa Catarina, southern Brazil. Biochar, a product originated from pyrolysis, generally presents high alkalinity, high specific surface area and, therefore, high affinity for the adsorption of chemical components, while serving as niche for the colonization of microorganisms. In this study, 120 liter capacity reactors were mounted with biochar and primary inoculum sources of BRS (70% of the reactor´s volume, with 80% biochar and 20% of the inoculum source), which included domestic sewage sludge, AMD sediment and cow manure. The reactors were evaluated fortnightly for a period of six months. Evaluations included the characterization of the biochar and the communities of total bacteria and BRS, monitoring of the water acidity, presence of coliforms and levels of trace elements. The results showed that after 30 days of bioreactor functioning all trace elements evaluated (Al, Cd, Cr, Cu, Fe, Mn, Pb and Zn) were within the acceptable levels, according to CONAMA (Brazilian water quality responsible council), and no coliforms were detected. Over time, there was a reduction of 41% in sulfate concentration (original 389 mg/L) in the treatment inoculated with cow manure. DGGE molecular analysis showed different BRS communities in each of the treatments tested, indicating that the inoculum source was of vital importance in AMD treatment. The results indicate that the use of biochar enriched with BRS is effective in the reduction of sulfate and trace elements in AMD waters.

Keywords: microbial ecology, trace elements, bioremediation, coal mining

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