

TITLE: MICROBIAL STRATEGY FOR METAL RETENTION IN THE DOCE RIVER HYDROGRAPHIC BASIN

AUTHORS: PEREIRA, R. S.; KEIM, C. N.; SELDIN, L.; JURELEVICIUS, D. A.

INSTITUTION: INSTITUTO DE MICROBIOLOGIA PAULO DE GÓES, UNIVERSIDADE FEDERAL DO RIO DE JANEIRO, RIO DE JANEIRO, RJ (AVENIDA CARLOS CHAGAS FILHO, 373, BLOCO I, CEP 21941-590, RIO DE JANEIRO - RJ, BRAZIL)

ABSTRACT:

On November 5th, 2015, a collapse in an iron mining tailings dam owned by Samarco Company released 32.6 to 62 million m³ of tailings containing fine particulate, iron oxides and quartz in Doce River Hydrographic Basin (DRHB). Microbial biofilms are well known to retaining metals and, then, represent a potential tool for the bioremediation of metal-contaminated environments. The objective of this study was to evaluate the formation of microbial biofilms and their capacity to capture metals from contaminated water. For microbial biofilms development, sterile glass slides associated with floats were placed on the riverbed of the Gualaxo do Norte River (GNR) and Doce River (DR) for a period of 14 days. Water samples from the two rivers were also collected at the beginning and at the end of the experiment. Subsequently, the iron quantification present in water and in biofilms samples was determined by the ferrozine method in flame atomic absorption spectrophotometry (FAAS). The biofilms and the presence of the metals associated with the biofilms were analyzed by Optical Microscopy and by Scanning Electron Microscopy (SEM) associated to the X-ray Spectroscopy by Energy Dispersion (EDX). In addition, the bacterial community present in each samples was characterized by high-throughput sequencing of gene coding for 16S rRNA. The results obtained by FAAS showed the presence of 0.245 mg/L of total iron and 0.041 mg/L of total manganese in the DR water. In the GNR, the iron concentration was below the detection limit of the ferrozine method (<0.28 mg/L of total iron). After 14 days complexes biofilms structures were formed on the glass slides placed on both rivers. SEM/EDX analysis showed the association of iron and manganese with microbial biofilms. On average, 64 mg/m² of total iron was quantified in the DR biofilms. 16S rRNA sequencing analysis showed the structure of the bacterial community of the GNR biofilms was different from that observed in the DR biofilms. While *Advenella*, *Pseudomonas*, *Enterococcus*, *Delftia* and *Pantoea* were the main genera observed in biofilms from GNR, in biofilms from DR the main genera were *Corynebacterium*, *Methylobacterium* and *Cloacibacterium*. Furthermore, the results and knowledge obtained in this research can be used to design bioremediation methods to clean-up metal contaminated waters.

Keywords: biofilms, bioremediation, Doce river, metals, mining tailings.

Development Agency: Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq).