Geophysical Research Abstracts,
Vol. 11, EGU2009-1967, 2009
EGU General Assembly 2009

Geoelectical Responses Associated with Activity of SRB in a Simplified Winogradsky column

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Electrical geophysical techniques, self-potential (SP) and Spectral induced polarization (SIP) have been used to monitor the response of activity of Sulphur Reducing Bacteria (SRB) in a simplified Winogradsky column. The columns allow biofilm growth on homogeneous, non-toxic silica beads of known surface roughness and diameter of 3mm. The growth medium contains 0.025M sodium lactate, FeSO4 (1 ppm) and KNO3 (1 ppm) in Lagan river water per liter. SP and Electrodic potential measurements were taken at spacing of 5cm have been monitored over 140 days on the surface of the column to follow biogeochemical evolution and microbial activities in the column Petieu electrodes that minimize chemical reactions on the electrode surface have been used, and compared with Ag-AgCl electrodes, in order to record only the SP response of the microbial activity, referenced to an electrode fixed in control column. The control and experiment columns have been connected electrolytic ally via a salt bridge. A second column, similar to experiment column, has been filled with the same matrix and fluid for biogeochemical analysis. As soon as the production of H2S has been observed in the column, a change in geophysical responses and geochemical properties has been found. The presence of SRBs (clostridium) has confirmed by most probable number (MPN) test on river water sample and the presence Fe2+ and S2- ions in the fluid in experiment column estimated by spectrophotometer suggest that the column turned darker possibly due to the formation of FeS after sulphate reduction. Exponential increase in imaginary conductivity has been noticed during this period suggesting probably the growth phase of dominating SRB species in the column. However, no major change has been observed in real component of complex conductivity. SP also decreases (negative) of the order of -15 t 20 mV. Geochemically, this period is characterized by decrease in Eh and increase in conductivity and pH. This experimental study suggests that the SP and SIP are sensitive to biogeochemical activities in contaminated environments and have the potential to monitor such activities in lab and field conditions noninvasively.