Geo-microbial prospecting method for hydrocarbon exploration in Vengannapalli village, Cuddapah Basin, Andhra Pradesh, India

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Geo-microbial prospecting for hydrocarbons is an exploration method based on the seepage of light hydrocarbon gases and their utilization by hydrocarbon oxidizing bacteria. The detection of anomalous population of methane, ethane, and propane oxidizing bacteria in the surface soils or sediments, helps to evaluate the prospects for hydrocarbon exploration [1, 2]. This method has been applied in Vengannapalli village, Cuddapah Basin, as natural leakage of gas from boreholes was reported.

In the present study, the bacterial populations was found to be maximum of 5.4×10^5 cfu/gm, 5.5×10^5 cfu/gm and 4.6×10^4 cfu/gm of soil for methane, ethane and propane oxidizing bacteria respectively. The microbial results indicate the anomalous population of methane, ethane and significant propane oxidizing bacteria were found in survey area. The bacterial concentration distribution maps follow the same pattern and significant anomalies have been observed in the northeastern and southwestern parts of the studied area. The adsorbed soil gas analysis showed the presence of moderate to low concentration of methane (12.4 to 222.8 ppb), ethane (3 to 35.9 ppb), propane (2 to 24.3) and butane (18.4 ppb). The study reveals good correlation between adsorbed soil gas and microbial studies, overlaying of these anomalies indicate the natural model of 'Halo' pattern. The $\delta^{13}C_1$ analysis of most of the samples show enriched carbon isotopic data of methane ranging from -35.0 ‰ to -10.6 ‰ indicating methane derived form coal/ Type III kerogen. Based on the microbial, adsorbed soil gas and carbon isotope studies, presence of hydrocarbon micro-seepage has been referred the area to be worth visiting for conventional hydrocarbons.

[1]. Sealy (1974a) *Oil & Gas Journal* **8**, 142-46. [2]. Wagner *et al.* (2002) *Geology* **48** and *SEG Geophysical References* **11**, 453-479.

Effect of Mn(II) on the oxidative dissolution of biogenic UO_2

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Bioremediation of U(VI) contaminated sites is predicated on the stability and long-term immobilization of the bioremediation product: biogenic uraninite (UO_2). Preventing re-oxidation of UO_2 is an important aspect governing the success of bioremediation. The goal of the study was to evaluate the effect of divalent cations on the structure and reactivity of biogenic UO_2. Thus, UO_2 was produced biologically in the presence of Mn(II), a divalent cation ubiquitous in the groundwater.

U(VI) reduction was carried out at two different pH values (6.3 and 8.0). The presence of 1mM or 5mM Mn(II) did not significantly affect U(VI) reduction. A method involving alkaline treatment followed by organic phase separation was developed to separate UO_2 from the biomass in order to perform spectroscopic and reactivity characterization. Characterization techniques included imaging with conventional TEM, BET determination of surface area, adsorption and dissolution experiments, and synchrotron-based analyses (XANES, EXAFS, WAXS spectroscopy).

Sorption experiments showed uptake of Mn(II) by UO_2 at near neutral and alkaline pH, but rule out significant sorption at and below pH 5. Thus, Mn(II) sorbed onto biogenic UO_2 during its synthesis was removed by multiple washes using water buffered with MES at pH 5 until no further Mn(II) could be desorbed. A mass balance study (involving acid digestion) and EXAFS measurements indicated that, prior to the pH 5 wash, the majority (~92%) of Mn(II) associated with UO_2 was adsorbed. However, after the wash, Mn(II) was found to be predominantly incorporated into the UO_2 crystal structure. To date, oxidative dissolution experiments using air as an oxidant indicate that the presence of Mn(II) does not significantly affect biogenic UO_2 dissolution rates at pH 6.3, but that at alkaline pH values, Mn(II) accelerates oxidative dissolution significantly.