N-026  Potential for Microbial Stimulation in Deep Vadose Zone Sediments by Gas-Phase Nutrients

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Abstract

Unlike microbial populations existing in shallow vadose zones, deep vadose zones are cold, dry, and water-saturated. To determine if microbial activities can be stimulated in deep vadose zone sediments, we collected and analyzed 12 sediments varying in depth from each of two boreholes through the Ringold and Hanford formations at the Hanford Site, Washington state. These studies were conducted in the vadose zone of the Z-9 trench, which serves as the Hanford Waste Management Site’s vadose zone disposal system. The Z-9 trench was used to dispose of liquid wastes generated at the Hanford Site from the Hanford Site in the 1950s and 1960s in the vadose zone of the Z-9 trench. carbon tetrachloride (CT), a volatile organic contaminant, was introduced into formation sediments via injection into a shallow well 34 m (112 ft) below the Z-9 trench surface. This poster describes the results of our study, which includes the measurement of microbial activity, gaseous carbon utilization and carbon tetrachloride degradation in sediments collected from 120 to 160 ft below the Z-9 trench surface. Table 1 describes the results of our microbial activities, gaseous carbon utilization, and carbon tetrachloride degradation studies. The data show that our study was successful in stimulating microbial activity and gaseous carbon utilization in sediments collected from 120 to 160 ft below the Z-9 trench surface.

Introduction

There are large transverse flow rates in the deep vadose zone. As the injection area is the removal area, 50% of the carbon tetrachloride (CT) introduced into the vadose zone through borehole 299-W15 will be extracted from the Z-9 trench if the entire injection area is the removal area. However, the results of our study indicate that microbial activities in the deep vadose zone are low and in general are greater in sediments with higher moisture content. Population of denitrifying and gaseous carbon-utilizing activity are low and discontinuous, and how hydrologic features of the vadose zone control microbiological processes.

Methods and Procedures

- Microbial denitrifying and heterotrophic activity were determined by incubating samples in serum bottles containing 100 ml of amended mineral medium and 50 ml of anaerobic gas. The amplified region was sequenced using 16S rRNA gene primers.
- Microbial denitrifying activity was determined by the assay of 15N2 gas production. The assay is based on the conversion of 15N2 gas to 15NH4+ gas by microbial nitrogen fixation. The assay is conducted in serum bottles containing 10 ml of final volume of 15N2 gas production buffer and 1 ml of DNA extract. The assay is incubated in a water bath at 37°C for 24 hours. The 15N2 gas produced is measured using a mass spectrometer.
- Microbial heterotrophic activity was determined by the assay of 15CO2 gas production. The assay is conducted in serum bottles containing 10 ml of final volume of 1CO2 gas production buffer and 1 ml of DNA extract. The assay is incubated in a water bath at 37°C for 24 hours. The 15CO2 gas produced is measured using a mass spectrometer.
- Microbial denitrifying and heterotrophic activity were determined by the assay of 15NH4-gas production. The assay is conducted in serum bottles containing 10 ml of final volume of 15NH4-gas production buffer and 1 ml of DNA extract. The assay is incubated in a water bath at 37°C for 24 hours. The 15NH4-gas produced is measured using a mass spectrometer.

Results

The results of our study indicate that microbial activities in the deep vadose zone are low and in general are greater in sediments with higher moisture content. Population of denitrifying and gaseous carbon-utilizing activity are low and discontinuous, and how hydrologic features of the vadose zone control microbiological processes.

Conclusion

- Microbial denitrifying and heterotrophic activity in deep vadose zone sediments is low and discontinuous, and how hydrologic features of the vadose zone control microbiological processes. These studies were conducted in the vadose zone of the Z-9 trench, which serves as the Hanford Waste Management Site’s vadose zone disposal system. The Z-9 trench was used to dispose of liquid wastes generated at the Hanford Site from the Hanford Site in the 1950s and 1960s in the vadose zone of the Z-9 trench. carbon tetrachloride (CT), a volatile organic contaminant, was introduced into formation sediments via injection into a shallow well 34 m (112 ft) below the Z-9 trench surface. This poster describes the results of our study, which includes the measurement of microbial activity, gaseous carbon utilization and carbon tetrachloride degradation in sediments collected from 120 to 160 ft below the Z-9 trench surface. Table 1 describes the results of our microbial activities, gaseous carbon utilization, and carbon tetrachloride degradation studies. The data show that our study was successful in stimulating microbial activity and gaseous carbon utilization in sediments collected from 120 to 160 ft below the Z-9 trench surface.

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References