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Alkane degrading bacterial gene dynamics in the process of oil contaminated soil biorestoration

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Abstract

© SGEM2019 All Rights Reserved. It is well known that soil polluted with different pollutants, including oil, can naturally remediate. Primarily, the process of oil utilization starts with the degradation of saturated alkanes by microorganisms. Alkane monooxygenase is the major enzyme involved in the degradation of alkanes and it is classified into three groups, each catalyzing the degradation of n-alkanes with different chain lengths. In this study, we investigated abundance of alkane monooxygenases genes in the soil contaminated with oil during the process of biorestoration that lasted for 120 days. We conducted a laboratory experiment with three oil doses – 6, 12 and 25% (P6, P12, P25). Dynamics of genes related to group I, group II, and group III alkane monooxygenases were quantified by qPCR. In addition, the total petroleum content and the content of hydrocarbon fractions were analyzed. It was found that the hydrocarbon content did not change significantly during 120 days. However, the content of saturated alkanes decreased by 9.8 and 24% for P6 and P12, respectively. It was determined that I group genes were characterized by a minimal amount in the range from 1.4x102 to 4.4x103 gene copy number g-1. The number of genes belonging to the II group was in the range from 2x102 to 7.7x105 gene copy number g-1, and the genes of the III group — from 9.9x104 to 3.2x106 gene copies number g-1. The content of I group genes increased immediately at the 3rd day after the contamination, and further their quantity decreased in comparison with the uncontaminated soil. The content of genes from the II and III groups increased from the 1st to 3rd days and further continued to grow with the maximum amount at the 30-60 days after the contamination. Thus, it was found that the content of genes encoding alkane monooxygenase increased after oil pollution, while a decrease in the content of aliphatic hydrocarbon fractions was also observed.

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Keywords

Alkane monooxygenase, Biorestoration, Gene abundance, Oily soil

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