Influence of nickel in petroleum biodegradation: a metagenomics approach

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Industry of energy is responsible for most of the soil multi-contamination with organic compounds and metals. The negatives effects of metals in the biodegradation of organic compounds turn the decontamination of these multi-contaminated sites challenging. Understanding the microbiological processes can help manipulate of remediation strategy. The aim of this study was to evaluate the effects of nickel on the biodegradation of crude oil in a tropical soil. To achieve this, we did a microcosm experiment under 4 conditions: soil (control), soil contaminated with oil (5% w/w), with oil (5% w/w) and nickel (260 mg/Kg) and soil contaminated with nickel during 30 days. Metagenomics and 16S rRNA libraries were sequenced using Ion Torrent technology. The results showed that taxonomic changes were more affected by oil contamination and the order of Actinobacteria was predominant and increased in the presence of oil. The abundance of sequences related to organic compounds degradation increased in oil and Ni containing treatment, in contrast to previous studies that shown the negative effect of metals in degradation activity. Even nickel caused significant changes in the microbial community, it was possible to observe a functional redundancy between β-proteobacteria and Actinobacteria (oil, oil-Ni, respectively) compared the degradation of aromatics compounds, this kind of redundancy can explain the fact that the levels of removal have not been different between treatments. This soil, regardless of the changes undergone by different pollutants, was able to remove the oil accessing microbial diversity, demonstrating the importance of the preservation of genetic resources in the environment.