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Implementation of a biosurfactant-enhanced treatment for soils impacted by Polycyclic Aromatic Hydrocarbons

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ABSTRACT

Background information:

Former industrial sites contaminated by Polycyclic Aromatic Hydrocarbons (PAHs) are an environmental and human health concern in Europe. These sites, often former gasworks and coke factory, are close to or are part of urban areas and are persistent sources of pollution that have to be cleaned. Bioremediation of PAHs in pore water and soils is possible and had already been done but is limited by the low solubility of such molecules, which reduces their bioavailability. Surfactants can enhance the apparent solubility of hydrophobic compounds, like PAHs, entrapping them by the formation of micelles. Chemically-produced surfactants, widely used in soil remediation (i.e. soil washing techniques, etc.) are impaired by the low biocompatibility between them and bacteria. Using biosurfactants, produced by bacteria, can improve this biocompatibility and then enhance PAHs bioavailability.

The objective of this project is to treat an industrial soil impacted by PAH with biosurfactant washing and biodegradation.

Approach:

The first step focuses on the biosurfactant production and optimization at lab scale. The optimal balance parameters have been selected to improve bacterial growth: carbon sources, mineral nutrients, oxygen supply and temperature. PAHs biodegradation trials were performed with contaminated water and contaminated soil samples. Biosurfactant injection, carbon source injection, and several nutrient injection techniques and balance were achieved.

Main results:

From our soil samples, we isolated and selected a biosurfactant-producing bacterial population. This strain can produce biosurfactant using soluble and insoluble carbon sources, even in rich culture medium. The nutrient balance determines the success of the production of biosurfactant. Biodegradation trials have already proved the high potential of bacterial strains for their ability to produce biosurfactant, which pushes the PAHs up to micellar state.

During the final step of this work, those lab trials will be extended to an *in situ* pilot treatment on an industrial site.

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