

Application of Synthetic and Natural Surfactants for Mobilizing Pahs in Marine Sediments for Remediation Purposes

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Extended Abstract

The presence of Polycyclic Aromatic Hydrocarbons (PAHs) in marine sediments is one of the major concern for human health and marine ecosystem because of their toxicity, mutagenicity and carcinogenicity [1]. The increase of industrial and urbanization processes contributes to rise PAHs level in the coastal regions. They readily associate with inorganic and organic suspended particles and may accumulate in sediments at high concentrations, due to their low solubility and hydrophobic nature [2]. In recent years, the use of surfactants, as soil-washing agents, is becoming particularly attractive for their low toxicity and favourable biodegradability in the environment relative to organic-solvent based systems [3]. It has been reported that the success of soil-washing with surfactants can be attributed to the capacity of these compounds to appreciably enhance the aqueous solubility of hydrophobic organic compounds [4] and then the efficiency of contaminants mobilization.

The aim of this research is the evaluation of the ability to solubilize and mobilize PAHs of different non-ionic and biodegradable surfactants, synthetic or biosurfactants, in order to remediate heavily contaminated sediments. Investigated Surfactants' families are Alkylpolyglycosides (APGs), Sophorolipids (SLs) and Rhamnolipids (RLs). Sediments from Bagnoli (Italy), Site of National Interest, since interested in the past by a heavy industrial contamination, had been collected during ABBaCo Project [5]. More than 100 samples were characterized, and among these, the 28 most contaminated samples were combined and homogenized in a 1,350 Kg stock, which is taken as a reference sample. Firstly, the characterization of PAHs' starting contamination (total and for each compound) of these sediments has been conducted, taking three aliquots from the stock. Then, different batch configuration tests (washes at 5xCMC, kinetic, washing and concentration) have been carried out to study the ability of investigated surfactants to mobilize sorbed contaminants. From the obtained results, the most performant surfactants are currently under investigation in soil flushing test in column.

The characterization of the sediments revealed a heavy PAHs contamination. All the available surfactants contribute to enhance the solubility of contaminants compared to water, with APG2 and SL being the best synthetic and natural surfactants, respectively. From the different tests, important data are obtained: the different chemical properties (e.g., solubility) of "light" (< 4 rings) and "heavy" PAHs (≥ 4 rings), the number of washes which increases the amount of PAHs removed and the relevance of surfactants' concentration in order to enhance the solubility of PAHs in water. As in the washes at 5xCMC test at the maximum concentration experimented, APG2 and SL resulted the most performing surfactants, new experiments in column are conducted: firstly just water, then surfactant APG2 and SL (1% m/m) in solution flow through the column filled of contaminated sediment. The results, after two weeks of elution, show that a low amount of total PAHs are solubilized in water from the sediment, while a solution with APG2 or SL reach a better total removal than water.

References

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