Morphological changes and organic´s removal by electrokinetic remediation of a dredged marine sediment

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Introduction: Marine sediments can contain persistent and toxic organic pollutants that pose a threat to the environment [1]. Industrial activities have generated polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), total petroleum hydrocarbons (TPH), chlorinated benzenes (CBs), amongst other pollutants. Marine sediments with high organic carbon content can accumulate high quantities of these hydrophobic compounds [2]. Due to the growing concern regarding the negative effects of these pollutants, a large number of studies have been conducted in recent years to understand their sources, their effects on the aquatic environment and the most effective technologies for their remediation. Different techniques have been carried out to remediate organic pollutants from soils and sediments. The electrochemical remediation technique has been used in recent years for PAHs, PCBs, pesticides and herbicides removal, and requires using surfactants, biosurfactants, cosolvents or cyclodextrins in order to enhance their removal [3].

This research was conducted on the effectiveness in electrokinetic remediation of organic matter from sediments. Different tests were conducted using different combinations of non-ionic surfactants and chelating agents in order to determine the most effective treatment to mobilize organic matter, as well as heavy metals.

Methods: Sediment samples were dredged from a European port and were characterised by various techniques [4]. Fourteen electrokinetic remediation tests were carried out using home-made mini Electroosmotic Cell Devices (m-ECD).

The tests consisted in using as electrolytes 4 different non-ionic surfactants in combination with either deionized water or an enhancing agent: citric acid (CA) or ethylenediaminetetraacetic acid (EDTA). A voltage of 40 V was applied to each cell and the tests lasted 60–72 hours. After the tests, solid samples were divided in three parts: cathodic (-), central (C) and anodic (+), and were analyzed through Differential Termal Analysis/Thermogravimetry (DTA/TG) and Fourier transformed infrared spectrometry (FTIR).

Results and Discussion: This research shows that the combination of a solubilizing agents with either deionized water or chelating agents have different effects on the electro-remediation of the studied marine sediment. The first 24-48 hours in surfactant-electrokinetic tests are crucial in the changes that take place in pH, electric current, conductivity, electric resistance and EOF of the surfactant-enhanced electrokinetic remediation experiments. By comparing the main results of the different parts of the sediments after the treatments [5,6] it has been possible to determine the variations in their morphological characteristics due to the treatments as well as identify the amount and type of the organic compounds in the sediments before and after the trials, correlating them with the main features of each electro-kinetic experiment.

References: [1] SedNet WP books, Vol 1-4, Elsevier; eBook ISBN: 9780080466675.; [2] Reddy et al. (2019) *Chem Eng J* 358:1186-1207; [3] Reddy and Camesselle. (2009) Wiley, New York, pp 3–28; [4] Garcia-Blas et al. (2019) *J Soils Sediments* 20:2673–2684. [5] Oudghiri et al, Infrared Physics & Technology Volume 72, September 2015, Pages 52-57, [6] Kariminez and Elektorowicz, Journal of Hazardous Materials, Volume 353, 5 July 2018, Pages 227-235