Bioremediation of sediments polluted with petroleum hydrocarbons : a case study of the port of Heraklion, Crete

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Hydrocarbon pollution constitutes one of the most common environmental concerns, especially when encountered in environments where treatment is quite difficult to apply. One of these environments, is also the bottom of the sea. Marine polluted sediments in particular, present one of the most recalcitrant environments for bioremediation and are often the final repository of petroleum contaminants, as a result of runoff and deposition. Indigenous microorganisms present in the sediments, are called to face the pollution, usually under oxygen-limited or oxygen-depleted conditions. Since aerobic bioremediation is faster than anaerobic or anoxic, research should focus on sustaining and increasing oxygen concentration levels on marine sediment environments, to enhance the microbial biodegradation of pollutants.

Even though different bioremediation techniques could be employed to enhance aerobic bioremediation of marine polluted sediments, aeration seems to be the most efficient and cost-effective way to provide oxygen for this purpose. In this research, we focused on aerobic bioremediation of marine sediments by aerating the sediments through nanobubble tube diffusers. Marine sediments were collected from different stations of the port of Heraklion to be tested for hydrocarbon pollution, and a significant amount was contracted from one station for mesocosm bioremediation experiments with aeration.

Results showed that the station where seawater recirculation was limited, presented a higher total petroleum hydrocarbons' content on the sediments, while the one closer to the open sea had significantly lower hydrocarbon pollution; almost 6.7 times lower compared to the most enclosed station. The mesocosm experiments did not provide the expected outcome, and aeration in this case did not seem to enhance hydrocarbon removal. However, a number of factors could have affected the results, such as algae formation on the first days of the experiment and the type of sediment itself (muddy sediment). An implementation of the aeration system using nanobubble diffusers directly on marine sediments at the bottom of the sea, could provide different results since it is a dynamic environment with constant replenishment of nutrients and microorganisms.

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