Bioremediation of mangroves: from the lab bench to field application

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The majority of oil from oceanic oil spills (e.g., the recent accident in the Gulf of Mexico) converges on coastal ecosystems such as mangroves. Microorganisms are directly involved in biogeochemical cycles as key drivers of the degradation of many carbon sources, including petroleum hydrocarbons. When properly understood and managed, microorganisms provide a wide range of ecosystem services, such as bioremediation, and are a promising alternative for the recovery of impacted environments. Previous studies have been conducted with emphasis on developing and selecting strategies for bioremediation of mangroves, mostly *in vitro*, with few field applications described in the literature. Many factors can affect the success of bioremediation of oil in mangroves, including the presence and activity of the oil-degrading microorganisms in the sediment, availability and concentration of oil and nutrients, salinity, temperature and oil toxicity. More studies are needed to provide efficient bioremediation strategies to be applicable in large areas of mangroves impacted with oil. A major challenge to mangrove bioremediation is defining pollution levels and measuring recuperation of a mangrove. Typically, chemical parameters of pollution levels, such as Polycyclic Aromatic Hydrocarbons (PAH), are used but are extremely variable in field measurements. Therefore, meaningful mangrove monitoring strategies must be developed. We will present the state of the art of bioremediation in oil-contaminated mangroves, new data about the use of different mangrove microcosms with and without tide simulation, the main factors that influence the success of bioremediation in mangroves and new prospects for the use of molecular tools to monitor the bioremediation process. We believe that in some environments, such as mangroves, bioremediation may be the most appropriate approach for cleanup. Because of the peculiarities and heterogeneity of these environments, which hinder the use of other physical and chemical analyses, we suggest that measuring plant recuperation should be considered with reduction in PAHs. This is a crucial discussion because these key marine environments are threatened with worldwide disappearance.