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BIOREMEDIATION OF OIL CONTAMINATED SOIL THROUGH INOCULATION OF AN INDIGENOUS SOIL MICROBIAL COMMUNITY

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The use of microbes to clean up polluted soils is a rapidly changing and expanding area of environmental biotechnology, although the mechanisms of bioremediation and the benefits which can be directly attributed to it are generally ill-defined. Microbial degradation of hydrocarbons has been measured to reduce petroleum concentrations at the soil surface by as much as 92% over two years (Jorgenson and Carter, 1996), but is dependant on many factors including environmental conditions, oil characteristics and the microbial biomass and community structure present in the soil (Balba et al., 1998; Baptista et al., 2005). Preliminary research at UWA has also shown the degradative potential of native soils previously exposed to different crude oil concentrations.

Different soil microbes have a metabolic preference for different hydrocarbon sources, hence, may selectively remove different parts of an oil pollutant. Furthermore, complex microbial communities may also serve as ideal, ecologically relevant toxicity indicators. Pollution Induced Community Tolerance (PICT; conceptualized by Blanck and Wangberg, 1988) concept states that the tolerance of a community to a toxicant is proportional to the exposure of that community to the toxicant which can also induce changes in the structure and activities of the soil microbial community.

Outcomes of a new study investigating the microbial adaptation and bioremediation performance of an Australian soil at risk of contamination due to high onshore petroleum activity, following its exposure to a representative oil sample will be reported. The manipulation of indigenous microbial communities may help deal with contamination of environmentally sensitive areas protected from the introduction non-native fauna. Two phase microcosm experiments have been conducted, the first phase involving the addition of crude oil and the control of soil moisture and nutrients with the aim of encouraging a hydrocarbon responsive microbial consortium. Control experiments were also conducted on soil without crude oil as well as on sterilised soil and oil, the latter allowing identification of abiotic processes. Following the two month phase one incubation, phase two commenced with addition of fresh oil. The extent to which the oil contaminant of both experimental phases is degraded is being determined by periodical hydrocarbon and microbial analysis.

Corresponding data from the phase one and two soils will be scrutinised for variation in the hydrocarbon biodegradation of hydrocarbon primed and non-primed soils.

Biodegradation levels are being established by the extent to which progressively more vulnerable hydrocarbon species are lost (Peters and Moldowan, 1993) as determined by GCMS analysis of solvent extractable aliphatic and aromatic fractions. The total metabolic activity of the soil is assessed by daily measurement of soil respiration. Microbial community diversity and function is additionally assessed at the commencement (just prior to the addition of the crude oil) and completion of the two phases by measurement of soil microbial biomasses, community level physiological profiles and phospholipids fatty acid distributions.

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