NATIVE MICROBIAL ACTIVITY POTENTIAL AS RESPONSE TO AN OIL SPILL IN A CLAYED TROPICAL SOIL

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Introduction. Southern Mexico is one of the areas with the highest incidence of oil spills due to the high intensity of oil exploitation and transportation operations, these incidents cause adverse effects in soils of the region both in their physicochemical properties and biotic conditions. Many remediation strategies are based on active processes that can cause even more damage affecting negatively the future land use. In particular, for freshly contaminated soil, the biological alternatives selection and self-recovery potential assessment (natural attenuation) are valuable tools in the field of bioremediation and ecological impact assessment. Last August there was an accidental oil spill at a site located near to a high activity oil field located in the region of Cunduacán, Tabasco. The spill was affecting about 15ha of pasture and crops.

The aim of the present work was to assess the microbial activity (respiratory profile) and the biodegradation potential (lipase and dehydrogenase activity) of the native microbial community after an oil spill occurring in a clayed tropical soil.

Methods. Soil Sampling was designed considering several contaminated points (6 sampling points, 5 to 8 subsamples of each one). Basal respiration and TPH soil content was measured. Biodegradation potential experiment was conducted using artificially contaminated perlite (10.000 and 20.000 ppm) as an inert support and contaminated soil suspension (SS, 200 g of soil in 700 ml of mineral the medium) as inoculum (15 ml). Endogenous activity was estimated (uncontaminated perlite plus SS). Water content was adjusted to 60% of the WHC of the support. Monitored parameters were: a) kinetic of lipase and dehydrogenase activities [1,2], b) CO_2 produced (System-SS4, Sable, Inc.), c) TPH-degrading microorganisms (MPN g^{-1}) and d) total petroleum hydrocarbons content (EPA 3540).

Results. In general sampled soil corresponds to a clayed soil, with a high microorganisms content and TPH ranging to 26,000 to 36,000 ppm. Soil basal respiration was ranging between 187.4 to 431.1 mg CO_2 Kg^{-1} h^{-1}. Heterotrophic microbial number was around $1x10^8$ UFC $g^{-1}$and the hydrocarbons-degrading counts ranging between 3.21 to 15.5 $x10^5$ cells g^{-1}.

Table 1. Initial conditions of contaminated soils.

Soil ID	Soil (%)			pH	Conductivity (mS/c^3m)	TPH (ppm)
	Clay	Silt	Sand			
P1	63	10	27	7.87±0.20	1.165±0.041	36,168±644
P2	72	13	15	7.11±0.79	1.289±0.310	34,465±836
P3	62	31	7	7.02±0.40	1.053±0.243	26,283±512

In order to evaluate the biodegradation potential of selected samples as a function of hydrocarbons concentration (10 and 20 g of TPH Kg^{-1} of dry perlite), the kinetic of CO2 production, lipase activity (LSA) and dehydrogenase (DHS; data not-shown) were determined (Fig. 1).

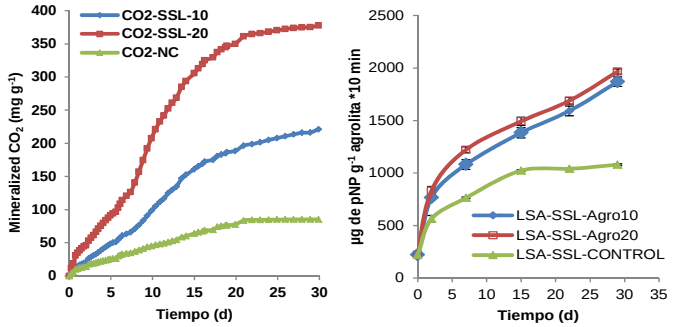

Fig.1 CO_2 evolution in presence of different TPH-perlite content and accumulative lipase activity during biodegradation potential assay.

The evolved CO_2 and the lipase activity behavior showed a highly positive correlation with the TPH increment respect to the non-contaminated solid support. Maximum period of microbial activity was between 5 to 18 days of culture. Results are comparable to those obtained under different bioremediation treatments for a range of TPH-concentrations (10-30 g kg^{-1} of soil) for lipase and dehydrogenase enzymes [3]. Use of these enzymes to assess the biodegrading-activity has been reported for address soil studies about effects of nutrients balance during diesel biodegradation in contaminated soils [4].

Conclusions. Results here presented are in concordance and allows estimating the intrinsic biodegradation potential of the soil microbial community representing a valuable strategy to assess the possibly natural attenuation and selection of remediation alternatives considering the native microbial community.

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