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"Gheorghe Asachi" Technical University of Iasi, Romania

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PHENOLIC METABOLITES, OXIDATIVE ENZYMES AND MICROBIAL ACTIVITY IN THE RIZOSPHERE OF *Cyperus laxus* IN PHYTOREMEDIATION OIL SPILL IMPACTED-SITES PROCESS

Noemí Araceli Rivera Casado[1], María del Carmen Montes Horcasitas[1], Refugio Rodríguez Vázquez[1], Fernando José Esparza García[1], Armando Ariza Castolo[1], Josefina Pérez Vargas[2], Octavio Gómez Guzmán[1], Graciano Calva Calva[1*]

[1]Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional, Av. IPN No. 2508, Col. San Pedro Zacatenco 07360 México D.F.; [2]TESE, México, e-mail : gcalva@cinvestav.mx, noemia_rivera@yahoo.com.mx

Abstract

Although it has been proposed that phytoremediation processes may be mediated by chemical and enzymatic interactions between contaminant compounds and plant metabolites there are few reports into systems that produce such compounds. With the objective to investigate such interactions, in this work the phenolic profile in a *Cyperus laxus* phytoremediation system was studied. The presence of complex compounds, in the rhizospheric soil and the plant tissue, derived from chemical interaction between polyaromatic hydrocarbons (PAH) and plant phenolics was investigated. *Cyperus laxus* is a pioneer plant species in this oil spill impacted-sites of the tropical wetlands of Tabasco, México, and was able to remove c.a. 270 g of total hydrocarbons (340)/kg soil when greenhouse-cultivated in soils from the impacted sites.

The PAH and phenolic HPLC-UV profile showed that in both soil and plants (root, bulb and leaf), most PAH were not chemically free but conjugated, typically with flavonoids and phenylpropanoids putatively produced by *Cyperus*. In both bulb and leaves anthracene, acenaphthene, phenanthrene and fluoranthene were the most common PAH, and protocatechuic acid, coniferyl alcohol, p-hydroxybenzoic acid, and compounds with structures like chrysine, quercetin and luteolin were the most common phenolics. Typically, conjugation of PAH in both soil and plants was mainly with quercetin or hydroxy-3-methoxybenzoic acid.

The presence of conjugated PAH with plant phenolic compounds, suggests chemical interactions, some of the probably mediated by enzymatic activity. Preliminary results from assays for peroxidases, catechol oxidases, dioxygenases and polyphenol oxidases from *Cyperus* plants over some PAH and phenolics seems to confirm such hypothesis. For example, oxidative enzymatic reactions of anthracene with plant extracts yielded structures-like *o*-quinone, *o*-phenols and 9,10-anthroquinone, the typical oxidative anthracene metabolites described for fungal enzyme. Further analysis of the enzymatic products by MS-TOF showed also the presence of acids, aldehydes, ketones and alcohols as principal products.

These results suggest that as part of the phytoremediation mechanism, *Cyperus laxus* produces phenolic compounds able to interact with PAH in both the rhizospheric soil and the plant tissue. Thus, the oxidative enzymes and phenolics from *Cyperus*, which could be secreted to the rhizosphere or not, could act as chemical mediators to produce the conjugated compounds detected in this work. These compounds finally should be directly metabolized by the plant itself and by the rhizospheric microorganisms.