BIOREMEDIATION OF AN AGRICULTURE SOIL IMPACTED WITH ORGANOCHLORINE PESTICIDES AND HYDROCARBONS.

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Introduction. Most of agricultural soils are contaminated by pesticides and their metabolites, where application is high (ca. 60 %), generating a human and environmental risk, due to their accumulation, persistence and biomagnification [1]. Hydrocarbons constitute the most important second source of pollution in agricultural soils, mainly in the central zone of Mexico [2]. A wide variety of technologies have been developed in order to diminish the effects of these substances; however, the use of sustainable technologies, such as the bioremediation by Solid Culture with addition of green coffee beans, will allow to determine its potential application for restoration of agricultural soils impacted with both type of pollutants.

Methods. In the solid culture technology, growth conditions were tested applying a Plackett-Burman experimental design [3] for 11 variables with 3 central points and 2 controls. Among tested variables were nutrients, water, organic material and green grain coffee having as response variable the reduction of organochlorine pesticides of 5 ppm each (Heptachlor, Endosulfan I and II, 2,4-DDT and 4,4-DDT), 26,500 ppm of Middle Hydrocarbons Fraction (MHF) and 19,600 ppm of Heavy Hydrocarbons Fraction (HHF). Determinations of pesticides and hydrocarbons were performed by EPA 8081A, EPA 8015 and EPA 9071B methodologies, respectively.

Results. At 40 days of treatment were obtained removal rates above 50 % in T4, T7, T11 and T12 for HHF. While in the case of MHF, its higher removal was between 45 to 50 % in the 40 days. Interestingly the most recalcitrant pesticide isomer 4,4-DDT, and Endosulfan I presented the highest removal percentages, in most of the treatments (79-96%). The removal achieved at four of the five pesticides treated was in T7, T8, T10 and T11 treatments, (Heptachlor: 16-47%, Endosulfan I: 50-91%, 2,4-DDT: 17-39%, 4,4-DDT: 80-96%). The different conditions of treatment, resulted in a positive correlation (R^2=0.62;p<0.05) between the removal of Heptachloro/4,4-DDT and MHF/HHF indicating a possible cometabolism. No inhibitory effect of both pollutants on their removal was presented.

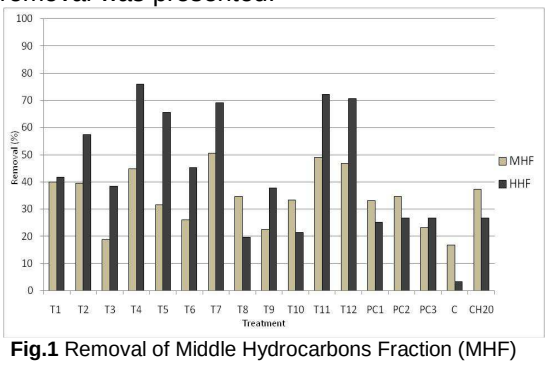

Fig.1 Removal of Middle Hydrocarbons Fraction (MHF) and Heavy Hydrocarbons Fraction (HHF) in the different treatments in microcosm.

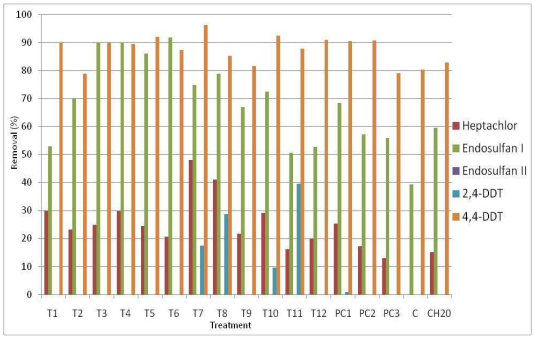

Fig.2 Removal of Organochlorine Pesticides in the different treatments in microcosm.

Conclusions. The modified technology of Solid Culture using green coffee beans, using other selected variables, enhanced the pesticides and hydrocarbons biodegradation through a possible cometabolism. These results are an indicator of the potential application of this sustainable technology in the restoration of polluted agricultural soils.

References.

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