BIOREMEDIATION OF SOIL CONTAMINATED WITH HYDROCARBONS BY USING BAGASSE OIL PALM

Clara Ivonne Ruiz Reyes; Oswaldo Guzmán López; Adriana Hernández Ordaz; Luis Felipe Sánchez Díaz; María del Carmen Cuevas Díaz; Facultad de Ciencias Químicas; Universidad Veracruzana campus Coatzacoalcos, CP 96538, clara.ruizr@hotmail.com

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Introduction. The alternative of adding agro-industrial waste in soil bioremediation processes has reduced costs and it is also a feasible improvement to the environment (1). These residues have the function of improving the characteristics of the soils and are considered as low density materials that can improve the physical, chemical and biological characteristics of soil (2). In this study, the use of bagasse oil palm (*Elaeis guineensis*) could increase the porosity of soil, it could enhance the oxygen diffusion which favors microbial activity, soil stability and structure to deal (3); however it is not known in what proportions should be added to contaminated soil.

Methods. A system of bioremediation in micro-scale (100 g) was used with different mixtures of contaminated soil and palm oil bagasse, these were placed in with ratios of 100:0, 98:2, 96:4 and 92:8. Respective controls in the treatments were employed. To ensure the reliability of results, three replicates were used. The treatments were incubated at 28 ° C, aeration was verified subjecting every third day with an air flow of 8 L/min. Experiments were carried out during 30 days. The response variables were the total petroleum hydrocarbons (TPH), CO_2 production (4) and total count of microorganisms.

Results. The initial concentration of TPH in soil was 117,109.7 ppm, it exceeds the maximum limit in the normativity (5), while the bagasse palm was found with high values of N and P (Table 1).

Table 1. Physicochemical parameters observed during the kinetics in the mixture 96:4.

	HTP´s (ppm)	P (%)	N(%)	CO_2(mg)
Initial	117109.7	0.710	0.039	--------
Soils Bagasse		5.22	0.21	--------
94:6 (30 days)	50616.93	4.089	0.032	59.48

The treatment with the best percentage of removal was the mixture of 96:4 with a 56% in relation with the initial concentration (Fig.1). The pH was between 6-7.5, and the respirometric response indicated a CO_2 production of 55 mg and this was verified with the increased presence of microorganisms.
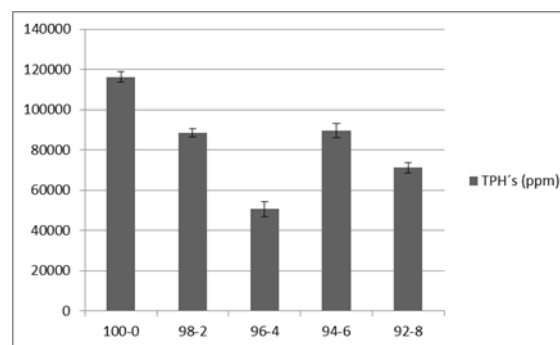
Fig. 1 TPH's in a kinetic of 30 days (ppm).

Conclusions. The addition of bagasse oil palm to hydrocarbon contaminated soils is an alternative for bioremediation. The best treatment could be used in further studies applying a mixture of 4% with bagasse oil palm.

References.
1. Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT). 2010. Contaminación y remediación anual de sitios afectados por emergencias ambientales. Base de datos estadísticos del Sistema Nacional de Información Ambiental y Recursos Naturales (SNIARN).
2. Cuevas M., Rojas N., Poggyvaraldo H., Esparza F., Rodriguez R. (2005). Remoción de hidrocarburos totales de petróleo utilizando cultivo sólido. XVI Congreso Chileno de Ingeniería Química
3. Antonio-Ordaz, J., Martínez-Toledo, A. Ramos-Morales, R.F., Sánchez-Díaz, L. F., Martínez, A. J., Tenorio-López, J.A., Cuevas-Díaz, M.C. 2011. Multiciencias. 11(2):136-145.
4.- Rochette P. y Hutchinson, G.L. "Measurement of soil respiration in situ: chamber techniques," en Hatfield, J. y Baker, J.M. eds., Micrometeorology in Agricultural Systems, Monografía ASA , nº 47,pp. 247-286. American Society of Agronomy, 2005. Madison, WI.
5.- SEMARNAT (2003). Norma Oficial Mexicana NOM–138–SEMARNAT/SS–2003 Límites máximos permisibles de hidrocarburos en suelo y las especificaciones para su caracterización y remediación.