INDIGENOUS OIL RESERVOIR MICROBES GROWTH IN THE PRESENCE OF TEQUILA VINASSE AND URBAN WASTEWATER FOR MEOR

Carlos Cano[2], Elsa N. Aguilera[1], Anna Iliná*[2], M. Isidora Castillo[1], Berthzaira Peimbert[1], Julia M. Ortiz[1], José L. Martínez[2], Carlos Vera*[1]; [1]Corporación Mexicana de Investigación en Materiales, S.A. de C.V. (COMIMSA); Calle Ciencia y Tecnología 190, Fracc. Saltillo-400, C.P. 25290, Saltillo, Coah., México Tel: 52-844-411-32-00 (Ext. 1203); E-mail: cvera@comimsa.com
[2]Coahuila Autonomous University, Chemistry Faculty; Blvd. V. Carranza e Ing. J. Cárdenas V., C.P. 25280, Saltillo, Coah., México, Fax: 52-844-415-95-34; E-mail: anna_ilina@hotmail.com

Key words: extremophile microorganisms' growth, tequila vinasse, urban wastewater, microbial enhanced oil recovery (MEOR)

Introduction. Tequila vinasse and urban wastewaters are produced in the great quantities in Mexico and are rich in organic matter that makes them candidates to be applied for diverse biotechnological processes [1]. In our other report presented in this congress we demonstrated that these residues stimulated growth of indigenous microorganisms obtained from the oil of reservoir samples.
The aim of this research was to evaluate the growth of indigenous microorganisms obtained from the oil, under different culture conditions in order to be applied in microbial enhanced oil recovery processes.

Methods. Bacteria were cultivated for 5 days under anoxic conditions in HACH tubes at 55, 70 and 80°C using the mineral culture medium composed of (g/L): NaCl (24 or 35); KH_2SO_4 (2), $MgSO_4$ (1), Na_2HPO_4 (3), NH_4NO_3 (1) [2] supplied with tequila vinasse (TV) or urban wastewater (UWW) at 10, 40 and 100% (v/v). Bacteria growth was monitored spectrophotometrically at 540 nm.
The tertiary oil extraction was performed after secondary extraction. Oil recovery was quantified as weight difference of system oil-sand before and after applied treatments. Applied treatments are enlisted in results section. Culture media contained 10% of liquid residue. All treatments contained NaCl at 24 g/L and carried out at 55°C for 5 days.

Results. Anaerobic, thermophilic, halotolerant and fermentative enrichment cultures obtained from the oil samples grew better at 55°C, 40% of liquid residues TV and UWW (Figs. 1 and 2). Their growth was inhibited with 100% of TV or UWW, 80°C and 35 g/L of NaCl. These results were used to determine the conditions for oil recovery assays. Tertiary oil recovery carried out with bacteria cultures and media with TV or UWW without bacteria allowed another 4–13% of the sand impregnated with oil residue (Fig. 3). Higher oil recovery was achieved in the presence of bacteria cultures obtained with vinasse (Fig. 3). Moreover, this was increased (up to 35%) by applying gentle agitation.

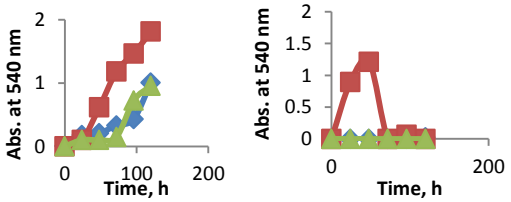

Fig.1 Bacteria growth at the presence of different TV concentrations (♦,-10%; ■, - 40%, ▲, - 100%) at 55 (left) and 70°C (right) and NaCl at 24 g/L.

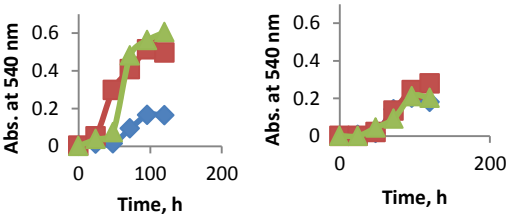

Fig.2 Bacteria growth at the presence of different UWW concentrations (♦,-10%; ■, - 40%, ▲, - 100%) at 55 (left) and 70°C (right) and NaCl at 24 g/L.

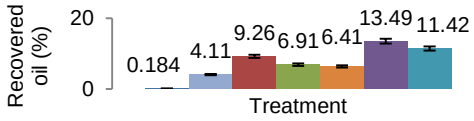

Fig.3 Oil recovery by fermentation with (from left to right): water; UWW; first bacteria culture from UWW stimulation; second bacteria culture from UWW stimulation; TV; first bacteria culture from TV stimulation; second bacteria culture from TV stimulation.

Conclusions. Tequila vinasse as well as urban wastewater may be applied to stimulation of bacteria from oil that allows enhancing oil recovery from sand.

Acknowledgements. The authors thank scholarship from CONACYT for master's student and the grant from COMIMSA.

References. 1. López-López, A., Davila-Vazquez, G., León-Becerril, E., Villegas García, E., Gallardo-Valdez, J. (2010). *Rev. Environ. Sci. Biotechnol*. 9(2): 109-116.
2. Mills A.L., Breul C., Colwell R.R. (1978) *Can. J. Microbiol.* 24: 552-557.