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MICROSCOPY OF BIOFILMS FORMED ON A METALLIC SURFACE IN DYNAMIC AND STATIC SYSTEMS IN THE PRESENCE OF OILY FLUIDS

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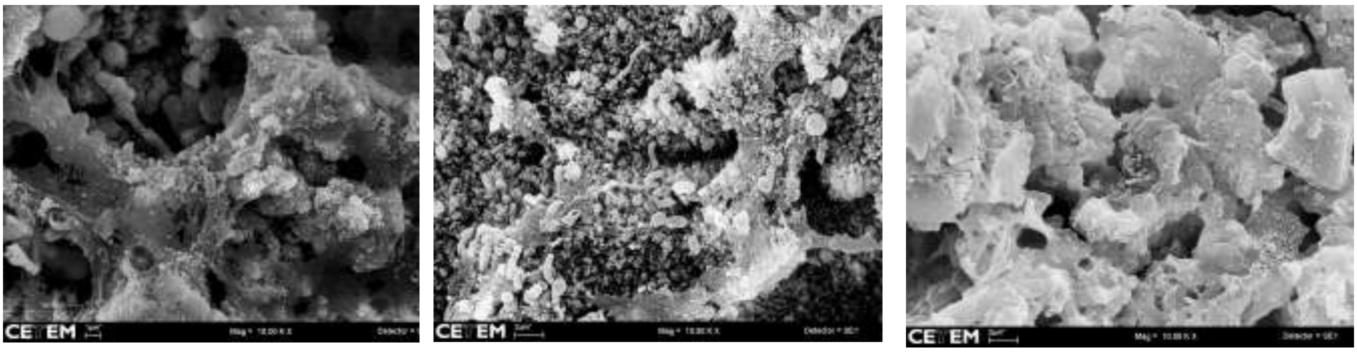
Abstract – The development of biofilms in the different systems was documented by Scanning Electron Microscopy (SEM). In order to obtain better imaging, where details of these biofilms could be observed, it was necessary to improve the existing sample preparation protocol [1], (fig. 1a). In the new technique, osmium tetroxide was used for post-fixation (fig. 1b), which permitted a better structural preservation of the biofilm, permitting the observation of details not revealed when using fixation with only glutaraldehyde

Corrosion processes in general, impact the petroleum industry to different degrees in a range of activities, including exploration systems, and those used in the production and transport of oil and its products. Among the different deleterious processes of this type, those associated with Microbiological Induced Corrosion (MIC) [2] include all processes which can be accelerated or promoted by the microorganisms present within these systems, collectively denominated Biocorrosion. Biocides are usually added by water injection processes in the secondary recovery of petroleum in order to stop or reduce biocorrosion. The detailed mechanisms involved in biocorrosion are not well understood and it is therefore important to evaluate all the aspects of the kinects of biofilm growth, and especially in presence of biocides.

The objective of the present work was to study the development of the biocorrosion process on an API X80 Steel surface in an oily fluid with low basic sediment water (BSW). Dynamic (looping) and static tests, with and without biocide additions, were undertaken and a kinect study of the film growth for both types of system was also carried out.

The effect of biocide addition to an oily fluid on both the formation and the subsequent growth of biofilms was studied. When the biocide was present from the beginning of the exposure period, no biofilm formed, whereas biofilms were detected on samples exposed to the fluid without biocide, after a period of 15 days. When samples for which a biofilm had been allowed to form during exposure to the fluid without biocide were subsequently exposed to the same fluid after a biocide addition (fig.1c), no further film growth was detected after 7 days of additional exposure. A microbial concentration count detected much lower microbe levels in the biocide-containing fluid than in the fluid without biocide.



(a) (b) (c)

Fig1. Coupon surface (a) without biocide using existing protocol; (b) without biocide using new protocol; (c) with biocide and using existing protocol

[1]. PENNA, M.O. (2004). Avaliação de Bases Ativas Biocidas para Controle de Microrganismos em Sistemas de Recuperação Secundária de Petróleo. Tese de mestrado, Pontifícia Universidade Católica.(in portuguese)

[2]. E. Ilhan-Sungur, N. Cansever, A. Cotuk (2007). Microbial corrosion of galvanized steel by a freshwater strain of sulphate reducing bacteria (Desulfovibrio sp.) Corrosion Science 49 1097–1109