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Anticorrosive Performances of “Methyl Ester Sulfonates” Biodegradable Anionic Synthetized Surfactants on Carbon Steel X 70 in Oilfields

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Abstract : This study covers two aspects ; the biodegradability and the performances in corrosion inhibition of a series of synthetized surfactants namely Φ- sodium methyl ester sulfonates (Φ-MES: C_{12}-MES, C_{14}-MES and C_{16}-MES. The biodegradability of these organic compounds was studied using the respirometric method, ‘the standard ISO 9408’. Degradation was followed by analysis of dissolved oxygen using the dissolved oxygen meter over 28 days and the results were compared with that of sodium dodecyl sulphate (SDS). The inoculum used consists of activated sludge taken from the aeration basin of the biological wastewater treatment plant in the city of Boumerdes-Algeria. In addition, the anticorrosive performances of Φ-MES surfactants on a carbon steel "X70" were evaluated in an injection water from a well of Hassi R'mel region- Algeria, known as Baremian water, and are compared to sodium dodecyl sulphate. Two technics, the weight loss and the linear polarization resistance corrosion rate (LPR) are used allowing to investigate the relationships between the concentrations of these synthetized surfactants and their surface properties, surface coverage and inhibition efficiency. Various adsorption isotherm models were used to characterize the nature of adsorption and explain their mechanism. The results show that the MES anionic surfactants was readily biodegradable, degrading faster than SDS, about 88% for C_{12}-MES compared to 66% for the SDS. The length of their carbon chain affects their biodegradability; the longer the chain, the lower the biodegradability. The inhibition efficiency of these surfactants is around 78.4% for C_{12}-MES, 76.60% for C_{14}-MES and 98.19% for C_{16}-MES and increases with their concentration and reaches a maximum value around their critical micelle concentrations (CMCs). Scanning electron microscopy coupled to energy dispersive X-ray spectroscopy allowed to the visualization of a good adhesion of the protective film formed by the surfactants to the surface of the steel. The studied surfactants show the Langmuirian behavior from which the thermodynamic parameters as adsorption constant (Kads), standard free energy of adsorption (□ΔG□_ads^0) are determined. Interaction of the surfactants with steel surface have involved physisorptions.

Keywords : corrosion, surfactants, adsorption, adsorption isotherems
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