



Inhibition efficiency of synthesized petroleum sulfonates mixtures against the acidic corrosion of mild steel

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Abstract

The inhibiting effects of surfactants synthesized by sulfonation from Algerian petroleum products (crude oil, gasoil, kerosene and platformat) of local origin (field of Hassi Messaoud in the south of Algeria) against the acidic corrosion of mild steel were determined by electrochemical techniques: polarization resistance (RP), polarization curves (Tafel slopes) and electrochemical impedance spectroscopy (EIS). The results showed that the inhibition effectiveness is a function of the nature and the families' contents of hydrocarbons in the initial products on one hand and of the physicochemical properties such as: solubility and critical micelle concentration (cmc) on other hand. It increases in the direction: platformat, kerosene, gasoil and crude oil. The examination of the isotherms showed that adsorption verifies the model of Temkin for the crude oil surfactant and the model of Frumkin in the other cases. The rise of temperature, in the field 30-60°C, decreases the effectiveness which indicates a physisorption of surfactants at steel surface, however it remains relatively significant compared with inhibitors of same type.

Keywords: mild steel corrosion, inhibiting effect, surfactant, oil sulphonates, hydrocarbons

1. Introduction

The protection of oil and gas structures against corrosion consumes large amounts of inhibiting substances in order to preserve their integrity for long duration [1-2]. The effectiveness, reliability and the cost are the most decisive criteria in the choice of these substances. The inhibiting effects of surfactants synthesized from petroleum products, against corrosion of different metals in aggressive media, were the subject of many studies [3-7]. It was shown that the effectiveness of synthesized compounds depends on the origin, the nature and the specific characteristics of the basic petroleum products (aromatic, naphthenic and paraffinic contents) [5, 8]. The reaction of synthesis generates active centers which are able to improve its adsorption on the surface of metal. These active centers should contain at least one donor atom such as nitrogen, sulphur, phosphorus, and/or oxygen, which exchange "coordinate bonds" with metal [9, 10]. This study had as objective firstly to synthesize surfactants by sulfonation of some hydrocarbons (gasoil, platformat, kerosene and the crude oil) of local origin (field of Hassi Messaoud in the south of Algeria), secondly to evaluate their inhibition effectiveness against the corrosion of mild steel in aggressive media by electrochemical techniques. The correlation between the inhibiting effect and some characteristic parameters: critical micelle concentration (cmc), solubility, and families contents of hydrocarbons were examined.

2. Materials and methods

2.1. Petroleum products

Petroleum products used are: kerosene (KN), gasoil (GO), plat format (PF) and crude oil (PB), provided by the refinery of Algiers. Oil cuts (kerosene, gasoil and platformat) were obtained by atmospheric distillation of crude oil. Contents in hydrocarbon families: aromatic X_{ar} , naphthenic X_{np} et paraffinic X_{pf} , evaluated by ndPa method [8].