



New α -Aminophosphonates as Corrosion Inhibitors for Oil and Gas Pipelines Protection

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Abstract

The problem of corrosion of metal equipment is one of the most actual problems in oil industry. One of the methods to solve this problem is the development of new low-toxic, accessible and effective corrosion inhibitors. For this purpose, we carried out the synthesis of the new α -aminophosphonates based on syntanyl phosphites, formalin and diethanolamine according to the Kabachnik-Fields reaction. The resulting products are characterized by ¹H, ³¹P, ¹³C NMR, IR and mass spectroscopy methods. The obtained compounds contain a long radical chain of industrial (poly) ethoxylated alcohol residue with different length of the hydroxyethyl fragment, as well as an active center containing O-P-C-N fragment, which impart them inhibitory properties toward corrosion processes. The anticorrosive activity of the new aminophosphonates was studied by gravimetric analysis method. In the article the effect of concentration, time and degree of ethoxylation of the hydrocarbon radical in alpha-aminophosphonates on the protective effect of inhibitors was studied. It was shown that the obtained aminophosphonates exhibit high values of the protective effect of steel in a highly mineralized medium containing 250 g/m³ CO₂ and 200 g/m³ H₂S. The high value of the protective effect (82-85%) at inhibitor concentration of 25 mg/l was found. The maximum protective effect at 50 mg/ml dosage of the inhibitor is 94.3%, while there is a decrease of the corrosion rate (less than 0.04 mm/year).

Keywords: Corrosion; Corrosion Inhibitor; α -Aminophosphonate; Synthanol; Protective Effect; Corrosion Rate.

1. Introduction

Corrosion is one of the most pressing problems of the oil and gas industry. Corrosive processes contribute to the deterioration of the mechanical properties of the equipment, which can lead to oil spill into the environment. The main corrosive agents in the oil and gas industry are H₂S and CO₂. Currently, there is a tendency to replace alloy equipment with materials that are more resistant to corrosion, but, unfortunately, this increases the cost of production.

One of the main solutions to this problem is the creation of new corrosion inhibitors that impede the process of damage to the material by creating a protective layer on the metal surface [1]. It can improve economic abilities of the industrial establishments and minimize different factors of the environment pollution [2]. In this case, molecule is adsorbed on the metal surface and causes a slowdown in either the anodic dissolution of the metal, or the cathodic reaction of hydrogen evolution, or both [3].

Considerable attention as inhibitors of metal corrosion was obtained by organic compounds, in particular, having a

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