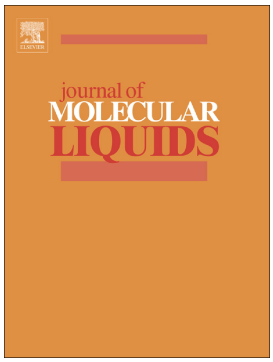

Controlling of mild-steel corrosion in acidic solution using environmentally friendly ionic liquid inhibitors: Effect of alkyl chain

Fadhel A. Azeez, Osama A. Al-Rashed, Ahmed Abdel Nazeer

PII: S0167-7322(17)36039-7
DOI: doi:10.1016/j.molliq.2018.05.093
Reference: MOLLIQ 9148

To appear in: *Journal of Molecular Liquids*

Received date: 17 December 2017
Revised date: 19 May 2018
Accepted date: 21 May 2018

Please cite this article as: Fadhel A. Azeez, Osama A. Al-Rashed, Ahmed Abdel Nazeer , Controlling of mild-steel corrosion in acidic solution using environmentally friendly ionic liquid inhibitors: Effect of alkyl chain. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Molliq(2017), doi:10.1016/j.molliq.2018.05.093

Controlling of Mild-Steel Corrosion in Acidic Solution using Environmentally Friendly ionic liquid Inhibitors: Effect of alkyl chain

Fadhel A. Azeez [a,*], Osama A. Al-Rashed [a], Ahmed Abdel Nazeer [a, b]

[a] *Chemical Engineering Department, College of Engineering and Petroleum, Kuwait University, P.O. Box 5969, Safat 13060, Kuwait.*

[b] *Electrochemistry and Corrosion Lab., National Research Centre, Dokki, Cairo-12622, Egypt*

Abstract

In this study three environmentally friendly ionic liquids (ILs) namely: 1-Methyl-3-propylimidazolium iodide (MPIMI), 1-Butyl-3-methylimidazolium iodide (BMIMI) and 1-Hexyl-3-methylimidazolium iodide (HMIMI) were examined as inhibitors for suppressing mild-steel corrosion in 1 M HCl solution. PDP, EFM and EIS techniques were used to study the inhibition action on the metal surface. PDP study revealed that these ILs acted as mixed-type inhibitors due to their adsorption on the steel surface following Langmuir adsorption isotherm. The negative values obtained for Gibbs free energy supported the spontaneous physical adsorption of these inhibitors. Pronounced elevation in the inhibition efficiency was achieved with increasing the concentration of the ILs with maximum inhibitions of 93.1%, 87.8% and 80.4% using 5 x 10^{-3}M for HMIMI, BMIMI and MPIMI, respectively. To confirm the electrochemical results, the surface morphology of mild-steel was examined using AFM, SEM, and FT-IR analysis. The results confirmed the significance of the alkyl-chain length and the iodide anion present in the ILs on the inhibition mechanism. The results obtained from the different electrochemical and imaging techniques supported each other and strongly suggested that these eco-friendly compounds can be important for several industrial applications.

Key words: Mild steel, ionic liquids, corrosion inhibition, HCl, EIS, SEM/AFM.