Performance of (HEMIM)⁺ (CN)⁻ and (DMIM)⁺ (Cl)⁻ as corrosion inhibitor of API 5L X52 steel in HCl medium

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Two ionic liquids, 1-(2-hydroxyethyl)-3-methylimidazolium dicyanamide (HEMIM)⁺ (CN)⁻ and 1,3-didecyl-2-methylimidazolium chloride (DMIM)⁺ (Cl)⁻, were evaluated as corrosion inhibitors of the API 5L X52 in 0.5 M HCl using electrochemical method, weight loss, and surface characterization techniques. Gravimetric tests showed that the ILs display high corrosion protection efficiency, % *EI*, (92 % and 97 %) with 100 and 5 ppm of (HEMIM)⁺ (CN)⁻ and (DMIM)⁺ (Cl)⁻, respectively. Electrochemical tests showed that the % *EI* depends on the IL concentration and the temperature. The polarization studies showed that the ILs are mixed type inhibitors and the adsorption of the ILs on the API 5L X52 obeyed the Langmuir adsorption isotherm displaying chemical interaction between the steel and the IL. SEM and AFM verified a considerable reduction of the corrosion process after the addition of the ILs. Uv-vis also confirmed the interaction between ILs and steel. Theoretical quantum chemical calculation studies agree with experimental results. The adsorption energy of (DMIM)⁺ (Cl)⁻ on Fe (110) surface is higher than that of (HEMIM)⁺ (CN)⁻, but both inhibitors are expected to bind strongly to the API 5L X52.

Keywords: Ionic liquid; corrosion inhibitor; API 5L X52 steel; electrochemical tests.

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