Corrosion Inhibition Efficiency of Cysteine-Metal ions Blends on Low Carbon Steel in Chloride-Containing Acidic Media

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This paper addresses the effect of some metal ions (e.g., Cu^{2+} , Ni^{2+} and Fe^{2+}) in their blends with cysteine (an environmentally friendly organic compound) on the inhibition efficiency (*IE*) of the corrosion of low carbon steel (LCS) in three different media, i.e., 0.5 M H_2SO_4 in the absence and the presence of 3.5 wt% NaCl or 0.5 M Na_2SO_4 . The results obtained from both electrochemical impedance spectroscopy (EIS) and electrochemical polarization measurements indicated a significant increase in *IE* of cysteine in the presence of a few micro molar amounts of Cu^{2+} ions instead of cysteine alone. On the other hand, blending cysteine with Ni^{2+} or Fe^{2+} decreased *IE*. That is *IE* reached ca. 90, 91 and 92% in the presence of 8 mM cysteine and 25 μM Cu^{2+} ions in the first, second and third medium, respectively, compared to ca. 70%, 66% and 58% in the presence of cysteine alone (i.e., in absence of Cu^{2+} ions). Moreover, polarization experiments indicated that cysteine and Cu^{2+} ions blend acts as a mixed-type inhibitor for the corrosion of LCS. The formation of Cu(I)–cysteinate complex and/or cysteine SAM at Cu atop the LCS surface (as evident from EDX and SEM results) protects the metal surface from exposure to the aggressive chloride ions. *IE* of cysteine– Cu^{2+} blend remains effectively high with time indicating its high stability in the applied chloride-containing acidic media.

Keywords: Cysteine, Low Carbon Steel, EIS, green corrosion inhibitor, acid medium.

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