7、Corrosion and Scale Inhibitors

Investigation of Black Tea Extract as green corrosion inhibitor for corrosion of mild steel under CO_2 condition

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Abstract: Use of corrosion inhibitor is one of the possible way of controlling CO_2 corrosion in oil and gas and presently in connection with CO_2 capture and storage application. Many commercial inhibitors used today have toxic constituents and overall composition is not environmental friendly. Hence, there is significant interest to explore green inhibitor chemistries that can provide comparable inhibitor efficiency similar to presently used molecules. In this study, the inhibition ability of black tea extract (BTE) on the corrosion behavior of 1Cr carbon steel was investigated in detail. An important step is the identification of the appropriate extraction method to produce the inhibition chemistry, which was explored and produced solid extract through vacuum distillation process. Different filtering process was also investigated as a part of this and connection to inhibition efficiency. UV spectroscopy and HPLC was used for analysing molecular constituents of BTE. DFT modelling was carried out to understand absorption energy related to various constituents with reference to water. For corrosion investigation, tests were conducted at atmospheric pressure in a 1wt.% NaCl solution saturated with CO_2 at 40 and 60 ^oC with different inhibitor concentrations (from 50 to 4000 ppm). Linear Polarization Resistance (LPR) and electrochemical impedance spectroscopy(EIS) were used to study the electrochemical behavior. Scanning Electron Microscopy (SEM), Energy Dispersive X-Ray Spectroscopy (EDS), and Transmission electron microscopy were utilized to analyze the phase composition and morphology of the film formed. Results showed changing the morphology and properties of the formed corrosion layers as a result of materials protection from corrosion by BTE. Moreover, extract synthesis approach found to affect the inhibitor efficiency. Increase in temperature found to increase inhibitor efficiency.

Keywords CO_2 corrosion, Green inhibitor, Carbon Steel, Black Tea