Complicated synergistic effects between three corrosion inhibitors for Q235 steel in a CO₂-saturated 3.5 wt% NaCl solution

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The corrosion inhibition of a one-component inhibitor, a bicomponent inhibitors and a three-component inhibitor consisting of 4-methylpyridine quaternary ammonium salt (PQ), quinoline quaternary ammonium salt (QQ) and thiourea (TU) for Q235 steel in a CO₂-saturated 3.5 wt% NaCl solution was investigated by electrochemical measurements, XPS analysis and quantum computational chemistry. The results showed that there were remarkable synergistic effects between PQ, QQ and TU, especially in the three-component inhibitor PQ+QQ+TU (1.5:1.5:1). It was also indicated that the different addition sequences of the three inhibitors had a significant influence on the synergistic effect. Additionally, the mechanism of the synergistic effects within the three-component inhibitor was proposed.

Keywords: CO₂ corrosion; inhibitors; synergistic effect; adsorption sequence; quantum computational chemistry

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