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Synthesis and evaluation of 2,3-diphenylquinazolin-4(3H)-one as a corrosion inhibitor for mild steel in acidic media

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Corrosion is an oxidation-reduction process where a metal is oxidized to a more consistent form such as its oxide, hydroxide, or sulfide by atmospheric oxygen. Corrosion is an excessively costly issue that is reported to cause significant economic damage globally each year. Therefore, the discovery of novel corrosion inhibitors is highly desirable. Corrosion inhibitor molecules are first absorbed into the metal surface by electrostatic interactions. Then coordinate covalent bonding occurs by share or transferring electrons from the inhibitor to the metallic surface. The inhibitor adsorption on to the surface of the metal hinders its active sites where oxidation occurs, and results in reduced corrosion. The adsorption process depends on the inhibitor structure, surface morphology, temperature, pressure as well as the pH. Compounds that possess heteroatoms such as nitrogen, oxygen, phosphorous, and sulfur atoms and multiple bonds in their structure have better corrosion properties as they have higher basicity and higher electron density. Quinazolinone derivatives have various biological, chemical, and physical activities, especially we focused on anticorrosive activities. Quinazolinone derivatives are widely employed as excellent corrosion inhibitors as well. They are capable of decreasing the corrosion process and protect steel in acidic environments. In this research, a quinazolinone derivative, 2,3-diphenylquinazolin-4(*3H*)-one was synthesized using anthranilic acid via intermediate, 2-phenyl-4H-benzo[d][1,3]oxazin-4-one and aniline and confirmed the structure using infrared (IR), ^{1}H-NMR, and ^{13}C-NMR analysis. The corrosion inhibitory activity of the 2,3-diphenylquinazolin-4(*3H*)-one on a mild steel, JIS 3113SPHE in 0.5 M hydrochloric acid solution was determined by two different corrosion analysis methods namely, the weight-loss method and the polarization method. Mass loss dependence on the content of inhibitor in the corroding medium, temperature of the corroding medium, and the pH of the solution were measured. Corrosion inhibition of 2,3-diphenylquinazolin-4(*3H*)-one was analyzed using different concentrations (1×10^{-4} M - 5×10^{-4} M). The compound exhibited maximum inhibition efficiency of 80-84 % at 5×10^{-4} M. When increasing the temperature, mass loss and the corrosion rate was increased. Though the corrosion rates increase gradually as temperature rises, even at 333 K, the corrosion rate of 2,3-diphenylquinazolin-4(*3H*)-one at 5×10^{-4} M was only 2.3 x 10^{-3} $gcm^{-2}hr^{-1}$. The mass loss was decreased as the pH of the medium was increased. The results of the potentiodynamic polarization method suggest that 2,3-diphenylquinazolin-4(*3H*)-one act as a mixed type corrosion inhibitor in the acidic medium. According to the experimental results 2,3-diphenylquinazolin-4(*3H*)-one is an efficient corrosion inhibitor.

Keywords: Corrosion inhibitor, 2,3-diphenylquinazolin-4(*3H*)-one, Inhibition efficiency