Studi Pengaruh Konsentrasi dan Temperatur terhadap Efisiensi dan Mekanisme Inhibisi dari Inhibitor Korosi Berbahan Dasar Piridin untuk Baja ASTM A106 pada Lingkungan yang Mengandung CO2 = The Study of Effect of Concentration and Temperature for Efficiency and Inhibition Mechanism of Pyridine-Based Inhibitor for ASTM A106 Steel in a CO2-Containing Environment

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Abstrak

Dalam industri minyak dan gas, korosi yang diakibatkan oleh karbon dioksida masih menjadi tantangan yang besar yang dapat menyebabkan kegagalan material. Penelitian ini menggunakan salah satu turunan dari senyawa piridin sebagai inhibitor yang dapat ditambahkan ke dalam sistem perpipaan untuk mengurangi laju korosi. Piridin ini diteliti dengan variasi konsentrasi, yaitu 25 ppm, 50 ppm, dan 75 ppm, serta variasi temepratur, yaitu 40° dan 90°C. Pengujian Fourier Transform Infrared Spectroscopy (FTIR) dan Gas Chromatography – Mass Spectrometry (GCMS) dilakukan untuk mengkarakterisasi inhibitor, dimana ditemukan bahwa inhibitor ini memiliki molekul dengan heteroatom nitrogen yang dapat memfasilitasi proses adsorpsi. Efisiensi inhibisi korosi juga diukur menggunakan metode polarisasi linear dan Electrochemical Impedance Spectroscopy (EIS), dimana ditemukan bahwa laju korosi menurun dengan meningkatnya konsentrasi inhibitor dan meningkat dengan meningkatnya temperatur. Data dari pengujian elektrokimia juga digunakan untuk menentukan model adsorpsi isoterm dan tipe adsorpsi, dimana ditemukan bahwa model adsorpsi yang didapat adalah adsorpsi isoterm Langmuir dengan tipe adsorpsi campuran fisika dan kimia. Morfologi permukaan sampel juga diteliti menggunakan Scanning Electron Microscopy (SEM) dan Energy Dispersive X-Ray (EDX) dan hasilnya menunjukkan bahwa sebelum diberikan inhibitor, produk korosi mendominasi permukaan dan jumlahnya menurun secara drastis setelah inhibitor diberikan, menandakan bahwa inhibitor ini telah sukses untuk menurunkan laju korosi baja karbon pada lingkungan CO₂. <hr /> In oil and gas industry, corrosion caused by carbon dioxide is one of the greatest challenges that could lead to material failure. This research uses a derivative of pyridine as an inhibitor that can be added to the piping system to reduce the rate of corrosion. Pyridine was examined with variations in concentration, namely 25 ppm, 50 ppm, and 75 ppm, as well as variations in temperature, namely 40° and 90°C. Fourier Transform Infrared Spectroscopy (FTIR) and Gas Chromatography - Mass Spectrometry (GCMS) tests were performed to characterize the inhibitors, which found that these inhibitors have molecules with nitrogen heteroatoms that can facilitate the adsorption process. The efficiency of corrosion inhibition was also measured using the potentiodynamic polarization method and Electrochemical Impedance Spectroscopy (EIS), which found that the corrosion rate decreased with increasing inhibitor concentration up to an optimal concentration of 50 ppm and increased with increasing temperature. The data from electrochemical testing was also used to determine the adsorption model of the isotherm and the type of adsorption, and it was found that the adsorption in this system obeyed Langmuir isotherm adsorption and is governed by a mixture of physical and chemical type. The surface morphology of the samples was also investigated using Scanning Electron Microscopy (SEM) and Energy Dispersive X-Ray (EDS) and the

results showed that before injected with inhibitors, corrosion products dominated the surface and the amount decreased dramatically after the inhibitor was given, indicating that this inhibitor was successful to reduce the rate of carbon steel corrosion in the CO₂ environment.</p>