UNIVERSITI TEKNOLOGI MARA

EFFICIENCY OF FATTY AMIDES AND OXYGEN SCAVENGERS AS CORROSION INHIBITORS OF CARBON STEEL

IZNI MARIAH BINTI IBRAHIM

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ABSTRACT

In this study, organic corrosion inhibitor has been synthesized by using palm fatty acid distillate (PFAD), a by-product from processing of crude palm oil. The synthesized corrosion inhibitor contained mixture of fatty amides. However, this amide-based corrosion inhibitor was only effective in static condition and at room temperature (25°C). In real industrial applications, most of conditions are facing with moving fluid or elevated temperature conditions. One would expect that the corrosion activity is more vigorous in these kinds of conditions. This study introduced selected oxygen scavengers into the inhibited solution consisting of fatty amides. The main objective is to enhance the inhibition performance in static, different rotation speeds and in elevated temperatures. At the initial stage of work, different concentrations of fatty amides (10-200 ppm) were tested to obtain the inhibition efficiency. Then, one concentration of fatty amide would be combined with different concentrations of different selected oxygen scavengers, (500-2000 ppm) (sodium sulphite, hydrazine and diethyl hydroxylamine). The corrosion inhibition performances were determined through electrochemical tests; linear polarization resistance and electrochemical impedance spectroscopy. From the electrochemical tests, it showed that increasing the concentration of oxygen scavengers in the inhibited solution, the inhibition efficiency increased. However, it was an exception for combination of fatty amides with diethyl hydroxylamine. The mixture of fatty amides with sodium sulphite and mixture of fatty amides with hydrazine achieved high increment in the inhibition efficiency (IE) in static condition (25°C). Both mixtures were further tested in different temperatures (30, 40 and 50°C) and different rotation speeds (laminar, transition and turbulent). The mixtures showed that increasing concentrations of sodium sulphite/hydrazine, the IE increased. However, the IE decreased with increasing temperatures and with increasing rotation speeds for both mixtures. After that, the nature of the film formed on the specimen surface was analyzed by surface analysis including Scanning Electron Microscope-equipped with an Energy Disperse X-ray spectrometer (SEM-EDX), Atomic Force Microscope (AFM) and X-ray Photoelectron Spectroscopy (XPS). The finding showed that the inhibitors adsorbed on the specimen surface through physical adsorption according to the Langmuir isotherm. It can be concluded that the mixture of fatty amides with sodium sulphite is the best mixture to protect the metal surface of carbon steel through physical adsorption.

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