

# Sintesis Inhibitor Korosi dari Minyak Sawit RBD (Refined, Bleached and Deodorized) untuk Baja Rendah Karbon pada Lingkungan NaCl 1,5% = Synthesis of Corrosion Inhibitors from Refined, Bleached and Deodorized Palm Olein for Low Carbon Steel in 1.5% NaCl Environment

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## Abstrak

Baja rendah karbon adalah paduan logam yang umum digunakan pada industri minyak dan gas. Sifatnya yang rentan terhadap korosi mendukung pengembangan inhibitor korosi organik yang dapat terbiodegradasi dan lebih mudah untuk disintesis. Penelitian ini berupaya untuk mensintesis inhibitor korosi TETA-MSRBD (trietilentetramin-minyak sawit RBD) melalui metode refluks yang kemudian discale-up menggunakan reaktor tangki BSTR (Batch Stirred Tank Reactor) pada variasi temperatur 140°C, 150°C, 160°C dan 170°C dengan variasi kecepatan pengadukan pada 700, 1000, dan 1200 rpm. Sintesis pertama berlangsung pada temperatur 150°C dengan kecepatan pengadukan 1200 rpm, mengikuti kondisi reaksi optimum sintesis imidazolin dari minyak sawit berdasarkan studi sebelumnya, menghasilkan TETA-MSRBD A dengan persentase konversi sebesar 66,85% setelah penentuan angka saponifikasi. Variasi kondisi reaksi dilanjutkan hingga didapatkan persentase konversi tertinggi sebesar 83,43% pada temperatur 150°C dengan kecepatan pengadukan 1000 rpm. Kedua produk dimurnikan (TETA-MSRBD B1 dan B2) dan dilanjutkan dengan karakterisasi menggunakan instrumentasi spektrofotometri UV-Visibel, spektroskopi FTIR, serta LC-MS. Hasil karakterisasi menunjukkan bahwa kedua produk TETA-MSRBD B1 dan B2 berupa senyawa amida. Akan tetapi produk kedua berhasil membentuk senyawa imidazolin. Kedua produk kemudian dianalisa efisiensinya sebagai inhibitor korosi untuk baja rendah karbon JIS G3123 grade SGD 400D pada larutan NaCl 1,5% yang jenuh CO<sub>2</sub> menggunakan metode gravimetri dan elektrokimia. Inhibitor diuji dengan variasi konsentrasi 0, 5, 20, 50, dan 100 ppm. Pengujian menghasilkan efisiensi inhibisi tertinggi pada konsentrasi 100 ppm dengan nilai 85,71% dan 90,47% untuk TETA-MSRBD B1 dan B2 secara berturut-turut. Karakter adsorpsi inhibitor mengikuti model isoterm Langmuir dengan campuran fisorpsi dan kemisorpsi yang lebih condong ke kemisorpsi.

.....Low carbon steel is an alloy that is commonly used in the oil and gas industry. Its vulnerability towards corrosion supports the development of organic corrosion inhibitors which are biodegradable and easier to synthesise. This study attempts to synthesise an organic inhibitor, TETA-MSRBD, through a reflux method which is followed by a scale-up with the use of a Batch Stirred Tank Reactor using temperature variations ranging from 140°C, 150°C, 160°C, to 170°C, with a variety of stirring speeds of 700, 1000, and 1200 rpms. The initial synthesis applies an optimum condition of 150°C and 1200 rpm based on previous studies to a moderate conversion percentage of 66,85% after determining its saponification value. Further variations were applied until the highest conversion percentage was determined to be 83,43% with reaction conditions of temperature 150°C and stirring speed of 1000 rpm. Both products were extracted from unwanted side products resulting in pure TETA-MSRBD B1 and TETA-MSRBD B2. Both products were followed by characterisation with UV-Visible spectrophotometer, FTIR spectroscopy, and LC-MS. Product characterisation showed that much of the composition consists of amide intermediates yet to form

imidazolines for the first product. However, the optimum product demonstrated imidazoline structures. Both products' efficiencies as inhibitors were tested on low carbon steel JIS G3123 grade SGD 400D in a CO<sub>2</sub>-saturated 1,5% NaCl solution (saline environment) with both gravimetric and electrochemical methods. Inhibitor concentration in the corroding media ranged from 0, 5, 20, 50, to 100 ppm. These tests resulted in a high inhibition efficiency of 85,71% and 90,47% for both TETA-MSRBD B1 and TETA-MSRBD B2 respectively when inhibitor concentration was the highest at 100 ppm. The adsorption mechanism during this study follows Langmuir's isotherm model with a mix of chemisorption and physisorption, with the latter being the more dominant.