ABSTRAK

KONVERSI MINYAK KELAPA SAWIT MENJADI SENYAWA NITROGEN MENGGUNAKAN ZEOLIT-A TERPROTONASI SEBAGAI KATALIS DAN UJI AKTIVITAS INHIBITOR KOROSI

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Baja lunak merupakan material logam yang rentan terhadap korosi dan mengalami degradasi struktural sehingga perlu dikendalikan. Salah satu metode pengendalian korosi adalah penambahan inhibitor korosi. Penelitian ini difokuskan pada sintesis senyawa inhibitor korosi melalui konversi minyak kelapa sawit menjadi senyawa nitrogen menggunakan katalis zeolit-A terprotonasi dan uji aplikasinya sebagai *green corrosion inhibitor*. Konversi ini dilakukan melalui dua tahap, yaitu reaksi transesterifikasi minyak kelapa sawit, metanol, dan zeolit-A terprotonasi (H-A) menjadi metil ester, dilanjutkan dengan reaksi amidasi antara metil ester dan dietanolamina menggunakan katalis yang sama.

Zeolit-A disintesis dari silika sekam padi dan dikarakterisasi menggunakan *X-Ray Diffraction* (XRD) dan *Scanning Electron Microscope* (SEM) yang menunjukkan bahwa zeolit-A telah terbentuk dengan baik. Zeolit-A diprotonasi menggunakan larutan amonium nitrat 3,5 M dan dikarakterisasi menggunakan *X-Ray Fluorescence* (XRF). Zeolit H-A yang terbentuk menghasilkan konversi Na menjadi H sebesar 17,26%. Produk reaksi transesterifikasi dan amidasi dikarakterisasi menggunakan *Gas Chromatography-Mass Spectrometry* (GC-MS) untuk mengetahui komposisi senyawa. Hasil konversi minyak kelapa sawit menjadi metil ester pada reaksi transesterifikasi yaitu sebesar 60% dengan kemurnian 100% yang ditunjukkan oleh hasil GC-MS.

Reaksi amidasi antara metil ester dan dietanolamina menggunakan katalis zeolit H-A menghasilkan senyawa nitrogen sebesar 25,34%. Senyawa nitrogen hasil sintesis diuji aktivitasnya sebagai inhibitor korosi baja lunak dalam larutan NaCl 3% jenuh CO_2 menggunakan metode kehilangan berat (*wheel test*) dengan persen proteksi sebesar 96,11%. Hasil proteksi ini didukung oleh data SEM yang menunjukkan permukaan baja lunak dalam medium korosif yang mengandung senyawa inhibitor korosi lebih halus dibandingkan tanpa inhibitor korosi.

Kata kunci: *green corrosion inhibitor*, senyawa nitrogen, amidasi, minyak kelapa sawit, zeolit-A terprotonasi.

ABSTRACT

CONVERSION OF PALM OIL INTO NITROGEN COMPOUNDS USING PROTONATED ZEOLITE-A CATALYST AND CORROSION INHIBITOR ACTIVITY TEST

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Mild steel is a metallic material that is susceptible to corrosion and undergoes structural degradation, thus requiring proper control. One method of corrosion control is the addition of corrosion inhibitors. This research focuses on the synthesis of corrosion inhibitor compounds through the conversion of palm oil into nitrogen-containing compounds using protonated zeolite-A as a catalyst and testing its application as a green corrosion inhibitor. This conversion is carried out in two stages: the transesterification reaction of palm oil, methanol, and protonated zeolite-A (H-A) into methyl esters, followed by an amidation reaction between methyl esters and diethanolamine using the same catalyst. Zeolite-A was synthesized from rice husk silica and characterized using X-Ray Diffraction (XRD) and Scanning Electron Microscopy (SEM), which confirmed the successful formation of zeolite-A. The zeolite-A was protonated using a 3.5 M ammonium nitrate solution and characterized using X-Ray Fluorescence (XRF). The resulting H-A zeolite showed a Na-to-H conversion rate of 17.26%. The products of the transesterification and amidation reactions were characterized using Gas Chromatography-Mass Spectrometry (GC-MS) to determine compound composition. The conversion of palm oil into methyl esters in the transesterification reaction yielded 60% with a purity of 100%, as indicated by the GC-MS results. The amidation reaction between methyl esters and diethanolamine using H-A zeolite as a catalyst produced nitrogen-containing compounds at 25.34%. The synthesized nitrogen compounds were tested for their activity as corrosion inhibitors for mild steel in a 3% NaCl solution saturated with CO_2 using the weight loss method (wheel test), showing a protection efficiency of 96.11%. This protective effect was supported by SEM data, which revealed that the surface of mild steel in the corrosive medium containing the corrosion inhibitor compound was smoother compared to that without the inhibitor.

Keywords: green corrosion inhibitor, nitrogen compound, amidation, palm oil, protonated zeolite-A.