Pengembangan Inhibitor Ramah Lingkungan dari bahan Bunga Pinang untuk Proteksi Korosi Baja Karbon API 5L Gr. B di Lingkungan Lapangan Migas = Development of Environmentally Friendly Inhibitors from Pinang Flower for Corrosion Protection of Carbon Steel API 5L Gr. B in the Oil and Gas Field Environment

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Abstrak

Memompa larutan hidroklorik ke dalam sumur lapangan migas dikenal sebagai stimulasi pengasaman sumur. Pengasaman dilakukan untuk menghilangkan kerak, karat, puing-puing atau partikulat larut asam lainnya pada permukaan internal pipa guna membersihkan jalan bagi minyak dan gas untuk mengalir dari dalam sumur ke permukaan. Untuk menghindari masalah seperti kebocoran pipa karena korosi, selama pengasaman biasanya diterapkan perlakuan penghambatan oleh inhibitor korosi anorganik yang sebagian besar senyawa ini tidak hanya mahal tetapi juga beracun bagi lingkungan. Sudah banyak riset inhibitor ramah lingkungan dari bahan ekstrak tumbuhan yang telah dilakukan, namun hampir semua riset tersebut tidak pernah di uji secara laboratorium industri maupun uji langsung di lapangan migas sehingga tidak cocok untuk sepenuhnya mengkarakterisasi potensi kemanjuran inhibitor,baik dari sifat ramah lingkungannya maupun sifat teknis di lapangan. Oleh karena itu, tantangan dalam penelitian ini adalah menghasilkan terobosan inhibitor ramah lingkungan yang aplikatif di lapangan migas. Kandidat ekstrak tanaman yang dipilih untuk pengembangan inhibitor ramah lingkungan adalah Bunga Pinang. Teknik pengujian meliputi uji kehilangan berat, Uji Wheel Test, Polarisasi, Spektroskopi Impedansi Elektrokimia (EIS), Spektroskopi Infra-merah Fourier Transform (FTIR), Uji Toksisitas akut dan Uji di lapangan migas. Hasil pengujian wheel test selama 72 jam pada dosis 20 ml untuk kayu secang didapatkan persentase perlindungan 82.27% dan bunga pinang 90.07%. Nilai toksisitas akut (LD₅₀₎untuk bunga pinang adalah 5728 mg/kgbb termasuk dalam kategori “praktis tidak toksik”. Adsorpsi terjadi secara spontan sesuai dengan adsorpsi isotermal Langmuir. Efisiensi hambatan optimal terjadi dengan penambahan pada konsentrasi 20 ml yaitu 96.6% pada pengujian Electrochemical Impedance Spectroscopy (EIS). Hasil polarisasi menunjukkan bahwa ekstrak bunga pinang bekerja melalui inhibisi tipe campuran. Nilai energi bebas adsorpsi –7.026 kJ / mol menunjukkan bahwa adsorpsi molekul inhibitor adalah khas dari adsorpsi fisik. Hasil uji di lapangan di dapatkan laju korosi 0.134 mm/tahun dengan nilai persentase perlindungan 78% pada dosis 20 ml, sehingga mengkonfirmasi bahwa Bunga Pinang sudah teruji sebagai inhibitor ramah lingkungan di sektor minyak dan gas bumi.

.....Pumping the hydrochloric solution into oil and gas field wells is known as well acid stimulation. Acidification is used to remove scale, rust, debris or other acid-soluble particulates on the internal surface of the pipe to clear a way for oil and gas to flow from the well to the surface. To avoid problems such as pipe leakage due to corrosion, during acidification it is usually applied an inhibitory treatment by inorganic corrosion inhibitors most of which these compounds are not only expensive but also toxic to the environment. There has been a lot of research on environmentally friendly inhibitors from plant extract ingredients that have been carried out, but almost all of this research has never been tested in industrial laboratories or directly in the oil and gas field so it is not suitable to fully characterize the potential efficacy

of the inhibitor, both from its environmentally friendly nature and technical properties in the field. Therefore, the challenge in this research is to produce a breakthrough environmentally friendly inhibitor that is applicable in the oil and gas field. The plant extract candidates selected for the development of environmentally friendly inhibitors are Pinang Flower. Testing techniques include weight loss test, Wheel Test, Polarization, Electrochemical Impedance Spectroscopy (EIS), Fourier Transform Infra-red Spectroscopy (FTIR), Acute Toxicity Test and Oil and Gas Field Testing. The results of wheel test for 72 hours at a dose of 20 ml for secang wood obtained a protection percentage of 82.27% and 90.07% for areca flowers. The acute toxicity value (LD₅₀) for areca flowers is 5728 mg / kg, which is included in the category of "practically non-toxic". Adsorption occurs spontaneously in accordance with Langmuir adsorption isotherm. Optimal inhibition efficiency occurs with the addition of a concentration of 20 ml, namely 96.6% in the Electrochemical Impedance Spectroscopy (EIS) test. The polarization results showed that the betel nut extract worked through a mixture type inhibition. The adsorption free energy value of –7,026 kJ / mol indicates that the adsorption of the inhibitor molecule is typical of physical adsorption. The field test results obtained a corrosion rate of 0.134 mm / year and a protection percentage value of 78% at a dose of 20 ml, thus confirming that Bunga Pinang has been tested as an environmentally friendly inhibitor in the oil and gas sector.