Pengaruh Aditif Karet Klorinasi, Polydimethylsiloxane dan Grafena Oksida Terhadap Poliuretan Sebagai Anti-fouling = Impact of the Addition of a Mixed Chlorinated Rubber, Polydimethylsiloxane and Graphene Oxide in Polyurethane as Anti-fouling Coatings

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Abstrak

Dalam studi ini, campuran Chlorinated Rubber (CR), Polydimethylsiloxane (PDMS) dan Grafena Oksida (GO) diteliti secara sistematis untuk diusulkan sebagai aditif anti-fouling dalam poliuretan (PU). Peningkatan kekuatan tarik diperoleh dengan penambahan campuran CR dan PDMS:GO. Spektrum Forier Transform Infra-red menunjukkan penurunan intensitas regangan ikatan rangkap C=C dan memunculkan ikatan Si pada senyawa kimia PU. Untuk mengetahui peran fungsi anti-fouling, sampel direndam di laut selama dua bulan. Selanjutnya sampel yang direndam di laut dikarakterisasi menggunakan mikroskop optik dan pengujian mekanik. Pengamatan mikroskop optik diperoleh bahwa penambahan CR mengurangi pertumbuhan teritip mikro dan penambahan PDMS:GO menurunkan pertumbuhan alga mikro. Untuk penelitian lebih lanjut, pengukuran Electrochemical Impedance Spectroscopy (EIS) dikembangkan untuk mengetahui spektrum impedansi sampel sebelum dan sesudah perendaman dalam air distilasi. Hal ini menunjukkan bahwa impedansi total berubah dengan perendaman. Elemen rangkaian ekivalen dari spektrum impedansi dimodelkan untuk mengekstrak resistansi seri, resistansi paralel, dan kapasitansi. Menariknya, resistansi seri, resistansi paralel dan kapasitansi berubah secara konsisten yang menunjukkan kemungkinan pelepasan elemen anti-fouling selama perendaman untuk setiap sampel. Selanjutnya dilakukan uji pelapukan di bawah sinar ultraviolet (UV) selama 500 jam untuk mengetahui kerusakan sifat mekanik. Hasil pengamatan menunjukkan bahwa pada awal paparan sinar UV hingga 80 jam kuat tarik meningkat signifikan.

.....In this study, a mixed chlorinated rubber (CR), polydimethylsiloxane (PDMS) and graphene oxide (GO) was systematically investigated to propose as anti-fouling additives in polyurethane (PU). The increasing of tensile strength were observed by the addition of the mixture of CR and PDMS:GO. The Fourier transform infra-red spectra showed the decreasing of a C=C strain group and increasing Si bond of chemical compounds of PU, respectively. In order to investigate the role of the anti-fouling function, the samples were immersed in the sea for two months. Further the immersed samples in the sea were characterized using optical microscope and mechanical testing. The optical microscope observation obtained the addition of CR reduced the growth of micro barnacle and the addition of PDMS:GO decreased the growth of micro algae. To more elaboration, the electrochemical impedance spectroscopy (EIS) measurement was developed to investigate the impedance spectra of the samples before and after immersion in distilled water. It showed that the total impedance changed by the immersed samples. The equivalent circuit element from the impedance spectra was modelled to extract the series resistance, parallel resistance and capacitance. Interestingly, the series resistance, parallel resistance and capacitance were changed consistently which indicated the probably of the anti-fouling element release during the immersion for each sample. Furthermore, the ageing test under ultraviolet (UV) light was performed for 500 hours to investigate the decay of the mechanical properties. It was observed that the UV light ageing initially increased the tensile

strength until of 80 hours exposure.