

INTISARI

Propeller (baling-baling) merupakan komponen krusial dalam sistem propulsi kapal yang rentan mengalami degradasi akibat korosi erosi dan aktivitas elektrokimia di lingkungan air laut. Penelitian ini bertujuan menentukan material terbaik antara paduan Aluminium 6061 dan Aluminium 5083 (*marine grade*) sebagai material alternatif *propeller* kapal, serta menguji efektivitas sistem *sacrificial protection* menggunakan anoda korban Magnesium (Mg). Metode pengujian mengintegrasikan uji spektrometer (komposisi kimia), uji kekerasan Vickers (beban 20 kgf) sebelum dan sesudah korosi, serta uji laju korosi melalui perendaman air laut dengan interval waktu hingga 500 jam. Hasil pengujian menunjukkan Aluminium 6061 memiliki keunggulan mekanis dengan kekerasan rata-rata sebesar 116 HV yang ideal menahan aus kavitas, namun rentan terhadap korosi alami sebesar 0,1837 mmpy. Sebaliknya, Aluminium 5083 memiliki kekerasan lebih rendah (84 HV) tetapi secara alami lebih tahan korosi dengan laju awal 0,1245 mmpy. Setelah diaplikasikan anoda korban Magnesium, laju korosi kedua logam berhasil ditekan secara radikal akibat mekanisme proteksi katodik. Efisiensi penurunan laju korosi pada Aluminium 5083 mencapai 40,64% (menjadi 0,0739 mmpy), sedangkan pada Aluminium 6061 mencapai 23,78% (menjadi 0,1400 mmpy, bahkan menyentuh titik minimum 0,0744 mmpy pada perendaman 400 dan 500 jam). Melalui sintesis data ini, kombinasi material Aluminium 6061 dengan sistem proteksi anoda korban Magnesium direkomendasikan sebagai opsi optimal untuk manufaktur *propeller* kapal karena mampu menghasilkan kekuatan struktural permukaan yang tinggi sekaligus menjamin usia pakai (*lifetime*) komponen yang panjang di lingkungan laut.

Kata Kunci: *Propeller* Aluminium, Aluminium 6061, Aluminium 5083, Kekerasan Vickers, Laju Korosi, Anoda Korban Magnesium.

ABSTRACT

Propellers are crucial components in a ship's propulsion system that are susceptible to degradation due to erosion corrosion and electrochemical activity in the seawater environment. This research aims to determine the optimal material between Aluminum 6061 and Aluminum 5083 (marine grade) for ship propeller applications, as well as to evaluate the effectiveness of a sacrificial cathodic protection system using Magnesium (Mg) anodes. The experimental method integrated spectrometer testing for chemical composition verification, Vickers microhardness testing (20 kgf load) before and after immersion, and corrosion rate analysis via seawater immersion with testing intervals up to 500 hours. The results indicated that Aluminum 6061 exhibits superior mechanical properties with an average hardness of 116 HV, making it ideal for resisting hydrodynamic erosion and cavitation, though it is highly susceptible to natural corrosion at a rate of 0.1837 mmpy without protection. Conversely, Aluminum 5083 demonstrates lower surface hardness (84 HV) but possesses superior natural corrosion resistance with an initial degradation rate of 0.1245 mmpy. Upon the application of Magnesium sacrificial anodes, the corrosion rates of both alloys were radically suppressed due to the cathodic protection mechanism. The corrosion rate reduction efficiency reached 40.64% for Aluminum 5083 (decreasing to 0.0739 mmpy) and 23.78% for Aluminum 6061 (decreasing to 0.1400 mmpy, while achieving a minimum point of 0.0744 mmpy at 400 and 500 hours of immersion). Through data synthesis, the combination of Aluminum 6061 alloy with a Magnesium sacrificial anode system is highly recommended as the optimal configuration for marine propeller manufacturing, as it delivers high structural surface hardness while ensuring an extended operational lifetime in corrosive marine environments.

Keywords: *Aluminum Propeller, Aluminum 6061, Aluminum 5083, Vickers Hardness, Corrosion Rate, Magnesium Sacrificial Anode.*