

ABSTRAK

Kemajuan teknologi otomotif memicu permintaan perangkat kendaraan yang aman. Rem adalah komponen yang sangat penting dalam kendaraan karena berfungsi untuk mengurangi energi kinetik kendaraan guna menjaga keselamatan pengendara. Indonesia kaya akan sumber daya alam yang melimpah dan harus dijaga kelestariannya dengan memanfaatkan limbah tempurung kelapa dan limbah cangkang kerang darah yang belum dimanfaatkan secara optimal dan efektif. Penelitian ini bertujuan untuk menganalisis pengaruh variasi fraksi volume serbuk arang tempurung kelapa dan cangkang kerang darah terhadap sifat mekanis komposit matriks polimer, khususnya kekerasan dan keausan. Uji kekerasan dilakukan menggunakan metode *Shore D* sesuai standar ASTM D2240, sementara uji keausan dilakukan menggunakan metode *Ogoshi* sesuai standar ASTM G99-95a. Variasi fraksi volume meliputi 10%, 20%, 30%, 40%, dan 50%, dengan tiga kali pengulangan untuk setiap spesimen. Hasil pengujian menunjukkan bahwa peningkatan fraksi serbuk cangkang kerang darah memberikan kontribusi signifikan terhadap peningkatan kekerasan. Nilai kekerasan optimal ditemukan pada fraksi volume 10%-50% dengan rata-rata 85,50 SHD, memenuhi standar SNI untuk kekerasan kampas rem. Sebaliknya, nilai keausan spesifik cenderung menurun dengan bertambahnya fraksi serbuk cangkang kerang darah. Fraksi dengan nilai keausan paling optimal pada fraksi volume 10%-50% yang mencapai rata-rata $6,1038 \times 10^{-4} \text{ mm}^2/\text{kg}$, berada dalam rentang nilai standar SNI $5 \times 10^{-4} \text{ mm}^2/\text{kg}$ - $5 \times 10^{-3} \text{ mm}^2/\text{kg}$. Hasil penelitian mengindikasikan bahwa komposisi cangkang kerang darah memiliki sifat tribologi yang lebih baik dibandingkan serbuk tempurung kelapa. Penggunaan cangkang kerang darah sebagai bahan alternatif dapat meningkatkan performa mekanik dan menurunkan laju keausan pada material komposit berbasis polimer.

Kata Kunci: Material kampas rem, Tempurung kelapa, Cangkang kerang darah, Pengujian kekerasan (*Shore D* ASTM D2240), Pengujian keausan (Metode *Ogoshi* ASTM G99-95a).

ABSTRACT

The advancement of automotive technology has triggered a demand for safe vehicle components. Brakes are a crucial component in vehicles as they function to reduce the vehicle's kinetic energy to ensure rider safety. Indonesia is rich in abundant natural resources, which must be preserved by utilizing coconut shell waste and blood clam shell waste that have not been optimally and effectively utilized. This study aims to analyze the effect of varying volume fractions of coconut shell charcoal powder and blood clam shells on the mechanical properties of polymer matrix composites, particularly hardness and wear resistance. Hardness testing was conducted using the Shore D method following ASTM D2240 standards, while the wear rate test was performed using the Ogoshi method according to ASTM G99-95a standards. The volume fraction variations included 10%, 20%, 30%, 40%, and 50%, with three repetitions for each specimen. The test results showed that an increase in the fraction of blood clam shell powder contributed significantly to the increase in hardness. The optimal hardness value was found at a volume fraction of 10%-50%, with an average of 85.50 SHD, meeting the Indonesian National Standard (SNI) for brake pad hardness. Conversely, the specific wear rate value tended to decrease as the fraction of blood clam shell powder increased. The optimal wear rate value was found in the 10%-50% volume fraction, reaching an average of $6.1038 \times 10^{-4} \text{ mm}^2/\text{kg}$, within the SNI standard range of $5 \times 10^{-4} \text{ mm}^2/\text{kg}$ - $5 \times 10^{-3} \text{ mm}^2/\text{kg}$. The research results indicate that the composition of blood clam shells has better tribological properties compared to coconut shell powder. The use of blood clam shells as an alternative material can enhance mechanical performance and reduce wear rates in polymer-based composite materials.

Keywords: Brake lining material, Coconut shell, Blood cockle shell, Hardness testing (Shore D ASTM D2240), Wear testing (Ogoshi Method, ASTM G99-95a).