

ABSTRAK

Komposit *sandwich* merupakan material ringan yang memiliki potensi tinggi untuk aplikasi struktural. Penelitian ini bertujuan menganalisis pengaruh fraksi volume kalsium karbonat (CaCO_3) hasil sintesis cangkang kerang hijau dan jenis serat pada skin terhadap sifat mekanik dan fisik komposit *sandwich*. Komposit disusun menggunakan core *Poly Lactic Acid* (PLA), matriks epoxy, serta skin berupa serat nipah, serat karbon, dan serat kaca. Variasi fraksi volume CaCO_3 yang digunakan adalah 5%, 10%, 15%. Pembuatan komposit dilakukan menggunakan metode *hand lay-up*, sedangkan core dibuat dengan teknologi 3D printing. Pengujian dilakukan meliputi uji Impak ASTM D6110, uji Bending ASTM C393, dan uji Laju Keterbakaran ASTM D635, data dianalisis menggunakan ANOVA dua arah. Hasil penelitian menunjukkan bahwa fraksi volume CaCO_3 dan jenis serat berpengaruh signifikan terhadap ketangguhan impact, kekuatan bending, dan laju keterbakaran. Nilai ketangguhan impact tertinggi sebesar 855,65 J/m diperoleh pada komposit serat karbon dengan fraksi volume CaCO_3 15%. Kekuatan bending tertinggi sebesar 161,25 MPa diperoleh pada komposit serat karbon dengan fraksi volume CaCO_3 5%. Nilai laju keterbakaran terendah sebesar 9,733 mm/menit diperoleh pada komposit serat nipah dengan fraksi volume CaCO_3 15%. Secara keseluruhan serat karbon memberikan performa mekanik terbaik, sedangkan peningkatan fraksi volume CaCO_3 mampu meningkatkan ketahanan api komposit *sandwich*.

Kata kunci : Komposit *sandwich*, kalsium karbonat, cangkang kerang hijau, serat karbon, sifat mekanik

ABSTRACT

Sandwich composites are lightweight materials with high potential for structural applications. This study aims to analyze the effect of calcium carbonate (CaCO_3) volume fraction synthesized from green mussel shells and the type of fiber used in the skin layer on the mechanical and physical properties of sandwich composites. The composites were fabricated using a Poly Lactic Acid (PLA) core, epoxy matrix, and skin layers reinforced with nipa palm fiber, carbon fiber, and glass fiber. The CaCO_3 volume fractions investigated were 5%, 10%, and 15%. The composites were manufactured using the hand lay-up method, while the core was produced using 3D printing technology. The tests conducted included Charpy impact testing according to ASTM D6110, bending testing according to ASTM C393, and flammability testing according to ASTM D635. The experimental data were analyzed using two-way ANOVA. The results showed that both the CaCO_3 volume fraction and fiber type significantly affected the impact toughness, bending strength, and flammability rate of the sandwich composites. The highest impact toughness, 855.65 J/m, was obtained from the carbon fiber-reinforced composite with 15% CaCO_3 volume fraction. The highest bending strength, 161.25 MPa, was achieved by the carbon fiber-reinforced composite with 5% CaCO_3 volume fraction. The lowest flammability rate, 9.733 mm/min, was recorded for the nipa palm fiber-reinforced composite with 15% CaCO_3 volume fraction. Overall, carbon fiber provided the best mechanical performance, while increasing the CaCO_3 volume fraction enhanced the fire resistance of the sandwich composites.

Keywords : Sandwich composite, calcium carbonate, green mussel shell, carbon fiber, mechanical properties.