

INTISARI

Penggunaan bahan sintetis seperti *fiberglass* di dunia industri saat ini banyak menyisakan limbah karena tidak bisa terurai secara alami. Berangkat dari kesadaran untuk menciptakan teknologi yang ramah lingkungan, penelitian ini mengembangkan alternatif lain yaitu komposit serat alam menggunakan serat rami (*Boehmeria nivea*). Serat rami dipilih karena bahan ini ringan dan memiliki kandungan selulosa yang tinggi (mencapai 76%) sehingga kuat menahan beban tarik. Penelitian ini bertujuan untuk mengetahui pengaruh variasi berat serat rami (15%, 20%, 25%, 30%, dan 35%) dengan posisi serat kontinu lurus searah (0°) terhadap kekuatan mekanis komposit berbasis resin *epoxy*, yang meliputi kekuatan tarik, regangan, dan kekuatan impak. Sampel komposit dibuat dengan metode pencetakan manual (*hand lay-up*). Sebelum dicetak, serat rami direndam terlebih dahulu dalam larutan alkali (NaOH 5% selama 2 jam) supaya serat dan resin dapat menempel dengan kuat (*interfacial bonding*). Proses pengujian tarik dilakukan berdasarkan standar ASTM D3039, sedangkan pengujian impak Charpy dilakukan berdasarkan standar ASTM D6110. Hasil penelitian menunjukkan bahwa penambahan fraksi berat serat rami memberikan pengaruh signifikan terhadap sifat mekanis komposit, dengan titik optimal yang berbeda sesuai jenis pembebanannya. Pada pengujian beban statis (uji tarik), performa tertinggi dicapai pada fraksi berat 15% sebesar 46,43 N/mm² karena proses transfer beban (*load transfer*) antara serat dan matriks berlangsung secara optimal. Sementara itu, pada pengujian beban dinamis (uji impak), ketangguhan tertinggi diperoleh pada fraksi berat 30% dengan energi serap sebesar 3,59 Joule akibat kepadatan serat yang efektif menahan laju perambatan retak (*crack propagation*). Peningkatan fraksi serat hingga 35% terbukti menurunkan seluruh performa mekanis secara drastis akibat terjadinya fenomena kekurangan matriks pembasah (*resin starvation*) dan dominasi cacat rongga udara (*void*).

Kata Kunci: komposit, serat rami, serat kontinu, kekuatan tarik, kekuatan impak, resin epoxy, fraksi berat.

ABSTRACT

The use of synthetic materials such as fiberglass in current industries leaves behind significant waste due to its non-biodegradable nature. Driven by the awareness to create environmentally friendly technology, this research develops an alternative through natural fiber composites using ramie fibers (*Boehmeria nivea*). Ramie fiber was selected due to its lightweight nature and high cellulose content (up to 76%), making it strong in withstanding tensile loads. This study aims to determine the effect of weight fraction variations of ramie fiber (15%, 20%, 25%, 30%, and 35%) with continuous unidirectional alignment (0°) on the mechanical properties of epoxy resin-based composites, including tensile strength, strain, and impact strength. Composite specimens were fabricated using the hand lay-up molding method. Prior to molding, the ramie fibers were soaked in an alkaline solution (5% NaOH for 2 hours) to enhance the interfacial bonding between the fibers and the resin matrix. Tensile testing was conducted according to the ASTM D3039 standard, while Charpy impact testing was performed based on the ASTM D6110 standard. The results indicated that the addition of ramie fiber weight fractions significantly influenced the mechanical properties of the composite, exhibiting different optimal points depending on the loading type. Under static loading (tensile test), the highest performance was achieved at a 15% weight fraction, reaching 46.43 N/mm², where the load transfer between the fiber and matrix functioned optimally. Meanwhile, under dynamic loading (impact test), the highest impact toughness was obtained at a 30% weight fraction with an energy absorption of 3.59 Joules, as the high fiber density effectively impeded crack propagation. Increasing the fiber fraction to 35% drastically decreased overall mechanical performance due to resin starvation and the dominance of void defects.

Keywords: *composite, ramie fiber, continuous fiber, tensile strength, impact strength, epoxy resin, weight fraction.*