INTISARI

Serat alam sebagai bahan penguat komposit telah menarik minat para peneliti di seluruh dunia karena sifat-sifatnya yang unggul seperti kekuatan spesifik tinggi, bobot ringan, biaya murah, sifat mekanik yang relatif baik, non-abrasif dan *biodegradable*. Komposit telah banyak digunakan untuk berbagai aplikasi dalam kehidupan manusia, tak terkecuali untuk aplikasi perangkat biomedis. Namun komposit serat alam memiliki kekuatan mekanis yang lebih rendah dibandingkan dengan komposit serat sintetis. Tujuan dari penelitian ini yaitu membuat komposit hibrida *high density polyethylene* (HDPE) berpenguat serat sisal, serat abaka dan serat karbon sebagai bahan perangkat biomedis, serta mengetahui karakteristik sifat mekanis bending dan sifat fisis *water absorption* material komposit hibrida dengan variasi fraksi volume serat hibrida.

Komposit hibrida difabrikasi dengan metode *hand lay-up* dalam mesin *hot press* pada temperatur 140˚C dan 1,4498 MPa selama 60 menit dengan komposisi matriks/filler yaitu 80/20 %berat. Serat sisal dan abaka dialkalisasi dengan cara merendam masing-masing serat dalam 6% NaOH selama 36 jam, sedangkan serat karbon diperlakukan dengan nitrogen cair selama 10 menit. Variasi dilakukan pada perbandingan fraksi volume serat hibrida abaka/sisal/karbon yaitu (3 : 0 : 1), (3 : 3 : 2), dan (0 : 3 : 1). Pengujian bending berdasarkan ASTM D790 dan pengujian daya serap air berdasarkan ASTM D570 dilakukan pada semua spesimen komposit hibrida. Karakterisasi struktur retak uji bending dilakukan dari sisi penampang melintang dengan mikroskop optik.

Hasil penelitian menunjukkan bahwa kekuatan tertinggi (45,93 MPa) dan modulus elastisitas (3,024 GPa) komposit abaka/sisal/karbon/HDPE dicapai oleh variasi komposit hibrida sisal/karbon (3:1) serta presentase penyerapan air dan pertambahan ketebalan yaitu 9,28% dan 3,91%. Hasil tersebut terkait dengan distribusi serat alam dan sintetis yang lebih merata.

Kata kunci : HDPE, serat sisal, serat karbon, serat abaka, komposit hibrida, *flexural strength*, *water absorption*

ABSTRACT

Natural fibers as composite reinforcing materials have attracted the interest of researchers around the world because of its superior properties such as specific strength, light weight, low prices, good mechanical properties, non-abrasive and biodegradable. Composites have been widely used for various applications in human life, including the application of biomedical devices. However, natural fiber composites have lower mechanical strength compared to synthetic fiber composites. The purpose of this study is to make high density polyethylene (HDPE) hybrid composites reinforced sisal fiber, abaca fiber and carbon fiber as biomedical device materials, and to know the mechanical properties of bending and physical properties of water absorption hybrid composites with variations in the volume fraction of hybrid fibers.

Hybrid composites were fabricated using the hand lay-up method in a hot press machine at 140˚C and 1.4498 MPa for 60 minutes with a matrix/filler composition of 80/20% by weight. Sisal and abaca fibers are alkalized by soaking each fiber in 6% NaOH for 36 hours, while carbon fiber is treated with liquid nitrogen for 10 minutes. Variations were made on the ratio of volume fraction of abaca/sisal/carbon hybrid fibers, that is (3: 0: 1), (3: 3: 2), and (0: 3: 1). Bending tests with ASTM D790 and water absorption tests with ASTM D570 were carried out on all hybrid composite specimens. The characterization of the bending test crack structure is carried out from the side of the cross section using an optical microscope.

The results showed that the highest strength (45.93 MPa) and elastic modulus (3.024 GPa) of abaca/sisal/carbon/HDPE composites were achieved by variations in sisal/carbon hybrid composites (3:1) and the percentage of water absorption and thickness increase is 9.28% and 3.91%. These results are related to the more even distribution of natural and synthetic fibers.

Keywords : HDPE, sisal fiber, abaca fiber, carbon fiber, hybrid composite, flexural strength, water absorption.