

INTISARI

Perkembangan teknologi yang pesat membuat industri berlomba-lomba menciptakan inovasi terbaru, guna meningkatkan kualitas produk, daya saing dan ramah lingkungan. Salah satunya inovasi di bidang material adalah perangkat biomedis, yang sebelumnya menggunakan material logam sekarang mulai beralih ke material komposit. Karena material logam mudah korosi, berat dan harganya mahal. Komposit serat alam mulai digunakan karena sifat-sifat materialnya yang kuat, ringan, lentur, tahan korosi, dan tahan terhadap keausan. Tujuan dari penelitian ini yaitu membuat komposit hibrida *high density polyethylene* (HDPE) dengan *filler* serat sisal dan serat karbon sebagai bahan perangkat biomedis, serta mengetahui karakteristik sifat mekanis *bending* dan sifat fisis *water absorption* material komposit hibrida dengan variasi panjang serat karbon.

Komposit hibrida sisal/karbon/HDPE dibuat dengan metode hand lay-up dalam cetakan panas pada suhu 140 °C dan 1,5 MPa selama 15 menit dengan kandungan serat 20% dan rasio sisal terhadap karbon 3:1. Serat sisal diperlakukan alkali dengan merendam serat dalam 6% NaOH selama 36 jam, sedangkan serat karbon diperlakukan dengan nitrogen cair selama 10 menit dan kemudian dipotong 6 mm, 10 mm, dan 15 mm. Uji *bending* dan penyerapan air dilakukan pada semua spesimen komposit hibrida masing-masing menurut ASTM D790 dan ASTM D570. Karakterisasi struktur retak dari spesimen uji *bending* dilakukan dari tampilan penampang dengan mikroskop optik.

Hasil penelitian menunjukkan bahwa kekuatan tertinggi (45,93 MPa) dan modulus (3,024) komposit sisal/karbon/HDPE dicapai oleh komposit dengan panjang serat karbon 15 mm. Komposit ini juga menunjukkan peyerapan air dan penambahan ketebalan masing-masing 9,37% dan 4%. Hasil tersebut terkait dengan distribusi serat yang merata dalam matriks.

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

ABSTRACT

The rapid technological development made the industries compete to create newer innovations, to improve product quality, competitiveness, and environmentally friendly. One of the innovative materials is the material for biomedical device application, which was previously made of metal materials. However, metal materials are easily corroded, heavy, and expensive. Thus, it now began to switch to the natural fiber composite materials, due to their strength, light weight, flexibility, corrosion resistance, and wear resistance. Objectives of this research are to fabricate the high-density polyethylene (HDPE) hybrid composites reinforced with sisal and carbon fibers and to study the influence of carbon fiber length on the bending properties and water absorption of the composites.

The sisal/carbon/HDPE hybrid composites were fabricated by hand lay-up method in a hot press molding at 140 °C and 1,5 MPa for 15 minutes with the fiber content of 20% and sisal to carbon ratio 3:1. Sisal fibers were alkali treated by soaking the fibers in 6% NaOH for 36 hours, whereas carbon fibers were treated in liquid nitrogen for about 10 min, and then chopped in various fiber length 6 mm, 10 mm, and 15 mm. Bending and water absorption tests were conducted on all hybrid composite specimens according to ASTM D790 and ASTM D570, respectively. The characterization of the fractured structure of the bending test specimens was carried out from the cross-section view with an optical microscope.

The results showed that the highest bending strength (38.9 MPa) and modulus (3,024 GPa) of sisal/carbon/HDPE hybrid composites reached by the composite with 15 mm carbon fiber length. This composite also showed the lowest water absorption and thickness swelling of 9.37% and 4%, respectively. Those results are related to the even fiber distribution in the matrices.

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