

## INTISARI

Serat alam yang digunakan sebagai material penguat pada komposit salah satunya adalah serat rami. Perlakuan kimia seperti perlakuan alkali pada serat alam dapat memberikan perbaikan sifat mekanis dan daya rekat dengan matriks. Kombinasi serat alam dan serat sintetis dapat memberikan perbaikan sifat komposit karena kelebihan satu jenis serat dapat menutupi kekurangan pada jenis serat lain. Sifat mekanis komposit dapat juga ditingkatkan dengan penambahan *filler* seperti *Microcrystalline cellulose* (MCC). Tujuan dari penelitian ini adalah untuk mengetahui pengaruh penambahan *microcrystalline cellulose* (MCC) pada sifat mekanis komposit hibrid rami/gelas/karbon/poliester.

Perlakuan alkali serat rami menggunakan larutan natrium hidroksida 5% dengan rasio serat terhadap larutan 1 : 50 selama 2 jam, setelah itu serat dikeringkan di oven selama 2 jam, kemudian serat rami dianyam berbentuk lembaran. Proses fabrikasi komposit menggunakan metode *vacuum infusion*. Matriks yang digunakan adalah *unsaturated polyester resin* (UPR) dengan katalis 1% berat dari UPR. Konsentrasi MCC digunakan sebanyak 0,5% berat dari UPR yang dicampur menggunakan *mechanical stirrer* dengan kecepatan 350 rpm selama 10 menit. Penguat komposit berupa serat rami (R), serat gelas (G) dan serat karbon (C) disusun 6 lapis yaitu RRGCR dan CRGGRC. Pengujian sifat mekanis komposit menggunakan uji tarik dan uji bending, karakterisasi komposit menggunakan SEM dan dilakukan uji daya serap air komposit.

Hasil uji mekanis komposit menunjukkan bahwa penambahan MCC memberikan perbaikan kekuatan mekanis tertinggi pada kombinasi serat rami/gelas/karbon (CRGGRC) dimana kenaikan kekuatan tarik, kekuatan bending, regangan patah dan defleksi masing – masing sebesar 15,5% ; 46,8% ; 6% dan 35,1%. Sedangkan pada komposit RRGCR penambahan MCC memberikan perbaikan kekuatan tarik, kekuatan bending, regangan patah dan defleksi masing – masing sebesar 7,3% ; 17,2% ; 0,54% dan 19,2%. Hasil uji daya serap air menunjukkan bahwa penambahan MCC memberikan kenaikan daya serap air komposit. Komposit RRGCR, RRGCR+MCC, CRGGRC dan CRGGRC+MCC memiliki daya serap air masing – masing sebesar 7,4% ; 8,2% ; 7,7% dan 8,6% setelah perendaman selama 120 jam.

**Kata Kunci :** MCC, serat rami, serat gelas, serat karbon, komposit hibrid, kuat tarik, kuat bending

## ABSTRACT

One of the natural fibers used as reinforcing material in composites is ramie fiber. Chemical treatments such as alkaline treatment of natural fibers can improve mechanical properties and bonding with the matrix. The combination of natural fiber and synthetic fiber can provide improved composite properties because the advantages of one type of fiber can cover the shortcomings of other types of fiber. The mechanical properties of composites can also be improved by adding fillers such as Microcrystalline cellulose (MCC). The purpose of this study is to determine the effect of adding microcrystalline cellulose (MCC) on the mechanical properties of the flax/glass/carbon/polyester hybrid composite.

The alkaline treatment of flax fiber used 5% sodium hydroxide solution with a ratio of fiber to solution 1:50 for 2 hours, after that the fiber was dried in an oven for 2 hours, then the ramie fiber was woven into sheets. Composite fabrication process using vacuum infusion method. The matrix used is unsaturated polyester resin (UPR) with a catalyst of 1% by weight of UPR. MCC concentration was used as much as 0.5% by weight of UPR which was mixed using a mechanical stirrer at a speed of 350 rpm for 10 minutes. Composite reinforcement in the form of ramie fiber (R), glass fiber (G) and carbon fiber (C) was arranged in 6 layers, namely RRGCR and CRGGRC. The mechanical properties of the composites were tested using tensile and bending tests, composite characterization using SEM and water absorption tests of the composites were carried out.

The results of the composite mechanical test showed that the addition of MCC gave the highest mechanical strength improvement in the combination of flax/glass/carbon fiber (CRGGRC) where the increase in tensile strength, bending strength, fracture strain and deflection was 15,5% ; 46,8% ; 6% and 35,1% respectively. While in the RRGCR composite, the addition of MCC gave an improvement in tensile strength, bending strength, fracture strain and deflection of 7,3% ; 17,2% ; 0,54% and 19,2% respectively. The results of the water absorption test showed that the addition of MCC gave an increase in the water absorption of the composite. Composites RRGCR, RRGCR+MCC, CRGGRC and CRGGRC+MCC have a water absorption capacity of 7,4% ; 8,2% ; 7,7% and 8,6% respectively, after soaking in water for 120 hours.

**Keywords:** MCC, ramie fiber, glass fiber, carbon fiber, hybrid composite, tensile strength, bending strength