Increasing Torque Capacity on Clutch Made From Coconut Fiber Composite

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Abstract

The aim of this study is to investigate composition of coconut fiber, copper powder, fiberglass and phenolic resin as matrice for material of motorcycle clutch. The coconut fiber is in the dicontinuous fiber, for subtituting asbestos componen that unfair for lung healty and environmental issues. The result were compared with existing clutch product SGP for their hardness, wearness and their friction coefficient in wet and dry condition. The method was materials compacted in 2 tons pressure during 60 minutes holding time, then sintered on 800C at 40 minutes holding time, and take out from oven, then it conduct on Brinell hardness tester, and wearing test according ASTM F 1957-99 and ASTM D 3702-94 standard of testing materials

The result shown that composition with 40% weight of coconut fiber, 20% copper powder, 20% fiberglass and 20% phenolic resin given 4.098 kg/mm2 on hardness number. Wearing at dry condition is 0,14 mm/hr and 0,19 mm/hr on oil wet condition. The exising material was SGP with 3,974 kg/mm2 hardness, its wearing on dry condition was 0,15 mm/hr and 0,20 mm/hr, on oil wet condition.

Keywords: *Clutch materials, coconut fiber, copper powder, fiberglass, phenolic resin, hardness , wearing*

Peningkatan Kapasitas Torsi pada Kopling Berbahan Komposit Sabut Kelapa

Abstrak

Penelitian ini bertujuan untuk mengetahui komposisi sabut kelapa, serbuk tembaga, fiberglass dan resin fenolik sebagai matriks bahan kopling sepeda motor. Sabut kelapa termasuk dalam serat dikontinyu, untuk menggantikan komponen asbes yang tidak adil bagi kesehatan paru-paru dan masalah lingkungan. Hasilnya dibandingkan dengan produk kopling SGP yang ada dalam hal kekerasan, keausan dan koefisien gesek pada kondisi basah dan kering. Caranya bahan dipadatkan dalam tekanan 2 ton dengan waktu penahanan 60 menit, kemudian disinter pada suhu 800C dengan waktu penahanan 40 menit, dikeluarkan dari oven, kemudian dilakukan uji kekerasan Brinell, dan uji keausan sesuai ASTM F 1957-99 dan ASTM. D 3702-94 standar bahan pengujian Hasil penelitian menunjukkan bahwa komposisi dengan 40% berat sabut kelapa, 20% serbuk tembaga, 20% fiberglass dan 20% resin fenolik memberikan angka kekerasan sebesar 4,098 kg/mm2. Keausan pada kondisi kering sebesar 0,14 mm/jam dan pada kondisi basah oli sebesar 0,19 mm/jam. Material eksisting adalah SGP dengan kekerasan 3,974 kg/mm2, keausan pada kondisi kering 0,15 mm/jam dan 0,20 mm/jam pada kondisi basah minyak.

Kata kunci: Clutch materials, serat sabut kelapa, serbuk tembaga, fiberglass, phenolic resin,kekerasan , keausan

e-ISSN: 2621-0584

1. Introduction

It is rarely using natural fiber as component of composite for clutch materials. Natural fiber, especially coconut fiber has good characteristic for contacting material such as break and clutching. That give good condition of clutching with good coefficient of friction , fair elasticity, and low wearing. Metal powder component was copper with good heat evacuation, copper powder is good conductivity. Greater stiff and toughness, by given by fiberglass component. The matrice was phenolic resin matrice, that good binder and good temperature resistance.

First step of this study was optimizing for mixing of material composition for friction of clutch materials for optimum its properties. Then it investigated for hardness , wearness, it coeficient of friction, time of clutching during contact periode, and its rising temperature during clutching.

Reference

(Ilmu, 2009a) had investigated on a friction materaial with 1000 kg pressure on 10 minutes holding time, and 80oC sintering temperatur, 30 minutes holding time . More compaction given more hardness. Its also depend on temperature, high temperatuture was given lower hardness result.[2]

(Ilmu, 2009b) had studied among influencing sintering temperature due to hardness and wearness. Higher sintering temperatur give less harndness and lower wearness. [3]

(Pradhan, Dwarakadasa, & Reucroft, 2004) A novel polymer matrix composite using coconut shell powder (CSP) as a filler material has been processed by a powder metallurgy technique. A mixture of ultrahigh molecular weight polyethylene (UHMWPE) powder and CSP was compacted at 200 ◦C in a die-punch arrangement. The composite material remained tough when the CSP content was 20–30 vol.%, as revealed by notch impact tests and fractog- raphy studies. However, the compressive strength of the UHMWPE–CSP composite decreased rapidly beyond 20 vol.% CSP[4]

(Humphreys, n.d.) The construction sector is one of the world's largest consumers of polymer composites. Unreinforced polymer composite materials have been used by the construction industry for many years in non-load bearing applications such as trimmings, kitchenware, vanities and cladding.[1]

Base Materials , coconut fiber that used was 5% weight water contain. Its density was 600-900 kg/m3. , with 8,6 -200 MN/m2 tensile strength. Fiber glass was on critical length, copper powder was 60 in mesh.

Tabel 1. Composition table for specimen 1, 2, 3 of clutch materials.

No Specimen	Coconut Fiber	Fiber *glass*	Copper Powder *(Cu)*	Polimer Phenolic
1	40%	20%	20%	20%
2	30%	30%	20%	20%
3	20%	40%	20%	20%

e-ISSN: 2621-0584

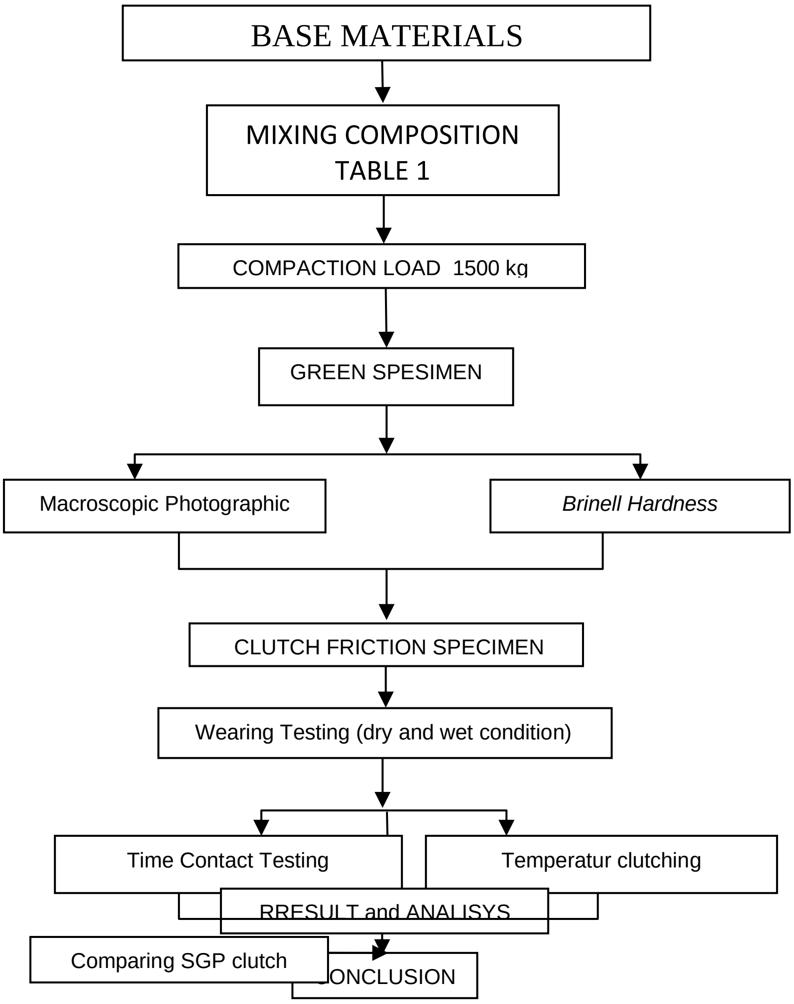

Figure 1. Flowchart

Result and Analysys

Wearing on Dry Condition

a. The result on wearing dry condition

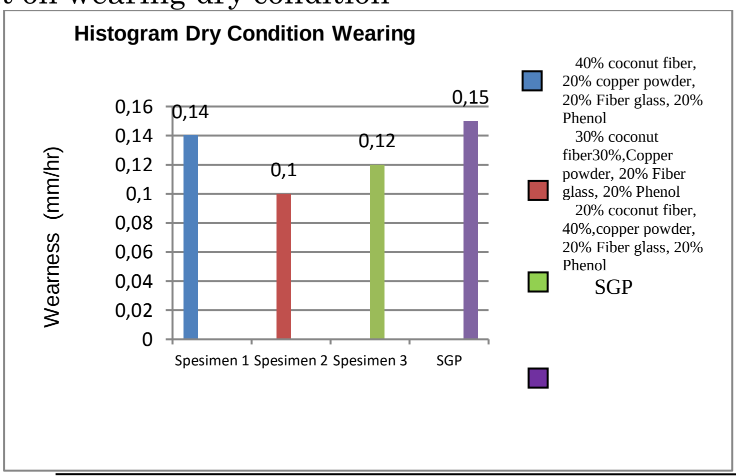

Figure 2. Histogram of wearing on dry condition

Fig.2, shown that on dry condition with 15 kg contact loading in 1 hour loading time, the wearness for specimen 1 is 0,14 mm/hr, specimen 2 is 0,10 mm/hr, and for specimen 3 is 0,12 mm/hr.Althouh for SGP is 0,15 mm/hr. The lowest wearness is on specimen 2, and closed to SGP.

b. b. The result of wearing on wet oil condition

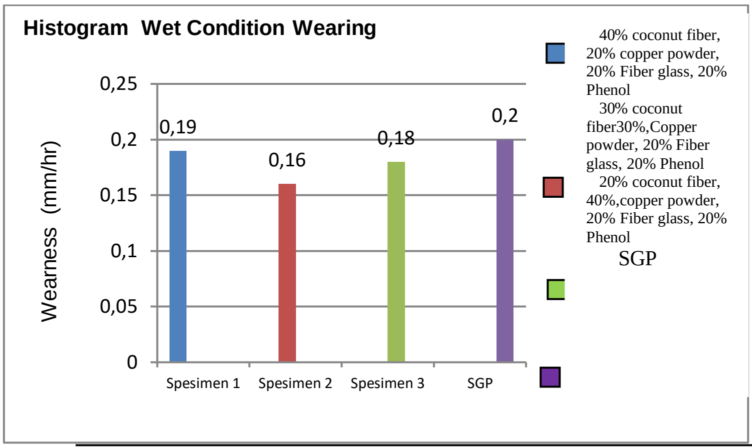

Figure 3. Histogram of wearing on wet oil condition

Fig 3. Shown that on oil wet condition with 15 kg contact loading in 1 hour loading time, the wearness for specimen 1 is 0,19 mm/hr, specimen 2 is 0,16 mm/hr, and for specimen 3 is 0,18 mm/hr.Althouh for SGP is 0,20 mm/hr. The lowest wearness is on specimen 2, and closed to SGP.

Result of Friction Coeficient

a.The result of friction coficient on dry condition

Fig . 4 shown that on dry condition the coefficient of friction for specimen 1 is 0,26 ,specimen 2 is 0,26 , and specimen 3 is 0,28 , although specimen SGP is 0,23. The lowest coefficient of friction is for SGP.

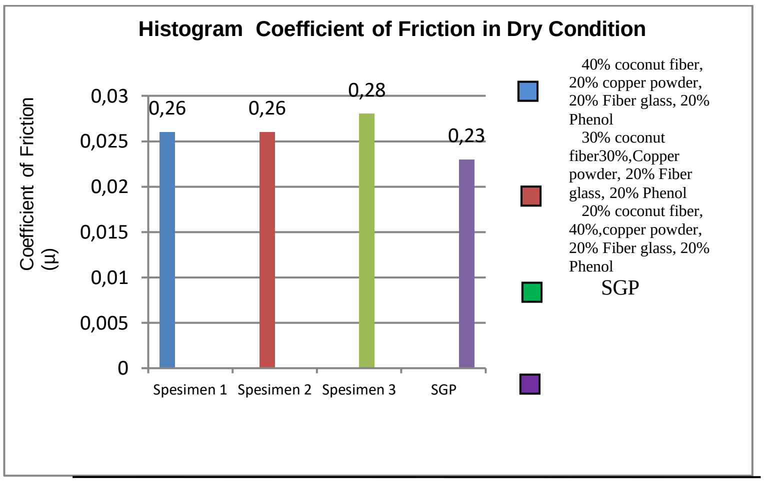

Figure 4. Histogram of friction coefficient on dry condition

b. The result of friction coficient on wet condition

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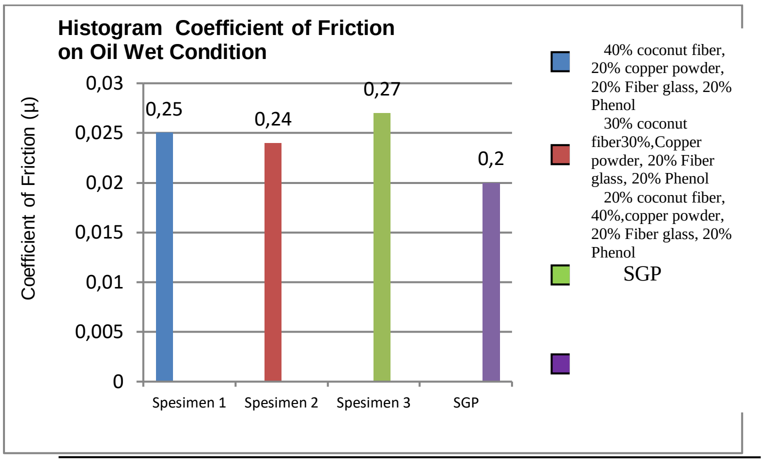

Figure 5. Histogram of Friction Coefficient on wet oil condition

Fig 5. Shown that on oil wet condition the coefficient of friction for specimen 1 is 0,25 ,specimen 2 is 0,24 , and specimen 3 is 0, 27 , although specimen SGP is 0,20. The lowest coefficient of friction is for SGP.

Result of Hardness (Brinell Hardness)

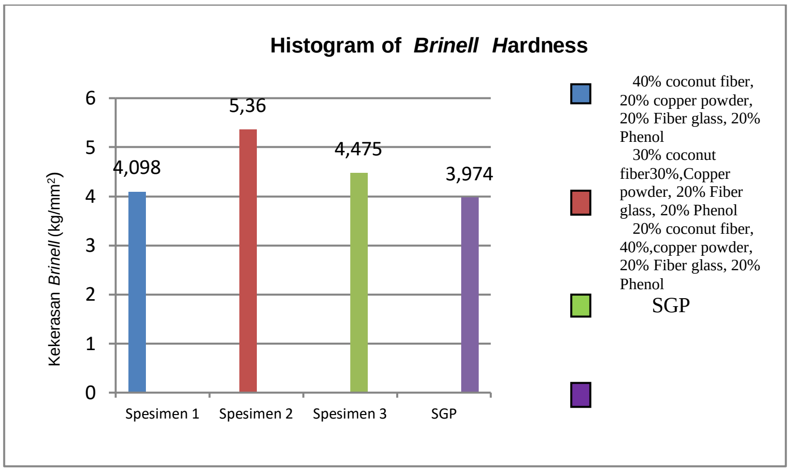

Figure 6. Histogram of Brinell Hardness

Fig.6 shown with Brinell 150 kg loading (153,2 N) , the harndness for specimen 1 is 4,098 BHN, specimen 2 is 5,360 BHN, specimen 3 is 4,475 BHN, and 3,97 BHN for SGP .

The hardest is for specimen 2. All of specimen that used copper powder has harder than SGP that used aluminum powder materias.

Conclution

From this study , we have conclusion:

1. From wearing investigation we have that wearness in dry condition for variation 1, 2 dan 3 for specimen 1 is 0,14 mm/hr , specimen 2 is 0,10 mm/hr, specimen 3 is 0,12 mm/hr and 0,15 mm/hr for SGP. For wet oil condition we have wearness specimen 1 is 0,19 mm/hr, specimen 2 is 0,16 mm/hr , specimen 3 is 0,18 mm/hr and 0,20 mm/hr for SGP. Specimen 1 is closed to SGP.
2. The hardness of specimen 1, 2 and are greater than SGP. Specimen 1 is 4,098 kg/mm^2, specimen 2 is 5,360 kg/mm^2, and 3is , while SGP is 4,475 kg/mm^2 .

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3. The result of friction coefficient for dry condition were for specimen 1 is 0,26 ,specimen 2 is 0,26 , and specimen 3 is 0,28 , although specimen SGP is 0,23. The lowest coefficient of friction is for SGP. For oil wet condition were for specimen 1 is 0,25 ,specimen 2 is 0,24 , and specimen 3 is 0, 27 , although specimen SGP is 0,20. The lowest coefficient of friction is for SGP.

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