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Use Powder of Wood Ulin (Eusideroxylon Zwageri) For Mixed Materials Builders Head Bushing

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ABSTRAK

Head bushing adalah bagian dari komponen mesin pembuatan karung plastik yang proses kerjanya selalu mengalami gesekan antara head bushing dengan cham sehingga menyebabkan keausan. Keausan ini menyebabkan terjadinya kerusakan yang lebih parah pada komponen - komponen spare part lainnya. Bahan head bushing adalah poliamida (nilon murni padat) yang mempunyai titik leleh 350 - 425 ^{o}C, namun tidak mampu untuk mempertahankan bentuknya karena sering mengalami gesekan - gesekan pada saat proses pembuatan karung plastik. Sehingga dalam penelitian ini dibuat head bushing dengan menambahkan serbuk kayu ulin sebagai penguatnya dan dilakukan pengujian keausan. Hasil yang diperoleh menunjukan nilai optimum pada serbuk kayu ulin komposisi 4% mengalami keausan 0,0544mm/jam dengan waktu aus 96 jam 29 menit 29 detik. Namun secara keseluruhan, penambahan serbuk kayu ulin, belum dapat dipakai sebagai bahan campuran pada head bushing, karena hasil keausannya masih lebih kecil head bushing tanpa bahan tambahan serbuk kayu ulin.

Kata kunci: *Head bushing, kayu ulin, aus, nilon padat*

ABSTRACT

Head bushing is part of the plastic sack-making machine components that process works always have friction between the bushing head cham causing wear and tear. This wear and tear leads to further damage to the components - components other spare parts. Head material is nylon pure solid has a melting point 350-425 ° C, but was unable to maintain its shape because happen frictions during the process of making plastic sack. Research to make head bushing by adding the powder of wood Ulin (Eusideroxylon Zwageri) as reinforcements and to do wear and tear. The results obtained show. that the optimum value of the powder composition wood ulin is 4% , with value of wear and tear 0,0544 mm/h with a time 96 hours 29 minutes 29 seconds. But overall, the addition powder of wood Ulin, cannot be used as ingredients of make head bushing, because value of wear and tear of head bushing without additive of powder of wood Ulin, more smaller than head bushing with additive powder wood Ulin.

Keywords: Head bushing, wood Ulin, wear and tear, solid nylon

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Prantasi Harmi Tjahjanti, dosen sekaligus peneliti di Prodi Teknik Mesin Universitas Muhammadiyah Sidoarjo. Penelitiannya banyak berkecimpung di bidang *Materials Science and Eengineering*. Penelitian tahun 2016 yang dikerjakan adalah Penelitian Hibah Kompetensi Tahun ke II. Selain sebagai Reviewer Penelitian Internal juga sebagai Asesor Serdos untuk Ilmu Material /Bahan.

INTRODUCTION

Plastic bag manufacturing industry there is a term circular loom or weaving which has the meaning of a device or machine used for weaving process. The basic purpose of the loom is for weaving knitting process or thread into a sack circular (circular loom) [1]. From the circular loom machine spare parts, there are several components to function as a single unit to produce the knitting process in the engine. Of all the parts are there, there is one component that has a very important role, namely head bushing that serves to carry out the knitting. Because of its function as a spare part, the process of working on the bushing head are always experienced friction between the head bushing with cham, causing wear and tear. This wear and tear resulting in further damage to the components - components of other spare parts [2]. Head bushing material is polyamide (nylon pure solid) having a melting point of 350-425°C, but was unable to retain its shape due to frequent frictions during the manufacturing process of plastic bags [3]. The number of head bushing is needed in one machine the component parts is 80 pcs. During head bushing with nylon plastic base material only lasts a maximum of 6-7 days in operation as component parts with cooling or lubrication using oil SAE 40. If the bushing head are worn for 6-7 days then it will wear out. In one day head replacement bushings that wear out can reach 16-17 pcs.

Several studies by making use of polymer matrix composite materials by adding fillers (filler) in the form of wood powders into the matrix with the aim to increase the strength of composite materials, among others conducted by Wirsanto Palangan (2007) [4]. Research carried out by adding powdered camphor wood, merbau and ironwood powder into polyethylene (PE) and the obtained results on the optimal tensile strength ironwood powder / PE by 2.95 kg/mm², modulus of elasticity of 25.25 kg/mm² and elongation break of 9.35%.

While result of research by adding fillers such rice husk ash with the composition of the volume fraction of 2, 4, 6, 8 and 10% into the matrix polypropylene (PP) would produce a tensile strength decreased with the addition of fillers. This is due to the spread of the filler in the PP matrix is less homogeneous or uneven [5].

Research which is added to the PP matrix sawdust fillers saws randomly with the volume fraction composition of 10, 30 and 50%. From these results we concluded that similar to the research conducted by Fuad, MYA that the addition of fillers will affect the tensile strength becomes decreased [6].

Some of the above study, carried out research to improve the head bushing where the material is nylon pure solid matrix by adding powder wood ulin (Eusideroxylon Zwageri) which is expected to improve the wear resistance properties. Selection of powder of wood ulin as an reinforcement because this powder has the advantages of lower process temperatures (less than 204^{o}C), thereby reducing energy costs, can be degraded naturally, its density is much lower, the low friction force so as not to damage equipment in the manufacturing process [7].

METHOD

The composition of material head bushing is made using polyamide matrix (solid pure nylon) by adding the powder of wood ulin varies with the volume fraction of 0% (original without powder, code marked A), 2% (marked code B), 4% (marked code C), 6% (marked code D), 8% (marked code E) and 10% (marked code F). Each one is made with 3 samples. The powder be sieved with a mesh size of 70 (0.21 mm), and then heated in an oven for 20 minutes at a temperature of 120 ° C, with the aim to eliminate the water content in the powder thus obtained wood ulin density dryness. While polyamide included in the ceramic container is then heated in a furnace to be melting, and added wood ulin powder dry. The next step stirring until well blended and then put into a mold and the mold is cooled in open air. The results of the mold is then performed according to the size of the head turning bushing (**Figure 1**), and the resulting after lathe process head bushing composition 2, 4, 6, 8 and 10% is shown in **Figure 2**.

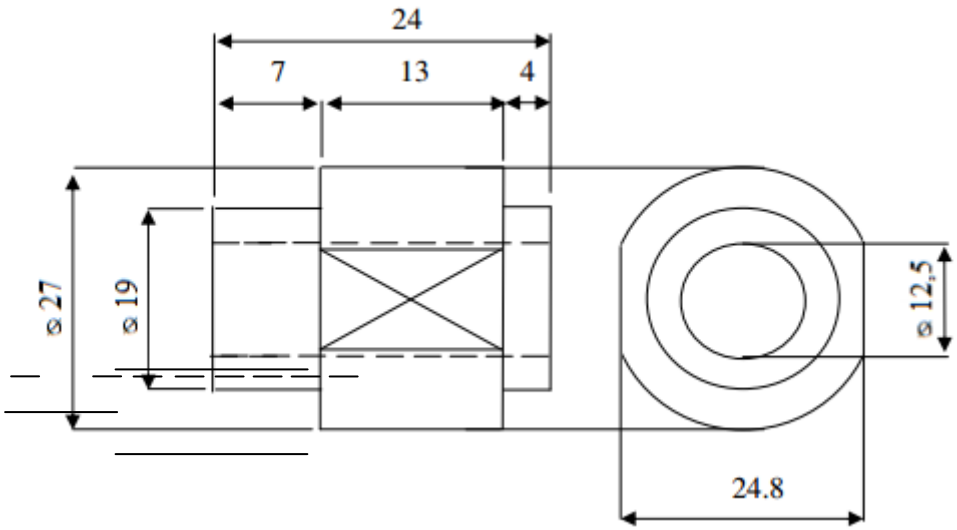

Figure 1. Scheme of head bushing specifications (in mm)

Wear and tear test by installing a bushing head into Circular Weaving Machine CS 8/125 UJADM. Checking bushing head on the engine when the damage is done. Data recording head include outer bushing diameter before and after in pairs until the damage and also the wear resistance of recording time. Limit head wear bushing in accordance with Circular Weaving Machines Manual book shown in **Table 1**.

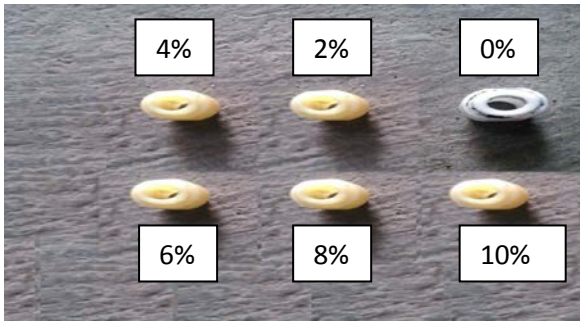

Figure 2. H*ead bushing* with volume fraction of 0% (original without powder), 2, 4, 6, 8 and 10% after lathe process

Standard that is used for mounting six types of head bushing to be tested in accordance with Circular Weaving Machines Manual book. Time of head bushing wear resistance after experiencing the test can be seen below.

M 1 = The diameter of the initial installation of the head bushing.

M 2 = Diameter head bushing after being installed for 53 hours 52 minutes 17 seconds (or equal to 2 days 5 hours 52 minutes 17 seconds).

of powder wood ulin most optimum is the composition

M 3 = Diameter head bushing after being installed for 71 hours 12 minutes 25 seconds (or equal to 2 days 23 hours 12 minutes 25 seconds).

M 4 = Diameter head bushing after being installed for 83 hours 2 minutes 5 seconds (or equal to 3 days 11 hours 2 minutes 5 seconds).

M 5 = Diameter head bushing after being installed for 90 hours 41 minutes 52 seconds (or equal to 3 days 18 hours 41 minutes 25 seconds)

M 6 = Diameter head bushing after being installed for 96 hours 29 minutes 29 seconds (or equal to 4 days 29 minutes 25 seconds).

M 7 = Diameter head bushing after being installed for 148 hours 27 minutes 43 seconds (or equal to 6 days 4 hours 27 minutes 43 seconds)

Table 1. Limit of wear and tear of head bushing

Diameter (mm)	Note
24.8 mm	Making head bushing (tolerance of camp 0.2 mm)
24.8 mm–21 mm	Use head bushing normally
< 21 mm	Head bushing must be replace

Source : Manual book Circular Weaving Machines

RESULT

The result of test wear and tear for each head bushing can be seen in **Table 2** and the diagram in **Figure 3**. While the amount of wear that occurs in units of millimeters per minute and one hour are presented in **Table 3**. **Table 2** and **Figure 3** shows that the addition

Table 2. The result of test wear and tear for each head bushing

Volume Fraction	Code	M1 (mm)	M2 (mm)	M3 (mm)	M4 (mm)	M5 (mm)	M6 (mm)	M7 (mm)
0 % (Code A)	A1	24.8	22.88	22.26	21.84	21.58	21.38	19.58
	A2	24.8	22.80	22.18	21.78	21.50	21.40	19.56
	A3	24.8	22.82	22.30	21.80	21.54	21.42	19.60
	Average	**24.8**	**22.83**	**22.36**	**21.80**	**21.54**	**21.40**	**19.58**
2 % (Code B)	B1	24.8	21.66	20.66	19.98	19.56	-	-
	B2	24.8	21.60	20.64	19.86	19.50	-	-
	B3	24.8	21.62	20.70	19.98	19.48	-	-
	Average	**24.8**	**21.63**	**20.66**	**19.94**	**19.51**	-	-
4 % (Code C)	C1	24.8	21.84	20.90	20.26	19.86	19.54	-
	C2	24.8	21.88	20.86	20.30	19.82	19.48	-
	C3	24.8	21.80	20.94	20.28	19.92	19.62	-
	Average	**24.8**	**21.84**	**20.90**	**20.28**	**19.87**	**19.55**	**-**
6 % (Code D)	D1	24.8	21.36	20.26	19.62	-	-	-
	D2	24.8	21.30	20.22	19.58	-	-	-
	D3	24.8	21.26	20.30	19.48	-	-	-
	Average	**24.8**	**21.31**	**20.26**	**19.56**	-	-	-
8 % (Code E)	E1	24.8	20.86	19.58	-	-	-	-
	E2	24.8	20.78	19.52	-	-	-	-
	E3	24.8	20.82	19.54	-	-	-	-
	Average	**24.8**	**20.82**	**19.55**	-	-	-	-
10 % (Code F)	F1	24.8	19.52	-	-	-	-	-
	F2	24.8	19.46	-	-	-	-	-
	F3	24.8	19.58	-	-	-	-	-
	Average	**24.8**	**19.52**	-	-	-	-	-

of 4% to have the highest wear resistance when compared with the addition of filler for other compositions (2, 6, 8 and 10%). The wear resistance of filler 4% in head bushing can last for 96 hours 29 minutes 29 seconds to 4 days 29 minutes 25 seconds. The wear and tear that occurs is 0.000907 mm/minute or 0.0544 mm/hour.

Tabel 3. Amount of wear that occurs in units of millimeters per minute and one hour of the 6 types of head bushing

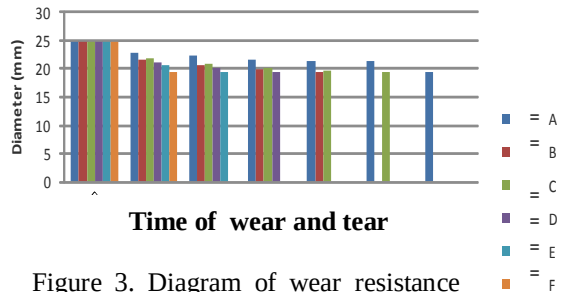

Figure 3. Diagram of wear resistance test results for each head bushing

seconds or as long as 2 days 5 hours 52 minutes 17 seconds at the time of testing, with the wear and tear that occurs is 0.00163 mm/minute or 0.0980 mm / h. This condition occurs because during the mixing process between the polyamide (nylon pure) and filler not mixed perfectly so that in the event of interlamellar stretching, happen deformation in the polyamide chains and filler irregular and eventually cause the wear resistance is low.

Nevertheless the results are still the highest wear resistance in head bushing are made of polyamide (nylon pure solid) without wood ulin powder (0%) were able to survive for 148 hours 27 minutes 43

Composition	Test for 1 minute (mm)	Test for 1 hour (mm)
0%	0.000586	0.0358
2%	0.000972	0.0583
4%		
6%	0.000907	0.0544
8%	0.00105	0.0628
10%	0.00123	0.0737
	0.00163	0.0980

seconds or as long as 6 days 4 hours 27 minutes 43 seconds with reduced of wear and tear of 0.000586 mm/minute or 0.0352 mm/hour. This condition occurs because the making of the original bushing head through the injection process, while the head bushing plus filler, to be melted polyamide mixed first and allows the reduction of the wear resistant properties.

CONCLUSION

The results obtained can be summarized as follows: Basically, the addition of powder of wood ulin has not able raise wear resistance in head bushing that essentially materials it is a polyamide (nylon pure solid). This is because the process of mixing the melted polyamide coupled with wood ulin powder, can not be mixed homogeneously. For further research will try to add the base material bushing head with ceramic materials. Because as it is known that the ceramic material is highly resistant to wear and tear.

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