

HASIL CEK_Charles

by Charles Proceeding

Submission date: 06-Jan-2023 11:34AM (UTC+0700)

Submission ID: 1989078894

File name: 2014-4th_isnpinsa_proceeding_Charles[1]_removed_compressed.pdf (109.8K)

Word count: 2582

Character count: 13962

The Effect of Sulfur Addition in to Polyisoprene on Mechanical Properties of Lignocellulof foam

Charles Banon^{a,c}, Bambang Setiaji^b, Ria Armunanto^b, Totok Eka Suharto^c

^aPostgraduate Student of Chemistry Department, Faculty of Mathematics and Natural Sciences, Gadjah Mada University, Yogyakarta, Indonesia.

^bDepartment of Chemistry, Faculty of Mathematics and Natural Sciences, Gadjah Mada University, Yogyakarta, Indonesia.

^cDepartment of Chemistry, Faculty of Mathematics and Natural Sciences, Bengkulu University, Bengkulu, Indonesia.

Telp : +6285664912774, Fax : - , email : banonc89@yahoo.com

ABSTRACT

Researches about the effect of sulfur addition in to polyisoprene on mechanical properties of lignocellulof foam has been done. Blending lignocellulose and polyisoprene was performed by immersion technique with concentration of polyisoprene 11.02% (v/v) and sulfur addition with variation of 0.1, 0.2 to 0.5 g. The Research was began by getting the cocodust from coconut husk using counter machine, separator and sifting. Cocodust was dried and sieved with 10 mesh size. Total of 30 g of cocodust was mixed with 100 cm³ of polyisoprene-sulfur, molded and dried in an oven 90°C until dry. The mechanical properties (strength and elasticity) were characterized by bending testing using Torsee-Tokyo testing machine. Bending strength and elasticity properties stated in the Modulus of Rupture (MOR) and Modulus of Elasticity (MOE). The lignocellulof foam density was determined by pycnometer method. Distribution molecule of lignocellulof foam was observed with a Transmission Electron Microscopy (TEM). Thermal stability of lignocellulof foam observed with DTA-TGA. The results showed that blending lignocellulose and polyisoprene-sulfur was getting optimum conditions at a sulfur addition of 0.4g. The values of MOR and MOE of lignocellulof foam was 31.41 g/mm² and 49.62 g/mm². The molecule distribution analysis (TEM) showed addition of sulfur to the polyisoprene causing lignocellulose molecule immiscible distributed. The TGA/DTA analysis proved that the Weight and Heat Flow Endo Down stability of lignocellulof foam until 200°C.

Keywords

lignocellulose, polyisoprene, lignocellulof foam.

1. INTRODUCTION

Electronic equipment are generally susceptible to vibration / shock. The process of transportation and storage of electronic equipment, to minimize vibration / shock protected equipment was using styrofoam. Besides as a protector of electronic equipment, styrofoam has become one of the options in the food business, which is a container of food or food ingredients. But the, recent research proves that is questionable safety of styrofoam. EPA (Environmental Protection Agency) in 1986 mentions, hazardous waste generated from the manufacturing styrofoam process is very much. One of the major plantation commodities in Indonesia is the coconut (*Cocos nucifera* L). Reference [1] shows, that the amount of coconut production reached 16.66 billion or copra equivalent to 3.33 million tonnes with export value of coconut and processed products reached U.S. \$ 427 million in 2004. Primary products of coconut coir processing consists of fiber (fiber length), bristle (fine and short fibers) and Lignocellulose. Lignocellulose also known as cocopeat can be used as hydroponic growing media material [2], extra material on the compost [3], peatlands substitute material for the flower industry, coating golf courses and and with the bristle can be processed into hardboard [4] and material for preparation particle board [5].

Commodities in Indonesia that is important is natural rubber. Indonesia is one country that has the the widest rubber plantations in the world. Natural rubber is obtained by tapping the rubber tree sap (polyisoprene) *Hevea brasiliensis*. Polyisoprene is a colloid of rubber particles in water and can be used as adhesives. Natural rubber including natural essential addition polymers. Rubber is tapped from rubber trees in the form of a suspension in the white water, characteristic odor and is known as latex. Natural rubber as the polymer of isoprene produced from the rubber tree is soft and sticky when heated. The strength of the chain in the elastomer (rubber) is limited, due to the structure of the network, but the cohesion energy should be low to allow for stretching. Examples of elastomers are widely used is poly vinyl chloride, polymers of styrene-butadiene-styrene (SBS) is a type of thermoplastic elastomer. When the world war II, natural rubber supply is reduced, the polymer industry is growing rapidly because chemists have been researching for a replacement rubber. Some replacement neoprene successfully

developed is now used to make hoses / water pipes to pump gas, rubber and styrene - butadiene (SBR / styrene - butadiene rubber), which is used in conjunction with natural rubber to make tires. Although synthetic rubber substitutes has a lot of character - desirable properties, but there is no substitute for synthetic rubber is one that has all the properties of natural rubber is cool [6,7]

Reference [8] shows, latex without the addition of sulfur or compound can maintain the flexibility that has been heated coconut fibers, although the desired properties of the product is still a lot that has not been achieved. Cocopeat is a waste of making coco fiber. Coir fiber / fiber usually used for the matting and foam replacement material in the manufacture of mattresses. Cocopeat has begun to be used as a growing medium for plants, but still not a lot of variation in utilization. In this study cocopeat used as a source of Lignocellulose then mixed with polyisoprene to make lignocellulose foam. The interaction between the polyisoprene with lignocellulose is expected to occur through a protein that coats polyisoprene. Proteins layer contained in the polyisoprene will form hydrogen bonds with lignocellulose. From all these descriptions, to minimize dependence on Styrofoam, this study was conducted to create a composite material called lignocellulose foam as a substitute for some functions of styrofoam.

2. MATERIALS AND METHODS

2.1 Materials and Instruments

Coir dust/cocopeat as source lignocellulose the source of latex, polyisoprene, sulfur. This research polyisoprene sourced from liquid latex brand Thumb obtained from the Liman Yogyakarta. Results of the analysis of the chemical composition of the liquid latex brand thumb which was done in the laboratory Center for food and nutrition, Building PAU Gadjah Mada University with the results: 43.99% moisture content of 0.25%, ash, fat 14.61% protein, 4.41% and polyisoprene 36.67%. The tools used are the counter machine, divider, coarse sieve, sieve 10 mesh, glass molds 10 cm x 5 cm x 3 cm, analytical balance (Mettler U.S. 200), oven glassware, Torsion (Tokyo testing machine made in Japan), FT-IR Analysis conducted to see the influence of sulfurisasi on the functional groups in the composite. Particle distribution analysis using TEM (Transmission electron microscopy). Thermal stability of lignocellulose foam observed with DTA-TGA.

2.2 Procedure

Sulfur addition done by dissolving a little sulfur (0.1, 0.2 to 0.5 grams) in to polyisoprene while stirring using a magnetic stirrer. The manufacture lignocellulose foam was using technique of immersion use lignocellulose dried at room temperature for 1 week, sifted with sieve mesh size 10 so obtained lignocellulose with powder size ≤ 10 mesh. Lignocellulose put 30 g addition in to 100 cm³ polyisoprene-sulfur and stir until blended. The sample included dough in to the mold that has been covered with aluminum foil. The sample is then removed from the mold and dried in an oven at a temperature of 90 ° c to dry.

3. RESULT AND DISCUSSION

3.1 The Effect of Sulfur Addition in to Polyisoprene on The Strength and Elasticity Value

Sulfur addition in to polyisoprene has been done when will blending with lignocellulose, that is the aim to increase the strength and elasticity of composite lignocellulose foam. Sulfur addition in to polyisoprene process was using technique of adding a little sulfur (0.1, 0.2 to 0.5) grams in to 100 cm³ of polyisoprene 11.02%, while stirring using magnetic stirrer. After sulfur mixed perfectly with polyisoprene, then the polyisoprene-sulfur direct blending with lignocellulose molecule using the technique of immersion. Lignocellulose foam composite, that it is dry and its elasticity, strength is measured with the following results.

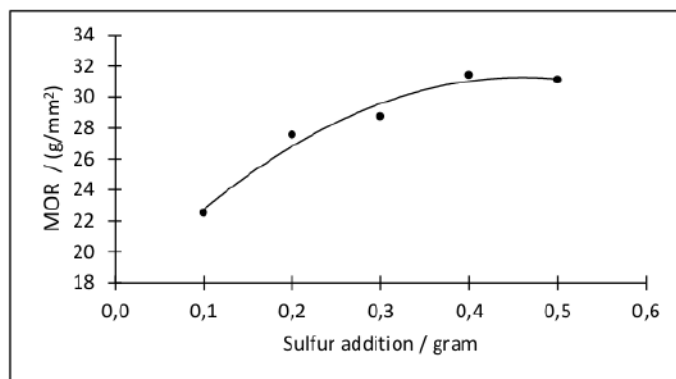


Figure 1: The effect of sulfur addition in to polyisoprene on the MOR value of lignocellulofoam

The composite strength (value of MOR) continued to increase in line with the growing number of addition of sulfur. Optimum point of the MOR value showed at a addition of sulfur 0.4 grams with the value of MOR 31.41 g/mm². The addition of 0.5 grams of sulfur have not resulted in a rise in the strength of the composite. When the amount of sulfur that are added as much as 1 gram or more, so it is hard to do blending with lignocellulose because it was formed of an aggregate as the result of cross linking in polyisoprene.

Phenomenon that occurs against the strength of the composite also occur in elasticity. Graph of the elasticity (MOE value) lignocellulofoam seen in the Figure below :

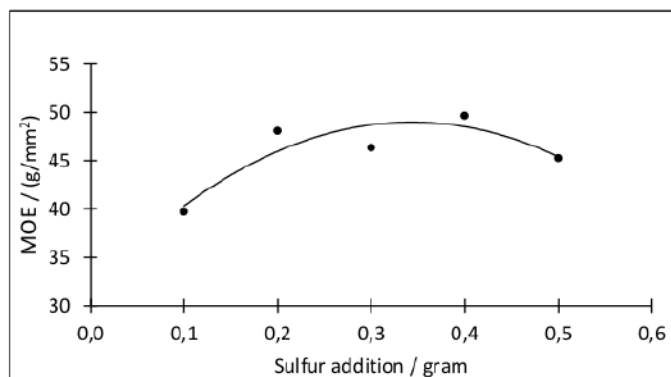


Figure 2: The effect of sulfur addition in to polyisoprene on the MOE value of lignocellulofoam

The elasticity of composite lignocellulofoam increases with the amount of sulfur. Optimum point of the MOR value showed at a addition of sulfur 0.4 grams with the value of MOE 49.62 g/mm². Value of MOE down on adding of sulfur to the next. Cross-bonding that occurs in polyisoprene cause begins to form aggregates in polyisoprene, and if more sulfur added to polyisoprene will rotate and so hard. The formation of aggregates as a result of the existence of cross ties in polyisoprene. Sulfur addition in to polyisoprene was very influential towards the distribution of lignocellulose molecules in to the polyisoprene-sulfur adhesive matrix. Sulfur addition in to polyisoprene was causes weak gluing aggregates due to wetting is not maximally reducing the strength and elasticity of lignocellulofoam composite.

3.2 The Effect of Sulfur Addition in to Polyisoprene on The Molecules distribution of Lignocellulose

The results of the TEM photo of lignocellulose composite shown in Figure 3. On the photo shown are the difference between molecules distribution models on lignocellulose and lignocellulose after sulfur additions. The molecule distribution of lignocellulose composite before sulfur addition was miscible distributed, meaning the molecules by wetting the adhesive matrix more perfect. The perfect wetting causes maximum interaction between the molecule with adhesive matrix lignocellulose, so that the gluing is becoming more powerful. Model of molecules distribution on the lignocellulose composite after sulfur addition is different from a lignocellulose composite one. In this composite as a result of sulfur addition then on cross ties formed polyisoprene which sparked the formation of aggregates. The presence of aggregates formed causing immiscible distribution of molecules, so the interaction of molecules with an adhesive matrix, not the maximum. Interactions that are not perfect be the cause of the decline in the composite adhesive strength.

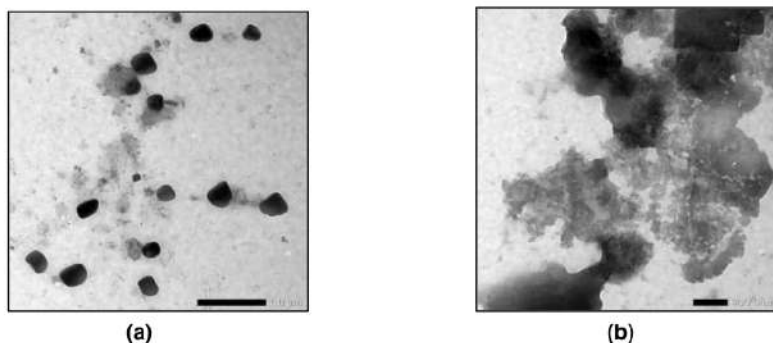


Figure 3: TEM photo of lignocellulose before sulfur addition (a) and after sulfur addition (b).

3.3 The Effect of Sulfur Addition in to Polyisoprene on The Density Value

Sulfur addition in to polyisoprene can be a bit lower density of composite. The composite was created using polyisoprene-sulfur more expands as a result of any such cross-bonding in the in the polyisoprene of the polymer structure. Results calculation of the density of a composite lignocellulose is as shown follows :

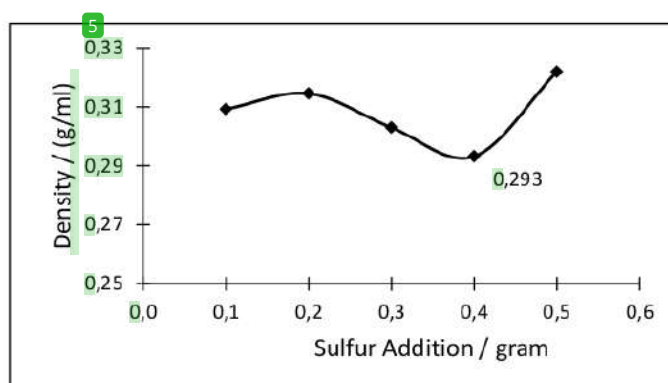


Figure 4: The effect of sulfur addition in to polyisoprene on the density value of lignocellulose

The density of lignocellulose composite can be reduced after addition of sulfur in to polyisoprene. The value of the lowest was showed on the addition 0.4 grams of sulfur with a density value of 0.293 g/cm³. That is nearly 15 times the density of styrofoam, but lignocellulose is very environmentally friendly.

3.4 Thermal Stability of Lignocellulofoam

The thermal stability analysis lignocellulofoam results showed in Figure 5. The chart weight-loss analysis of samples from the TGA is also demonstrated by the graph with a continue line. The graph shows the stability of weight of lignocellulofoam at temperature to 212.75°C and the temperature of the sample is 208.93°C, weight of sample is 9,345 mg. The next temperature rise of lignocellulofoam continue to experience weight loss. The graph with the dotted line is the result of the DTA analysis. The results showed in the graph of the drastic increase in heat flow endo with a value of 53.527 mW at a temperature programs of 217.58°C, and sample temperature at 216.50°C. This phenomenon indicated has been occurred which resulted the degradation of endothermic compound in the lignocellulofoam composite.

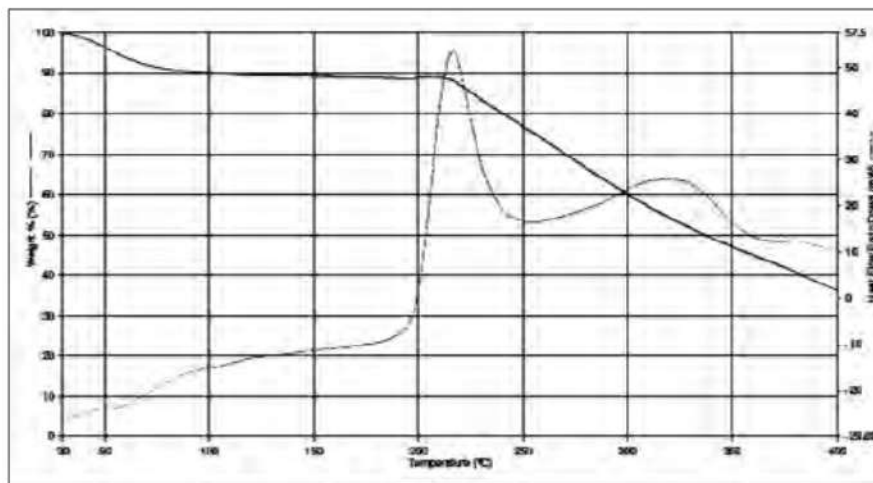


Figure 5: The Analysis result of DTA (.....) and TGA (____) of lignocellulofoam

4. CONCLUSION

Sulfur additions in to polyisoprene was getting optimum conditions at a sulfur addition of 0.4g. The values of MOR and MOE of lignocellulofoam was 31.41 g/mm² and 49.62 g/mm². The molecule distribution analysis showed addition of sulfur to the polyisoprene causing lignocellulose molecule immiscible distributed. The value of the lignocellulofoam density lowest was showed on the addition 0.4 grams of sulfur with a density value of 0.293 g/cm³. The thermal stability analysis proved that the Weight and Heat Flow Endo Down stability of lignocellulofoam until 200°C.

4

ACKNOWLEDGMENT

This investigation was supported by PT. Tropical Nuciferra Industry Yogyakarta Indonesia, and by Laboratory Facilities from the Department of Physical Chemistry and Engineering Laboratory, University of Gadjah Mada, Yogyakarta, Indonesia.

REFERENCES

- [1] Luntungan, H.T., Coconut Genetic Resources Preservation For Commodities in Tidal Swamp Land Development and Lebak, *Development of Agricultural Innovation*, vol.1, no. 4, pp. 243-258, 2008.
- [2] Putra Sinly E., *Coconut as a Potensial Bioindustry of Indonesia*, 2008, <http://www.chem-is-try.org> accessed Feb. 2011.
- [3] Treder, J., The Effect of Cocopeat and Fertilization on the Growth and Flowering of Oriental Lily 'Star Gazer', *J. Fruit ornam. Plant Res.*, vol. 16, pp. 361-370, 2008.
- [4] Nur I, Kardiyo, Umar and Aris A., Waste Utilization of Coconut Coir Dust in Tidal Rice Farm, Coconut Institutional in the Era of Regional Autonomy, *Proceedings of the National Conference of Coconut V*, Tembilahan 22-24 October 2002, pp. 160-165, 2003.

- [5] Setyawati, D., Hadi, Y.S., Massijaya, Y. and Nugroho, N., The characteristics of Composite Panel from Coconut coir fiber and Plastik Polypropylene Recycling Layered Bamboo Matting, *Journal of Research University Tanjungpura*, vol.10, no. 2, pp. 88-101, 2008.
- [6] Yanto, D.H.Y. and Hermiati, e., Mixture of natural rubber Latex-Styrene and Polyisocyanate as Wood Adhesive Lamina, *J. Trop. Wood Sci. Techno.*, vol. 6, pp. 63-68, 2008.
- [7] Azizah Utayah, Natural rubber and synthetic rubber, 2009, <http://www.chem-is-try.org>. accessed 24 Jan. 2010.
- [8] Anom I. K., Preparation and characterization of Cocofoam of Coconut Fibers, *Dissertation Doctoral Program of Chemistry, Gadjah Mada University*, Yogyakarta, Indonesia, 2012.

HASIL CEK_Charles

ORIGINALITY REPORT

9%

SIMILARITY INDEX

9%

INTERNET SOURCES

4%

PUBLICATIONS

1%

STUDENT PAPERS

PRIMARY SOURCES

1

ijens.org

Internet Source

3%

2

eprints.undip.ac.id

Internet Source

2%

3

journal.ugm.ac.id

Internet Source

1%

4

docplayer.net

Internet Source

1%

5

www.coursehero.com

Internet Source

1%

6

panafrican-med-journal.com

Internet Source

<1%

Exclude quotes On

Exclude matches Off

Exclude bibliography On