Plagiarism Checker X Originality Report

Similarity Found: 24%

Date: Friday, March 22, 2019
Statistics: 694 words Plagiarized / 2911 Total words
Remarks: Medium Plagiarism Detected - Your Document needs Selective Improvement.

S a pproah t ee s ttof a ba s ing f ir Abstrt Related to the importance of selectivity to natural fibers that can be used and qualify as one of the raw material composite engineering substitute for Fiber Reinforced Plastics (FRP) or Fiber Reinforced Metals (FRM), one plants that have the potential of fiber and volume growth is very abundant, namely abaca.

This research aims to clarify scattering in tensile strength of an abaca single fiber through statistical approach and to search a way of suppression in the scatter with intention that abaca fibers can be used as a raw material for engineering structural components. Tensile test specimens were prepared from fiber samples from two different areas, East Aceh and North Aceh, Indonesia.

Specimen gauge length is 25 mm, then as the holder of a fiber made of paper (20mm x 100mm), where the specimen size for fiber tensile test in accordance with JIS standard K-760. Diameter the specimen fibers obtained varied from 0.060 mm to 0.140 mm. The tensile strength of abaca fiber varies in the wide range from 100 MPa to 900 MPa. Coefficient of variation was calculated for East Aceh abaca fibre 0.32 and North Aceh abaca fibre 0.35. It was examined whether Weibull distribution or log-normal distribution could well express scatted experimental results.

The results showed that both the distribution types could well express the experimental probabilty density, but log-normal distribution could be more rational for expression of biologial and chronological effects. To reduce scattering of tensile strength, pre-concept was proposed. 1. Introduction Climate change and global warning have triggered extensive researches on ecological or environmentally friendly materials.

Automotive industry tries to use advanced high strength steel to reduce plate thickness of vehicle structures that eventually aims to lighten vehicle weight resulting in enhancement of fuel economy. From viewpoint of ecology and environmental friendliness, total CO2 emission is evaluated in a period of life span from mining of raw materials to depositing process after usage. It is defined as life cycle assessment of CO2 emission, namely LCA of CO2 emission.

LCA of CO2 emission of metallic and plastic materials is rather high, for instance, it is around 2.3 t CO2 emission/t steel (Fujita et al., 2010) and 2.0 to 9.0 t CO2/t plastic (Groot, and Boren, 2010). In addition, that of carbon fiber used for carbon fiber reinforced plastics (CFRP) is around 20.0 t CO2/t carbon fiber (JCFMA, 2014).

Density of CFRP is much smaller than metallic materials, and consequently, vehicles and aircrafts fabricated with CFRP are significantly lighter than metallic vehicles and aircrafts resulting in lower emission of CO2 in their life cycle than those manufactured by metallic materials (JCFMA, 2014). Therefore, composite materials reinforced by strong and advanced fibers, such as carbon, glass, kevlar fibers and so on, receive great attention as environmentally friendly materials. However, as described above, LCA of CO2 emission of the advanced fibers is not necessarily low.

Hence, more ecological reinforcement fibers are recently sought. One potential candidate is cellulosic natural fibers. Cellulosic natural fibers are extracted from leafs, trunks, Keywords : Statistical approach, Tensile strength, Abaca fiber, Weibull, Log-normal Received: 13 February 2018; Revised: 6 July 2018; Accepted: 13 September 2018 Abubakar DABET*, Hiroomi HOMMA**, Hiroki HOMMA*** and SUARDI**** * Department of Mechanical Engineering, Universitas Malikussaleh, Jl. Universitas Malikussaleh, Lhokseumawe, Aceh, 24351, Indon esia, and Universitas Sumatera Utara, Medan, Indonesia. E-mail: abubakar@unimal.ac.id ** Department of Mechanical Engineering, Universitas Sumatera Utara, Medan, Indonesia, Professor Emeritus, Toyohashi University of Technology, Toyohashi, Japan.

*** Department of Mechanical Engineering, Matsue National Institute of Technology, Matsue, Japan. **** Universitas Sumatera Utara, Medan, Indonesia. basts, and seeds of plants. Absorption of CO2 by photosynthetic reaction during their growing process can be considered to be counterbalanced with CO2 emission during depositing process of burning and chemical decomposition.

Thus, LCA of CO2 emission for cellulosic natural fibers is much lower than one of synthetic fibers like carbon fibers, glass fibers, and kevlar fibers. For instance, LCA of CO2 emission for flax fibers is 1.07 t CO2/t fiber (Deng, 2014), which is around 5 % of one for carbon fiber. There are several cellulosic natural fibers that have been used for clothes, bank bills, papers, marine cordages, handicrafts such as a bag, a floor mat, a tray, and others. Recently, application of natural cellulosic fibers to engineering structural components was initiated merely in automotive industry (Akova, 2013).

When natural cellulosic fibers are used for engineering structural components, one of critical issues is wide scattering in fiber strength. An index of scattering in tensile strength is a ratio of standard deviation ? to mean value ? called coefficient of variation. The coefficient of variation of natural fiber strength is larger than 0.28 for curaua, jute, coir, piassava, and sisal (Fidelis et. al.,

2013), while for man-made materials like steel, E glass and aramid in yellow rows, the coefficient of variation is less than 0.14. The man-made materials have been used for engineering structural components over a long period of industrial history and safe design concepts based on fail-safe, and damage tolerance have been effectively applied to dimensional decision of engineering components manufactured by those materials.

Onthoterd,celulc talfis erft naurafis) rctfr antarstllew o gin eer Sttstildat ese aeris e otsuffien oughto feldesi rura pontusing ese aeri l Reenls ea eseachs ioutexpermtonnalfi sten .Manof h Weildiii teorforsttiilaoa o delscated enlsten ntlfis (Joffe et.al., 2009) and (Liu et.al.,2013). Torres et. al. (2017), rtlprded aildafornurl bercomtusime 500 sapl sie operi g ′ s odul tatsten d aurstr,of e,flx ncar ber rforcposie aes e epored n e i r sttiil t .

astcaanysiwaconed nt - paamer Weildirii. e h d, L . . (2008) poitoutthaWeildiiicouln wa rsonbldesiwiy cated ene enof atu rafis,anthy iza euranworalitht estmtprbiiy siy ctonso s o t severl expermtaesuls. It should be noted that tensile strength data of flax uniaxially reinforced composite indicates surprisingly small coefficient of variation, 0.045 (Torres et. al.,

2017) while flax fiber tensile strength is scattered so widely that the coefficient of variation is more than 0.28. Natural fibers may be used for engineering structural materials as reinforcement of plastic matrix composites. Abaca fibers can be potentially used for uniaxially reinforced composite materials because of availability of long fibers and high strength.

However, statistical approach to abaca fiber tensile strength has been carried out in very limited number (Liu et.al., 2013), (Richter et. al., 2013) and (Agung et.al., 2011). 2. Experiment p , Inesi . 3 . Dimer of an aca berspecien wa msur athrposiis, ie d wo ds thspecien ge lgth usinadiamcrope . m 70 ′ t to . , - 609. a nd d isc si 3. Diamer f ers Diameter histogram of two regions is shown in Fig. 2.

The range of the diameters is divided into 7 intervals, the frequency is 14 at maximum and 7 at minimum. It can be considered that the frequency at each interval is fluctuated, but roughly uniform. Then, the sample number falling in each interval is shown in histograms. A diameter histogram was constructed by randomly selected fiber specimens from North Aceh samples.

Then, diameters of specimens from East Aceh were selected so as to be the same histogram as one from North Aceh. As seen in Fig. 2, although frequencies of two bins are slightly higher than those of other bins, all the data fall near the mean frequency 10. It should be noted that fiber diameter almost uniformly distributes over the range. East Aceand th Ace Fig. Histogram of fiber diameter of two regions.

Diameter the specimen fibers obtained varied from 0.060 mm to 0.140 mm, the frequency is 14 at maximum and 7 at minimum. It can be considered that the frequency at each interval is fluctuated, but roughly uniform. 3.2 Tensile strength of fibers and statistical data analysis Tenlstrgth acasiglfi s oted s cti fi aet . I a e W . (Gunawan et.al., 2009) and (Nonteiro et.al., 2012).

- ? ? were determined by the median rank and - - T - . (a) Bacal bul strii eoribaonthwea inthy.Tere,Weildibuton canbe rillaitsttstca cte aorof a - mmtalof i auridomatby e - exiig flws.On e h d,pl berhve ecei chonca effecttough eir owig i cumton of chon lca ect in - (Gronholm and Annila, 2007) .

Beuse ba berhagr eceinbiogilanchrolca ffes,i condertht og - nma diii tonlldea wih stastca aorof acafi enlstrgth ash gur4 . Thefor ithist og - nmadibutons eferblused erer. Tae 1. Pametersed tlculae prbilitensy Regis Weildiii Log - nml strii shpe sie mn st Est Aceh 3. 524. 6. 0. Norh Aceh 2. 629. 6. 0.

InTae e merused o lae obaltdentof wo stiis e own omt parets l - naldiiiprbiiy tfuni f), expectvaue E) anstand deviton v ?? (??) argi athfolowig is : f (x) = ?? v ???? ?? ?? ?? ?????? [- (?????? - ??) ?? ?? ?? ??] (1) E (x) = ? 1 v 2p s 2 x [- (lnx - µ) 2 2 s 2] 8 - 8 xdx = (?? + s 2 2) v V (x) = [? 1 v 2 ?? ?? 2 ?? ???? [- (?? - ??) 2 2 ?? 2] 8 - 8 (?? - ??) 2 ????] 1 2 = v (?? ?? 2 - 1) exp (2 ?? + ?? 2) (3) (a) - .

(b) - - - - Fr q uai (2),t hexpectvaue tsie en i451.MPa,an635.MPa aAcehanNorAceh fis, riy .Fr q uaton (3),thstdardevit s 9 ,an215.MPaforEaAcehanNor Acehfis,riy.Com rson weenlied besames ed om wo egis ditth ber fr tAcehe uchstrgeranfis omEst .Itshd owe otttthacpai caotbe ppled e erl fferce we b erstgth tron 3. A nceo p re - sniofib Coecitof raton s and 34 aAcehanNorh espectvel nthvaues rthgh tuse ba berforeneerg uctl tis.

ths k,oniiprtrthcoecit f (2016) 3 A - A - - MPa , 35 bafis whch ene ength s on an 0 can surve om ts e - scrin Howe dea e - scring estivery ffittcon.Ma he s e posbiiy for fis kerthan0 tsurv e nthe s e possilt forfis ston th566.MPa o eaunder apr - scring est e vilfis eabinof e iogr e imtby ghed verRaei diii (Fatima and Ahmad, 2017). .e

equeny ea ch iogrbiof ene enaer e e - scrg t abe laed s l : (4) ?? (?? ??) = ?? 1 × ???? (- (?? - ??) 2 (?? ?? - ??) 2) (5) ?? ?? ?? - ?? b (x i) = b 0 (i) q (x i) ?? (?? ??) = ?? (?? ??) ?? ?? < ?? ?? (?? ??) = 1 ?? ?? = ?? - - Thasurva ctonwaused o lae ienl obaltdentfuni. en ?? ???? i 670. MPaan ?? ?????? MPa , imaprbiiy ctonwa caculaed .

stam n dth s ot chged th e plnberdecrsed om70 o obaltdentdaaish o cparwih l - nmaprbiiy siy ctonfitthexperen adatin gur5. en s esulicomed th e rt ownin gur4(b), t s athprbiiy siy cton tsie enof e - scred beri am erinthrof est MPa,whie t tsie str gth of berwih e - scrindecrses o zo thange ls han200 Cumtve prbiiy tsie ength s ownforthpr - scred d o e - scred ber i n f ie . In te gur cumtve prbiiy tuntl - nadiriiiaso own iicorrdintthda aerthil e - scrint.Thtrcaed og - nma strbutonwacacultby of hequai opose by L.Zaeti (2017). In the future, the pre-screening by elongation must be verified experimentally.

If weak fibers are abandoned by this pre-screening method, for instance, the screening criterion is set 566.0 MPa for abaca fiber in North Aceh, 35 abaca fibers of which tensile strength is stronger than 566.0 MPa survive from this pre-screening. For the survived abaca fibers, log-normal distribution is fitted with the experimental data to obtain the mean value and the variance. Those are Mean value: 6.55 and standard deviation: 0.127. Then, expected value and standard deviation of tensile strength for the survived abaca fibers are calculated as E(x) = 704.7

MPa and v ?? (??) = 89.9 MPa Then, coefficient of variation is significantly reduced to 0.13 and approaches that of metallic materials. In addition, when we design a mechanical component using abaca fibers of which tensile strength is 566.0 MPa, and safety factor is defined as 1.5, the fracture probability of this component is less than 10-6 when applied stress is kept constant, 566.0 MPa. This situation is shown in Figure 6.

In the figure, cumulative probability is plotted as a function of stress. - 10 - 4 - 6 . Fr e gur 6 , e lblstess f pr - scred ber i240.MPa iurprbi ltof - 6 ,whie e llblstess n - scred beri130 MPaforthsamfale obalt fetfaorof chcomeni2.an3.forpr - scred beran no - - - - - - ???? - ?? 4. C oncusi Ths rr ductsttiilpprcho ene rgtof ba berculitinwo egis,EaAce h anNorthAceh dona.

In der o iata m ctfr stii als acafi enl sten of tron fi plwercoleed o hat diaet stamof berfr wo egis e e sae .Two stbutont bul strbut ianl - nora dibuton werseled o nayztsie rgth daa acasiglfis. Th conusis obtinfr s rrarsummzs l 1. Log-normal and Weibull distributions could successfully represent probability density data of tensile strength measured by 70 fiber samples of each region.

However, it was deduced that log-normal distribution could more rationally represent statistical results of abaca fibers than Weibull distribution from theoretical aspects of these distributions. 2. From log-normal distributions fitted with tensile strength results of East Aceh and North Aceh fibers, it was indicated that expected value of the tensile strength was much higher for North Aceh than that for East Aceh. The difference between two expected values was significant in t-test. 3. A pr - scrinmod s opos he.Thpr - scrintwasttiilldied d t s owntha ts ethcoulprde acafis thacoulbe for gininstruramaerl .

Howe s eth m exainfr aprail spect Acleme ThaorargrefultthPre ier ResrTechn o ly nHierEti esi anal suppor Docta Diaon PrlResrGrd thpr o.of 072/LTDRPM/2017. References Agung E.H., Sapuan S.M., Hamdan M.M., Zaman D.K., and Mustofa U., Optimization of the Mechanical Properties of Abaca Fibre-Reinforced High Impact Polystyrene (HIPS) Composites Using Box-Behnken Design of Experiments, Polymers & Polymer Compsites, Vol. 19, No. 8 (2011), pp. 697-710. Akova Ing. E., Development of Natural Fiber Reinforced Polymer Composites, Transfer Inovacii, Vol. 25 No.1

(2013), pp.3-5. Deng Y., Life Cycle Assessment of Biobased Fibre-reinforced Polymer Composites, Doctoral Thesis of KU Leuven Belgium, Faculty of Engineering Science (2014). Fatima K. and Ahmad S.P., Weighted Inverse Rayleigh Distribution, International Journal of Statistics and Systems Vol. 12, No. 1 (2017), pp.119-137. Fidelis M.E.A.,

Pereira T.V.C., Comes O. da F.M., Silva F. de A., and Filho R.D.T., The Effect of Fiber Morphology on the Tensile Strength of Natural Fibers, J. Materials Research and Technology Vol.2 No. 2 (2013), pp. 149-157. Fujita K., Harada T., Michishita H., and Tanaka H., CO2 Emission Comparison Between Coal-Based Direct Reduction Process and Conventional Blast Furnace Process, Proceedings of International Symposium on Ironmaking for Sustainable Development, Osaka, Japan (2010), pp.145-152. Gronholm T., and Annila A., Natural Distribution, Mathematical Biosciences Vol. 210, (2007), pp.659-667.

Groot W. J., and Boren T., Life Cycle Assessment of the Manufacture of Lactide and PLA Biopolymers from Sugar Cane in Thailand, International Journal of Life Cycle Assessment, Vol.15 No. 9, (2010), pp.970-984. Gunawan F.E., Homma H., Brodjonegoro S. S., Hudin A.B.B., and Zainuddin A.B., Mechanical Properties of Oil Palm Empty Fruit Bunch Fiber, Journal of Solid Mechanics and Materials Engineering, Vol. 3, No. 7 (2009), pp.943-951. https://www.steel.org/~/media/Files/SRI/Media%20Center/AutomotiveCaseStudy.pdf?la =en (accessed on 22 April, 2017). JCMA LCA model, The Japan Carbon Fiber Manufactures Association (online), available from <http://www.carbonfiber.gr.jp/english/material/what.html>, (accessed on 15 Februari, 2017). Joffe R., Andersons J., and Spamins E.,

Applicability of Weibull Strength Distribution for Cellulose Fibers with Highly Non-linear Behavior, International Conference on Composite Materials 2009, Edinburgh, UK (2009), pp.24-31. Liu K., Takagi H. and Yang Z., Dependence of Tensile Properties of Abaca Fiber Fragments and Its Unidirectional Composites on the Fragment Height in the Fiber Stem, Composites: Part A Vo.45 No.

1 (2013), pp.14-22. Nonteiro S.N., Satyanarayana K.G., Ferreira A.S., Nascimento D.C.O, Lopes F.P.D., Silva I. L.A., Bevitori A.B., Inacio W.P., Bravo Neto J., and Portela T.G., Selection of High Strength Natural Fibers, Revista Materia, Vol.15, No.4, (2011), pp. 488-505. Peponi L., Biagiotti J., Tome L., Kenny J. M. and Mondragon I., Statistical Analysis of the Mechanical Properties of Natural Fibers and Their Composite Materials, I. Natural fibers. Polymer Composites, Vol.

29, No.3 (2008), pp.313-320. Philippine National Stadard PNS/BAFS 181:2016, Bureau of Agriculuter and Fisheries Standard, (2016), pp.1-9. Richter S., Stromann K., and Mussig J., Abaca (Musa Textilis) Grades and Their Properties a Study of Reproducible Fibre Characterization and a Critical Evaluation of Existing Grading Systems, Industrial Crops and Products, Vol. 42, (2013), pp.601-612. Torres J.P., Vandi L.-J., Veidt M. and Heiztmann M.T.,

Statistical Data for the Tensile Properties of Natural Fiber Composites, Data in Brief Vol. 12 No. 3 (2017), pp.222-226. Torres J.P., Vandi L.-J., Veidt M. and Heiztmann M.T., The Mechanical Properties of Natural Composite Laminates : A Statistical Study, Composites : Part A Vol. 98 No. 1 (2017), pp.99-104. Zaninetti L., A Left and Right Truncated Log-normal Distribution for the Stars, Advances in Astrophysics, Vol. 2, No. 3, (2017), pp.197-213.

INTERNET SOURCES:

9% - https://www.jstage.jst.go.jp/article/mej/5/5/5_18-00078/_article/-char/en
3% -
https://www.iaeme.com/MasterAdmin/uploadfolder/IJMET_09_13_124/IJMET_09_13_124.pdf
1% - http://www.bmwheaven.com/index.php/1-series/113-212?start=4
<1% -
https://en.wikipedia.org/wiki/Life-cycle_greenhouse-gas_emissions_of_energy_sources
2% -
https://www.researchgate.net/publication/225475064_Life_cycle_assessment_of_the_manufacture_of_lactide_and_PLA_biopolymers_from_sugarcane_in_Thailand
<1% - https://link.springer.com/referenceworkentry/10.1007/978-3-319-58538-3_154-1
<1% - https://ocs.usu.ac.id/public/conferences/12/book-of-abstract-nae2017.pdf
<1% - https://epdf.tips/natural-fibers-biopolymers-and-biocomposites.html
<1% - https://medworm.com/journal/journal-of-physics-and-chemistry-of-solids.xml
<1% - https://www.mdpi.com/2079-6439/3/4/504/htm
1% -
https://www.researchgate.net/publication/257371988_Abaca_Musa_textilis_grades_and_their_properties-A_study_of_reproducible_fibre_characterization_and_a_critical_evaluation_of_existing_grading_systems
<1% - https://es.scribd.com/document/230210920/Physical-Chenistry
<1% - https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=9100KZUQ.txt
1% -
https://www.researchgate.net/publication/282688601_Optimization_of_the_Mechanical_Properties_of_Abaca_Fibre-Reinforced_High_Impact_Polystyrene_HIPS_Composites_Using_Box-Behnken_Design_of_Experiments
<1% - https://www.hindawi.com/journals/amse/2015/909523/
<1% - http://archive.org/stream/nasa_techdoc_19780072547/19780072547_djvu.txt
<1% - https://www.researchgate.net/profile/Hiro_Homma2
<1% -
https://www.researchgate.net/publication/259486218_Applicability_of_Weibull_strength_distribution_for_cellulose_fibers_with_highly_non-linear_behavior
<1% -
https://www.researchgate.net/publication/320831006_Influence_of_Kenaf_Fibre_Orientation_Effect_on_the_Mechanical_Properties_of_Hybrid_Structure_of_Fibre_Metal_Laminate
<1% -
https://www.slideshare.net/iaeme/a-review-on-chemical-and-physical-properties-of-natural-fiber-reinforced-composites
1% - https://www.sciencedirect.com/science/article/pii/S0921883117302169
1% - https://link.springer.com/chapter/10.1007%2F978-3-319-66981-6_54
1% - https://www.sciencedirect.com/science/article/pii/S0167663614001616

<1% - https://www.researchgate.net/publication/263773568_Non-Homogeneous_thermal_properties_of_bamboo
1% - https://www.sciencedirect.com/science/article/pii/S0261306914002544
1% - http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1516-14392015000800193
1% - https://onlinelibrary.wiley.com/doi/abs/10.1002/pc.20408
<1% - https://www.sciencedirect.com/science/article/pii/S0254058418306163
1% - https://researchers.uq.edu.au/researcher/460