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2175 , 020061 © 2019 Author(s). Comparison study on morphology and mechanical properties of starch, lignin, cellulose – based polyurethane foam Cite as: AIP Conference Proceedings 2175 , 020061 (2019); <https://doi.org/10.1063/1.5134625> Published Online: 20 November 2019 E. Kustiyah , D. A. Setiaji , I. A. Nursan , W. N. Syahidah , and M.

Chalid ARTICLES YOU MAY BE INTERESTED IN Crystallinity index evaluation of Dendrocalumus asper fibers through variation of chemical treatment AIP Conference Proceedings 2175 , 020060 (2019); <https://doi.org/10.1063/1.5134624> Synthesis hybrid bio-polyurethane foam from biomass material AIP Conference Proceedings 2175 , 020068 (2019); <https://doi.org/10.1063/1.5134632> Effect of time alkali treatment on chemical composition and tensile strength properties of kenaf single fibers AIP Conference Proceedings 2175 , 020059 (2019); <https://doi.org/10.1063/1.5134623> Comparison Study on Morphology and Mechanical Properties of Starch, Lignin, Cellulose – Based Polyurethane Foam E. Kustiyah 1, 2, D. A. Setiaji 1, a, I. A.

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2 Chemical Engineering, Universitas Bina Nusantara 2 nd Campus, Bekasi 17121, West Java – Indonesia
a) Cor: dimas.agung52@ui.ac.id Abstract .

In research, hybrid - polyurethane was by using biomass as starch and bio - polyurethane was by using Diisocyanate (TDI and Polypropylene 2000 2000), and the variation biomass added the Hybrid - polyurethane was done tensile indentation deflection airflow . properties measurements that highest strength obtained ethane (PU) - lignin meanwhile highest hardness was PU - cel foam.

Airflow test that – cellulose has more cell PU - lignin PU - starchThe of was investigated using emission electron (FE - SEM). SEM that starch has a pore than biomass . The morphology hybrid biomass based polyurethane foam were closed with particle stick onto twall. INTRODUCTION Polymer is y in human in automotive to Id [1] . Every n atur and polymer has rapid in industrial .

Extensive and low costs triggered research in material , of them is po (PU) which is generally into on furnitur [2] . U is as multifunction material it unique including tness, toughnhigh high resistance, to processing, relatively nsive. makes PU not ly as am, also be app Advances in fields chemistryandtechnomake use increasingly commercial [3 – 5] .

industryinterest PU foam conto because can used a produ [6] . The basic ingredients for making polyo two stages making lyurethane, the ofdiisocyanate polyol r eacted a extender [2] . important poby PU foam having cavity an cell is interconnected. structurplays imporrole contromechanical thermal erties [7] . - filled es PU foam and isolator .

elastic can mo dified become so it be as car Headliners mounin ceilingin car the ofdecoration, e insulation, , and passeng. Polyol used synthesizing PU foam usually tained a or lyester group which a of leum P olyether pols ha ve a hydroxy l number (OH so it used synthesize ethane foam, popolyols a er OH number that foam produwill morrigid [7] [8] . hydroxyl can be from al groups commonly biomass.

level sales car t separated t he factorTo a headliner, the of PU fofrom to can donbyadding material to PU foThis b iomass be obtained nature with a cheap in is material that is easily degraded into a material that is mor nv [9] Starch, in , and are with al lymer that rich hydroxygroups, can be as ls the posynthesis [10] . research biomass been e by people, related biomass the properties still further In study, the biomass to PU foto its properties.

study cuses the of types the ing mechanical of lyurethane - foand compatibil ity by studying of PU foThe biomass e increase number crosslinkformed that can increase mechanical properties. EXPERIMENTAL Material s Polyol polypropy(PPG) 2000 from DOW Indonesia, (TDI) 80 CosmonT - 80 Mitsui and SKC Inc., lene (MC) with pur from Samsung Fine Chemical Co. ., NIAX amine c atalyst A - 230 from Momentive Performance Materials, NIAX Silicone urfactant from OSI Singe Ltd.

, tin KOSMOS from Evonik AG , and K raft lignin, Prep aration of PU f oam As as ml PPG 2000, 354.80 of TDI 80 , 36 of MC a solvent, then 25.68 of water and 0.6 amine as agent ,

9.9 silic and 1.8 of tin as are added. independent variables in study three es biomass in form f starch, and cellulose powder as much as 21 grams. Material Characterization Tensile to mechanical of ultimate tensile (UTS) elon gation, t hermal testingto changes the e adation e biomass .

observations confirmed chemical sition are l determine compatibility polyurethane am and biomass . After that, density testinge which has a relationess. Field Emission Electron (FE - SEM) ctionto the and of by looking morphological The l was FEI F50 a ificationof - 5000x the for Processing Failu re (CMPFA), as Indonesia. Sample is done dipthe into id so it brthen sample broken.

sample broken in britions so there is no mechanical inf actur Density t ensile ere carried by InoPolytechno Density carried based the K Then , U niversal (UTM) The AI - 7000S aws dogbone samples fracturwith constant ($500 \pm$ per te room Inaddition, i nd l oad d eflexion (was carried ouILD a hard ness measurement of foam is ed by the of essure to a inch foup to thick a squinch In addition pressing to thick am is ILD carried t to thick called ILD65.

The resistance in study differential ing (DSC) and t hermogra nalysis (TGA). RESULT Morphology h ybrid bio - polyurethane foam FIGURE 1 . - v irgin, - lignin, (c - starc - c ellulose with The of - SEM carri ed t facilitate servand clusions terms morphology. Morphological can seen Fig.1 . Observof morphological found Fig.1

uses 25 0x magnification, shows the es med in form pore structures, is accordance the results research by et (1998) [11] which lains by starch pof foam , the strue result an en . Henceforth, is to the of starch centr at ion on pore size of papa polyurethane foam. On and r cellulose con por has studby S az - o rosco [12] that increasing of decrease diameter and increase cell density.

Density and Mechanical Properties of h ybrid bio - polyurethane foam From result t ensile s trengas Fig. 2 a, PU - v irgin 0 . 06 That the number the PU. being treatment the of addition , got number MPa. T here an of 0 .02 which it a result . Wh ile PU the of tarch, number MPa is obwhich that is 0.0 1 of - v irgin . can concl uded additives PU - v irg can flexibility is than . Then PU am cellulose the 0.062 T here an of Of four the results given PU - Lignin a of 0.08 MPa . A sign l ign ides the best flexibility among the others .

Figure 2 b shows a percentage diagram of PU - v irgin has 196%. That is the standard number the PU - l ignin ces of T here a increase PU - v irg . PU - s tarch, there 202%, showed 6% in PU - v irgin . the sample PU - c ellulose only 106%. pretty reductionof From results icate cellulose a density but noin of ity.

this the st were by - s tarch 202% which then foby - l ignin a of These provide positive that have elasticity than the add PU - Virgin . The o f tear shown Fig. 2 c provide ovof duof foam. PU - v irgin produa f 0.048 Mich standard for other n PU - l ignthe figuris 0.053 MPa. positive with increase 0.0 0 5 While PU - s tarch, number 0.052 An of 0.00 4 It gives poresults. the - c ellulose obtained 0.037 A of 0,0 11 from PU - v irgin which gives conclusion cellulose vides increase terms rigidity, noduThe resu lt tear is - l ignwith number 0.053MPa indthat l ign PU - v irg . FIGURE 2 .

Comparison Chart of (a) Tensile Strength , (b) Elongati , c) T ear Strength, (d) Air Flow The flow is out polyurethane that been with dimensions air blower exhaled into lyurethane m. showed much you get through foThis generally with level cell ennin The air means foam has opcell. results measurwater are shown Fig. 2 d . The ighair is by (a) (b) (c) (d) PU v rgin which not y bis equal 70 then for lowest flow PU- which 4 result icates PU-has number closed compared other samples, then this is probably related to its tear strength and elongation.

C ONCLUSION In results morphologtests, is that are particles may particles biomass that attached the cell but not attached. is by gap these particles the wall pof foam. based ethane am better properties compared polyurv irgin Curing can the t physical in form hydrogen and crosslink the of bonds. lign the UTS 0.06 and highest strength 3 PU-has highest ess elongation %, th highest hardn R EFERENCES 1. O. M.

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