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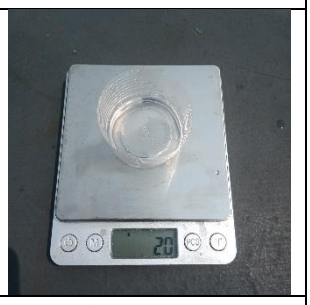
LAMPIRAN – LAMPIRAN

Lampiran 1. 1 Penimbangan Komposisi Serat



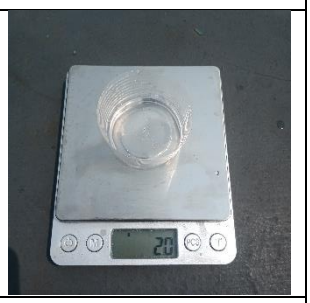
Penimbangan Komposisi 6% Serat 94% Matriks





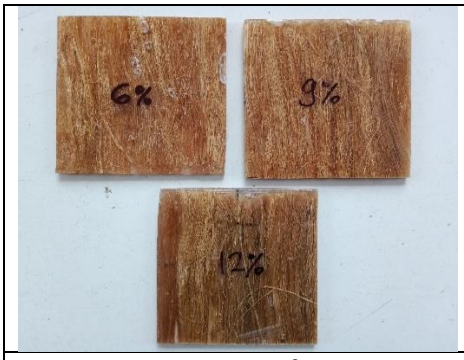
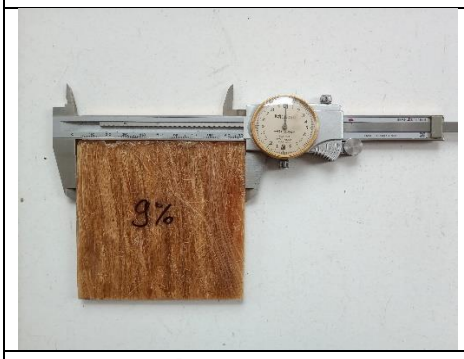
Penimbangan Komposisi 9% Serat 91% Matriks





Penimbangan Komposisi 12% Serat 88% Matriks

Lampiran 1. 2 Pengujian Sifat Fisis

	
Spesimen Uji Sifat Fisis	Penimbangan Spesimen
	
Pengukuran Spesimen	Perendaman

Lampiran 1. 3 Hasil Pengujian Densitas

Komposisi Serat : UPR (%)	Panjang (cm)	Lebar (cm)	Tebal (cm)	Volume (cm^3)	Massa (gr)	Densitas (gr/cm^3)
6 : 94	10	10	0,53	53	64,1	1,20
	10	10	0,52	52	63,2	1,21
	10	10	0,53	53	65,4	1,23
	10	10	0,53	53	64,0	1,20
Rata – rata	10	10	0,5275	52,75	64,175	1,21
9 : 91	10	10	0,52	52	62	1,19
	10	10	0,53	53	64	1,21
	10	10	0,51	51	60	1,18
	10	10	0,51	51	61,8	1,21
Rata – rata	10	10	0,5175	51,75	61,95	1,197
12 : 88	10	10	0,50	50	59,1	1,182
	10	10	0,52	52	62,7	1,205
	10	10	0,51	51	61,1	1,198
	10	10	0,50	50	59,4	1,188
Rata – rata	10	10	0,5075	50,75	60,575	1,193

Lampiran 1. 4 Hasil Pengujian Daya Serap Air

Komposisi Serat : UPR (%)	Spesimen Pengujian	Massa (gr)		Pertambahan massa (gr)	Penyerapan air (%)
		Awal	Akhir		
6 : 94	I	14,4	14,5	0,1	0,694
	II	16,0	16,1	0,1	0,625
	II	16,2	16,4	0,2	1,234
	IV	14,0	14,1	0,1	0,714
	V	15,5	15,6	0,1	0,645
	VI	15,1	15,3	0,2	1,324
	VII	14,8	14,9	0,1	0,675
	VIII	14,1	14,2	0,1	0,709
	Rata – rata	15,0375	15,1375	0,125	0,83
9 : 91	I	14,5	14,6	0,1	0,689
	II	13,5	13,8	0,3	2,222
	III	14,8	15,1	0,3	2,027
	IV	13,9	14,0	0,1	0,719
	V	15,6	15,8	0,2	1,282
	VI	15,8	16,0	0,2	1,265
	VII	15,2	15,4	0,2	1,315
	VIII	14,8	15,1	0,3	2,027
	Rata – rata	14,7625	14,975	0,2125	1,44
12 : 88	I	13,6	14,0	0,4	2,041
	II	14,5	14,7	0,2	1,379
	III	14,4	14,6	0,2	1,388
	IV	15,9	16,2	0,3	1,886
	V	14,7	15,0	0,3	2,040
	VI	14,4	14,6	0,2	1,388
	VII	15,2	15,4	0,2	1,315
	VIII	15,5	15,8	0,3	1,935
	Rata – Rata	14,775	15,0375	0,2625	1,78

Lampiran 1. 5 Hasil Pengujian Pengembangan Tebal

Komposisi Serat : UPR (%)	Spesimen Pengujian	Tebal (cm)		Pertambahan tebal (cm)	Pengembangan (%)
		Awal	Akhir		
6 : 94	I	5,6	5,672	0,072	1,28
	II	5,61	5,65	0,04	0,71
	II	5,54	5,56	0,02	0,36
	IV	5,70	5,74	0,04	0,70
	V	5,26	5,31	0,05	0,95
	VI	5,28	5,30	0,02	0,378
	VII	5,33	5,38	0,05	0,938
	VIII	5,36	5,39	0,03	0,559
	Rata – rata	5,46	5,40	0,04	0,73
9 : 91	I	5,37	5,42	0,05	0,931
	II	5,17	5,23	0,06	1,160
	III	5,28	5,36	0,08	1,151
	IV	5,22	5,25	0,03	0,574
	V	5,33	5,38	0,05	0,938
	VI	5,388	5,436	0,048	0,890
	VII	5,536	5,56	0,024	0,433
	VIII	5,024	5,072	0,048	0,955
	Rata – rata	5,29	5,34	0,05	0,94
12 : 88	I	5,07	5,14	0,07	1,38
	II	5,24	5,28	0,04	0,763
	III	5,20	5,25	0,05	0,961
	IV	5,08	5,14	0,06	1,181
	V	5,20	5,24	0,04	0,769
	VI	5,16	5,22	0,06	1,162
	VII	5,30	5,364	0,064	1,207
	VIII	5,13	5,19	0,06	1,169
	Rata – Rata	5,1725	5,228	0,055	1,06

Lampiran 1. 6 Perhitungan Nilai Densitas

Fraksi Volume (%)	Volume (mm^3)	Massa (gr)	Densitas (g/cm^3)
6 : 94	52,75	64,175	1,21
9 : 91	51,75	61,95	1,197
12 : 88	50,75	60,575	1,193

1) Variasi Fraksi Volume 6% serat + 94% matriks

Diketahui :

Massa Komposit (m) = 64,175 g
Volume (v) = 52,75 cm^3
Densitas (ρ) = $\frac{m}{v}$

$$\rho = \frac{m}{v} = \frac{64{,}175\ g}{52{,}75\ cm^3}$$

$$= 1{,}21\ g/cm^3$$

2) Variasi Fraksi Volume 9% serat + 91% matriks

Diketahui :

Massa Komposit (m) = 64,175 g
Volume (v) = 52,75 cm^3
Densitas (ρ) = $\frac{m}{v}$

$$\rho = \frac{m}{v} = \frac{61{,}95\ g}{51{,}75\ cm^3}$$

$$= 1{,}197\ g/cm^3$$

3) Variasi Fraksi Volume 12% serat + 88% matriks

Diketahui :

Massa Komposit (m) = 64,175 g
Volume (v) = 52,75 cm^3
Densitas (ρ) = $\frac{m}{v}$

$$\rho = \frac{m}{v} = \frac{60{,}575\ g}{50{,}75\ cm^3}$$

$$= 1{,}193\ g/cm^3$$

Lampiran 1. 7 Perhitungan Nilai Daya Serap Air

Berat (gr)				
Fraksi Volume (%)	B_1	B_2	ΔB	Penyerapan (%)
6 : 94	15,0375	15,1375	0,125	0,83
9 : 91	14,7625	14,975	0,2125	1,44
12 : 88	14,775	15,0375	0,2625	1,78

1) Variasi Fraksi Volume 6% serat + 94% matriks

   Diketahui :

   B_1 = 15,0375 g

   B_2 = 15,1375 g

   WA $= \frac{B_1 - B_2}{B_1}$ x 100%

   $= \frac{15{,}0375 - 15{,}1375}{15{,}0375}$ x 100%

   = 0,83%

2) Variasi Fraksi Volume 9% serat + 91% matriks

   B_1 = 14,7625 g

   B_2 = 14,975 g

   WA $= \frac{B_1 - B_2}{B_1}$ x 100%

   $= \frac{14{,}7625 - 14{,}975}{14{,}7625}$ x 100%

   = 1,44%

3) Variasi Fraksi Volume 12% serat + 88% matriks

   Diketahui :

   B_1 = 14,775 g

   B_2 = 15,0375 g

   WA $= \frac{B_1 - B_2}{B_1}$ x 100%

   $= \frac{14{,}775 - 15{,}0375}{14{,}775}$ x 100%

   = 1,78%

Lampiran 1. 8 Perhitungan Pengembangan Tebal

Tebal (mm)				
Fraksi Volume (%)	T_1	T_2	ΔT	Pengembangan (%)
6 : 94	5,46	5,50	0,04	0,73
9 : 91	5,29	5,34	0,05	0,94
12 : 88	5,1725	5,228	0,055	1,06

1) Variasi Fraksi Volume 6% serat + 94% matriks

Diketahui :

T_1 = 5,46 mm

T_2 = 5,50 mm

$P = \frac{T_1 - T_2}{T_1}$ x 100%

$= \frac{5,46 - 5,50}{5,46}$ x 100%

$= 0,73\%$

2) Variasi Fraksi Volume 9% serat + 91% matriks

T_1 = 5,29 mm

T_2 = 5,34 mm

$P = \frac{T - T_2}{T_1}$ x 100%

$= \frac{5,29 - 5,34}{5,29}$ x 100%

$= 0,94\%$

3) Variasi Fraksi Volume 12% serat + 88% matriks

Diketahui :

T_1 = 5,1725 mm

T_2 = 5,228 mm

$P = \frac{T - T_2}{T_1}$ x 100%

$= \frac{5,1725 - 5,228}{5,1725}$ x 100%

$= 1,06\%$

Lampiran 2. 1 Dokumentasi Uji Tarik

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Spesimen Uji Tarik</td><td>Uji Tarik Spesimen I</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Uji Tarik Spesimen II</td><td>Uji Tarik Spesimen III</td></tr>
</table>

Lampiran 2. 2 Spesimen Sebelum dan Setelah Uji Tarik

(a)

(b)

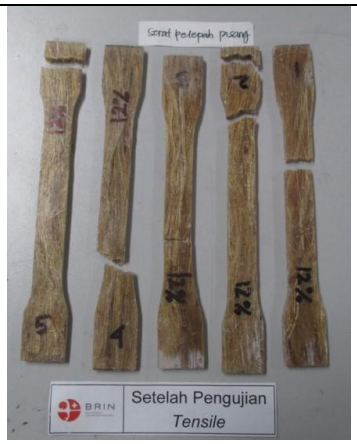
Sample Serat Pelepah Pisang 6% - Polyester 94%, Sebelum (a) dan Sesudah (b) Pengujian Tensile

(a)

(b)

Sample Serat Pelepah Pisang 9% - Polyester 91%, Sebelum (a) dan Sesudah (b) Pengujian Tensile

(a)



(b)

Sample Serat Pelepah Pisang 12% - Polyester 88%, Sebelum (a) dan Sesudah (b) Pengujian Tensile

Lampiran 2. 3 Hasil Uji Tarik Serat 6%-94% Matriks

MESSPHYSIK Laborgeräteges.m.b.H.

Test Certificate

Plastics Tensile Test

Order No.....J22050172
Sample Name.....Srt Plph Psng 6% - Plyetr 94%
Standard.....ASTM D638

Operator.....HKM/BMA
Tested on.....2022-06-02
Test Condition.....22.9 oC & 55.9 % RH

Testing machine.....AGS-G
Pretension.....0.5 MPa
Gripped length.....115 mm
Test speed 1.....0 % -> 5 mm/min

Directory.....J22050172
Parameterset.....ASTM D638

Legend

BNo.....Batch number
a.....Thickness
b.....Width

E.....E-Modulus
"M.....Tensile strength
"B.....Strain at Break

ORIGINAL

Test No	BNo	a mm	b mm	E GPa	"M MPa	"B %
1	Specimen 1	5.340	14.67	2.323	30.60	2.160
2	Specimen 2	5.380	14.30	2.689	14.17	1.762
3	Specimen 3	5.390	15.10	2.483	15.05	3.723
4	Specimen 4	5.380	15.17	2.464	12.93	1.056
7	Specimen 5	5.410	13.92	1.737	21.68	2.613
Mean:		5.380	14.63	2.339	18.89	2.263
Std.dev.:		0.025	0.531	0.361	7.373	0.997

Lampiran 2. 4 Hasil Uji Tarik 9%-91% Matriks

MESSPHYSIK Laborgeräteges.m.b.H.

Test Certificate

Plastics Tensile Test

Order No.....J22050172
Sample Name.....Srt Plph Psng 9% - Plyetr 91%
Standard.....ASTM D638

Operator.....HKM/BMA
Tested on.....2022-06-02
Test Condition.....22.9 oC & 55.9 % RH

Testing machine.....AGS-G
Pretension.....0.5 MPa
Gripped length.....115 mm
Test speed 1.....0 % -> 5 mm/min

Directory.....J22050172
Parameterset.....ASTM D638

Legend

BNo.....Batch number
a.....Thickness
b.....Width

E.....E-Modulus
"M.....Tensile strength
"B.....Strain at Break

ORIGINAL

Test No	BNo	a mm	b mm	E GPa	"M MPa	"B %
9	Specimen 1	5.070	14.55	2.242	17.96	1.777
10	Specimen 2	5.160	14.29	3.204	15.16	1.620
11	Specimen 3	5.080	13.82	2.974	15.85	1.337
12	Specimen 4	5.050	14.25	3.268	16.43	3.469
15	Specimen 5	5.080	14.31	2.568	14.72	1.506
Mean:		5.088	14.24	2.851	16.02	1.942
Std.dev.:		0.042	0.265	0.437	1.264	0.869

Lampiran 2. 5 Hasil Uji Tarik Serat 12%-88% Matriks

MESSPHYSIK Laborgeräteges.m.b.H.

Test Certificate

Plastics Tensile Test

Order No.....J22050172
Sample Name.....Srt Plph Psng 12% - Plyetr 88%
Standard.....ASTM D638

Operator.....HKM/BMA
Tested on.....2022-06-02
Test Condition.....22.9 oC & 55.9 % RH

Testing machine.....AGS-G
Pretension.....0.5 MPa
Gripped length.....115 mm
Test speed 1.....0 % -> 5 mm/min

Directory.....J22050172
Parameterset.....ASTM D638

Legend

BNo.....Batch number
a.....Thickness
b.....Width

E.....E-Modulus
σM.....Tensile strength
εB.....Strain at break

ORIGINAL

Test No	BNo	a mm	b mm	E GPa	σM MPa	εB %
20	Specimen 1	5.170	14.51	2.687	34.16	2.177
24	Specimen 2	5.330	14.62	2.616	38.76	1.984
25	Specimen 3	5.180	14.82	3.788	38.10	1.332
26	Specimen 4	5.270	14.86	3.001	35.21	1.452
27	Specimen 5	5.160	14.54	3.001	38.69	1.597
Mean:		5.222	14.67	3.019	36.98	1.708
Std.dev.:		0.075	0.161	0.465	2.147	0.359

Lampiran 2. 6 Perhitungan Uji Tarik Serat 6%-94% Matriks

	Width (mm)	Thickness (mm)	Sectional (mm^2)	Max Load (kgf)	Kekuatan Tarik (MPa)	Elongation (Δl) (mm)	Strain (%)	Modulus Elastisitas (GPa)
	14,30	5,380	76,934	111,160	14,17	2,0263	1,762	2,689
	15,10	5,390	81,389	125,90	15,05	4,281	3,723	2,483
	15,17	5,380	81,614	107,603	12,93	1,2144	1,056	2,464
Σ	14,85	5,383	79,979	114,887	14,08	2,507	2,180	2,545

1) Tensile Strength

Diketahui :

F = 114,887 kgf

= 1.126,6968 N

A_0 = 79,979 mm^2

$$\sigma = \frac{F}{A_0}$$

$$\sigma = \frac{1.126{,}6968\ N}{79{,}979\ mm^2}$$

$$\sigma = 14{,}08\ \frac{N}{mm^2}$$

2) Strain (Regangan)

Diketahui :

L_0 = 115 mm

ΔL = 2,507 mm

$$\varepsilon = \frac{\Delta L}{L_0} \text{ x } 100\%$$

$$\varepsilon = \frac{2{,}507\ mm}{115\ mm^2} \text{ x } 100\%$$

ε = 2,18%

3) Modulus Elastisitas (E)

Diketahui :

E = 2,545

ε_2 = 2,180% = 0,0218

σ_1 = 0,5 MPa = 0,0005 GPa

σ_2 = 14,08 MPa = 0,01408 GPa

Δσ = 0,01408 – 0,0005

Δσ = 0,01358 GPa

a) Mencari nilai Δε

$$\Delta\varepsilon = \frac{\Delta\sigma}{E}$$

$$\Delta\varepsilon = \frac{0{,}01358\ GPa}{2{,}545\ GPa}$$

Δε = 0,00533

b) Mencari Nilai E

$$E = \frac{\Delta\sigma}{\Delta\varepsilon}$$

$$E = \frac{0{,}01355\ GPa}{0{,}00533}$$

E = 2,545 GPa

Lampiran 2. 7 Perhitungan Uji Tarik Serat 9%-91% Matriks

	Width (mm)	Thickness (mm)	Sectional (mm^2)	Max Load (kgf)	Kekuatan Tarik (MPa)	Elongation (Δl) (mm)	Strain (%)	Modulus Elastisitas (GPa)
	14,55	5,070	73,7685	135,095	17,96	2,0435	1,777	2,242
	13,82	5,080	70,2056	113,465	15,85	1,5375	1,337	2,974
	14,31	5,080	72,6948	109,113	14,72	1,7319	1,506	2,568
Σ	14,226	5,076	72,223	119,224	16,18	1,771	1,54	2,595

1) Tensile Strength
Diketahui :
F = 119,224 kgf
= 1.169,23 N
A_0 = 72,223 mm^2

$$\sigma = \frac{F}{A_0}$$

$$\sigma = \frac{1.169{,}23\ \text{N}}{72{,}223\ mm^2}$$

$$\sigma = 16{,}18\ \frac{N}{mm^2}$$

2) Strain (Regangan)
Diketahui :
L_0 = 115 mm
ΔL = 1,771 mm

$$\varepsilon = \frac{\Delta L}{L_0} \text{ x } 100\%$$

$$\varepsilon = \frac{1{,}771\ mm}{115\ mm^2} \text{ x } 100\%$$

$$\varepsilon = 1{,}54\%$$

3) Modulus Elastisitas (E)
Diketahui :
E = 2,595
ε_2 = 1,54% = 0,0154
σ_1 = 0,5 MPa = 0,0005 GPa
σ_2 = 16,18 MPa = 0,01618 GPa
Δσ = 0,01618 – 0,0005
Δσ = 0,01568 GPa

a) Mencari nilai Δε

$$\Delta\varepsilon = \frac{\Delta\sigma}{E}$$

$$\Delta\varepsilon = \frac{0{,}01568\ GPa}{2{,}595\ GPa}$$

$$\Delta\varepsilon = 0{,}006042$$

b) Mencari Nilai E

$$E = \frac{\Delta\sigma}{\Delta\varepsilon}$$

$$E = \frac{0{,}01568\ GPa}{0{,}006042}$$

E = 2,595 GPa

Lampiran 2. 8 Perhitungan Uji Tarik Serat 12%-88% Matriks

	Width (mm)	Thickness (mm)	Sectional (mm^2)	Max Load (kgf)	Kekuatan Tarik (MPa)	Elongation (Δl) (mm)	Strain (%)	Modulus Elastisitas (GPa)
	14,82	5,180	76,7676	298,24	38,10	1,5318	1,332	3,788
	14,86	5,270	78,3122	281,163	35,21	1,6698	1,452	3,001
	14,58	5,160	75,2328	295,989	38,69	1,836	1,597	3,001
Σ	14,753	5,203	76,76	291,797	37,28	1,679	1,40	3,263

4) Tensile Strength
Diketahui :
F = 291,797 kgf
= 2.861,656 N
A_0 = 76,76 mm^2

$$\sigma = \frac{F}{A_0}$$

$$\sigma = \frac{2.861{,}663\ \text{N}}{76{,}76\ mm^2}$$

$$\sigma = 37{,}28\ \frac{N}{mm^2}$$

5) Strain (Regangan)
Diketahui :
L_0 = 115 mm
ΔL = 1,599 mm

$$\varepsilon = \frac{\Delta L}{L_0} \text{ x } 100\%$$

$$\varepsilon = \frac{1{,}679\ mm}{115\ mm^2} \text{ x } 100\%$$

$$\varepsilon = 1{,}46\ \%$$

6) Modulus Elastisitas (E)
Diketahui :
E = 3,263 GPa
ε_2 = 1,46% = 0,0146
σ_1 = 0,5 MPa = 0,0005 GPa
σ_2 = 37,28 MPa = 0,03728 GPa
Δσ = 0,03728 – 0,0005
Δσ = 0,03678 GPa

c) Mencari nilai Δε

$$\Delta\varepsilon = \frac{\Delta\sigma}{E}$$

$$\Delta\varepsilon = \frac{0{,}03678\ GPa}{3{,}263\ GPa}$$

$$\Delta\varepsilon = 0{,}01127$$

d) Mencari Nilai E

$$E = \frac{\Delta\sigma}{\Delta\varepsilon}$$

$$E = \frac{0{,}03678\ GPa}{0{,}01127}$$

E = 3,263 GPa