LAMPIRAN

1. Dekomposisi Kain:

Kain tenun *Polyester* (gloria)

Jenis Anyaman = *Keeper* 2/2

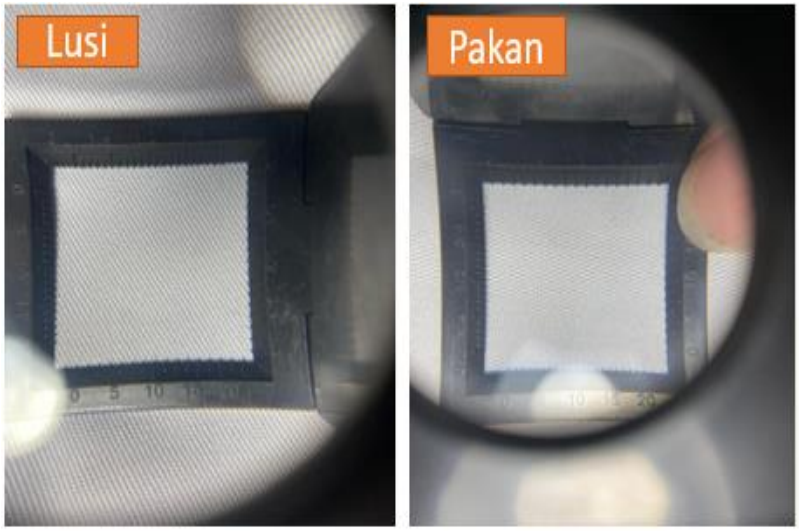
Berat Kain *Polyester* = 2100,76 *mg* = 2,1 *gram*

Lampiran 1 kain 10 x 10 *cm* dan berat kain 10 x 10 *cm*

Berat 10 helai lusi = 31,95 *mg* = 0,03195 *gram*

Berat 10 helai pakan = 30,42 *mg* = 0,03042 *gram*

Lampiran 2 Berat benang 10 helai lusi dan 10 helai pakan



Lampiran 3 Tetal Lusi dan Pakan

Lampiran 4 Tabel tetal Lusi dan Pakan

No	Tetal (helai / *inch*)	
	Lusi	Pakan
1	112	55
2	113	54
3	114	56
x	339	165
$\bar{x}$	113	55

Lampiran 5 Tabel panjang benang Lusi dan Pakan

No	Panjang Benang (*cm*)	
	Lusi	Pakan
1	10,8	10,5
2	10,8	10,7
3	10,7	10,6
4	10,8	10,5
5	10,8	10,8
6	10,8	10,7
7	10,8	10,6
8	10,8	10,7
9	10,8	10,6
10	10,7	10,7
x	107,8	106,4
$\bar{x}$	10,78	10,64

a. Perhitungan Benang Lusi

Tetal lusi = $113\,\frac{hl}{inch} = \frac{113}{2{,}54} = 44{,}48\,\frac{hl}{cm}$

Jumlah panjang 10 hl benang = $107{,}8\ cm = \frac{107{,}8}{100} = 1{,}078\ m$

Berat benang 10 hl = $0{,}03195\ Gram$

Panjang rata-rata 10 hl benang = $10{,}78\ cm$

Mengkeret= $\frac{\bar{X}\text{ Panjang 10 benang} - \text{panjang kain}}{\bar{X}\text{ panjang 10 benang}}\ \text{X}\ 100\ \% = \frac{10{,}78 - 10}{10{,}78}\ \text{X}\ 100 = 7{,}23\ \%$

Nm = $\frac{panjang\ (m)}{berat\ (g)} = \frac{1{,}078}{0{,}03195} = 33{,}74$

Ne_1 = 0,59 x N_m = 0,59 x 33,74 = 19,9

Tex = $\frac{1000}{NM} = \frac{1000}{33{,}74} = 29{,}63$

Td = $\frac{9000}{Nm} = \frac{9000}{33{,}74} = 266{,}74$

b. Perhitungan Benang Pakan

Tetal pakan = $55\frac{hl}{inch} = \frac{55}{2{,}54} = 21{,}65\frac{hl}{cm}$

Jumlah Panjang 10 hl benang = 106,4 cm = 1, 064 *m*

Berat Benang 10 hl = 0,03042 *g*

Panjang rata-rata 10 hl benang = 10,64 cm

Mengkeret = $\frac{\bar{X}\text{ Panjang 10 benang} - \text{panjang kain}}{\bar{X}\text{ panjang 10 benang}}\ \text{X}\ 100\ \% = \frac{10{,}64 - 10}{10{,}64}\ \text{X}\ 100 = 6{,}015\ \%$

Nm = $\frac{\text{panjang (m)}}{\text{berat (g)}} = \frac{1{,}064}{0{,}03042} = 34{,}97$

Ne_1 = 0,59 x N_m = 0,59 x 34,97 = 20,63

Tex = $\frac{1000}{NM} = \frac{1000}{34{,}97} = 28{,}59$

Td = $\frac{9000}{\text{Nm}} = \frac{9000}{34{,}97} = 257{,}36$

c. Berat Kain Contoh

Berat per m^2 penimbangan = $\frac{100\text{ cm x }100\text{ cm}}{\text{ukuran kain uji x }(10\text{ x }10)\text{ cm}}$ x berat kain uji (g)

= $\frac{100\ \text{x}\ 100}{10\ \text{x}\ 10}$ x 2,1 g = 210 g/m^2

Berat per m^2 kain 3D penimbangan = $\frac{100\text{ cm x }100\text{ cm}}{\text{ukuran kain uji x }(10\text{ x }10)\text{ cm}}$ x berat kain uji (g)

= $\frac{100\ \text{x}\ 100}{10\ \text{x}\ 10}$ x 7,6988 g = 769,88 g/m^2

Gramasi = Berat kain 3d berlubang x 4 = 7,6988 x 4 = 30,795 g/40cm^2

Berat per m^2 perhitungan :

Berat lusi per m^2 = $\frac{\text{tetal lusi (cm) x 100 (cm) x 100 (cm)}}{\text{Nm x 100 cm/m}}$ x $\frac{100}{(100-ML)}$

= $\frac{44{,}488\ x\ 100\ x\ 100}{33{,}77\ x\ 100}$ x $\frac{100}{(100-7{,}2)}$

= *142 g/m^2*

Berat pakan per m^2 = $\frac{\text{tetal lusi (cm) x 100 (cm) x 100 (cm)}}{\text{Nm x 100 cm/m}}$ x $\frac{100}{(100-ML)}$

= $\frac{21{,}65 \text{ x } 100 \text{ x } 100}{34{,}97 \text{ x } 100}$ x $\frac{100}{(100-6{,}015)}$

= *65 g/m^2*

Berat per m^2 penimbangan = B. lusi per m^2 + B. pakan per m^2

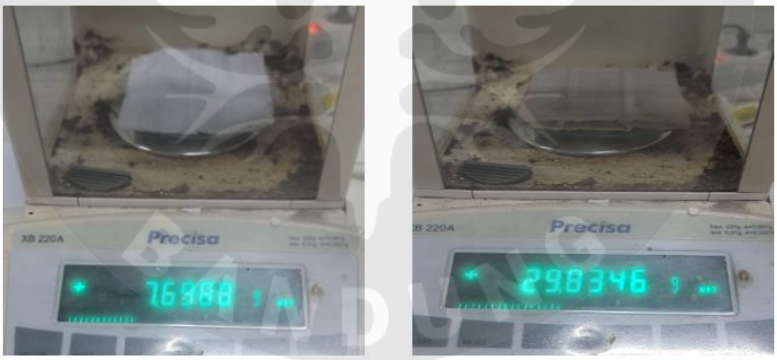
= 142 + 65 = 207 *g/m^2*

d. Selisih berat

Selisih Berat kain tenun = $\frac{\text{Berat besar} - \text{berat kecil}}{\text{Berat Besar}}$ x $100 = \frac{210-207}{210}$ x 100 % = 0,95 %

Selisih Berat kain tenun 3D = $\frac{\text{Berat besar} - \text{berat kecil}}{\text{Berat Besar}}$ x $100 = \frac{769{,}88-207}{769{,}88}$ x 100 % = 73,11 %

2. Fraksi Weight



Berat Kain Berat Komposit

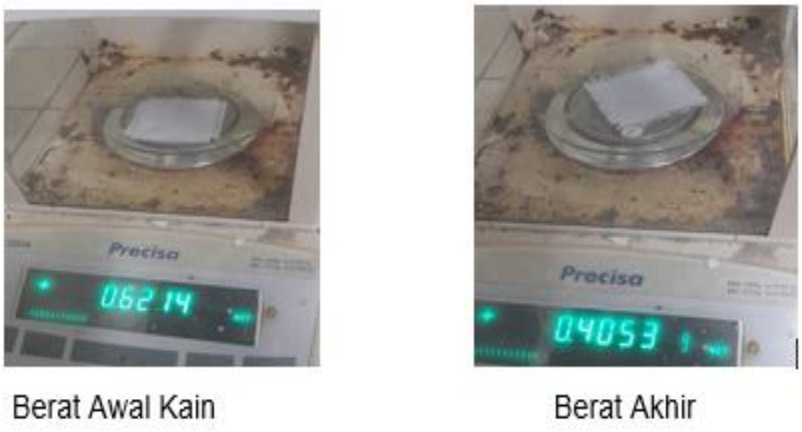
Lampiran 6 Berat Kain dan Berat Komposit

= $\frac{B_{komposit} - B_{kain}}{B_{komposit}}$ x 100%

= $\frac{29{,}834-7{,}698}{29{,}834}$ x 100%

= 74,19 %

3. Komposisi Pelarutan *Rayon*



Berat Awal Kain Berat Akhir

Lampiran 7 Berat Awal dan Berat Akhir Pelarutan Serat *Rayon*

$= \frac{B_0 - B_1}{B_0}$ x 100%

$= \frac{0{,}6214 - 0{,}4053}{0{,}6214}$ x 100%

= 34,77 % *Rayon* = 65,23 % *Polyester*

4. Hasil pengujian ketebalan kain

Lampiran 8 Gambar pengujian ketebalan kain

Lampiran 9 tabel data pegujian ketebalan kain

No	1	2	3	4	5	x	$\bar{x}$
Tebal Kain (*mm*)	0,43	0,44	0,44	0,42	0,44	2,17	0,434

5. Hasil pengujian dan perhitungan kekuatan tarik kain

a) Hasil pengujian dan perhitungan tarik kain arah *horizontal*

Lampiran 10 Tabel hasil pengujian tarik arah *horizontal*

Sampel *Horizontal* Kain	*Max Force (N)*	*Max Elongation (%)*
1	2083.26	70.20
2	2020.94	81.00
3	2514.10	84.00
$\bar{x}$	2206,1	78,4

Hasil perhitungan tarik arah *horizontal* diketahui:

Lebar = 9 *cm* = 90 *mm*

Tebal kain = 0,434 *mm*

Maka luas penampang = 90 x 0,434 x 2

= 78,12 mm^2

Kekuatan tarik $\sigma = \frac{F(N)}{A(mm^2)} = \frac{2206.1}{78,12} = 28,23\ Mpa$

Berikut gambar hasil uji tarik kain *horizontal* :

Lampiran 11 Gambar robekan tarik kain *horizontal*

b) Hasil pengujian dan perhitungan tarik kain arah *vertical*

Lampiran 12 tabel hasil pengujian tarik kain arah *vertical*

Sampel *vertical* Kain	*Max Force (N)*	*Max Elongation (%)*
1	2208.83	93.00
2	2357.62	101.00
3	2147.50	97.00
$\bar{x}$	2237.98	97

Hasil perhitungan tarik arah *vertical* diketahui:

Luas penampang *vertical* = lebar x tebal x 2

Diketahui:

Lebar = 4 *cm* = 40 *mm*

Tebal kain = 0,434 *mm*

Maka luas penampang = 40 x 0,434 x 2

= 34,72 mm^2

Kekuatan tarik σ = $\frac{F(N)}{A(mm^2)} = \frac{2237.98}{34,72} = 64,457\ Mpa$

Berikut gambar hasil uji tarik kain *Vertical* :

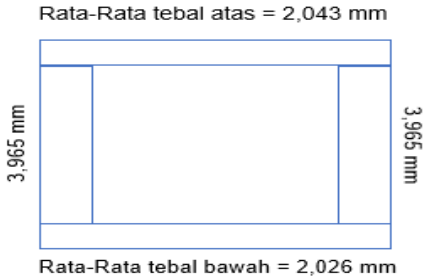
Lampiran 13 Gambar robekan tarik kain *Vertical*

6. *Modulus Elastis Tensile*

a) Tarik *Horizontal* Komposit

Lampiran 14 tabel hasil pengujian tarik komposit *horizontal*

Sampel *Horizontal*	*Max Force (N)*	*Max Elongation (%)*
1	2382.71	19.33
2	2501.54	24.67
3	2173.59	16
$\bar{x}$	2352.61	20



Lampiran 15 Gambar rata-rata ketebalan komposit 3D

Luas penampang *horizontal* = lebar x tebal x 2

Diketahui:

Lebar = 9 cm = 90 *mm*

Rata-rata tebal tengah = 3,965 *mm*

Maka luas penampang = 90 x 3,965 x 2

= 713,7 mm^2

$$Stress = \frac{Max\ Force\ (N)}{Luas\ Penampang\ (mm)} = \frac{2353{,}61}{713{,}7} = 3{,}29\ Mpa$$

$$Strain = \frac{\Delta L\ (\text{pertambahan panjang})}{L0\ (sampel\ length)} = \frac{9}{45} = 0{,}2$$

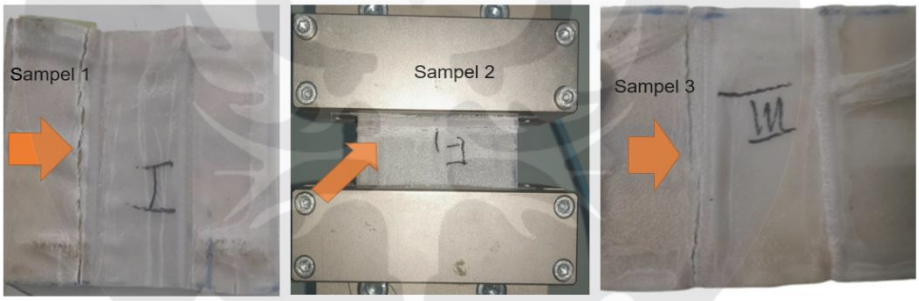
ΔL = *Sampel Length (mm) x Max elongation (%)*

= 45 x 20 = 9 %

$$Elastic\ modulus = \frac{stress}{strain}$$

$$= \frac{3{,}29}{0{,}2} = 16{,}45\ Mpa$$

Berikut gambar hasil uji tarik komposit *Horizontal* :



Lampiran 16 Gambar robekan tarik komposit *Horizontal*

b) Tarik *Vertical* Komposit

Lampiran 17 tabel hasil pengujian tarik komposit *vertical*

Sampel *Vertical*	*Max Force (N)*	*Max Elongation (%)*
1	4594.95	42.97
2	4592.08	41.62
3	4593.04	35.68
$\bar{x}$	4593,35	40,09

Diketahui luas penampang *vertical* sebagai berikut:

Lebar = 4 *cm* = 40 *mm*

Tinggi = 1 *cm* = 10 *mm*

Luas penampang *vertical* = lebar x tebal = A + B

Tebal atas bawah = 2,043 *mm*+ 2,026 *mm* = 4,069 *mm*

Tebal kanan dan kiri = 3,965 *mm* x 2 = 7,93 *mm*

A (atas dan bawah) = 40 *mm* x 4,069 *mm* = 162,76 mm^2

B (kanan dan kiri) = 10 *mm* x 7,93 = 79,3 mm^2

Luas Penampang = A + B = 162,76 + 79,3 = 242,06 (mm^2)

$$Stress = \frac{Max\ Force\ (N)}{Luas\ Penampang\ (mm)} = \frac{4593,35}{242,06} = 18,97\ Mpa$$

$$Strain = \frac{\Delta L}{L0} = \frac{18,405}{45} = 0,409$$

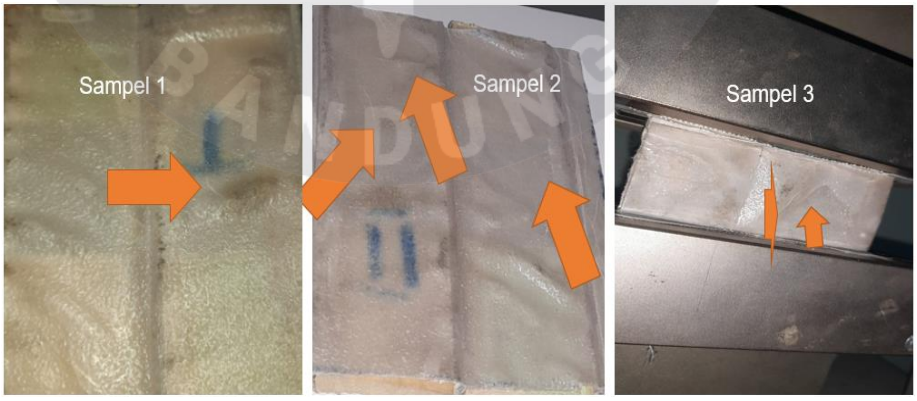
ΔL = *Sampel Length (mm) x Max elongation (%)*

= 45 x 40,09 = 18,405 %

$$Elastic\ modulus = \frac{stress}{strain}$$

$$= \frac{18,97}{0,409} = 46,38\ Mpa$$

Berikut gambar hasil uji tarik komposit *Vertical* :



Lampiran 18 Gambar retakan tarik komposit *Vertical*

7. *Modulus Elastis Compress*

a) Tekan *Horizontal*

Lampiran 19 tabel hasil pengujian tekan *horizontal*

Crack	*Max force (N)*	*Displacement (mm)*	*Compress strain (%)*	*Compress displacement (mm)*
1	128,6096	0,8616	8,3651	0,8616
2	172,0536	2,0435	19,840	2,0435

Crack 1

Stress = $\frac{Max\ Force\ (N)}{Luas\ Penampang\ (mm)} = \frac{128{,}6096}{100} = 1{,}286$ *N/mm² / Mpa*

Strain = $\frac{\Delta L\ (\text{Max Compressed Displaceent})}{L0\ (Original\ Length)} = \frac{0{,}8616\ mm}{10\ mm} = 0{,}0862$ mm²

Elastic modulus = $\frac{stress}{strain}$

$= \frac{1{,}286}{0{,}0862} = 14{,}91\ Mpa$

Crack 2

Stress = $\frac{Max\ Force\ (N)}{Luas\ Penampang\ (mm)} = \frac{172{,}0536}{100} = 1{,}720\ Mpa$

Strain = $\frac{\Delta L}{L0} = \frac{2{,}0435}{10} = 0{,}2043$

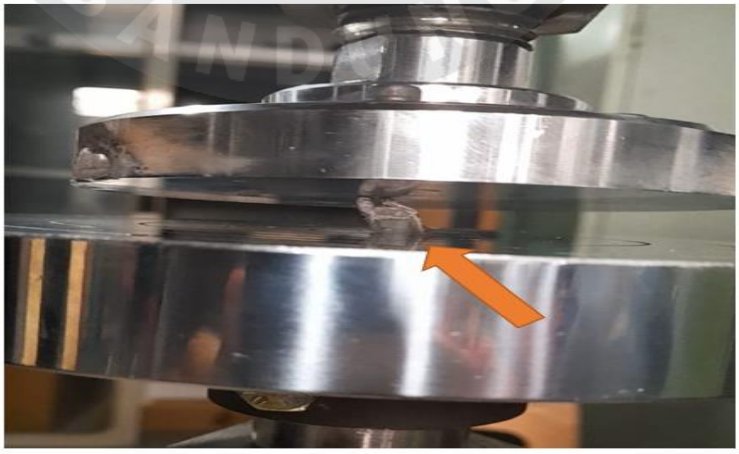
Elastic modulus = $\frac{stress}{strain}$

$= \frac{1{,}720}{0{,}2043} = 8{,}41\ Mpa$

Lampiran 20 tabel kesimpulan perhitungan kekuatan tekan *horizontal*

Crack	*Horizontal*						
	Max Compres (N)	*Luas Penampang (mm²)*	*Stress*	*Compressed Displacement Max* $\Delta\mathbf{L}$ *(mm)*	*Original Length (Lo)*	*Strain*	*Compres Modulus (Mpa)*
1	128,6096	100	1,286	0,8616	10	0,0862	14,91
2	172,0536	100	1,720	2,0435	10	0,2043	8,41

Berikut gambar hasil uji tekan komposit *Horizontal* :



Sample Horizontal

Lampiran 21 Gambar patahan uji tekan *Horizontal*

b) Tekan *Vertical*

Lampiran 22 tabel hasil pengujian tekan *vertical*

Crack	*Max force (N)*	*Displacement (mm)*	*Compress strain (%)*	*Compress displacement (mm)*
1	270,1165 N	1,0999	9,9987	1,0999
2	142,7243	3.4292	31.1743	3,4292

Crack 1

Stress $= \frac{Max\ Force\ (N)}{Luas\ Penampang\ (mm)} = \frac{270{,}116}{100} = 2{,}701\ Mpa$

Strain $= \frac{\Delta L}{L0} = \frac{1{,}099}{10} = 0{,}1099$

Elastic modulus $= \frac{stress}{strain}$

$= \frac{2{,}701}{0{,}1099} = 24{,}57\ Mpa$

Crack 2

Stress $= \frac{Max\ Force\ (N)}{Luas\ Penampang\ (mm)} = \frac{142{,}724}{100} = 1{,}427\ Mpa$

Strain $= \frac{\Delta L}{L0} = \frac{3{,}429}{10} = 0{,}3429$

Elastic modulus $= \frac{stress}{strain}$

$= \frac{1{,}427}{0{,}3429} = 4{,}58\ Mpa$

Lampiran 23 tabel kesimpulan perhitungan kekuatan tekan *vertical*

Crack	*Vertical*						
	Max Compres (N)	*Luas Penampang (mm2)*	*Stress*	*Compressed Length (mm)*	*Original Length*	*Strain*	*Compres Modulus*
1	270,116	100	2,701	1,099	10	0,1099	24,57 *Mpa*
2	142,724	100	1,427	3,429	10	0,3429	4.58 *Mpa*

Berikut gambar hasil uji tekan komposit *Vertical* :

Sample Vertical

Lampiran 24 Gambar patahan uji tekan *Vertical*

8. *Modulus Elastis Bending*

Lampiran 25 tabel hasil pengujian tekuk

Dimension			*Support span*	*Max Force*	*Deflection Max Force*
L	W	H			
220 *mm*	10 *mm*	7 *mm*	160 *mm*	47,55 *N*	11,20 *mm*

$Stress = \frac{3\ x\ (47{,}55\ N\ x\ 160\ mm)}{2\ x\ (10\ mm\ x\ 7^2 mm)} = \frac{3\ x\ 47{,}55\ x\ 160}{2\ x\ 490} = \frac{22.824}{980}$ = 23,289 *Mpa*

$strain = \frac{6.D.h}{L^2} = \frac{6\ x\ 11{,}20\ x\ 10}{160^2}$

$= \frac{672}{25.600} = 0{,}02625\ mm^2$

Elastic modulus $= \frac{stress}{strain}$

$= \frac{23{,}289}{0{,}02625} = 887{,}2\ Mpa$

Lampiran 26 tabel hasil perhitungan kekuatan tekuk

Sampel	*Stress*	*Strain*	*Elastis Modulus (Mpa)*
1	23,289	0,02625	887,2

Berikut gambar hasil uji tekuk / *Flexural* komposit *Vertical* :

Sample Uji Tekuk ukuran panjang 22 cm lebar 1 cm

Lampiran 27 Gambar Kelenturan uji tekuk *Vertical*