LAMPIRAN

Hasil Pengujian Tarik

Data uji tarik komposit resin poliester berpenguat anyaman rami orientasi arah serat 0^0 dan 45^0

Zwick / Roell

15.01.22

Test report

Customer	: PT. Krakatau Posco	Specimen type	: Flat
Test standard	: ASTM D 638	Tester	: AGUS WAHYUDIN
Material	: JS-SM6=570	Machine data	: Tensile 600 kN

Pre-load	: 2	MPa	Speed in the yield range	: 0.00025	1/s
Speed, E-Modulus	: 20	MPa/s	Test speed	: 0.007	1/s
Speed, yield point	: 11.5	MPa/s			

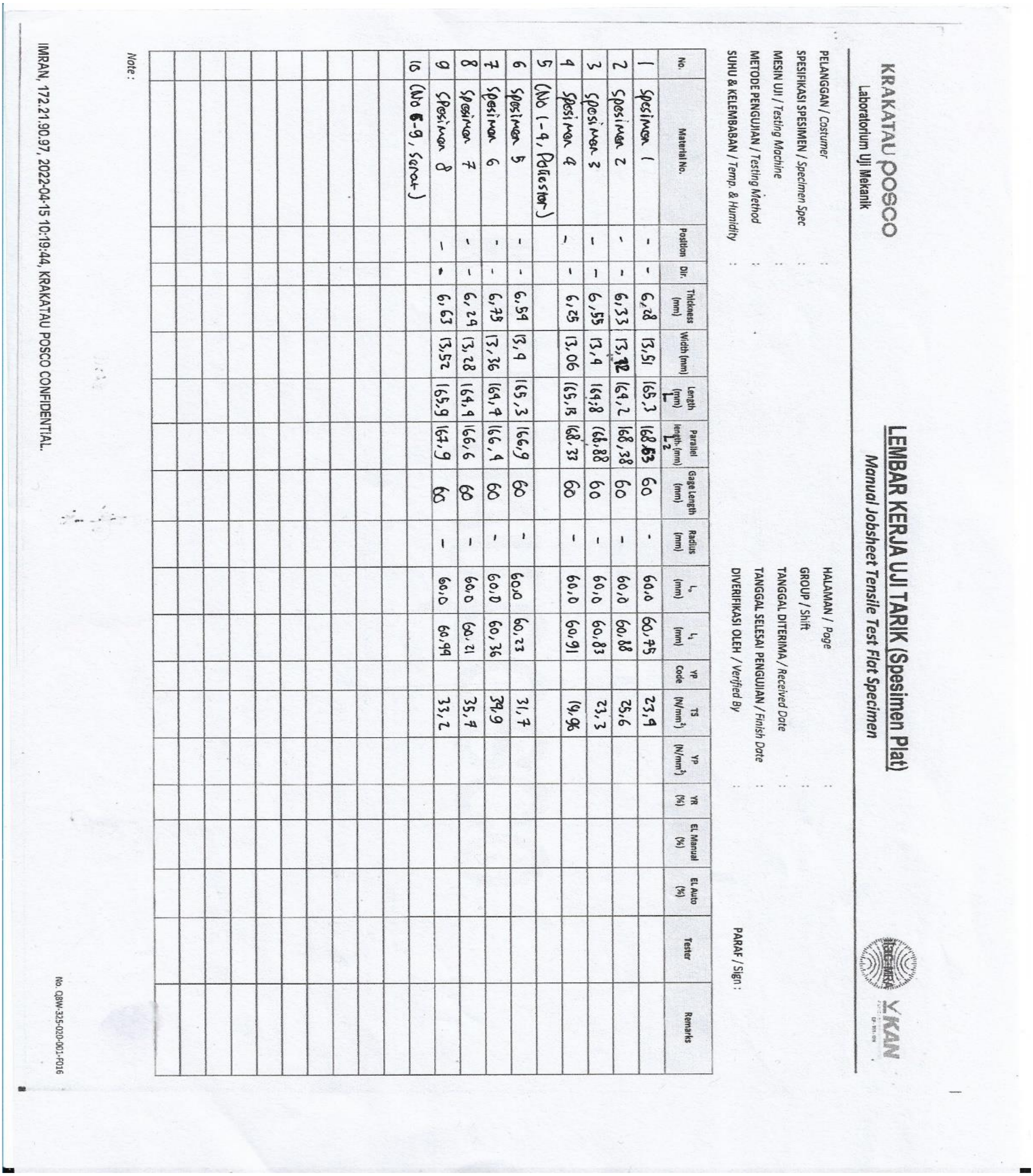
Test results:

No.	Material Number	Test Code	Specimen Code	Thickness mm	Width mm	Young Modulus N/mm²	Upper Yield N/mm²	Lower Yield N/mm²	Yield 0.2% N/mm²
11	SAMPLE E			6.7200	13.170	1017.430	9.23	-	-
12	SAMPLE F			6.8000	12.920	2715.736	16.9	-	-
13	SAMPLE G			6.9400	12.810	1797.530	8.6	-	-
14	SAMPLE H			6.7900	12.770	2825.320	14.8	-	-
15	SAMPLE A			6.7700	12.760	3550.821	33.2	-	-
16	SAMPLE B			6.9300	13.240	4683.578	37.5	36.3	-
17	SAMPLE C			6.8100	12.680	3412.706	32.1	-	-
18	SAMPLE D			6.8500	12.870	2995.074	27.1	21.6	-
19	SAMPLE 1			6.8700	12.950	1533.221	40.8	-	-
20	SAMPLE 2			6.9800	13.140	1976.504	65.7	-	-
21	SAMPLE 3			6.7500	12.700	1667.561	42.9	-	-
22	SAMPLE 4			6.8600	12.820	1882.408	55.3	54.7	-

No.	Yield 0.5% N/mm²	Yield 1% N/mm²	Yield Ratio %	TS N/mm²	Elongation %
11	5.58	3.70	100.00	9.23	0.9072
12	10.3	-	100.00	16.9	0.6223
13	-	-	86.43	9.95	0.5535
14	7.22	3.82	100.00	14.8	0.5238
15	32.1	-	95.40	34.8	0.9801
16	30.6	45.5	69.02	54.3	1.1594
17	28.7	-	100.00	32.1	0.9406
18	22.7	21.7	68.95	39.3	1.3122
19	21.3	37.3	100.00	40.8	2.6611
20	27.0	46.5	100.00	65.7	3.3241
21	24.0	39.4	94.18	45.5	2.7285
22	23.5	39.4	95.62	57.9	3.0758

Hasil Pengujian Tarik

Data uji tarik spesimen material resin poliester dan komposit resin poliester berpenguat serat rami susunan lurus kontinyu.



KRAKATAU POSCO
Laboratorium Uji Mekanik

LEMBAR KERJA UJI TARIK (Spesimen Plat)
Manual Jobsheet Tensile Test Flat Specimen

PELANGGAN / *Costumer* :
SPESIFIKASI SPESIMEN / *Specimen Spec* :
MESIN UJI / *Testing Machine* :
METODE PENGUJIAN / *Testing Method* :
SUHU & KELEMBABAN / *Temp. & Humidity* :

HALAMAN / *Page* :
GROUP / *Shift* :
TANGGAL DITERIMA / *Received Date* :
TANGGAL SELESAI PENGUJIAN / *Finish Date* :
DIVERIFIKASI OLEH / *Verified By* : PARAF / Sign :

No.	Material No.	Position	Dir.	Thickness (mm)	Width (mm)	Length (mm) L	Parallel length (mm) L2	Gage Length (mm)	Radius (mm)	L_0 (mm)	L_1 (mm)	YP Code	TS (N/mm²)	YP (N/mm²)	YR (%)	EL Manual (%)	EL Auto (%)	Tester	Remarks
1	Spesimen 1	-	-	6,28	13,51	165,3	168,63	60	-	60,0	60,75		23,9						
2	Spesimen 2	-	-	6,33	13,12	169,2	168,38	60	-	60,0	60,88		25,6						
3	Spesimen 3	-	-	6,55	13,4	169,8	168,88	60	-	60,0	60,83		23,3						
4	Spesimen 4	-	-	6,25	13,06	165,13	168,33	60	-	60,0	60,91		19,96						
5	(No 1-4, Poliester)																		
6	Spesimen 5	-	-	6,59	13,9	165,3	166,9	60	-	60,0	60,23		31,7						
7	Spesimen 6	-	-	6,75	13,36	169,7	166,4	60	-	60,0	60,36		39,9						
8	Spesimen 7	-	-	6,29	13,28	164,9	166,6	60	-	60,0	60,21		35,7						
9	Spesimen 8	-	-	6,63	13,52	165,9	167,9	60	-	60,0	60,99		33,2						
10	(No 6-9, Serat)																		

Note :

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No. QBW-325-020-001-F016

Data dimensi spesimen untuk pengujian tarik material resin poliester

Variasi Sampel	No spesimen	Lebar (mm)	Tebal (mm)	Panjang awal (mm)	Luas (mm2)
Poliester	1	13,51	6,28	165,3	84,84
	2	13,12	6,33	164,2	83,05
	3	13,4	6,55	164,8	87,77
	4	13,06	6,25	165,13	81,63

Data uji tarik spesimen material resin poliester

Test code	Kekuatan Tarik (N/mm2)	Modulus Elastisitas (Mpa)	Elongation (%)
1	23,4	1161,567	2,01
2	25,6	1005,627	2,55
3	23,3	941,137	2,48
4	19,96	1029,99	1,94
Min	19,96	941,137	1,94
Max	25,6	1161,567	2,55
Average	23,06	1034,582	2,24

Data dimensi spesimen untuk pengujian tarik komposit serat rami

Variasi Sampel	No spesimen	Lebar (mm)	Tebal (mm)	Panjang awal (mm)	Luas (mm2)
Serat Lurus	5	13,4	6,54	165,3	87,65
	6	13,36	6,75	164,7	90,18
	7	13,28	6,24	164,4	82,87
	8	13,52	6,63	165,9	89,64

Data dimensi spesimen untuk pengujian tarik komposit Arah Serat 0^0

Variasi Sudut	No spesimen	Lebar (mm)	Tebal (mm)	Panjang awal Gage (mm)	Luas (mm2)
0^0	A	12,76	6,77	58,16	86,39
	B	13,24	6,93	57,79	91,75
	C	12,68	6,81	57,41	86,35
	D	12,87	6,85	57,92	88,16

Data uji tarik orientasi 0^0 komposit resin poliester berpenguat tenun rami

Test code	Kekuatan Tarik (N/mm2)	Modulus Elastisitas (Mpa)	Elongation (%)
A	34,8	3550,821	0,98
B	54,3	4683,578	1,16
C	32,1	3412,706	0,94
D	39,3	2995,074	1,31
Min	32,1	2995,074	0,98
Max	54,3	4683,578	1,31
Average	40,125	3660,54	1,10

Data dimensi spesimen untuk pengujian tarik komposit Arah Serat 45^0

Variasi Sudut	No spesimen	Lebar (mm)	Tebal (mm)	Panjang awal (mm)	Luas (mm2)
45^0	E	13,17	6,72	57,84	88,50
	F	12,92	6,8	58,21	87,86
	G	12,81	6,94	58,13	88,90
	H	12,77	6,79	57,57	86,71

Uji Tarik Orientasi 45^0 Komposit Resin Poliester Berpenguat Tenun Rami

Test code	Kekuatan Tarik (N/mm2)	Modulus Elastisitas (Mpa)	Elongation (%)
E	9,23	1017,430	0,9072
F	16,9	2715,736	0,6223
G	9,95	1797,530	0,5535
H	14,8	2825,320	0,5238
Min	9,23	1017,43	0,5238
Max	16,9	2825,320	0,9072
Average	12,72	2089,00	0,65

Data dimensi spesimen untuk pengujian tarik komposit Arah Serat 0^0

Variasi Sudut	No spesimen	Lebar (mm)	Tebal (mm)	Panjang awal Gage (mm)	Luas (mm2)
0^0	A	12,76	6,77	58,16	86,39
	B	13,24	6,93	57,79	91,75
	C	12,68	6,81	57,41	86,35
	D	12,87	6,85	57,92	88,16

Data uji tarik orientasi 0^0 komposit resin poliester berpenguat tenun rami

Test code	Kekuatan Tarik (N/mm2)	Modulus Elastisitas (Mpa)	Elongation (%)
A	34,8	3550,821	0,98
B	54,3	4683,578	1,16
C	32,1	3412,706	0,94
D	39,3	2995,074	1,31
Min	32,1	2995,074	0,98
Max	54,3	4683,578	1,31
Average	40,125	3660,54	1,10

Data dimensi spesimen untuk pengujian tarik komposit Arah Serat 45^0

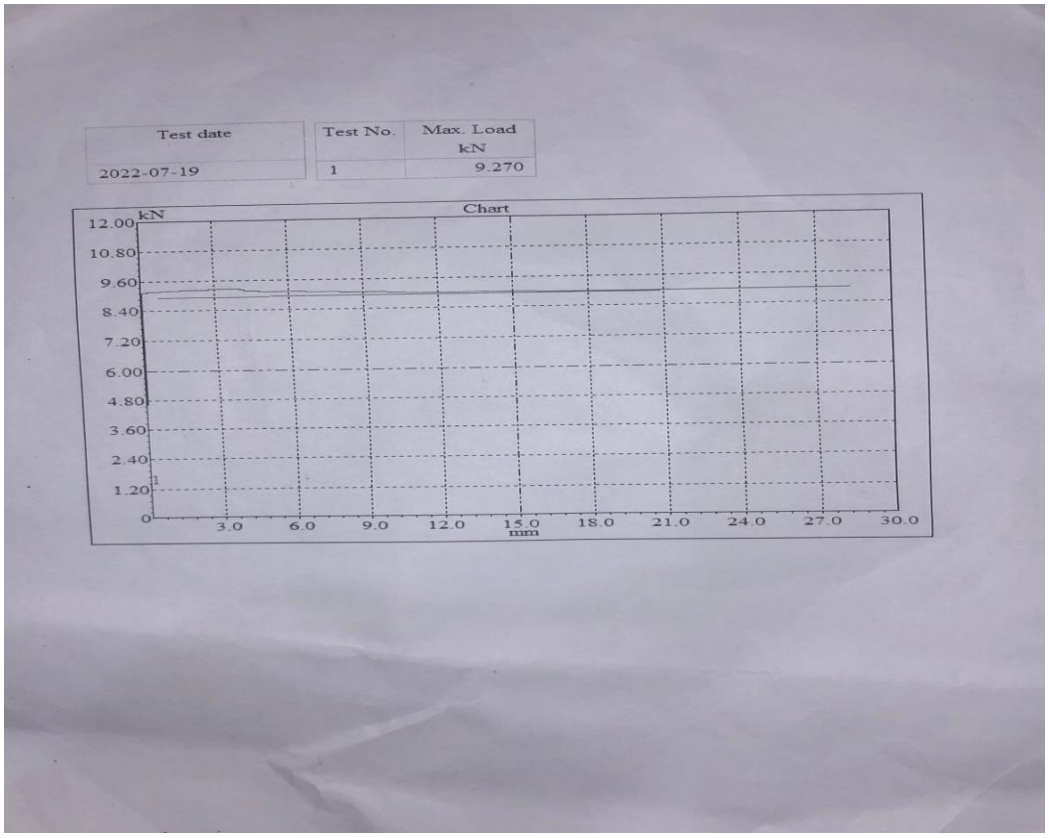
Variasi Sudut	No spesimen	Lebar (mm)	Tebal (mm)	Panjang awal (mm)	Luas (mm2)
45^0	E	13,17	6,72	57,84	88,50
	F	12,92	6,8	58,21	87,86
	G	12,81	6,94	58,13	88,90
	H	12,77	6,79	57,57	86,71

Uji Tarik Orientasi 45^0 Komposit Resin Poliester Berpenguat Tenun Rami

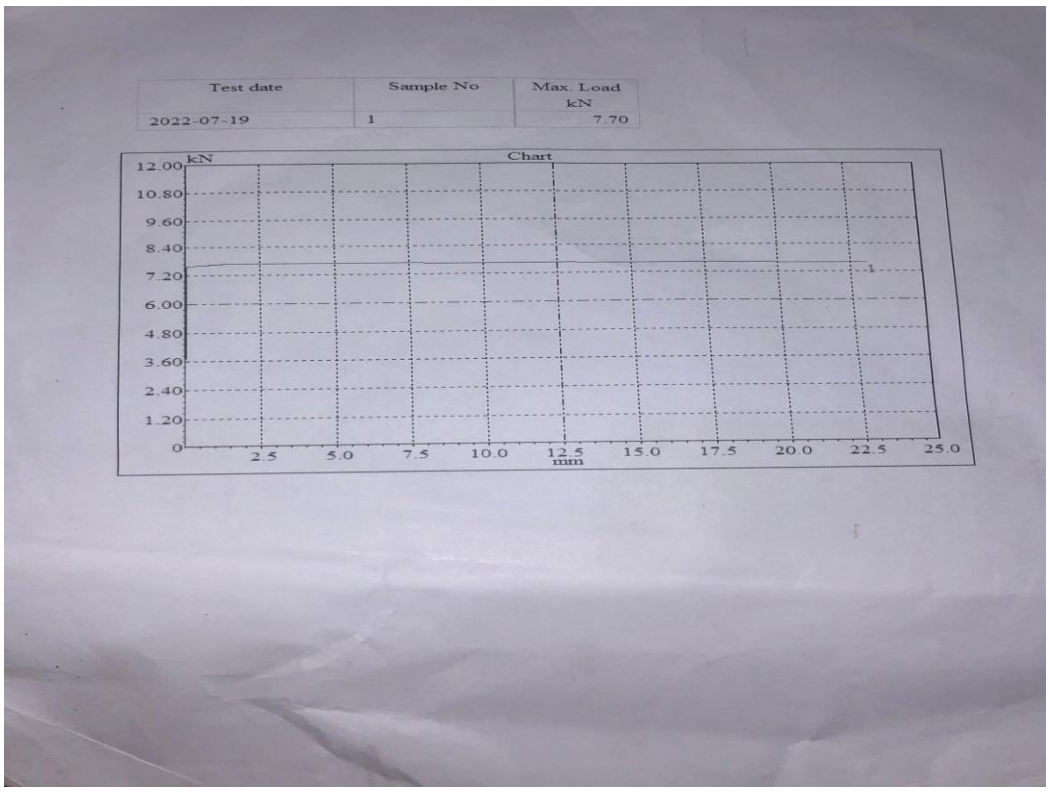
Test code	Kekuatan Tarik (N/mm2)	Modulus Elastisitas (Mpa)	Elongation (%)
E	9,23	1017,430	0,9072
F	16,9	2715,736	0,6223
G	9,95	1797,530	0,5535
H	14,8	2825,320	0,5238
Min	9,23	1017,43	0,5238
Max	16,9	2825,320	0,9072
Average	12,72	2089,00	0,65

Hasil Pengujian *Bending*

Data uji *Bending* komposit resin poliester berpenguat tenun rami orientasi arah serat 0^0 dan 45^0



Test date	Test No.	Max. Load kN
2022-07-19	1	9.270



Test date	Sample No	Max. Load kN
2022-07-19	1	7.70

Perhitungan

1. **Perhitungan fraksi volume specimen uji tarik**

1.1 Menghitung volume cetakan

Diketahui :
Panjang = 180 mm
Lebar = 180 mm
Tebal = 7 mm
Vcetakan = p x l x t
= 180 x 180 x 7
= 226800 mm3
= 226,8 cm3

1.2 Menghitung fraksi volume serat

Diketahui :
Vfraksi serat = 30%
Vcetakan = 226,8 cm3
V Serat = Vfraksi x Vcetakan
= 30% x 226,8cm3
= 68,04 cm3
Massa serat = Vserat x ρserat
= 68,04 cm3 x 1,5 gr/cm3
= 102,06 gr

1.3 Menghitung massa matrik

Diketahui :
Vfraksi matrik = 70%
Vcetakan = 226,8 cm3
V Matrik = Vfraksi x Vcetakan
= 70% x 226,8 cm3
= 158,76 cm3
Massa Matrik = Vmatrik x ρmatrik
Poliester = 158,76 cm3 x 1,3 gr/cm3
= 206,388 gr

1.4 Menghitung berat penyusun komposit polyester

Diketahui :
Massa serat = 102,06 gr
Massa matrik = 206,388gr +
= 308,448 gr

1.5 Menghitung massa matrix specimen poliester

Vcetakan = Vmatrix = p x l x t
= 180 x 180 x 7
= 226800 mm3
= 226,8 cm3
Massa Matrik = Vmatrik x ρmatrik
Poliest = 226,8 cm3 x 1,3gr/cm3
= 294,84 gr

a. Perhitungan fraksi volume spesimen uji *bending*

1.1 Menghitung volume cetakan

Diketahui :
Panjang = 180 mm
Lebar = 180 mm
Tebal = 10 mm
Vcetakan = p x l x t
= 180 x 180 x 10
= 324000 mm3
= 324 cm3

1.2 Menghitung fraksi volume serat

Diketahui :
Vfraksi serat = 30%
Vcetakan = 324 cm3
V Serat = Vfraksi x Vcetakan
= 30% x 324cm3
= 97,2 cm3
Massa serat = Vserat x ρserat
= 97,2 cm3 x 1,5 gr/cm3
= 139,05 gr

1.3 Menghitung massa matrik

Diketahui :
Vfraksi matrik = 70%
Vcetakan = 324 cm3
V Matrik = Vfraksi x Vcetakan
= 70% x 324 cm3
= 226,8 cm3
Massa Matrik = Vmatrik x ρmatrik
Poliester = 226,8 cm3 x 1,3 gr/cm3
= 294,84 gr

1.4 Menghitung berat penyusun komposit polyester

Diketahui :
Massa serat = 139,05 gr
Massa matrik = 294,84gr +
= 433,89 gr

1.5 Menghitung massa matrix specimen poliester

Vcetakan = Vmatrix = p x l x t
= 180 x 180 x 10
= 324000 mm3
= 324 cm3

Massa Matrik = Vmatrik x ρmatrik
Poliest = 226,8 cm3 x 1,3gr/cm3
= 294,84 gr

Perhitungan Data

1.Perhitungan pengujian tarik

1.1 Orientasi Arah Serat 0^0 (Spesimen A)

Diketahui :

T = 6,77 mm (ketebalan)
L_0 = 58,16 mm (panjang awal)
W = 12,76 mm (lebar)
F = 3176 N (Load maks)
E = 3550,821 Mpa (Modulus Young)
TS_{aktual} = 34,8 N/mm2 (Tensile Strength)

a. Mencari luas penampang (A_0)

A_0 = W x T
= 12,76 x 6,77
= 86,39 mm^2

b. Perhitungan tensile strength teoritis ($TS_{teoritis}$)

$$TS = \frac{F}{A}$$
$$= \frac{3176}{86,39}$$
$$= 36,76 \text{ N/mm2}$$

c. Mencari regangan / strain (ε)

$$\varepsilon = \frac{TS_{aktual}}{E}$$
$$= \frac{34,8 \text{ N/mm2}}{3550,821 \text{ Mpa}}$$
$$= 0,0098$$

d. Mencari panjang akhir (L_1)

$$\varepsilon = \frac{(L_1 - L_0)}{L_0}$$
$$(\varepsilon \text{ x } L_0) + L_0 = L_1$$
$$(0,0098 \text{ x } 58,16) + 58,16 = L_1$$
$$0,5699 + 58,16 = L_1$$
$$L_1 = 58,73 \text{ mm}$$

1.2 Orientasi Arah Serat 0^0 (Spesimen B)

Diketahui :

T = 6,93 mm (ketebalan)
L_0 = 57,79 mm (panjang awal)
W = 13,24 mm (lebar)
F = 4835 N (Load maks)
E = 4683,578 Mpa (Modulus Young)
TS_{aktual} = 54,3 N/mm2 (Tensile Strength)

a. Mencari luas penampang (A_0)

A_0 = W x T
= 13,24 x 6,93
= 91,75 mm^2

b. Mencari tensile strength teoritis ($TS_{teoritis}$)

$$TS = \frac{F}{A}$$
$$= \frac{4835}{91,75}$$
$$= 52,7 \text{ N/mm2}$$

c. Mencari regangan / strain (ε)

$$\varepsilon = \frac{TS_{aktual}}{E}$$
$$= \frac{54,3 \text{ N/mm2}}{4683,578 \text{ Mpa}}$$
$$= 0,0116$$

d. Mencari panjang akhir (L_1)

$$\varepsilon = \frac{(L_1 - L_0)}{L_0}$$
$$(\varepsilon \text{ x } L_0) + L_0 = L_1$$
$$(0,0116 \text{ x } 57,79) + 57,79 = L_1$$
$$0,6704 + 57,79 = L_1$$
$$L_1 = 58,46 \text{ mm}$$

1.3 Orientasi Arah Serat 0^0 (Spesimen C)

Diketahui :

T = 6,81 mm (ketebalan)
L_0 = 57,41 mm (panjang awal)
W = 12,68 mm (lebar)
F = 2976 N (Load maks)
E = 3412,76 Mpa (Modulus Young)
TS_{aktual} = 32,1 N/mm2 (Tensile Strength)

a. Mencari luas penampang (A_0)

A_0 = W x T
= 12,68 x 6,81
= 86,35 mm^2

b. Mencari tensile strength teoritis ($TS_{teoritis}$)

$$TS = \frac{F}{A}$$
$$= \frac{2976}{86,35}$$
$$= 34,46 \text{ N/mm2}$$

c. Mencari regangan / strain (ε)

$$\varepsilon = \frac{TS_{aktual}}{E}$$
$$= \frac{32,1 \text{ N/mm2}}{3412,76 \text{ Mpa}}$$
$$= 0,0094$$

d. Mencari panjang akhir (L_1)

$$\varepsilon = \frac{(L_1 - L_0)}{L_0}$$
$$(\varepsilon \text{ x } L_0) + L_0 = L_1$$
$$(0,0094 \text{ x } 57,41) + 57,41 = L_1$$
$$0,5396 + 57,41 = L_1$$
$$L_1 = 57.95 \text{ mm}$$

1.4 Orientasi Arah Serat 0^0 (Spesimen D)

Diketahui :

T = 6,85 mm (ketebalan)
L_0 = 57,92 mm (panjang awal)
W = 12,87 mm (lebar)

F = 3322 N (Load maks)
E = 2995,074 Mpa (Modulus Young)
TS_{aktual} = 39,3 N/mm2 (Tensile Strength)

a. Mencari luas penampang (A_0)

A_0 = W x T
= 12,87 x 6,85
= 88,16 mm^2

b. Mencari tensile strength teoritis ($TS_{teoritis}$)

$$TS = \frac{F}{A}$$
$$= \frac{3322}{88,16}$$
$$= 37,68 \text{ N/mm2}$$

c. Mencari regangan / strain (ε)

$$\varepsilon = \frac{TS_{aktual}}{E}$$
$$= \frac{39,3 \text{ N/mm2}}{2995,074 \text{ Mpa}}$$
$$= 0,0131$$

d. Mencari panjang akhir (L_1)

$$\varepsilon = \frac{(L_1 - L_0)}{L_0}$$
$$(\varepsilon \text{ x } L_0) + L_0 = L_1$$
$$(0,0131 \text{ x } 57,92) + 57,92 = L_1$$
$$0,757 + 57,92 = L_1$$
$$L_1 = 58,68 \text{ mm}$$

1.5 Orientasi Arah Serat 45^0 (Spesimen E)

Diketahui :
T = 6,72 mm (ketebalan)
L_0 = 57,84 mm (panjang awal)
W = 13,17 mm (lebar)
F = 839 N (Load maks)
E = 1017,430 Mpa (Modulus Young)
TS_{aktual} = 9,23 N/mm2 (Tensile Strength)

a. Mencari luas penampang (A_0)

A_0 = W x T
= 13,17 x 6,72
= 88,50 mm^2

b. Mencari tensile strength teoritis ($TS_{teoritis}$)

$$TS = \frac{F}{A}$$
$$= \frac{839}{88,50}$$
$$= 9,48 \text{ N/mm2}$$

c. Mencari regangan / strain (ε)

$$\varepsilon = \frac{TS_{aktual}}{E}$$
$$= \frac{9,23 \text{ N/mm2}}{1017,430 \text{ Mpa}}$$
$$= 0,0091$$

d. Mencari panjang akhir (L_1)

$$\varepsilon = \frac{(L_1 - L_0)}{L_0}$$
$$(\varepsilon \text{ x } L_0) + L_0 = L_1$$
$$(0,0091 \text{ x } 57,84) + 57,84 = L_1$$
$$0,5263 + 57,84 = L_1$$
$$L_1 = 58,36 \text{ mm}$$

1.6 Orientasi Arah Serat 45^0 (Spesimen F)

Diketahui :
T = 6,8 mm (ketebalan)
L_0 = 58,21 mm (panjang awal)
W = 12,92 mm (lebar)
F = 1496 N (Load maks)
E = 2715,736 Mpa (Modulus Young)
TS_{aktual} = 16,9 N/mm2 (Tensile Strength)

a. Mencari luas penampang (A_0)

A_0 = W x T
= 12,92 x 6,8
= 87,86 mm^2

b. Mencari tensile strength teoritis ($TS_{teoritis}$)

$$TS = \frac{F}{A}$$
$$= \frac{1496}{87,86}$$
$$= 7,03 \text{ N/mm2}$$

c. Mencari regangan / strain (ε)

$$\varepsilon = \frac{TS_{aktual}}{E}$$
$$= \frac{16,9 \text{ N/mm2}}{2715,736 \text{ Mpa}}$$
$$= 0,0062$$

d. Mencari panjang akhir (L_1)

$$\varepsilon = \frac{(L_1 - L_0)}{L_0}$$
$$(\varepsilon \text{ x } L_0) + L_0 = L_1$$
$$(0,0062 \text{ x } 58,21) + 58,21 = L_1$$
$$0,3609 + 58,21 = L_1$$
$$L_1 = 58,57 \text{ mm}$$

1.7 Orientasi Arah Serat 45^0 (Spesimen G)

Diketahui :
T = 6,94 mm (ketebalan)
L_0 = 58,13 mm (panjang awal)
W = 12,81 mm (lebar)
F = 891 N (Load maks)
E = 1797,530 Mpa (Modulus Young)
TS_{aktual} = 9,95 N/mm2 (Tensile Strength)

a. Mencari luas penampang (A_0)

A_0 = W x T
= 12,81 x 6,94
= 88,9 mm^2

b. Mencari tensile strength teoritis ($TS_{teoritis}$)

$$TS = \frac{F}{A}$$
$$= \frac{891}{88,9}$$
$$= 10,02 \text{ N/mm2}$$

c. Mencari regangan / strain (ε)

$$\varepsilon = \frac{TS_{aktual}}{E}$$
$$= \frac{9,95 \text{ N/mm2}}{1797,530 \text{ Mpa}}$$

= 0,0055

d. Mencari panjang akhir (L_1)

$\varepsilon = \frac{(L_1 - L_0)}{L_0}$

$(\varepsilon \text{ x } L_0) + L_0 = L_1$

(0,0055 x 58,13) + 58,13 $= L_1$

0,3197 + 58,13 $= L_1$

L_1 = 58,45 mm

1.8 Orientasi Arah Serat 45⁰ (Spesimen H)

Diketahui :

T = 6,79 mm (ketebalan)

L_0 = 57,57 mm (panjang awal)

W = 12,77 mm (lebar)

F = 1262 N (Load maks)

E = 2825,320 Mpa (Modulus Young)

TS_{aktual} = 14,8 N/mm2 (Tensile Strength)

a. Mencari luas penampang (A_0)

A_0 = W x T

= 12,77 x 6,79

= 86,71 mm^2

b. Mencari tensile strength teoritis ($TS_{teoritis}$)

$TS = \frac{F}{A}$

$= \frac{1262}{86,71}$

= 14,55 N/mm2

c. Mencari regangan / strain (ε)

$\varepsilon = \frac{TS_{aktual}}{E}$

$= \frac{14,8 \text{ N/mm2}}{2825,530 \text{ Mpa}}$

= 0,0052

d. Mencari panjang akhir (L_1)

$\varepsilon = \frac{(L_1 - L_0)}{L_0}$

$(\varepsilon \text{ x } L_0) + L_0 = L_1$

(0,0052 x 57,57) + 57,57 $= L_1$

0,3005 + 57,57 $= L_1$

L_1 = 57,87 mm

2. Perhitungan Pengujian *Bending*

2.1 perhitungan orientasi 0°

a. Spesimen 1

$\sigma u = \frac{3PL}{2Bd^2}$

$= \frac{3 \, x \, 95,3 \, x \, 100}{2 \, x \, 10 \, x \, 5^2}$

= 57,18 Mpa

b. Spesimen 2

$\sigma u = \frac{3PL}{2Bd^2}$

$= \frac{3 \, x \, 92,7 \, x \, 100}{2 \, x \, 10 \text{ x } 5^2}$

= 55,06 Mpa

c. Spesimen 3

$\sigma u = \frac{3PL}{2Bd^2}$

$= \frac{3 \, x \, 77,0 \, x \, 100}{2 \, x \, 10 \text{ x } 5^2}$

= 46,2 Mpa

2.2 perhitungan orientasi 45°

d. Spesimen 1

$\sigma u = \frac{3PL}{2Bd^2}$

$= \frac{3 \, x \, 73,8 \, x \, 100}{2 \, x \, 10,5 \, x \, 5,5^2}$

= 34,85 Mpa

e. Spesimen 2

$\sigma u = \frac{3PL}{2Bd^2}$

$= \frac{3 \, x \, 64,6 \, x \, 99}{2 \, x \, 9,5 \, x \, 6^2}$

= 28,04 Mpa

f. Spesimen 3

$\sigma u = \frac{3PL}{2Bd^2}$

$= \frac{3 \, x \, 62,3 \, x \, 99}{2 \, x \, 10,5 \, x \, 6^2}$

= 24,42 Mpa

3. Perhitungan Pengujian Fisis

3.1 Sampel uji tarik orientasi 0⁰ (A)

Diketahui :

M = M_k = 22,06 gr (Massa Kering)

V = V_T = 10 cm^3 (Volume Kenaikan)

M_b = 22,6 gr (Massa Basah)

ρ_{air} = 1 gr/cm^3 (Massa Jenis Air)

a. Densitas (gr/cm^3)

$\rho = \frac{m}{V}$

$\rho = \frac{22,06 \, gr}{10 \, cm^3}$

ρ = 2,21 gr/cm^3

b. Penyerapan Air (%)

Penyerapan Air $= \frac{M_b - M_k}{M_k}$ x 100%

$= \frac{22{,}6\ gr - 22{,}06\ gr}{22{,}06\ gr}$ x 100%

Penyerapan Air = 2,45 %

c. Porositas(%)

Porositas $= \frac{M_b - M_k}{\rho_{air} \times V_T}$ x 100%

$= \frac{22{,}6\ gr - 20{,}06\ gr}{1\frac{gr}{cm^3} \times 10\ cm^3}$ x 100%

Porositas = 5,40 %

3.2 Sampel uji tarik orientasi 0^0 (B)

Diketahui :

M = M_k = 20,63 gr (Massa Kering)

V = V_T = 9 cm^3 (Volume Kenaikan)

M_b = 21,15 gr (Massa Basah)

ρ_{air} = 1 gr/cm^3 (Massa Jenis Air)

a. Densitas (gr/cm^3)

$\rho = \frac{m}{V}$

$\rho = \frac{20{,}63\ gr}{9\ cm^3}$

ρ = 2,29 gr/cm^3

b. Penyerapan Air (%)

Penyerapan Air $= \frac{M_b - M_k}{M_k}$ x 100%

$= \frac{21{,}15\ gr - 20{,}63\ gr}{20{,}63\ gr}$ x 100%

Penyerapan Air = 2,52 %

c. Porositas (%)

Porositas $= \frac{M_b - M_k}{\rho_{air} \times V_T}$ x 100%

$= \frac{21{,}15\ gr - 20{,}63\ gr}{1\frac{gr}{cm^3} \times 9\ cm^3}$ x 100%

= 5,78 %

3.3 Sampel uji tarik orientasi 0^0 (C)

Diketahui :

M = M_k = 22,14 gr (Massa Kering)

V = V_T = 11 cm^3 (Volume Kenaikan)

M_b = 22,73 gr (Massa Basah)

ρ_{air} = 1 gr/cm^3 (Massa Jenis Air)

a. Densitas (gr/cm^3)

$\rho = \frac{m}{V}$

$\rho = \frac{22{,}14\ gr}{11\ cm^3}$

ρ = 2,01 gr/cm^3

b. Penyerapan Air (%)

Penyerapan Air $= \frac{M_b - M_k}{M_k}$ x 100%

$= \frac{22{,}73\ gr - 22{,}14\ gr}{22{,}14\ gr}$ x 100%

Penyerapan Air = 2,66 %

c. Porositas (%)

Porositas $= \frac{M_b - M_k}{\rho_{air} \times V_T}$ x 100%

$= \frac{22{,}73\ gr - 22{,}14\ gr}{1\frac{gr}{cm^3} \times 11\ cm^3}$ x 100%

= 5,36 %

3.4 Sampel uji tarik orientasi 0^0 (D)

Diketahui :

M = M_k = 20,89 gr (Massa Kering)

V = V_T = 9 cm^3 (Volume Kenaikan)

M_b = 21,02 gr (Massa Basah)

ρ_{air} = 1 gr/cm^3 (Massa Jenis Air)

a. Densitas (gr/cm^3)

$\rho = \frac{m}{V}$

$\rho = \frac{20{,}89\ gr}{9\ cm^3}$

ρ = 2,32 gr/cm^3

b. Penyerapan Air (%)

Penyerapan Air $= \frac{M_b - M_k}{M_k}$ x 100%

$= \frac{21{,}02\ gr - 20{,}89\ gr}{20{,}89\ gr}$ x 100%

Penyerapan Air = 1,63 %

c. Porositas (%)

Porositas $= \frac{M_b - M_k}{\rho_{air} \times V_T}$ x 100%

$= \frac{21{,}02\ gr - 20{,}89\ gr}{1\frac{gr}{cm^3} \times 9\ cm^3}$ x 100%

= 3,78 %

3.5 Sampel uji tarik orientasi 45^0 (E)

Diketahui :

M = M_k = 21,41 gr (Massa Kering)

V = V_T = 13 cm^3 (Volume Kenaikan)

M_b = 21,66 gr (Massa Basah)

ρ_{air} = 1 gr/cm^3 (Massa Jenis Air)

a. Densitas (gr/cm^3)

$\rho = \frac{m}{V}$

$\rho = \frac{21{,}41\ gr}{13\ cm^3}$

ρ = 1,65 gr/cm^3

b. Penyerapan Air (%)

Penyerapan Air $= \frac{M_b - M_k}{M_k}$ x 100%

$= \frac{21{,}66\ gr - 21{,}41\ gr}{21{,}41\ gr}$ x 100%

Penyerapan Air = 1,17 %

c. Porositas (%)

Porositas $= \frac{M_b - M_k}{\rho_{air} \times V_T}$ x 100%

$= \frac{21{,}66\ gr - 21{,}41\ gr}{1\frac{gr}{cm^3} \times 13\ cm^3}$ x 100%

= 1,92 %

3.6 Sampel uji tarik orientasi 45⁰ (F)

Diketahui :

M = M_k = 20,88 gr (Massa Kering)

V = V_T = 11 cm^3 (Volume Kenaikan)

M_b = 21,24 gr (Massa Basah)

ρ_{air} = 1 gr/cm^3 (Massa Jenis Air)

a. Densitas (gr/cm^3)

$$\rho = \frac{m}{V}$$

$$\rho = \frac{20{,}88\ gr}{11\ cm^3}$$

$$\rho = 1{,}90\ \text{gr/cm}^3$$

b. Penyerapan Air (%)

$$\text{Penyerapan Air} = \frac{M_b - M_k}{M_k} \times 100\%$$

$$= \frac{21{,}24\ gr - 20{,}88\ gr}{20{,}88\ gr} \times 100\%$$

Penyerapan Air = 1,72 %

c. Porositas (%)

$$\text{Porositas} = \frac{M_b - M_k}{\rho_{air} \times V_T} \times 100\%$$

$$= \frac{21{,}24\ gr - 20{,}88\ gr}{1\frac{gr}{cm^3} \times 11\ cm^3} \times 100\%$$

= 3,27 %

3.7 Sampel uji tarik orientasi 45⁰ (G)

Diketahui :

M = M_k = 21,11 gr (Massa Kering)

V = V_T = 9 cm^3 (Volume Kenaikan)

M_b = 21,28 gr (Massa Basah)

ρ_{air} = 1 gr/cm^3 (Massa Jenis Air)

a. Densitas (gr/cm^3)

$$\rho = \frac{m}{V}$$

$$\rho = \frac{21{,}11\ gr}{9\ cm^3}$$

$$\rho = 2{,}35\ \text{gr/cm}^3$$

b. Penyerapan Air (%)

$$\text{Penyerapan Air} = \frac{M_b - M_k}{M_k} \times 100\%$$

$$= \frac{21{,}28\ gr - 21{,}11\ gr}{21{,}11\ gr} \times 100\%$$

Penyerapan Air = 0,81 %

c. Porositas (%)

$$\text{Porositas} = \frac{M_b - M_k}{\rho_{air} \times V_T} \times 100\%$$

$$= \frac{21{,}28\ gr - 21{,}11\ gr}{1\frac{gr}{cm^3} \times 9\ cm^3} \times 100\%$$

= 1,89 %

3.8 Sampel uji tarik orientasi 45⁰ (H)

Diketahui :

M = M_k = 20,78 gr (Massa Kering)

V = V_T = 10 cm^3 (Volume Kenaikan)

M_b = 21,02 gr (Massa Basah)

ρ_{air} = 1 gr/cm^3 (Massa Jenis Air)

a. Densitas (gr/cm^3)

$$\rho = \frac{m}{V}$$

$$\rho = \frac{20{,}78\ gr}{10\ cm^3}$$

$$\rho = 2{,}08\ \text{gr/cm}^3$$

b. Penyerapan Air (%)

$$\text{Penyerapan Air} = \frac{M_b - M_k}{M_k} \times 100\%$$

$$= \frac{21{,}02\ gr - 20{,}78\ gr}{20{,}78\ gr} \times 100\%$$

Penyerapan Air = 1,15 %

c. Porositas (%)

$$\text{Porositas} = \frac{M_b - M_k}{\rho_{air} \times V_T} \times 100\%$$

$$= \frac{21{,}02\ gr - 20{,}78\ gr}{1\frac{gr}{cm^3} \times 10\ cm^3} \times 100\%$$

= 2,40 %

3.9 Sampel uji *bending* orientasi 0° (1)

Diketahui :

M = M_k = 7,36 gr (Massa Kering)

V = V_T = 5 cm^3 (Volume Kenaikan)

M_b = 7,62 gr (Massa Basah)

ρ_{air} = 1 gr/cm^3 (Massa Jenis Air)

a. Densitas (gr/cm^3)

$$\rho = \frac{m}{V}$$

$$\rho = \frac{7{,}36\ gr}{5\ cm^3}$$

$$\rho = 1{,}47\ \text{gr/cm}^3$$

b. Penyerapan Air (%)

$$\text{Penyerapan Air} = \frac{M_b - M_k}{M_k} \times 100\%$$

$$= \frac{7{,}62\ gr - 7{,}36\ gr}{7{,}36\ gr} \times 100\%$$

Penyerapan Air = 3,5 %

c. Porositas (%)

$$\text{Porositas} = \frac{M_b - M_k}{\rho_{air} \times V_T} \times 100\%$$

$$= \frac{7{,}62\ gr - 7{,}36\ gr}{1\frac{gr}{cm^3} \times 5\ cm^3} \times 100\%$$

= 5,2 %

3.10 Sampel uji *bending* orientasi 0° (2)

Diketahui :

M = M_k = 7,06 gr (Massa Kering)

V = V_T = 5 cm^3 (Volume Kenaikan)

M_b = 7,33 gr (Massa Basah)

ρ_{air} = 1 gr/cm^3 (Massa Jenis Air)

a. Densitas (gr/cm^3)

$$\rho = \frac{m}{V}$$

$$\rho = \frac{7{,}06\ gr}{5\ cm^3}$$

ρ = 1,41 gr/cm^3

b. Penyerapan Air (%)

$$\text{Penyerapan Air} = \frac{M_b - M_k}{M_k} \text{ x } 100\%$$

$$= \frac{7{,}33\ gr - 7{,}06\ gr}{7{,}06\ gr} \text{ x } 100\%$$

Penyerapan Air = 3,8 %

c. Porositas (%)

$$\text{Porositas} = \frac{M_b - M_k}{\rho_{air} \text{ x } V_T} \text{ x } 100\%$$

$$= \frac{7{,}33\ gr - 7{,}06\ gr}{1\frac{gr}{cm^3} \text{ x } 5\ cm^3} \text{ x } 100\%$$

= 5,4 %

3.11 Sampel uji *bending* orientasi 0° (3)

Diketahui :

M = M_k = 7,72 gr (Massa Kering)

V = V_T = 5 cm^3 (Volume Kenaikan)

M_b = 7,75 gr (Massa Basah)

ρ_{air} = 1 gr/cm^3 (Massa Jenis Air)

a. Densitas (gr/cm^3)

$$\rho = \frac{m}{V}$$

$$\rho = \frac{7{,}72\ gr}{5\ cm^3}$$

ρ = 1,54 gr/cm^3

b. Penyerapan Air (%)

$$\text{Penyerapan Air} = \frac{M_b - M_k}{M_k} \text{ x } 100\%$$

$$= \frac{7{,}75\ gr - 7{,}72\ gr}{7{,}72\ gr} \text{ x } 100\%$$

Penyerapan Air = 3,8 %

c. Porositas (%)

$$\text{Porositas} = \frac{M_b - M_k}{\rho_{air} \text{ x } V_T} \text{ x } 100\%$$

$$= \frac{7{,}75\ gr - 7{,}72\ gr}{1\frac{gr}{cm^3} \text{ x } 5\ cm^3} \text{ x } 100\%$$

= 6 %

3.12 Sampel uji *bending* orientasi 45° (1)

Diketahui :

M = M_k = 7,09 gr (Massa Kering)

V = V_T = 5 cm^3 (Volume Kenaikan)

M_b = 7,68 gr (Massa Basah)

ρ_{air} = 1 gr/cm^3 (Massa Jenis Air)

a. Densitas (gr/cm^3)

$$\rho = \frac{m}{V}$$

$$\rho = \frac{7{,}09\ gr}{5\ cm^3}$$

ρ = 1,41 gr/cm^3

b. Penyerapan Air (%)

$$\text{Penyerapan Air} = \frac{M_b - M_k}{M_k} \text{ x } 100\%$$

$$= \frac{7{,}68\ gr - 7{,}09\ gr}{7{,}09\ gr} \text{ x } 100\%$$

Penyerapan Air = 0,83 %

c. Porositas (%)

$$\text{Porositas} = \frac{M_b - M_k}{\rho_{air} \text{ x } V_T} \text{ x } 100\%$$

$$= \frac{7{,}68\ gr - 7{,}09\ gr}{1\frac{gr}{cm^3} \text{ x } 5\ cm^3} \text{ x } 100\%$$

= 1,1 %

3.13 Sampel uji *bending* orientasi 45° (2)

Diketahui :

M = M_k = 6,60 gr (Massa Kering)

V = V_T = 5 cm^3 (Volume Kenaikan)

M_b = 7,03 gr (Massa Basah)

ρ_{air} = 1 gr/cm^3 (Massa Jenis Air)

d. Densitas (gr/cm^3)

$$\rho = \frac{m}{V}$$

$$\rho = \frac{6{,}60\ gr}{5\ cm^3}$$

ρ = 1,32 gr/cm^3

e.Penyerapan Air (%)

$$\text{Penyerapan Air} = \frac{M_b - M_k}{M_k} \text{ x } 100\%$$

$$= \frac{7{,}03\ gr - 6{,}60\ gr}{6{,}60\ gr} \text{ x } 100\%$$

Penyerapan Air = 0,65 %

f. Porositas (%)

$$\text{Porositas} = \frac{M_b - M_k}{\rho_{air} \text{ x } V_T} \text{ x } 100\%$$

$$= \frac{7{,}03\ gr - 6{,}60\ gr}{1\frac{gr}{cm^3} \text{ x } 5\ cm^3} \text{ x } 100\%$$

= 0,86 %

3.14 Sampel uji *bending* orientasi 45° (3)

Diketahui :

M = M_k = 7,07 gr (Massa Kering)

V = V_T = 5 cm^3 (Volume Kenaikan)

M_b = 7,40 gr (Massa Basah)

ρ_{air} = 1 gr/cm^3 (Massa Jenis Air)

g. Densitas (gr/cm^3)

$$\rho = \frac{m}{V}$$

$$\rho = \frac{7{,}07\ gr}{5\ cm^3}$$

ρ = 1,41 gr/cm^3

h. Penyerapan Air (%)

$$\text{Penyerapan Air} = \frac{M_b - M_k}{M_k} \text{ x } 100\%$$

$$= \frac{7{,}40\ gr - 7{,}07\ gr}{7{,}07\ gr} \text{ x } 100\%$$

Penyerapan Air = 0,46 %

i. Porositas (%)

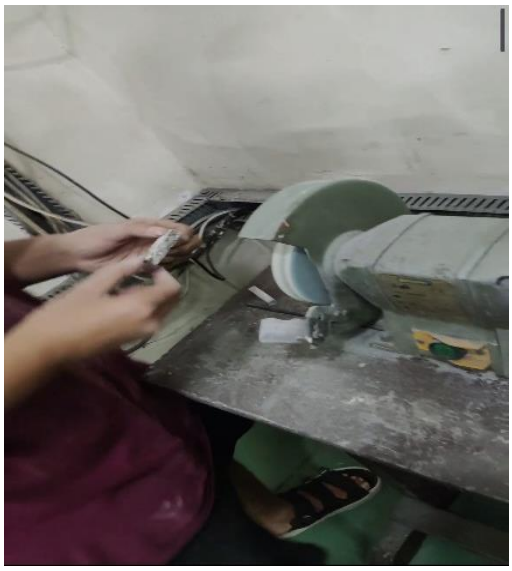
$$\text{Porositas} = \frac{M_b - M_k}{\rho_{air} \text{ x } V_T} \text{ x } 100\%$$

$$= \frac{7{,}40\ gr - 7{,}07\ gr}{1\frac{gr}{cm^3} \text{ x } 5\ cm^3} \text{ x } 100\%$$

= 0,66 %

Dokumentasi Penelitian


HAN RIVER
on/off
Preset
keep warm
Temperature
Temperature
Time
Time
80C




Tinius Ols
2


UNIVERSAL TESTING MACHINE