LAMPIRAN

LAMPIRAN 1

Nilai Kekerasan (*hardness)*

Tabel Lampiran 1. Hasil Pengujian Kekerasan (*hardness*)

Variasi	No	Titik I HVN	Titik II HVN	Titik III HVN	Titik IV HVN	Titik V HVN	Rata-rata HVN	HVN	Δ HVN
100°C	1	46	49.6	61.2	52.3	55.1	52.84	56.32	11.88
	2	46.6	46.1	47.7	42.7	50	46.62		
	3	56.1	46.4	89.4	80.5	75.2	69.52		
120°C	1	57.6	52	61.4	49.9	53.5	54.88	60.58	5.32
	2	69.1	66.5	65.6	64.2	60.1	65.1		
	3	54.9	68.1	62.5	64.7	58.7	61.78		
140°C	1	68.4	69.3	68.1	66	64.5	67.26	65.42	4.23
	2	105.2	65.7	55.9	62.9	52.4	68.42		
	3	62.3	55.9	55.6	76.8	52.3	60.58		
160°C	1	71.2	69.1	70.6	67.5	63.2	68.32	68.84	1.86
	2	68.8	70.4	65.1	73.5	71.3	69.82		
	3	76.6	65.8	61.9	64.3	73.4	68.4		

Perhitungan kekerasan (*hardness*) sebagai berikut.

VHN = VHN ± Δ VHN

Rata-rata kekerasan per sampel

$$\text{VHN} = \frac{\sum VHNi}{n}$$

$$\text{VHN} = \frac{VHN_1 + VHN_2 \ldots + VHN_n}{n}$$

Dan

$$\Delta\,(\text{VHN}) = \sqrt{\frac{\sum VHN_i{}^2 - n(VHN)^2}{(n-1)}}$$

1. Sampel Magnesium/HA/*Shellac*/Serat nanas (100°C)

   $\text{VHN}_{100°C} = \frac{52.84+46.62+69.52}{3}$ = 56,32 VHN

   Dan

   $\Delta\ \text{VHN} = \sqrt{\frac{(52.84^2+46.62^2+69.52^2)-3(56,32)^2}{(3-1)}}$

   = 11.88 VHN

Sehingga diperoleh

VHN $_{100°C}$ = (56,32 ± 11,88) HVN

2. Sampel Magnesium/HA/*Shellac*/Serat nanas (120°C)

$$\text{VHN}_{120°C} = \frac{54.88+65.1+61.78}{3} = 60.58 \text{ VHN}$$

Dan

$$\Delta \text{ VHN} = \sqrt{\frac{(54.88^2+65.1^2+61.78^2)-3(60.58)^2}{(3-1)}}$$

$$= 5.32 \text{ VHN}$$

Sehingga diperoleh

VHN $_{120°C}$ = (60,58 ± 5.32) HVN

3. Sampel Magnesium/HA/*Shellac*/Serat nanas (140°C)

$$\text{VHN}_{140°C} = \frac{67.26+68.42+60.58}{3} = 65.42 \text{ VHN}$$

Dan

$$\Delta \text{ VHN} = \sqrt{\frac{(67.26^2+68.42^2+60.58^2)-3(65.42)^2}{(3-1)}}$$

$$= 4,23 \text{ VHN}$$

Sehingga diperoleh

VHN $_{140°C}$ = (65.42 ± 4,23) HVN

4. Sampel Magnesium/HA/*Shellac*/Serat nanas (160°C)

$$\text{VHN}_{160°C} = \frac{68.32+69.82+68.4}{3} = 68.84 \text{ VHN}$$

Dan

$$\Delta \text{ VHN} = \sqrt{\frac{(68.32^2+69.84^2+68.4^2)-3(68.84)^2}{(3-1)}}$$

$$= 2,01 \text{ VHN}$$

Sehingga diperoleh

VHN $_{160°C}$ = (68.84 ± 2.01) HVN

LAMPIRAN 2

Nilai Kuat Tekan

Tabel Lampiran 2. Hasil Pengujian Kuat Tekan

Variasi	Sampel	Max. Force (kN)	ΔD	t(mm)	b (mm)	d(mm)	σ (MPa)	Rata-Rata σ (MPa)	Δ σ (MPa)
100°C	1	0.219	0.72	5.52	4.89	17.20	8.11	11.79	8.63
	2	0.211	0.88	5.48	5.39	17.23	7.14		
	3	0.233	0.86	5.68	5.33	17.22	7.69		
	4	0.230	0.64	5.60	4.62	17.20	8.88		
	5	0.701	0.68	5.42	4.76	17.20	27.17		
120°C	1	0.322	0.62	5.62	4.54	17.24	12.62	18.58	8.46
	2	0.389	0.56	5.70	4.32	17.30	15.7		
	3	0.334	0.52	5.46	4.17	17.22	14.66		
	4	0.770	0.54	5.40	4.25	17.24	33.5		
	5	0.412	0.58	5.70	4.40	17.23	16.42		
140°C	1	0.389	0.50	5.58	4.09	17.25	18.04	19.99	3.08
	2	0.493	0.56	5.64	4.32	17.20	20.23		
	3	0.541	0.54	5.52	4.25	17.22	23.06		
	4	0.566	0.58	5.66	4.40	17.30	22.72		
	5	0.217	0.54	5.72	4.25	17.32	15.92		
160°C	1	0.369	0.66	5.58	4.69	17.30	14.10	22.25	9.36
	2	0.431	0.64	5.62	4.62	17.40	16.59		
	3	0.746	0.56	5.74	4.32	17.20	30.08		
	4	0.778	0.50	5.52	4.09	17.22	34.46		
	5	0.440	0.72	5.58	4.89	17.26	16.12		

Keterangan :

σ = *Compressive Strength* (MPa)

Perhitungan kekuatan tekan (DCT) sebagai berikut.

$$\sigma = \frac{P}{A}$$

$$\sigma = \frac{P}{b\ x\ t}$$

Dimana :

$$b = 2\ x \sqrt{r^2 - (r - \frac{1}{2}\Delta D)^2}$$

$$\therefore \sigma = \sigma \pm \Delta\sigma$$

Keterangan:

σ : *Compressive Strength* (MPa)

P : Beban masukan (N)

ΔD : Deformasi diameter tablet (mm)

b : Panjang spesimen setelah deformasi (mm)

t : Tebal tablet (mm)

Rata-rata kuat tekan per sampel

$$\sigma = \frac{\sum \sigma i}{n}$$

Δσ dengan menggunakan bantuan excel didapatkan nilai sebagai berikut:

Variasi	Δσ
100°C	8.63
120°C	8.46
140°C	3.08
160°C	9.36

1. Sampel Magnesium/HA/*Shellac*/Serat nanas(100°C)

$$\sigma_{100°C} = \frac{8.11+7.14+7.69+8.88+27.17}{5} = 11.79 \text{ MPa}$$

Sehingga diperoleh $\sigma_{100°C}$ = (11.79 ± 8.63) MPa

2. Sampel Magnesium/HA/*Shellac*/Serat nanas (120°C)

$$\sigma_{120°C} = \frac{12.62+15.70+14.66+33.50+16.42}{5} = 18.58 \text{ MPa}$$

Sehingga diperoleh $\sigma_{120°C}$ = (18.58 ± 8.46) MPa

3. Sampel Magnesium/HA/*Shellac*/Serat nanas (140°C)

$$\sigma_{140°C} = \frac{18.04+20.23+23.06+22.72+15.92}{5} = 19.99 \text{ MPa}$$

Sehingga diperoleh $\sigma_{140°C}$ = (19.99 ± 3.08) MPa

4. Sampel Magnesium/HA/*Shellac*/Serat nanas (160°C)

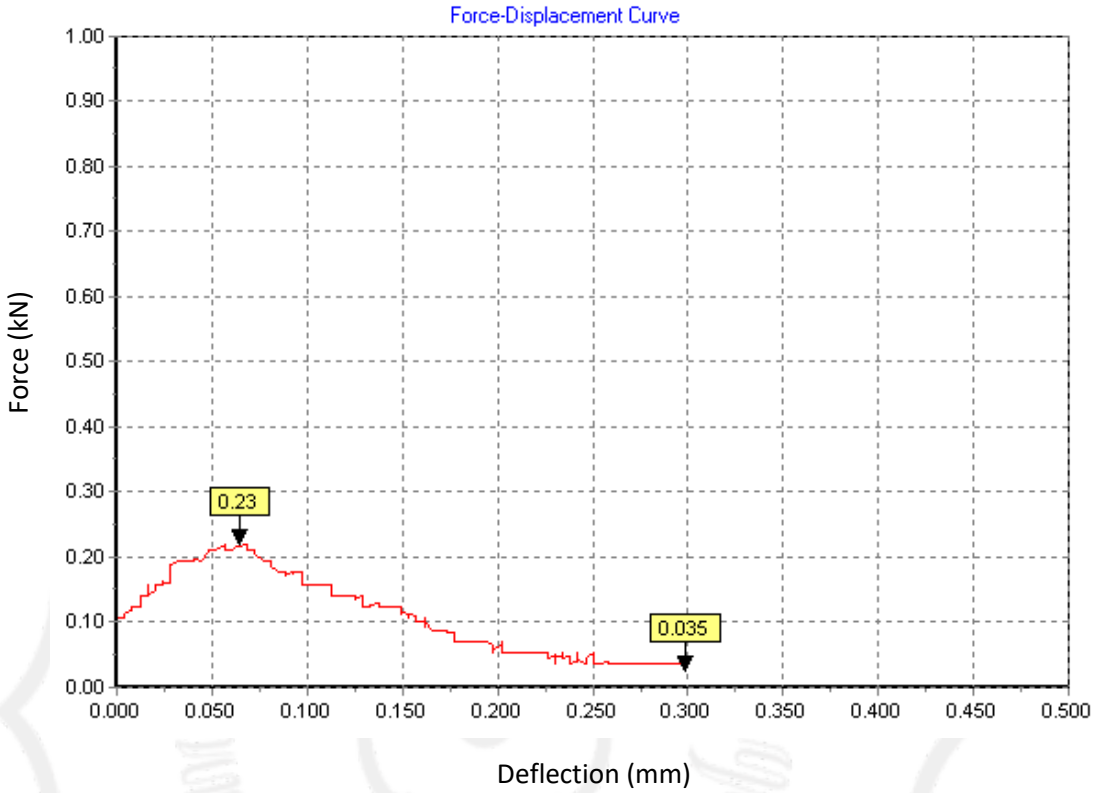
$$\sigma_{160°C} = \frac{14.10+16.59+30.08+34.46+16.12}{5} = 22.25 \text{ MPa}$$

Sehingga diperoleh $\sigma_{160°C}$ = (22.25 ± 9.36) MPa

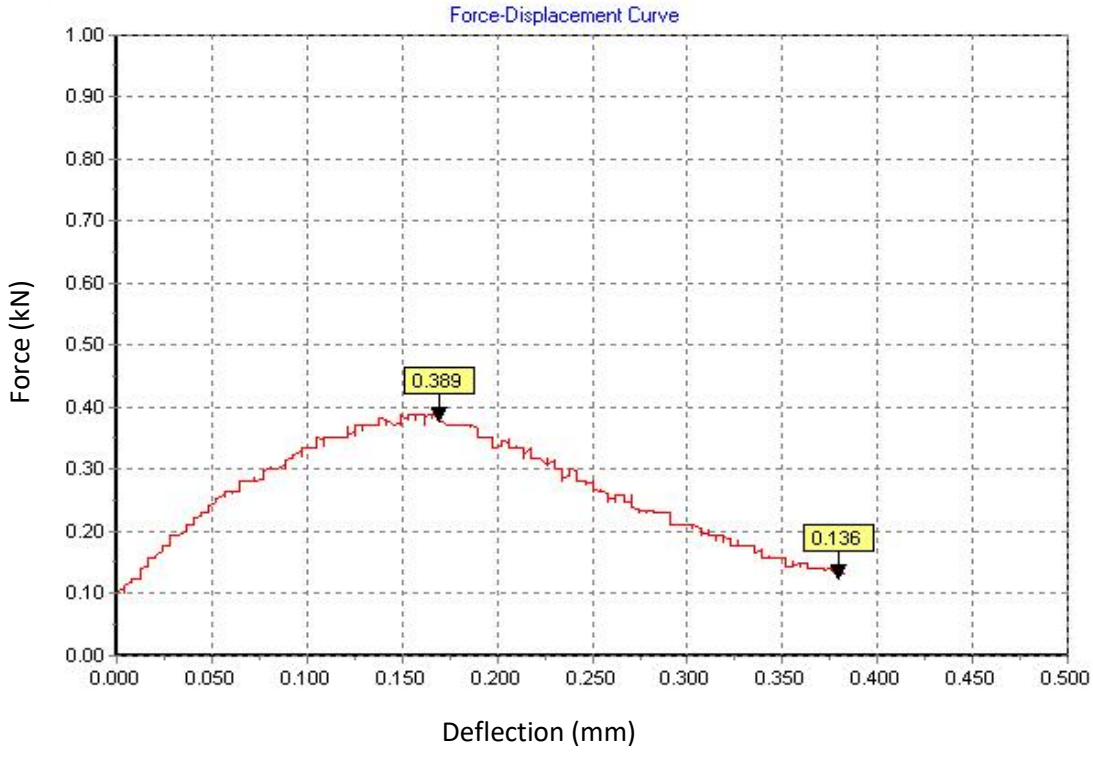
LAMPIRAN 3

Grafik Uji Kuat Tekan

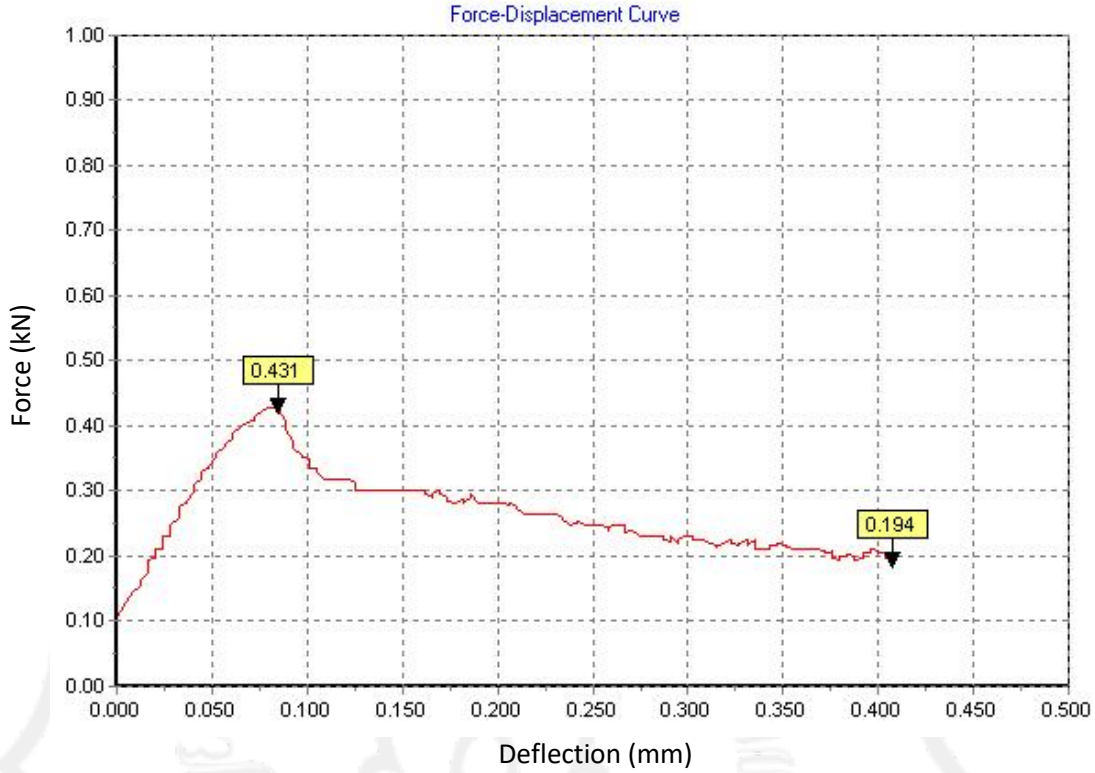
Hasil Kuat Tekan Variasi Magnesium/HA/*Shellac*/Serat nanas : 100°C



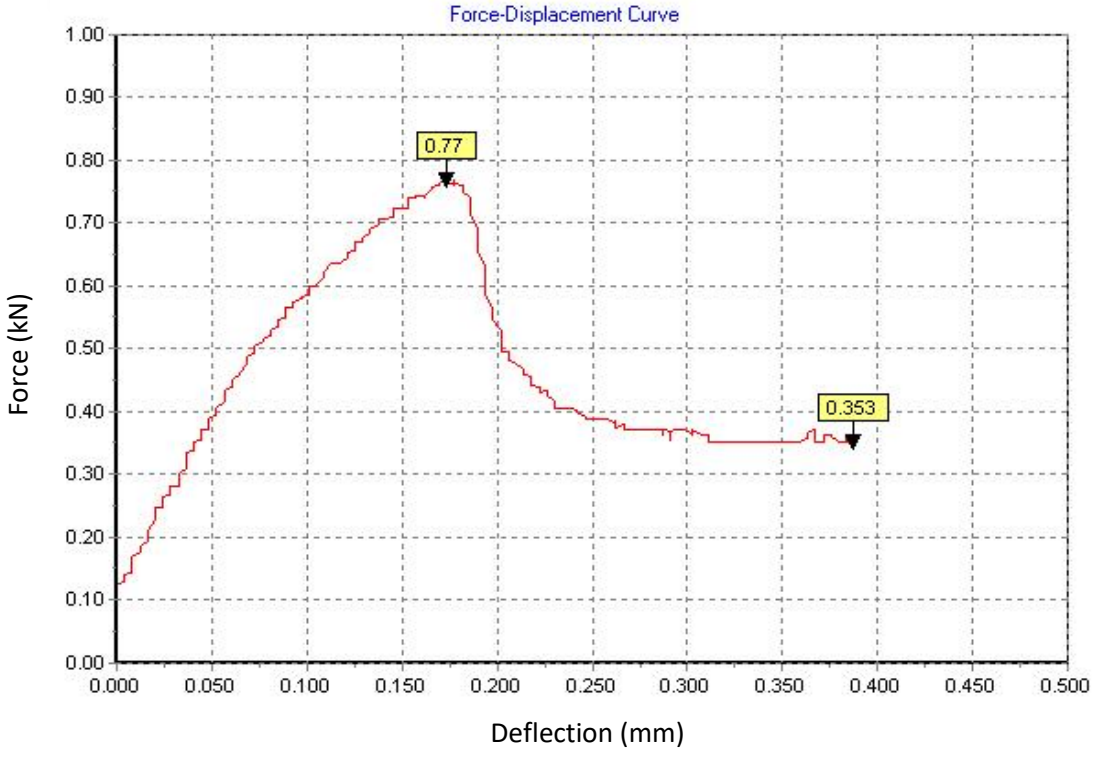
Hasil Kuat Tekan Variasi Magnesium/HA/*Shellac*/Serat nanas : 120°C



Hasil Kuat Tekan Variasi Magnesium/HA/*Shellac*/Serat nanas : 140°C



Hasil Kuat Tekan Variasi Magnesium/HA/*Shellac*/Serat nanas : 160°C



LAMPIRAN 4

Nilai Laju Degradasi

Tabel 4. Nilai Laju Degradasi

Spesimen	Berat	Hari	Degradasi	Laju Degradasi	Rata-rata
Mg/HA/*Shellac*/*Serat nanas*	**Awal (g)**	**ke**	**(g/hari)**	**(cm/tahun)**	**cm/tahun)**
100°C	1.866	7	0.037	1.04	1.01
		14	0.034	1.01	
		21	0.030	0.97	
120°C	1.860	7	0.032	0.99	0.96
		14	0.029	0.96	
		21	0.028	0.95	
140°C	1.853	7	0.028	0.95	0.89
		14	0.025	0.86	
		21	0.022	0.87	
160°C	1.847	7	0.021	0.86	0.81
		14	0.017	0.80	
		21	0.015	0.77	

Tabel Lampiran 4. Hasil Laju Degradasi

Variasi	r (g/hari)
100°C	0,0027
120°C	0,0026
140°C	0.0024
160°C	0.0022

Keterangan:

r = Rata-rata pengurangan massa per hari (g/hari)

1. Sampel Magnesium/Hidroksiapatit/*Shellac*/Serat nanas (100°C)

   PD/T (100°C) = $\sqrt[3]{\frac{r1\ x\ 365}{\rho}} = \sqrt[3]{\frac{0.0027\ x\ 365}{1.67}}$ = 1.01 cm/tahun

2. Sampel Magnesium/Hidroksiapatit/*Shellac*/Serat nanas (120°C)

   PD/T (150°C) = $\sqrt[3]{\frac{r1\ x\ 365}{\rho}} = \sqrt[3]{\frac{0.0026\ x\ 365}{1.67}}$ = 0.96 cm/tahun

3. Sampel Magnesium/Hidroksiapatit/*Shellac*/Serat nanas (140°C)

   PD/T (200°C) = $\sqrt[3]{\frac{r1\ x\ 365}{\rho}} = \sqrt[3]{\frac{0.0024\ x\ 365}{1.67}}$ = 0.89 cm/tahun

4. Sampel Magnesium/Hidroksiapatit/*Shellac*/Serat nanas (160°C)

   PD/T (250°C) = $\sqrt[3]{\frac{r1\ x\ 365}{\rho}} = \sqrt[3]{\frac{0.0022\ x\ 365}{1.67}}$ = 0.81 cm/tahun

LAMPIRAN 5
Nilai Densitas dan Porositas

Tabel Lampiran 5. Hasil Pengujian Densitas

Suhu (°C)	Kering (gram)	Basah (gram)	Densitas (g/cm^3)	Rata-Rata Densitas
100	1.86	0.46	1.324	1.323
	1.84	0.44	1.310	
	1.89	0.48	1.336	
120	1.94	0.58	1.422	1.407
	1.92	0.55	1.397	
	1.96	0.57	1.405	
200	1.94	0.62	1.465	1.470
	1.93	0.63	1.480	
	1.91	0.61	1.464	
250	1.84	0.63	1.517	1.529
	1.82	0.65	1.549	
	1.83	0.63	1.520	

Tabel Lampiran 5. Hasil Pengujian Porositas

Suhu (°C)	Densitas Teoritis	Densitas Aktual	Porositas (%)	Rata-Rata Porositas
100	1.67	1.324	20.72	20.75
	1.67	1.310	21.56	
	1.67	1.336	20.00	
150	1.67	1.422	14.85	15.68
	1.67	1.397	16.35	
	1.67	1.405	15.87	
200	1.67	1.465	12.28	11.99
	1.67	1.480	11.38	
	1.67	1.464	12.34	
250	1.67	1.517	9.16	8.46
	1.67	1.549	7.25	
	1.67	1.520	8.98	

Perhitungan Densitas dan Porositas
Perhitungan Densitas Teoritis

Perhitungan densitas teoritis Magnesium/HA/*Shellac*/Serat nanas 75:25 :

$\rho_{Magnesium}$	= 1.738 gr/cm^3	V_{Tablet}	= 1.14 cm^3
ρ_{HA}	= 3.15 gr/cm^3	$V_{Magnesium}$ dan V_{HA}	= 75%
$\rho_{serat\ nanas}$	= 1.072 gr/cm^3	$V_{serat\ nanas}$	= 25%

$\rho_{komposit}$ Magnesium/HA/*Shellac*/Serat nanas = $\rho_{Magnesium}$ x $V_{Magnesium}$ + ρ_{HA} x V_{HA} + $\rho_{Magnesium}$ x $V_{Magnesium}$ + $\rho_{serat\ nanas}$ x $V_{serat\ nanas}$

= 1.738 (90% x 75%) + 3.15 (10% x 75%) + 1.072 x 25%

= 1.67 gr/cm^3

Perhitungan Densitas Aktual

Keterangan

ρ = Densitas (g/cm^3)

Perhitungan densitas aktual sebagai berikut.

$$\rho_{aktual} = \frac{\rho kering}{\rho kering - \rho basah} \text{ x } 0{,}997 \text{ g/cm}^3 \pm \Delta\rho$$

Rata-rata densitas per sampel

$$\rho = \frac{\sum \rho aktual}{n}$$

Δρ dengan menggunakan excel didapatkan nilai sebagai berikut:

Variasi	Δρ
100°C	0.027
120°C	0.009
140°C	0.009
160°C	0.026

1. Perhitungan densitas aktual 100°C

$$\rho_{100°C} = \frac{1.324+1.310+1.336}{3} = 1.323 \text{ g/cm}^3$$

Sehingga diperoleh $\rho_{100°C} = (1.323 \pm 0.027)$ g/cm^3

2. Perhitungan densitas aktual 120°C

$$\rho_{120°C} = \frac{1.422+1.397+1.405}{3} = 1.408 \text{ g/cm}^3$$

Sehingga diperoleh $\rho_{120°C} = (1.408 \pm 0.009)$ g/cm^3

3. Perhitungan densitas aktual 140°C

$$P_{140°C} = \frac{1.465+1.480+1.464}{3} = 1.470 \text{ g/cm}^3$$

Sehingga diperoleh $\rho_{140°C} = (1.470 \pm 0.009)$ g/cm^3

4. Perhitungan densitas aktual 160°C

$$P_{160°C} = \frac{1.667+1.649+1.721}{3} = 1.679 \text{ g/cm}^3$$

Sehingga diperoleh $\rho_{160°C} = (1.679 \pm 0.026)$ g/cm^3

Perhitungan Porositas

Keterangan

Ø = Porositas (%)

Perhitungan porositas sebagai berikut

$$Ø = \frac{\rho teoritis - \rho aktual}{\rho teoritis} \times 100 \pm \Delta Ø$$

Rata-rata porositas per sampel

$$Ø = \frac{\sum ø}{n}$$

ΔØ dengan menggunakan excel didapatkan nilai sebagai berikut:

Variasi	ΔØ
100°C	0.63
120°C	0.59
140°C	2.56
160°C	0.74

1. Perhitungan porositas 100°C

$$Ø_{100°C} = \frac{20.71+21.55+20.00}{3}$$

= 20.75 %

Sehingga diperoleh $Ø_{100°C}$ = (20.75 ± 0.63) %

2. Perhitungan porositas 120°C

$$Ø_{120°C} = \frac{14.85+16.34+15.86}{3}$$

= 15.68 %

Sehingga diperoleh $Ø_{120°C}$ = (15.68 ± 0.59) %

3. Perhitungan porositas 140°C

$$Ø_{140°C} = \frac{12.27+11.37+13.33}{3}$$

= 11.99 %

Sehingga diperoleh $Ø_{140°C}$ = (11.99 ± 2.56) %

4. Perhitungan porositas 160°C

$$Ø_{160°C} = \frac{9.16+7.24+8.98}{3} =$$

8.46 %

Sehingga diperoleh $Ø_{160°C}$ = (8.46 ± 0.74)