

LAMPIRAN

Lampiran 1 Contoh perhitungan

Perhitungan uji tarik

$$\sigma = \frac{F_{maks}}{A_0}$$

- **Larutan 15ml**

$$L = 19\text{mm} * t = 0,068\text{mm} = 1,292\text{mm}$$

$$\sigma = \frac{2,254}{1,292 \times 10^{-6}} = 1,74 \text{ Mpa}$$

- **Larutan 20ml**

$$L = 19\text{mm} * t = 0,071\text{mm} = 1,349\text{mm}$$

$$\sigma = \frac{2,543}{1,349 \times 10^{-6}} = 1,89 \text{ Mpa}$$

- **Larutan 30ml**

$$L = 19\text{mm} * t = 0,88\text{mm} = 1,672\text{mm}$$

$$\sigma = \frac{2,629}{1,672 \times 10^{-6}} = 1,57 \text{ Mpa}$$

- **Larutan 45ml**

$$L = 19\text{mm} * t = 0,097\text{mm} = 1,843\text{mm}$$

$$\sigma = \frac{2,588}{1,843 \times 10^{-6}} = 1,4 \text{ Mpa}$$

Perhitungan elongation

$$\varepsilon = \frac{\Delta l}{l_0} \times 100 \%$$

- **Larutan 15ml**

$$\varepsilon = \frac{3,16}{25} \times 100 \% = 12,64\%$$

- **Larutan 20ml**

$$\varepsilon = \frac{4,05}{25} \times 100 \% = 16,2\%$$

- **Larutan 30ml**

$$\varepsilon = \frac{5,63}{25} \times 100 \% = 22,52\%$$

- **Larutan 45ml**

$$\varepsilon = \frac{7,35}{25} \times 100 \% = 29,4\%$$

Pehitungan ketebalan rata-rata

$$\text{Ketebalan rata-rata} = \frac{(\text{titik 1} + \text{titik 2} + \text{titik 3} + \text{titik 4} + \text{titik 5})}{5}$$

- **Larutan 15ml**

$$\text{Ketebalan rata-rata} = \frac{(0,068 + 0,071 + 0,07 + 0,065 + 0,07)}{5} = 0,0688\text{mm}$$

- **Larutan 20ml**

$$\text{Ketebalan rata-rata} = \frac{(0,071 + 0,074 + 0,078 + 0,077 + 0,078)}{5} = 0,0756\text{mm}$$

- **Larutan 30ml**

$$\text{Ketebalan rata-rata} = \frac{(0,088 + 0,084 + 0,089 + 0,088 + 0,085)}{5} = 0,0868\text{mm}$$

- **Larutan 45ml**

$$\text{Ketebalan rata-rata} = \frac{(0,097 + 0,09 + 0,092 + 0,089 + 0,096)}{5} = 0,0928\text{mm}$$

Pehituangn Tegangan permukaan

1. Rumus mencari nilai rata-rata

$$x = \frac{\sum xi}{n}$$

Dimana:

X = Nilai rata-rata

Xi = Jumlah semua nilai

n = Banyak data

- **Larutan 15ml**

$$x = \frac{\sum 88 + 86 + 70}{3} = 81,3$$

- **Larutan 20ml**

$$x = \frac{\Sigma 92.6+78.6+85.7}{3} = 85.63$$

- **Larutan 30ml**

$$x = \frac{\Sigma 93+89.7+82}{3} = 88.23$$

- **Larutan 45ml**

$$x = \frac{\Sigma 104.6+80.4+87.4}{3} = 90.8$$

2. Rumus simpangan baku

$$S = \sqrt{\frac{\Sigma(Xi-X)^2}{n}}$$

Dimana:

S = Simpangan baku

X = Nilai rata-rata

Xi = Jumlah semua nilai

n = Banyak data

- **Larutan 15ml**

$$S = \sqrt{\frac{\Sigma(88-81.3)^2+(86-81.3)^2+(70-81.3)^2}{3}} = 9.86$$

- **Larutan 20ml**

$$S = \sqrt{\frac{\Sigma(92.6-85.6)^2+(78.6-85.6)^2+(85.7-85.6)^2}{3}} = 7$$

- **Larutan 30ml**

$$S = \sqrt{\frac{\Sigma(93-88.2)^2+(89.7-88.2)^2+(82-88.2)^2}{3}} = 5.64$$

- **Larutan 45ml**

$$S = \sqrt{\frac{\Sigma(104.6-90.8)^2+(80.4-90.8)^2+(87.4-90.8)^2}{3}} = 12.45$$

3. Rumus tegangan permukaan *solid*

$$\cos \theta = -1 + \sqrt{\frac{\gamma C}{\gamma L}}$$

$$\sqrt{\frac{\gamma C}{\gamma L}} = 1 + \cos \theta$$

$$\sqrt{\frac{\gamma C}{\gamma L}} = \frac{1 + \cos \theta}{2}$$

$$\sqrt{\frac{\gamma C}{\gamma L}} = \left(\frac{1 + \cos \theta}{2}\right)^2 \cdot \gamma L$$

$$\gamma C = \left(\frac{1 + \cos \theta}{2}\right)^2 \cdot \gamma L$$

Dimana:

γC = Tegangan permukaan cairan

γL = Tegangan permukaan material = Larutan pada *liquid aquadest* sehingga nilainya yaitu 72.8

- **Larutan 15ml**

$$\gamma C = \left(\frac{1 + \cos(0.33)}{2}\right)^2 \cdot 72.8 = 24.10 \text{ N/m}^2$$

- **Larutan 20ml**

$$\gamma C = \left(\frac{1 + \cos(0.29)}{2}\right)^2 \cdot 72.8 = 21.08 \text{ N/m}^2$$

- **Larutan 30ml**

$$\gamma C = \left(\frac{1 + \cos(0.27)}{2}\right)^2 \cdot 72.8 = 19.34 \text{ N/m}^2$$

- **Larutan 45ml**

$$\gamma C = \left(\frac{1 + \cos(0.24)}{2}\right)^2 \cdot 72.8 = 17.70 \text{ N/m}^2$$

Lampiran 2 Foto-foto

➤ Proses Pembuatan



➤ Hasil Spesimen

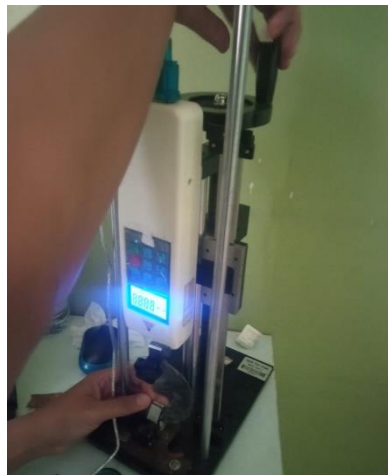


➤ **Proses Pengujian**

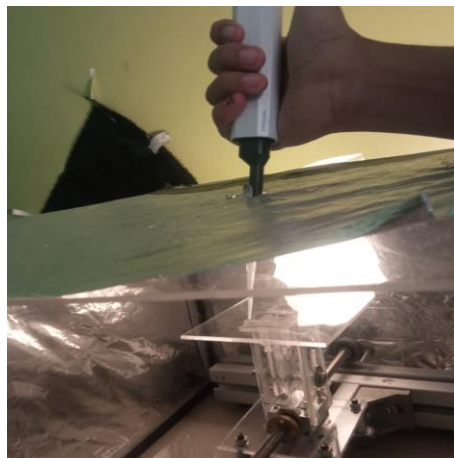
1. Pengujian Ketebalan



2. Pengujian Tarik



3. Sudut Kontak



Chitosan Properties

Melting point	102.5 °C
Density	1 g/cm ³
storage temp.	2-8°C
solubility	dilute aqueous acid (pH <6.5): soluble
form	(Coarse ground flakes and powder)
color	White to Off-white
Odor	Odorless
Stability	Stable. Incompatible with strong oxidizing agents.
InChI	
SMILES	
LogP	-11.706 (est)
CAS DataBase Reference	9012-76-4
EWG's Food Scores	1

https://www.chemicalbook.com/ChemicalProductProperty_EN_CB5209844.htm

Sodium carboxymethyl cellulose Properties

Melting point	274 °C (dec.)
Density	1,6 g/cm ³
FEMA	2239 CARBOXYMETHYLCELLULOSE
storage temp.	room temp
solubility	H ₂ O: 20 mg/mL, soluble
form	low viscosity
pka	4.30(at 25°C)
color	White to light yellow
Odor	Odorless
PH Range	6.5 - 8.5
PH	pH (10g/l, 25°C) 6.0 ~ 8.0
Viscosity	900 to 1400 mPa-s(1 %, H ₂ O, 25 °C)
Water Solubility	soluble
Merck	14,1829

https://www.chemicalbook.com/ChemicalProductProperty_EN_CB1479274.htm

Lampiran 3. Hasil analisis anova *one way*

Ketebalan

15 ml	20ml	30ml	45ml
0,068	0,071	0,071	0,097
0,071	0,074	0,084	0,09
0,07	0,078	0,089	0,092
0,065	0,077	0,088	0,089
0,07	0,078	0,085	0,096

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0,001601	3	0,000534	26,67583	1,83E-06	3,238872
Within Groups	0,00032	16	0,00002			
Total	0,001921	19				

Ketebalan

Duncan

Larutan	N	Subset for alpha = 0.05		
		1	2	3
15ml	5	,069		
20ml	5	,076	,076	
30ml	5		,083	
45ml	5			,093
Sig.		,116	,061	1,000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 5,000.

Ujitarik

15ml	20ml	30ml	45ml
1,74	1,89	1,57	1,4
1,79	1,81	1,63	1,41
1,82	1,72	1,52	1,38

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0,335933	3	0,111978	36,91575	4,93E-05	4,066181
Within Groups	0,024267	8	0,003033			
Total	0,3602	11				

UjiTarik

Duncan

Larutan	N	Subset for alpha = 0.05		
		1	2	3
45ml	3	1,397		
30ml	3		1,573	
15ml	3			1,783
20ml	3			1,807
Sig.		1,000	1,000	,952

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3,000.

Elongation

15ml	20ml	30ml	45ml
3,16	4,05	5,63	7,35
3,24	4,21	5,54	7,47
3,31	4,12	5,47	8,62

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	35,86483	3	11,95494	93,73974	1,42E-06	4,066181
Within Groups	1,020267	8	0,127533			
Total	36,88509	11				

elongation

Duncan^a

larutan	N	Subset for alpha = 0.05			
		1	2	3	4
15ml	3	3,237			
20ml	3		4,127		
30ml	3			5,547	
45ml	3				7,120
Sig.		1,000	1,000	1,000	1,000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3,000.

Sudut Kotak

15ml	20ml	30ml	45ml
88	92,6	93	104,6
86	78,6	89,7	80,4
70	85,7	82	87,4

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	146,82	3	48,94	0,587374	0,640147	4,066181
Within Groups	666,56	8	83,32			
Total	813,38	11				

Sudutkonta

Duncan^a

Larutan	N	Subset for alpha = 0.05
		1
15ml	3	81,333
20ml	3	85,633
30ml	3	88,233
45ml	3	90,800
Sig.		,266

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3,000.

Lampiran 4. Perlakuan Terbaik Der Garmo

Bobot	Pengujian	15ml	20ml	30ml	45ml	Tertinggi	Terendah	selisih
0,3	Uji tarik	1,79	1,8	1,59	1,4	1,8	1,4	0,4
0,3	Renggangan	12,95	16,5	22,2	28,5	28,5	12,95	15,55
0,3	Ketebalan	0,0688	0,0756	0,0868	0,0928	0,0928	0,0688	0,024
0,1	Sudut Kontak	81,3	85,63	88,23	90,8	90,8	81,3	9,5

Parameter	Bobot	15ml		20ml		30ml		45ml	
		NE	NP	NE	NP	NE	NP	NE	NP
Uji tarik	0,3	0,975	0,2925	1	0,3	0,475	0,1425	0	0
Renggangan	0,3	0	0	0,22829582	0,06848875	0,59485531	0,17845659	1	0,3
Ketebalan	0,3	0	0	0,28333333	0,085	0,75	0,225	1	0,3
Sudut Kontak	0,1	0	0	0,45578947	0,04557895	0,72947368	0,07294737	1	0,1
			0,2925		0,49906769		0,61890396		0,7