LAMPIRAN - LAMPIRAN

Lampiran 01. Hasil pengukuran berat kering *Phaffia rhodozyma* pada medium air kelapa dengan pH awal yang berbeda

Perlakuan	Ulangan	Umur (jam)									
		12	24	36	48	60	72	84	96	108	120
P_0	1	0.60	1.30	2.47	4.50	4.33	5.00	4.93	5.20	6.07	6.07
	2	0.53	1.30	2.67	3.23	4.00	4.93	5.47	5.53	5.87	6.33
	3	0.47	1.47	2.33	3.23	4.60	4.73	5.20	5.60	6.20	6.07
	4	0.80	1.13	2.07	3.33	3.87	4.67	5.93	5.60	5.67	6.20
P_1	1	0.53	2.20	3.27	4.20	4.40	6.00	6.60	5.80	6.80	7.00
	2	0.60	2.40	3.40	4.13	5.47	6.13	6.53	6.87	6.27	7.00
	3	0.47	2.00	2.80	4.20	4.80	6.40	6.67	6.93	7.47	6.80
	4	0.33	1.90	3.47	4.00	4.53	6.20	6.00	6.93	7.33	6.67
P_2	1	0.85	2.33	3.47	4.07	4.80	6.67	7.13	8.07	8.73	8.53
	2	0.60	2.40	3.60	3.87	5.33	6.80	7.87	8.20	8.33	8.27
	3	0.60	2.40	3.27	4.00	4.87	6.33	7.33	8.07	8.73	8.53
	4	0.67	1.87	2.60	4.13	5.07	7.07	7.07	8.07	8.27	8.73
P_3	1	0.54	1.73	2.93	3.60	4.33	5.53	6.07	6.25	6.60	6.67
	1	0.57	1.87	2.73	3.27	4.27	5.87	6.13	6.33	6.87	6.73
	1	0.49	1.47	2.87	3.80	4.50	5.67	6.33	6.53	6.60	6.73
	1	0.53	1.53	2.53	3.67	4.53	5.73	6.43	6.53	6.93	6.87
P_4	1	0.53	1.53	2.47	3.93	3.93	5.33	7.20	6.60	6.33	6.33
	2	0.53	1.60	2.67	4.40	5.07	4.93	6.27	6.73	7.80	6.73
	3	0.47	1.47	2.13	3.80	4.60	5.07	6.53	7.13	5.93	6.80
	4	0.47	1.53	2.40	3.60	4.67	5.40	5.47	7.13	5.67	6.27
P_5	1	0.47	1.80	2.67	3.47	4.80	5.20	6.00	6.20	6.27	6.20
	2	0.60	2.00	2.73	3.33	4.40	5.33	5.67	6.27	6.07	6.00
	3	0.53	1.67	2.87	3.27	4.13	5.00	5.00	5.87	6.47	5.67
	4	0.53	1.73	2.47	3.60	4.47	4.93	6.27	5.87	6.67	6.47

Lampiran 02. Uji normalitas (Uji W dari Shapiro dan Wilk) berat kering *P. rhodozyma* pada medium air kelapa dengan pH awal yang berbeda (Widasari, 1988)

Tabel 08. Perhitungan uji normalitas berat kering *P. rhodozyma* umur 12 jam

Perlakuan	Y_i				$Y_i - \overline{Y}$				$(Y_i - \overline{Y})^2$			
	Ulangan				Ulangan				Ulangan			
	1	2	3	4	1	2	3	4	1	2	3	4
P_0	0.60	0.53	0.47	0.80	0.0167	-0.05	-0.017	0.25	0.0002778	0.0025	0.000278	0.0625
P_1	0.53	0.60	0.47	0.33	-0.083	0.05	-0.017	-0.25	0.0069444	0.0025	0.000278	0.0625
P_2	0.85	0.60	0.60	0.67	0.3167	0.05	0.0833	0.15	0.1002778	0.0025	0.006944	0.0225
P_3	0.54	0.57	0.49	0.53	-0.083	-0.05	-0.017	-0.05	0.0069444	0.0025	0.000278	0.0025
P_4	0.53	0.53	0.47	0.47	-0.083	-0.05	-0.017	-0.05	0.0069444	0.0025	0.000278	0.0025
P_5	0.47	0.60	0.53	0.53	-0.083	0.05	-0.017	-0.05	0.0069444	0.0025	0.000278	0.0025
Jumlah	3.5	3.3	3.1	3.3					0.1283333	0.015	0.008333	0.155
Rataan	0.583	0.55	0.517	0.55								

Keterangan :

Yi = Data ke-i

$\overline{Y_i}$ = Rataan data ke-i

Perhitungan :

1. $\sum_{i=1}^{n} (Y_i - \overline{Y})^2 = (Y_1 - \overline{Y})^2 + (Y_2 - \overline{Y})^2 + \ldots + (Y_n + \overline{Y})^2$

$= 0.266196$

2. $b = \sum_{i=1}^{k} a_{n-i+1}(Y_{n-i+1} - Y_i)$

$= (0.4403)(0.9 - 0.3) + (0.3098)(0.8 - 0.5) + \ldots + (0.0107)(0.5 - 0.5)$

$= 1.67$

3. $W_0 = \dfrac{b^2}{\sum_{i=1}^{n} (Y_i - \overline{Y})^2}$

$= 0.854746$

$W_{tabel}\ (\alpha = 0.01\ ;\ 24) = 0.884$

$W_0 < W_{tabel}\ (\alpha = 0.01\ ;\ 24)$ ⟶ asumsi normalitas ditolak

Karena asumsi normalitas ditolak maka dilakukan transformasi data. Adapun hasil perhitungan uji normalitas setelah dilakukan transformasi adalah sebagai berikut :

Perlakuan	Yi								$(Yi-Y)^2$			
	Ulangan								Ulangan			
	1	Trans 1	2	Trans 2	3	Trans 3	4	Trans 4	Trans 1	Trans 2	Trans 3	Trans 4
P_0	0.60	0.778	0.53	0.699	0.47	0.699	0.80	0.9031	0.0005494	0.0015674	0.000174	0.0333866
P_1	0.53	0.699	0.60	0.778	0.47	0.699	0.33	0.4771	0.0031072	0.0015674	0.000174	0.0591699
P_2	0.85	0.954	0.60	0.778	0.60	0.7782	0.67	0.8451	0.0398123	0.0015674	0.004354	0.0155571
P_3	0.54	0.699	0.57	0.699	0.49	0.699	0.53	0.699	0.0031072	0.0015674	0.000174	0.000458
P_4	0.53	0.699	0.53	0.699	0.47	0.699	0.47	0.699	0.0031072	0.0015674	0.000174	0.000458
P_5	0.47	0.699	0.60	0.778	0.53	0.699	0.53	0.699	0.0031072	0.0015674	0.000174	0.000458
Jumlah		4.528		4.431		4.273		4.3222	0.0527905	0.0094045	0.005225	0.1094875
Rataan		0.755		0.739		0.7122		0.7204				

Keterangan :
Trans = Data hasil transformasi

Perhitungan :

1. $$\sum_{i=1}^{n} (Y_i - \overline{Y})^2 = (Y_1 - \overline{Y})^2 + (Y_2 - \overline{Y})^2 + \ldots + (Y_n + \overline{Y})^2$$
$$= 0.15351$$

2. $$b = \sum_{i=1}^{k} a_{n-i+1}(Y_{n-i+1} - Y_i) = (0.4403)(0.954 - 0.4771) + (0.3098)(0.9031 - 0.6989) + \ldots + (0.0107)(0.6989 - 0.6989)$$
$$= 1.2956$$

3. $W_0 = \dfrac{b^2}{\sum_{i=1}^{n} (Y_i - \overline{Y})^2}$

$= 0.884648$

$W_{tabel}\ (\alpha = 0.01\ ;\ 24) = 0.884$

$W_0 > W_{tabel}\ (\alpha = 0.01\ ;\ 24) \longrightarrow$ asumsi normalitas diterima

Dengan perhitungan analog seperti diatas didapatkan hasil sebagai berikut :

Tabel 09. Hasil uji normalitas berat kering *P. rhodozyma* ($W_{0.01}$)

Umur	Wo	Asumsi Normalitas	Transformasi
12 jam	0.854746	Ditolak	0.884648
24 jam	0.927843	Diterima	
36 jam	0.926968	Diterima	
48 jam	0.929376	Diterima	
60 jam	0.985198	Diterima	
72 jam	0.923394	Diterima	
84 jam	0.963171	Diterima	
96 jam	0.920618	Diterima	
108 jam	0.8871	Diterima	
120 jam	0.885414	Diterima	

Lampiran 03. Uji homogenitas (uji Bartlett) berat kering *P. rhodozyma* pada medium air kelapa dengan pH awal yang berbeda (Widasari, 1988)

Tabel 10. Perhitungan uji homogenitas berat kering *P. rhodozyma* umur 12 jam

Perlakuan	Y_i						$(Y_i - \overline{Y})^2$						
	Ulangan				Jumlah	Rataan	Ulangan				Jumlah	S^2	$LogS^2$
	1	2	3	4			1	2	3	4			
P_0	0.60	0.53	0.47	0.80	2.4	0.6	0	0.0049	0.0169	0.04	0.0618	0.0206	-1.68613
P_1	0.53	0.60	0.47	0.33	1.93	0.4825	0.0023	0.0138	0.0002	0.0233	0.039475	0.013158	-1.8808
P_2	0.85	0.60	0.60	0.67	2.72	0.68	0.0289	0.0064	0.0064	1E-04	0.0418	0.013933	-1.85594
P_3	0.54	0.57	0.49	0.53	2.13	0.5325	6E-05	0.0014	0.0018	6E-06	0.003275	0.001092	-2.96191
P_4	0.53	0.53	0.47	0.47	2	0.5	0.0009	0.0009	0.0009	0.0009	0.0036	0.0012	-2.92082
P_5	0.47	0.60	0.53	0.53	2.13	0.5325	0.0039	0.0046	6E-06	6E-06	0.008475	0.002825	-2.54898
Jumlah							0.036	0.032	0.0262	0.0643		0.052808	-13.8546

$$S_i^2 = \frac{1}{3}\{(Y_{i1} - \overline{Y}i)^2 + (Y_{i2} - \overline{Y}_i)^2 + (Y_{i3} - \overline{Y}_i)^2 + (Y_{i4} - \overline{Y}^{ii})^2\}$$

Perhitungan :

1. $S^2 = \frac{\sum S_i^2}{a} = \frac{0.052808}{4} = 0.013202$

$\text{Log}\, S^2 = -1.8794$

2. $m = 2.30256(d.b)\{a\log S^2 - (\sum \log S^2)\}$
   $= 17.81105$

3. $c = 1 + \frac{a+1}{3a(n-1)} = 1.12963$

4. $X^2_{hit} = \frac{m}{c} = \frac{17.81105}{1.12963} = 15.76716$

5. $X^2_{tab(0,001;5)} = 20.517$

$X^2_{hit} < X^2_{tab}$ ⟶ asumsi homogenitas diterima

Dengan perhitungan analog seperti diatas didapatkan hasil sebagai berikut :

Tabel 11. Hasil perhitungan uji homogenitas berat kering *P. rhodozyma* ($X_{0.001}$)

Umur	Xo	Asumsi homogenitas
12 jam	15.76716	Diterima
24 jam	12.156	Diterima
36 jam	10.23159	Diterima
48 jam	20.13075	Diterima
60 jam	11.65019	Diterima
72 jam	8.809318	Diterima
84 jam	12.06566	Diterima
96 jam	18.42847	Diterima
108 jam	19.46064	Diterima
120 jam	15.55021	Diterima

Lampiran 04. Perhitungan analisis sidik ragam (Anova) berat kering *P. rhodozyma* dalam medium air kelapa dengan pH awal yang berbeda (Gomez and Gomez, 1995).

Tabel 12. Berat kering *P. rhodozyma* umur 12 jam

P	Ulangan								Jumlah (Trans)	Rataan (Trans)
	I	Trans I	II	Trans II	III	Trans III	IV	Trans IV		
P_0	0.60	1.77815	0.53	1.72428	0.47	1.67209	0.8	1.90309	7.07761	1.769403
P_1	0.53	1.72428	0.60	1.77815	0.47	1.67209	0.33	1.51851	6.69303	1.673258
P_2	0.85	1.92942	0.60	1.77815	0.60	1.77815	0.67	1.82608	7.3118	1.82795
P_3	0.54	1.73239	0.57	1.75588	0.49	1.69019	0.53	1.72428	6.90274	1.725685
P_4	0.53	1.72428	0.53	1.72428	0.47	1.67209	0.47	1.67209	6.79274	1.698185
P_5	0.47	1.67209	0.60	1.77815	0.53	1.72428	0.53	1.72428	6.8988	1.7247
Jumlah									41.67672	10.41918
Rataan										1.73643

Perhitungan :

1. $FK = \frac{(\sum_{i=1} Y_i)^2}{n} = \frac{(41.67672)^2}{24} = 72.37294$

2. $JKU = (\sum Yi^2) - FK$

$= [(1.77815^2) + (1.72428^2) + \ldots + (1.72428^2)] - 72.37294$

$= 0.15306$

3. $JKP = \frac{(\sum T_p{}^2)}{r} - \text{FK}$

$= \frac{[(7.07761^2) + (6.69303^2) + \ldots + (6.8988^2)]}{4} - 72.37294$

$= 0.060676$

4. JKG = JKU – JKP

$= 0.15306 - 0.060676 = 0.09283$

5. $KTP = \frac{JKP}{dbPerlakuan} = \frac{0.060676}{5} = 0.012135$

6. $KTG = \frac{JKG}{dbGalat} = \frac{0.153056}{18} = 0.005157$

7. $Fhit = \frac{KTP}{KTG} = \frac{0.012135}{0.005157} = 2.353048$

$F_{tabel(5\%)} = 2.77$ dan $F_{tabel\ (1\%)} = 4{,}43$

$F_{hit} < F_{tabel\ (5\%)} < F_{tabel\ (1\%)}$ ⟶ perlakuan berbeda tidak nyata

Tabel 13. Hasil perhitungan analisis sidik ragam (Anova) berat kering *P. rhodozyma* umur 12 jam

Sb. Keragaman	d.b	JK	KT	Fhit	$F_{0.05}$	$F_{0.01}$
Perlakuan	5	0.0607	0.0121	2.35	2.77	4.43
Galat	18	0.0928	0.0052			
Total	23	0.1531				

Tabel 14. Hasil perhitungan analisis sidik ragam (Anova) berat kering *P. rhodozyma* umur 24 jam

Sb. Keragaman	d.b	JK	KT	Fhit	$F_{0.05}$	$F_{0.01}$
Perlakuan	5	2.5952	0.519	16.31**	2.77	4.43
Galat	18	0.573	0.0318			
Total	23	3.1682				

Keterangan :
** = berbeda sangat nyata

Tabel 15. Hasil perhitungan analisis sidik ragam (Anova) berat kering *P. rhodozyma* umur 36 jam

Sb. Keragaman	d.b	JK	KT	Fhit	$F_{0.05}$	$F_{0.01}$
Perlakuan	5	2.831	0.5662	7.38**	2.77	4.43
Galat	18	1.3802	0.0767			
Total	23	4.2111				

Tabel 16. Hasil perhitungan analisis sidik ragam (Anova) berat kering *P. rhodozyma* umur 48 jam

Sb. Keragaman	d.b	JK	KT	Fhit	$F_{0.05}$	$F_{0.01}$
Perlakuan	5	1.6653	0.3331	3.36*	2.77	4.43
Galat	18	1.7829	0.0991			
Total	23	3.4482				

Keterangan :
* = berbeda nyata

Tabel 17. Hasil perhitungan analisis sidik ragam (Anova) berat kering *P. rhodozyma* umur 60 jam

Sb. Keragaman	d.b	JK	KT	Fhit	$F_{0.05}$	$F_{0.01}$
Perlakuan	5	1.7231	0.3446	2.92*	2.77	4.43
Galat	18	2.1238	0.1180			
Total	23	3.8470				

Tabel 18. Hasil perhitungan analisis sidik ragam (Anova) berat kering *P. rhodozyma* umur 72 jam

Sb. Keragaman	d.b	JK	KT	Fhit	$F_{0.05}$	$F_{0.01}$
Perlakuan	5	10.3755	2.0751	49.96**	2.77	4.43
Galat	18	0.7476	0.0415			
Total	23	11.1231				

Tabel 19. Hasil perhitungan analisis sidik ragam (Anova) berat kering *P. rhodozyma* umur 84 jam

Sb. Keragaman	d.b	JK	KT	Fhit	$F_{0.05}$	$F_{0.01}$
Perlakuan	5	9.1363	1.8353	8.78**	2.77	4.43
Galat	18	3.7435	0.2080			
Total	23	12.8698				

Tabel 20. Hasil perhitungan analisis sidik ragam (Anova) berat kering *P. rhodozyma* umur 96 jam

Sb. Keragaman	d.b	JK	KT	Fhit	$F_{0.05}$	$F_{0.01}$
Perlakuan	5	15.7266	3.1453	38.51**	2.77	4.43
Galat	18	1.4700	0.0817			
Total	23	17.1966				

Tabel 21. Hasil perhitungan analisis sidik ragam (Anova) berat kering *P. rhodozyma* umur 108 jam

Sb. Keragaman	d.b	JK	KT	Fhit	$F_{0.05}$	$F_{0.01}$
Perlakuan	5	15.9879	3.1976	13.71**	2.77	4.43
Galat	18	4.1988	0.2333			
Total	23	20.1867				

Tabel 22. Hasil perhitungan analisis sidik ragam (Anova) berat kering *P. rhodozyma* umur 120 jam

Sb. Keragaman	d.b	JK	KT	Fhit	$F_{0.05}$	$F_{0.01}$
Perlakuan	5	15.7153	3.1431	69.43**	2.77	4.43
Galat	18	0.8148	0.0453			
Total	23	16.5301				

Lampiran 05. Perhitungan konsentrasi pigmen total *Phaffia rhodozyma* pada medium air kelapa dengan pH awal yang berbeda

Umur	P	Ulangan	BK (g/ml)	A	Vol (ml)	V*A*100	16*BK	PT (µg/g)	Rataan
12 jam	P_0	1	0.0006	0.01	0.5	0.5	0.0096	52.0833333	
		2	0.00053	0.01	0.5	0.5	0.00848	58.9622642	
		3	0.00047	0.01	0.5	0.5	0.00752	66.4893617	
		4	0.0008	0.02	0.5	1	0.0128	78.125	63.9149898
	P_1	1	0.00053	0.01	0.5	0.5	0.00848	58.9622642	
		2	0.0006	0.01	0.5	0.5	0.0096	52.0833333	
		3	0.00047	0.01	0.5	0.5	0.00752	66.4893617	
		4	0.00033	0.01	0.5	0.5	0.00528	94.6969697	68.0579822
	P_2	1	0.00085	0.02	0.5	1	0.0136	73.5294118	
		2	0.0006	0.01	0.5	0.5	0.0096	52.0833333	
		3	0.0006	0.01	0.5	0.5	0.0096	52.0833333	
		4	0.00067	0.01	0.5	0.5	0.01072	46.641791	56.0844674
	P_3	1	0.00054	0.01	0.5	0.5	0.00864	57.8703704	
		2	0.00057	0.01	0.5	0.5	0.00912	54.8245614	
		3	0.00049	0.01	0.5	0.5	0.00784	63.7755102	
		4	0.00053	0.01	0.5	0.5	0.00848	58.9622642	58.8581765
	P_4	1	0.00053	0.01	0.5	0.5	0.00848	58.9622642	
		2	0.00053	0.01	0.5	0.5	0.00848	58.9622642	
		3	0.00047	0.01	0.5	0.5	0.00752	66.4893617	
		4	0.00047	0.01	0.5	0.5	0.00752	66.4893617	62.7258129
	P_5	1	0.00047	0.01	0.5	0.5	0.00752	66.4893617	
		2	0.0006	0.01	0.5	0.5	0.0096	52.0833333	
		3	0.00053	0.01	0.5	0.5	0.00848	58.9622642	
		4	0.00053	0.01	0.5	0.5	0.00848	58.9622642	59.1243058

Keterangan : P : Perlakuan
BK : berat kering sel
Vol : volume metanol (pelarut organik)
PT : pigmen total

Umur	P	Ulangan	BK (g/ml)	A	Vol (ml)	V*A*100	16*BK	PT (µg/g)	Rataan
24 jam	P_0	1	0.0013	0.03	0.5	1.5	0.0208	72.1153846	
		2	0.0013	0.03	0.5	1.5	0.0208	72.1153846	
		3	0.00147	0.03	0.5	1.5	0.02352	63.7755102	
		4	0.00113	0.02	0.5	1	0.01808	55.3097345	65.8290035
	P_1	1	0.0022	0.05	0.5	2.5	0.0352	71.0227273	
		2	0.0024	0.05	0.5	2.5	0.0384	65.1041667	
		3	0.002	0.05	0.5	2.5	0.032	78.125	
		4	0.0019	0.04	0.5	2	0.0304	65.7894737	70.0103419
	P_2	1	0.00233	0.04	0.5	2	0.03728	53.6480687	
		2	0.0024	0.05	0.5	2.5	0.0384	65.1041667	
		3	0.0024	0.06	0.5	3	0.0384	78.125	
		4	0.00187	0.05	0.5	2.5	0.02992	83.5561497	70.1083463
	P_3	1	0.00173	0.04	0.5	2	0.02768	72.2543353	
		2	0.00187	0.04	0.5	2	0.02992	66.8449198	
		3	0.00147	0.04	0.5	2	0.02352	85.0340136	
		4	0.00153	0.04	0.5	2	0.02448	81.6993464	76.4581538
	P_4	1	0.00153	0.03	0.5	1.5	0.02448	61.2745098	
		2	0.0016	0.04	0.5	2	0.0256	78.125	
		3	0.00147	0.03	0.5	1.5	0.02352	63.7755102	
		4	0.00153	0.03	0.5	1.5	0.02448	61.2745098	66.1123825
	P_5	1	0.0018	0.04	0.5	2	0.0288	69.4444444	
		2	0.002	0.03	0.5	1.5	0.032	46.875	
		3	0.00167	0.03	0.5	1.5	0.02672	56.1377246	
		4	0.00173	0.04	0.5	2	0.02768	72.2543353	61.1778761

Umur	P	Ulangan	BK (g/ml)	A	Vol (ml)	V*A*100	16*BK	PT (µg/g)	Rataan
36 jam	P_0	1	0.00247	0.03	1	3	0.03952	75.9109312	
		2	0.00267	0.03	1	3	0.04272	70.2247191	
		3	0.00233	0.03	1	3	0.03728	80.472103	
		4	0.00207	0.03	1	3	0.03312	90.5797101	79.2968659
	P_1	1	0.003267	0.04	1	4	0.052272	76.5228038	
		2	0.0034	0.04	1	4	0.0544	73.5294118	
		3	0.0028	0.04	1	4	0.0448	89.2857143	
		4	0.003467	0.05	1	5	0.055472	90.1355639	82.3683734
	P_2	1	0.003467	0.05	1	5	0.055472	90.1355639	
		2	0.0036	0.05	1	5	0.0576	86.8055556	
		3	0.003267	0.05	1	5	0.052272	95.6535047	
		4	0.0026	0.04	1	4	0.0416	96.1538462	92.1871176
	P_3	1	0.00293	0.04	1	4	0.04688	85.3242321	
		2	0.00273	0.04	1	4	0.04368	91.5750916	
		3	0.00287	0.04	1	4	0.04592	87.1080139	
		4	0.00253	0.04	1	4	0.04048	98.8142292	90.7053917
	P_4	1	0.00247	0.04	1	4	0.03952	101.214575	
		2	0.00267	0.03	1	3	0.04272	70.2247191	
		3	0.00213	0.03	1	3	0.03408	88.028169	
		4	0.0024	0.03	1	3	0.0384	78.125	84.3981158
	P_5	1	0.00267	0.03	1	3	0.04272	70.2247191	
		2	0.00273	0.04	1	4	0.04368	91.5750916	
		3	0.00287	0.04	1	4	0.04592	87.1080139	
		4	0.00247	0.03	1	3	0.03952	75.9109312	81.2046889

Umur	P	Ulangan	BK (g/ml)	A	Vol (ml)	V*A*100	16*BK	PT (µg/g)	Rataan
48 jam	P_0	1	0.0045	0.07	1	7	0.072	97.2222222	
		2	0.00323	0.06	1	6	0.05168	116.099071	
		3	0.00323	0.06	1	6	0.05168	116.099071	
		4	0.00333	0.06	1	6	0.05328	112.612613	110.508244
	P_1	1	0.0042	0.08	1	8	0.0672	119.047619	
		2	0.00413	0.07	1	7	0.06608	105.932203	
		3	0.0042	0.08	1	8	0.0672	119.047619	
		4	0.004	0.07	1	7	0.064	109.375	113.35061
	P_2	1	0.00407	0.09	1	9	0.06512	138.206388	
		2	0.00387	0.08	1	8	0.06192	129.198966	
		3	0.004	0.09	1	9	0.064	140.625	
		4	0.00413	0.08	1	8	0.06608	121.065375	132.273932
	P_3	1	0.0036	0.08	1	8	0.0576	138.888889	
		2	0.00327	0.07	1	7	0.05232	133.792049	
		3	0.0038	0.07	1	7	0.0608	115.131579	
		4	0.00367	0.07	1	7	0.05872	119.209809	126.755582
	P_4	1	0.00393	0.07	1	7	0.06288	111.323155	
		2	0.0044	0.07	1	7	0.0704	99.4318182	
		3	0.0038	0.07	1	7	0.0608	115.131579	
		4	0.0036	0.08	1	8	0.0576	138.888889	116.19386
	P_5	1	0.00347	0.06	1	6	0.05552	108.069164	
		2	0.00333	0.05	1	5	0.05328	93.8438438	
		3	0.00327	0.06	1	6	0.05232	114.678899	
		4	0.0036	0.07	1	7	0.0576	121.527778	109.529921

Umur	P	Ulangan	BK (g/ml)	A	Vol (ml)	V*A*100	16*BK	PT (µg/g)	Rataan
60 jam	P_0	1	0.00433	0.04	2	8	0.06928	115.473441	
		2	0.004	0.05	2	10	0.064	156.25	
		3	0.0046	0.05	2	10	0.0736	135.869565	
		4	0.00387	0.04	2	8	0.06192	129.198966	134.197993
	P_1	1	0.0044	0.06	2	12	0.0704	170.454545	
		2	0.00547	0.06	2	12	0.08752	137.111517	
		3	0.0048	0.06	2	12	0.0768	156.25	
		4	0.00453	0.05	2	10	0.07248	137.969095	150.446289
	P_2	1	0.0048	0.06	2	12	0.0768	156.25	
		2	0.00533	0.07	2	14	0.08528	164.165103	
		3	0.00487	0.07	2	14	0.07792	179.671458	
		4	0.00507	0.08	2	16	0.08112	197.238659	174.331305
	P_3	1	0.00433	0.05	2	10	0.06928	144.341801	
		2	0.00427	0.05	2	10	0.06832	146.370023	
		3	0.0045	0.06	2	12	0.072	166.666667	
		4	0.00453	0.06	2	12	0.07248	165.562914	155.735351
	P_4	1	0.00393	0.05	2	10	0.06288	159.033079	
		2	0.00507	0.06	2	12	0.08112	147.928994	
		3	0.0046	0.05	2	10	0.0736	135.869565	
		4	0.00467	0.05	2	10	0.07472	133.832976	144.166154
	P_5	1	0.0048	0.05	2	10	0.0768	130.208333	
		2	0.0044	0.05	2	10	0.0704	142.045455	
		3	0.00413	0.04	2	8	0.06608	121.065375	
		4	0.00447	0.06	2	12	0.07152	167.785235	140.2761

Umur	P	Ulangan	BK (g/ml)	A	Vol (ml)	V*A*100	16*BK	PT (µg/g)	Rataan
72 jam	P_0	1	0.005	0.07	2	14	0.08	175	
		2	0.00493	0.06	2	12	0.07888	152.129817	
		3	0.00473	0.06	2	12	0.07568	158.562368	
		4	0.00467	0.06	2	12	0.07472	160.599572	161.572939
	P_1	1	0.006	0.09	2	18	0.096	187.5	
		2	0.00613	0.08	2	16	0.09808	163.132137	
		3	0.0064	0.08	2	16	0.1024	156.25	
		4	0.0062	0.08	2	16	0.0992	161.290323	167.043115
	P_2	1	0.00667	0.1	2	20	0.10672	187.406297	
		2	0.0068	0.1	2	20	0.1088	183.823529	
		3	0.00633	0.09	2	18	0.10128	177.725118	
		4	0.00707	0.11	2	22	0.11312	194.483734	185.85967
	P_3	1	0.00553	0.08	2	16	0.08848	180.831826	
		2	0.00587	0.08	2	16	0.09392	170.357751	
		3	0.00567	0.07	2	14	0.09072	154.320988	
		4	0.00573	0.08	2	16	0.09168	174.52007	170.007659
	P_4	1	0.00533	0.07	2	14	0.08528	164.165103	
		2	0.00493	0.06	2	12	0.07888	152.129817	
		3	0.00507	0.07	2	14	0.08112	172.583826	
		4	0.0054	0.07	2	14	0.0864	162.037037	162.728946
	P_5	1	0.0052	0.07	2	14	0.0832	168.269231	
		2	0.00533	0.07	2	14	0.08528	164.165103	
		3	0.005	0.07	2	14	0.08	175	
		4	0.00493	0.06	2	12	0.07888	152.129817	164.891038

Umur	P	Ulangan	BK (g/ml)	A	Vol (ml)	V*A*100	16*BK	PT (µg/g)	Rataan
84 jam	P_0	1	0.00493	0.07	2	14	0.07888	177.484787	
		2	0.00547	0.07	2	14	0.08752	159.963437	
		3	0.0052	0.07	2	14	0.0832	168.269231	
		4	0.00593	0.08	2	16	0.09488	168.634064	168.58788
	P_1	1	0.0066	0.09	2	18	0.1056	170.454545	
		2	0.00653	0.09	2	18	0.10448	172.281776	
		3	0.00667	0.1	2	20	0.10672	187.406297	
		4	0.006	0.09	2	18	0.096	187.5	179.410655
	P_2	1	0.00713	0.11	2	22	0.11408	192.847125	
		2	0.00787	0.12	2	24	0.12592	190.597205	
		3	0.00733	0.11	2	22	0.11728	187.585266	
		4	0.00707	0.11	2	22	0.11312	194.483734	191.378332
	P_3	1	0.00607	0.08	2	16	0.09712	164.744646	
		2	0.00613	0.09	2	18	0.09808	183.523654	
		3	0.00633	0.09	2	18	0.10128	177.725118	
		4	0.00643	0.1	2	20	0.10288	194.401244	180.098666
	P_4	1	0.0072	0.1	2	20	0.1152	173.611111	
		2	0.00627	0.09	2	18	0.10032	179.425837	
		3	0.00653	0.09	2	18	0.10448	172.281776	
		4	0.00547	0.08	2	16	0.08752	182.815356	177.03352
	P_5	1	0.006	0.08	2	16	0.096	166.666667	
		2	0.00567	0.08	2	16	0.09072	176.366843	
		3	0.005	0.07	2	14	0.08	175	
		4	0.00627	0.09	2	18	0.10032	179.425837	174.364837

Umur	P	Ulangan	BK (g/ml)	A	Vol (ml)	V*A*100	16*BK	PT (µg/g)	Rataan
96 jam	P_0	1	0.0052	0.07	2	14	0.0832	168.269231	
		2	0.00553	0.08	2	16	0.08848	180.831826	
		3	0.0056	0.08	2	16	0.0896	178.571429	
		4	0.0056	0.08	2	16	0.0896	178.571429	176.560979
	P_1	1	0.0058	0.09	2	18	0.0928	193.965517	
		2	0.00687	0.1	2	20	0.10992	181.950509	
		3	0.00693	0.1	2	20	0.11088	180.37518	
		4	0.00693	0.1	2	20	0.11088	180.37518	184.166597
	P_2	1	0.00807	0.12	2	24	0.12912	185.873606	
		2	0.0082	0.13	2	26	0.1312	198.170732	
		3	0.00807	0.13	2	26	0.12912	201.363073	
		4	0.00807	0.13	2	26	0.12912	201.363073	196.692621
	P_3	1	0.00625	0.1	2	20	0.1	200	
		2	0.00633	0.09	2	18	0.10128	177.725118	
		3	0.00653	0.1	2	20	0.10448	191.424196	
		4	0.00653	0.1	2	20	0.10448	191.424196	190.143378
	P_4	1	0.0066	0.1	2	20	0.1056	189.393939	
		2	0.00673	0.1	2	20	0.10768	185.735513	
		3	0.00713	0.11	2	22	0.11408	192.847125	
		4	0.00713	0.1	2	20	0.11408	175.315568	185.823036
	P_5	1	0.0062	0.09	2	18	0.0992	181.451613	
		2	0.00627	0.09	2	18	0.10032	179.425837	
		3	0.00587	0.09	2	18	0.09392	191.65247	
		4	0.00587	0.09	2	18	0.09392	191.65247	186.045598

Umur	P	Ulangan	BK (g/ml)	A	Vol (ml)	V*A*100	16*BK	PT (µg/g)	Rataan
108 jam	P_0	1	0.00607	0.09	2	18	0.09712	185.337727	
		2	0.00587	0.09	2	18	0.09392	191.65247	
		3	0.0062	0.09	2	18	0.0992	181.451613	
		4	0.00567	0.08	2	16	0.09072	176.366843	183.702163
	P_1	1	0.0068	0.11	2	22	0.1088	202.205882	
		2	0.00627	0.1	2	20	0.10032	199.362041	
		3	0.00747	0.11	2	22	0.11952	184.069612	
		4	0.00733	0.12	2	24	0.11728	204.638472	197.569002
	P_2	1	0.00873	0.15	2	30	0.13968	214.776632	
		2	0.00833	0.14	2	28	0.13328	210.084034	
		3	0.00873	0.15	2	30	0.13968	214.776632	
		4	0.00827	0.14	2	28	0.13232	211.608222	212.81138
	P_3	1	0.00667	0.1	2	20	0.10672	187.406297	
		2	0.00687	0.12	2	24	0.10992	218.340611	
		3	0.0068	0.11	2	22	0.1088	202.205882	
		4	0.00693	0.11	2	22	0.11088	198.412698	201.591372
	P_4	1	0.00633	0.1	2	20	0.10128	197.472354	
		2	0.0078	0.12	2	24	0.1248	192.307692	
		3	0.00593	0.1	2	20	0.09488	210.79258	
		4	0.00567	0.09	2	18	0.09072	198.412698	199.746331
	P_5	1	0.00627	0.09	2	18	0.10032	179.425837	
		2	0.00607	0.09	2	18	0.09712	185.337727	
		3	0.00647	0.1	2	20	0.10352	193.199382	
		4	0.00667	0.11	2	22	0.10672	206.146927	191.027468

Umur	P	Ulangan	BK (g/ml)	A	Vol (ml)	V*A*100	16*BK	PT (µg/g)	Rataan
120 jam	P_0	1	0.00607	0.09	2	18	0.09712	185.337727	
		2	0.00633	0.1	2	20	0.10128	197.472354	
		3	0.00607	0.1	2	20	0.09712	205.930807	
		4	0.0062	0.09	2	18	0.0992	181.451613	192.548125
	P_1	1	0.007	0.12	2	24	0.112	214.285714	
		2	0.007	0.11	2	22	0.112	196.428571	
		3	0.0068	0.1	2	20	0.1088	183.823529	
		4	0.00667	0.11	2	22	0.10672	206.146927	200.171185
	P_2	1	0.00853	0.15	2	30	0.13648	219.812427	
		2	0.00827	0.15	2	30	0.13232	226.723096	
		3	0.00853	0.15	2	30	0.13648	219.812427	
		4	0.00873	0.15	2	30	0.13968	214.776632	220.281145
	P_3	1	0.00667	0.11	2	22	0.10672	206.146927	
		2	0.00673	0.11	2	22	0.10768	204.309064	
		3	0.00673	0.11	2	22	0.10768	204.309064	
		4	0.00687	0.12	2	24	0.10992	218.340611	208.276416
	P_4	1	0.00633	0.11	2	22	0.10128	217.219589	
		2	0.00673	0.11	2	22	0.10768	204.309064	
		3	0.0068	0.11	2	22	0.1088	202.205882	
		4	0.00627	0.1	2	20	0.10032	199.362041	205.774144
	P_5	1	0.0062	0.1	2	20	0.0992	201.612903	
		2	0.006	0.1	2	20	0.096	208.333333	
		3	0.00567	0.09	2	18	0.09072	198.412698	
		4	0.00647	0.1	2	20	0.10352	193.199382	200.389579

Lampiran 06. Data produksi pigmen *Phaffia rhodozyma* pada medium air kelapa dengan pH awal yang berbeda

Perlakuan	Ulangan	Umur (jam)									
		12	24	36	48	60	72	84	96	108	120
P_0	1	52.083	72.115	75.911	97.222	115.47	175	177.48	168.27	185.34	185.34
	2	58.962	72.115	70.24	116.1	156.25	152.13	159.96	180.83	191.65	197.47
	3	66.489	63.776	80.47	112.61	135.87	158.56	168.27	178.57	181.45	205.93
	4	78.125	55.31	90.58	116.1	129.2	160.6	168.63	178.57	176.37	181.45
P_1	1	58.962	71.023	76.52	119.05	170.45	163.13	170.45	193.97	202.21	214.29
	2	52.083	65.104	73.53	105.93	137.11	187.5	172.28	181.95	199.36	196.43
	3	66.489	78.125	89.29	119.05	156.25	156.25	187.41	180.38	184.07	183.82
	4	94.697	65.789	90.14	109.38	137.97	161.29	187.5	180.38	204.64	206.15
P_2	1	73.529	53.648	90.14	138.21	156.25	187.41	192.85	185.87	214.78	219.81
	2	52.083	65.104	86.81	129.2	164.17	183.82	190.6	198.17	210.08	226.72
	3	52.083	78.125	95.65	140.63	179.67	177.73	187.59	201.36	214.78	219.81
	4	46.642	83.556	96.15	121.07	197.24	194.48	194.48	201.36	211.61	214.78
P_3	1	57.87	72.254	85.3242	138.89	144.34	180.83	164.74	200	187.41	206.15
	2	54.825	66.845	91.58	133.79	146.37	170.36	183.52	177.73	218.34	204.31
	3	63.776	85.034	87.11	115.13	166.67	154.32	177.73	191.42	202.21	204.31
	4	58.962	81.699	98.81	119.21	165.56	174.52	194.4	191.42	198.41	218.28
P_4	1	58.962	61.275	101.21	111.32	159.03	164.17	173.61	189.39	197.47	217.22
	2	58.962	78.125	70.22	99.43	147.93	152.13	179.43	185.74	192.31	204.31
	3	66.489	63.776	88.03	115.13	135.87	172.58	172.28	192.85	210.79	202.21
	4	66.489	61.275	78.13	138.89	133.83	162.04	182.82	175.32	198.41	199.36
P_5	1	66.489	69.444	70.22	108.07	130.21	168.27	166.67	181.45	179.43	201.61
	2	52.083	46.875	91.58	93.84	142.04	164.17	176.37	179.43	185.34	208.33
	3	58.962	56.138	87.11	114.68	121.07	175	175	191.65	193.2	198.41
	4	58.962	72.254	75.91	121.53	167.79	152.13	179.43	191.45	206.15	193.2

Lampiran 07. Uji normalitas (uji W dari Shapiro dan Wilk) pigmen total *P. rhodozyma* pada medium air kelapa dengan pH awal yang berbeda (Widasari, 1988)

Tabel 23. Perhitungan uji normalitas pigmen total *P. rhodozyma* umur 12 jam

P	Yi				$Y_i - \overline{Y_i}$				$(Y_i - \overline{Y_i})^2$			
	Ulangan				Ulangan				Ulangan			
	1	2	3	4	1	2	3	4	1	2	3	4
P_0	52.08	58.96	66.49	78.13	-9.233	-4.129	4.1077	10.812	85.245211	17.048641	16.87293	116.90295
P_1	58.96	52.08	66.49	94.70	-2.354	-2.75	4.1077	27.384	5.5405314	7.5625	16.87293	749.89258
P_2	73.53	52.08	52.08	46.64	12.213	-2.75	-10.3	-20.67	149.16144	7.5625	106.0557	427.28335
P_3	57.87	54.83	63.78	58.96	-3.446	-0.008	1.3947	-8.351	11.873767	6.4E-05	1.945095	69.736417
P_4	58.96	58.96	66.49	66.49	-2.354	4.129	4.1077	-0.824	5.5405314	17.048641	16.87293	0.6787014
P_5	66.49	52.08	58.96	58.96	5.1732	-2.75	-3.419	-8.351	26.761653	7.5625	11.69184	69.736417
Jumlah	367.9	329	374.3	403.9					284.12313	56.784846	170.3114	1434.2304
Rataan	61.32	54.83	62.38	67.31								

Perhitungan :

1. $\sum_{i=1}^{n} (Y_i - \overline{Y})^2 = (Y_1 - \overline{Y})^2 + (Y_2 - \overline{Y})^2 + \ldots + (Y_n + \overline{Y})^2$

$= 2419.7043$

2. $b = \sum_{i=1}^{k} a_{n-i+1}(Y_{n-i+1} - Y_i)$ = (0,4403) (94.697 – 46.642) + (0,3098) (78.125 – 52.083) + ... + (0,0107) (58.962 – 58.962)

= 45.19952

3. $W_0 = \dfrac{b^2}{\sum_{i=1}^{n} (Y_i - \overline{Y})^2}$

= 0.844317

W_{tabel} (α = 0,01 ; 24) = 0,884

$W_0 < W_{tabel}$ (α = 0,01 ; 24) ⟶ asumsi normalitas ditolak

Karena asumsi normalitas ditolak maka dilakukan transformasi data. Adapun hasil uji normalitas setelah data ditransformasi adalah sebagai berikut :

P	Yi								$(Y_i - \overline{Y}_i)^2$			
	Ulangan								Ulangan			
	1	Trans 1	2	Trans 2	3	Trans 3	4	Trans 4	Trans 1	Trans 2	Trans 3	Trans 4
P_0	52.08	2.717	58.96	2.771	66.489	2.8227	78.125	2.8928	0.0046541	0.0010371	0.000864	0.0057492
P_1	58.96	2.771	52.08	2.717	66.489	2.8227	94.697	2.9763	0.0002058	0.0004697	0.000864	0.0253988
P_2	73.53	2.866	52.08	2.717	52.083	2.7167	46.642	2.6688	0.006649	0.0004697	0.005878	0.02196
P_3	57.87	2.762	54.83	2.739	63.776	2.8047	58.962	2.7706	0.0005046	0.0000037	0.000128	0.0021524
P_4	58.96	2.771	58.96	2.771	66.489	2.8227	66.489	2.8227	0.0002058	0.0010371	0.000864	3.345E-05
P_5	66.49	2.823	52.08	2.717	58.962	2.7706	58.962	2.7706	0.0014313	0.0004697	0.000519	0.0021524
Jumlah		16.71		16.43		16.76		16.902	0.0136506	0.0034836	0.009116	0.0574463
Rataan		2.785		2.738		2.7934		2.817				

Perhitungan :

1. $$\sum_{i=1}^{n} (Y_i - \overline{Y})^2 = (Y_1 - \overline{Y})^2 + (Y_2 - \overline{Y})^2 + \ldots + (Y_n + \overline{Y})^2$$
$$= 66.80169$$

2. $$b = \sum_{i=1}^{k} a_{n-i+1} (Y_{n-i+1} - Y_i)$$
$$= (0{,}4403)\,(2.976336 - 2.668777) + (0{,}3098)\,(2.89279 - 2.716698) + \ldots + (0{,}0107)\,(2.770572 - 2.770572)$$
$$= 0.304834$$

3. $W_0 = \dfrac{b^2}{\sum_{i=1}^{n} (Y_i - \overline{Y})^2}$

$= 0{,}900139$

$W_{tabel}\ (\alpha = 0{,}01\ ;\ 24) = 0{,}884$

$W_0 > W_{tabel}\ (\alpha = 0{,}01\ ;\ 24) \longrightarrow$ asumsi normalitas diterima

Dengan perhitungan analog dengan perhitungan diatas maka didapatkan hasil sebagai berikut :

Tabel 24. Hasil uji normalitas pigmen total *P. rhodozyma* ($W_{0.01}$)

Umur	Wo	Asumsi Normalitas	Transformasi
12 jam	0.844317	Ditolak	0.900139
24 jam	0.926399	Diterima	
36 jam	0.956301	Diterima	
48 jam	0.908967	Diterima	
60 jam	0.948825	Diterima	
72 jam	0.964376	Diterima	
84 jam	3.948837	Diterima	
96 jam	0.931205	Diterima	
108 jam	0.952755	Diterima	
120 jam	0.897228	Diterima	

Lampiran 08. Uji homogenitas pigmen total *P. rhodozyma* pada medium air kelapa dengan pH awal yang berbeda (Widasari, 1988)

Tabel 25. Perhitungan uji homogenitas pigmen total *P. rhodozyma* umur 12 jam

P	Y_i						$(Y_i - \overline{Y})^2$					S^2	$LogS^2$
	Ulangan				Jumlah	Rataan	Ulangan				Jumlah		
	1	2	3	4			1	2	3	4			
P_0	52.08	58.96	66.49	78.13	255.659	63.9148	139.99	24.53	6.6268	201.93	373.078	124.3593	2.094678
P_1	58.96	52.08	66.49	94.7	272.231	68.0578	82.733	255.19	2.461	709.65	1050.036	350.012	2.544083
P_2	73.53	52.08	52.08	46.64	224.337	56.0843	304.32	16.01	16.01	89.156	425.4954	141.8318	2.151774
P_3	57.87	54.83	63.78	58.96	235.433	58.8583	0.9766	16.267	24.184	0.0108	41.43877	13.81292	1.140286
P_4	58.96	58.96	66.49	66.49	250.902	62.7255	14.164	14.164	14.164	14.164	56.65573	18.88524	1.276123
P_5	66.49	52.08	58.96	58.96	236.496	59.124	54.243	49.576	0.0262	0.0262	103.8714	34.6238	1.539375
Jumlah							596.43	375.74	63.472	1014.9		683.5251	10.74632

Keterangan :

$$S_i^2 = \frac{1}{3}\{(Y_{i1} - \overline{Y}i)^2 + (Y_{i2} - \overline{Y}_i)^2 + (Y_{i3} - \overline{Y}_i)^2 + (Y_{i4} - \overline{Y}^{ii})^2\}$$

Perhitungan :

1. $S^2 = \frac{\sum S_i^2}{a} = \frac{672.3737217}{4} = 168.0934$

   $\text{Log}\, S^2 = 2.225551$

2. $m = 2.30256(d.b)\{a \log S^2 - (\sum \log S^2)\}$

   $= 17.38739$

3. $c = 1 + \frac{a+1}{3a(n-1)} = 1.12963$

4. $X^2_{hit} = \frac{m}{c} = \frac{17.38739}{1.12963} = 15.39212$

5. $X^2_{tab(0,001;5)} = 20.517$

$X^2_{hit} < X^2_{tab}$ ⟶ asumsi homogenitas diterima

Dengan perhitungan analog seperti diatas didapatkan hasil sebagai berikut :

Tabel 26. Hasil perhitungan uji homogenitas pigmen total *P. rhodozyma* ($X_{0.001}$)

Umur	Xo	Asumsi homogenitas
12 jam	15.39212	Diterima
24 jam	8.732721	Diterima
36 jam	9.992003	Diterima
48 jam	9.005145	Diterima
60 jam	7.701574	Diterima
72 jam	7.972837	Diterima
84 jam	12.44776	Diterima
96 jam	7.233443	Diterima
108 jam	12.92256	Diterima
120 jam	10.08233	Diterima

Lampiran 09. Perhitungan analisis sidik ragam (Anova) pigmen total *P. rhodozyma* dalam medium air kelapa dengan pH awal yang berbeda

Tabel 27. Pigmen total *P. rhodozyma* umur 12 jam

P	Ulangan								Jumlah (Trans)	Rataan (Trans)
	I	Trans I	II	Trans II	III	Trans III	IV	Trans IV		
P_0	52.083	1.7167	58.962	1.77057	66.489	1.82275	78.125	1.89279	7.202808	1.800702
P_1	58.962	1.77057	52.083	1.7167	66.489	1.82275	94.697	1.97634	7.286354	1.821589
P_2	73.529	1.86646	52.083	1.7167	52.083	1.7167	46.642	1.66878	6.968628	1.742157
P_3	57.87	1.76245	54.825	1.73898	63.776	1.80466	58.962	1.77057	7.076662	1.769165
P_4	58.962	1.77057	58.962	1.77057	66.489	1.82275	66.489	1.82275	7.186644	1.796661
P_5	66.489	1.82275	52.083	1.7167	58.962	1.77057	58.962	1.77057	7.08059	1.770148
Jumlah									42.80169	10.70042
Rataan										1.783404

Perhitungan :

1. $FK = \frac{(\sum_{i=1} Y_i)^2}{n} = \frac{(42.80)^2}{24} = 13.01946$

2. $JKU = (\sum Yi^2) - FK$

$= [(1.76245^2) + (1.73898^2) + \ldots + (1.77057^2)] - 13.01946$

$= 0.153506$

3. $JKP = \frac{(\sum T_p{}^2)}{r} - FK$

$= \frac{[(7.076662^2) + (7.202808^2) + \ldots + (7.08059^2)]}{4} - 13.01946$

$= 0.060676$

4. $JKG = JKU - JKP$

$= 0.153506 - 0.060676 = 0.09283$

5. $KTP = \frac{JKP}{dbPerlakuan} = \frac{0.060676}{5} = 0.012135$

6. $KTG = \frac{JKG}{dbGalat} = \frac{0.09283}{18} = 0.005157$

7. $Fhit = \frac{KTP}{KTG} = \frac{0.012135}{0.005157} = 2.353048$

$F_{tabel(5\%)} = 2.77$ dan $F_{tabel\ (1\%)} = 4{,}43$

$F_{hit} < F_{tabel\ (5\%)} < F_{\ tabel\ (1\%)}$ ⟶ perlakuan berbeda tidak nyata

Tabel 28. Hasil perhitungan analisis sidik ragam (Anova) pigmen total *P. rhodozyma* umur 12 jam

Sb. Keragaman	d.b	JK	KT	Fhit	$F_{0.05}$	$F_{0.01}$
Perlakuan	5	0.060676	0.012135	2.35	2.77	4.43
Galat	18	0.09283	0.005157			
Total	23	0.153506				

Tabel 29. Hasil perhitungan analisis sidik ragam (Anova) pigmen total *P. rhodozyma* umur 24 jam

Sb. Keragaman	d.b	JK	KT	Fhit	$F_{0.05}$	$F_{0.01}$
Perlakuan	5	537.4489	107.4898	1.16	2.77	4.43
Galat	18	1672.393	92.91071			
Total	23	2209.842				

Tabel 30. Hasil perhitungan analisis sidik ragam (Anova) pigmen total *P. rhodozyma* umur 36 jam

Sb. Keragaman	d.b	JK	KT	Fhit	$F_{0.05}$	$F_{0.01}$
Perlakuan	5	553.5345	110.7069	1.38	2.77	4.43
Galat	18	1439.293	79.9607			
Total	23	1992.827				

Tabel 31. Hasil perhitungan analisis sidik ragam (Anova) pigmen total *P. rhodozyma* umur 48 jam

Sb. Keragaman	d.b	JK	KT	Fhit	$F_{0.05}$	$F_{0.01}$
Perlakuan	5	1732.685	346.5369	2.78*	2.77	4.43
Galat	18	2247.988	124.8882			
Total	23	3980.672				

Tabel 32. Hasil perhitungan analisis sidik ragam (Anova) pigmen total *P. rhodozyma* umur 60 jam

Sb. Keragaman	d.b	JK	KT	Fhit	$F_{0.05}$	$F_{0.01}$
Perlakuan	5	4013.329	802.6659	3.08*	2.77	4.43
Galat	18	4690.389	260.5772			
Total	23	8703.719				

Tabel 33. Hasil perhitungan analisis sidik ragam (Anova) pigmen total *P. rhodozyma* umur 72 jam

Sb. Keragaman	d.b	JK	KT	Fhit	$F_{0.05}$	$F_{0.01}$
Perlakuan	5	1599.441	319.8881	3.06*	2.77	4.43
Galat	18	1882.447	104.5804			
Total	23	3481.888				

Tabel 34. Hasil perhitungan analisis sidik ragam (Anova) pigmen total *P. rhodozyma* umur 84 jam

Sb. Keragaman	d.b	JK	KT	Fhit	$F_{0.05}$	$F_{0.01}$
Perlakuan	5	1147.212	229.4423	3.89*	2.77	4.43
Galat	18	1061.489	58.97162			
Total	23	2208.701				

Tabel 35. Hasil perhitungan analisis sidik ragam (Anova) pigmen total *P. rhodozyma* umur 96 jam

Sb. Keragaman	d.b	JK	KT	Fhit	$F_{0.05}$	$F_{0.01}$
Perlakuan	5	888.0907	177.6181	3.04*	2.77	4.43
Galat	18	940.0333	52.22407			
Total	23	1828.124				

Tabel 36. Hasil perhitungan analisis sidik ragam (Anova) pigmen total *P. rhodozyma* umur 108 jam

Sb. Keragaman	d.b	JK	KT	Fhit	$F_{0.05}$	$F_{0.01}$
Perlakuan	5	1952.586	390.5171	4.77**	2.77	4.43
Galat	18	1474.927	81.94058			
Total	23	3427.513				

Tabel 37. Hasil perhitungan analisis sidik ragam (Anova) pigmen total *P. rhodozyma* umur 120 jam

Sb. Keragaman	d.b	JK	KT	Fhit	$F_{0.05}$	$F_{0.01}$
Perlakuan	5	1773.05	354.61	4.53**	2.77	4.43
Galat	18	1410.237	78.34649			
Total	23	3183.287				

Lampiran 10. Uji Duncan pigmen total *P. rhodozyma* pada medium air kelapa dengan pH awal yang berbeda (Hanafiah, 1991 ; Gomez dan Gomez, 1995)

1. Umur 48 jam

P2	132.28
P3	126.76
P4	116.19
P1	113.35
P0	110.51
P5	109.53

$$S_d = \sqrt{\frac{2(KTG)}{6}} = \sqrt{\frac{2(124.8882)}{6}} = 6.452085$$

$$\text{Rp} = \frac{rp.S_d}{\sqrt{2}}$$

P	$rp_{0.05}$	$rp_{0.01}$	$Rp_{0.05}$	$Rp_{0.01}$
2	2.97	4.07	13.55007	18.56861
3	3.12	4.27	14.23442	19.48108
4	3.21	4.38	14.64502	19.98293
5	3.27	4.46	14.91876	20.34792
6	3.32	4.53	15.14688	20.66728

Selisih rata-rata antar perlakuan :

P	P_2	P_3	P_4	P_1	P_0
P_2	-	-	-	-	-
P_3	5.52	-	-	-	-
P_4	16.09*	10.57	-	-	-
P_1	18.93*	13.41	2.84	-	-
P_0	21.77**	16.25*	5.68	2.84	-
P_5	22.75**	17.23*	6.66	3.82	0.98

2. Umur 60 jam

P2	174.33
P3	155.74
P1	150.45
P4	144.17
P5	140.28
P0	134.2

$$S_d = \sqrt{\frac{2(KTG)}{6}} = \sqrt{\frac{2(260.5772)}{6}} = 9.319821$$

P	$rp_{0.05}$	$rp_{0.01}$	$Rp_{0.05}$	$Rp_{0.01}$
2	2.97	4.07	19.57262	26.82174
3	3.12	4.27	20.56114	28.13976
4	3.21	4.38	21.15425	28.86468
5	3.27	4.46	21.54966	29.39189
6	3.32	4.53	21.87916	29.85319

Selisih rata-rata antar perlakuan :

P	P_2	P_3	P_1	P_4	P_5
P_2	-	-	-	-	-
P_3	18.59	-	-	-	-
P_1	23.88*	5.29	-	-	-
P_4	30.16**	11.57	6.28	-	-
P_5	34.05**	15.46	10.17	3.89	-
P_0	40.13**	21.54	16.25	9.97	6.08

3. Umur 72 jam

P2	185.86
P3	170.01
P1	167.04
P5	164.89
P4	162.73
P0	161.57

$$S_d = \sqrt{\frac{2(KTG)}{6}} = \sqrt{\frac{2(104.5804)}{6}} = 5.904247$$

P	$rp_{0.05}$	$rp_{0.01}$	$Rp_{0.05}$	$Rp_{0.01}$
2	2.97	4.07	12.39955	16.99198
3	3.12	4.27	13.02579	17.82696
4	3.21	4.38	13.40154	18.28621
5	3.27	4.46	13.65203	18.6202
6	3.32	4.53	13.86078	18.91245

Selisih rata-rata antar perlakuan :

P	P_2	P_3	P_1	P_5	P_4
P_2	-	-	-	-	-
P_3	15.85*	-	-	-	-
P_1	18.82**	2.97	-	-	-
P_5	20.97**	5.12	2.15	-	-
P_4	23.13**	7.28	4.31	2.16	-
P_0	24.29**	8.44	5.47	3.32	1.16

4. Umur 84 jam

P2	191.38
P3	180.1
P1	179.41
P4	177.04
P5	174.37
P2	168.59

$$S_d = \sqrt{\frac{2(KTG)}{6}} = \sqrt{\frac{2(58.97162)}{6}} = 4.433645$$

p	rp 0.05	rp 0.01	Rp0.05	Rp 0.01
2	2.97	4.07	9.311129	12.7597
3	3.12	4.27	9.781388	13.38671
4	3.21	4.38	10.06354	13.73156
5	3.27	4.46	10.25165	13.98237
6	3.32	4.53	10.4084	14.20182

Selisih rata-rata antar perlakuan :

P	P_2	P_3	P_1	P_4	P_5
P_2	-	-	-	-	-
P_3	11.28*	-	-	-	-
P_1	11.97*	0.69	-	-	-
P_4	14.34**	3.06	2.37	-	-
P_5	17.01**	5.73	5.04	2.67	-
P_0	22.79**	11.51	10.82	8.45	5.78

5. Umur 96 jam

P2 191.38

P3 180.1

P1 179.41

P4 177.04

P5 174.37

P0 168.59

$$S_d = \sqrt{\frac{2(KTG)}{6}} = \sqrt{\frac{2(52.22407)}{6}} = 4.172292$$

P	$rp_{0.05}$	$rp_{0.01}$	$Rp_{0.05}$	$Rp_{0.01}$
2	2.97	4.07	8.762261	12.00754
3	3.12	4.27	9.204799	12.59759
4	3.21	4.38	9.470322	12.92212
5	3.27	4.46	9.647338	13.15814
6	3.32	4.53	9.794851	13.36466

Selisih rata-rata antar perlakuan :

P	P_2	P_3	P_1	P_5	P_4
P_2	-	-	-	-	-
P_3	6.55	-	-	-	-
P_1	10.69*	4.14	-	-	-
P_5	10.86*	4.31	0.17	-	-
P_4	12.52*	5.97	1.83	1.66	-
P_0	20.13**	13.58**	9.44	9.27	7.61

5. Umur 108 jam

P2 212.81

P3 201.59

P4 199.75

P1 197.57

P5 191.03

P0 183.7

$$S_d = \sqrt{\frac{2(KTG)}{6}} = \sqrt{\frac{2(41.18816))}{6}} = 3.705319$$

P	$rp_{0.05}$	$rp_{0.01}$	$Rp_{0.05}$	$Rp_{0.01}$
2	2.97	4.07	7.781566	10.66363
3	3.12	4.27	8.174575	11.18764
4	3.21	4.38	8.41038	11.47585
5	3.27	4.46	8.567583	11.68545
6	3.32	4.53	8.698586	11.86885

Selisih rata-rata antar perlakuan :

P	P_2	P_3	P_4	P_1	P_5
P_2	-	-	-	-	-
P_3	11.22**	-	-	-	-
P_4	13.06**	1.84	-	-	-
P_1	15.24**	4.02	2.18	-	-
P_5	21.78**	10.56*	8.72*	6.54	-
P_0	29.11**	17.89**	16.05**	13.87**	7.33

6. Umur 120 jam

P2	220.28
P3	208.26
P4	205.78
P5	200.39
P1	200.17
P0	192.55

$$S_d = \sqrt{\frac{2(KTG)}{6}} = \sqrt{\frac{2(37.68813)}{6}} = 3.544391$$

P	rp 0.05	rp 0.01	$Rp_{0.05}$	$Rp_{0.01}$
2	2.97	4.07	7.443602	10.20049
3	3.12	4.27	7.819541	10.70174
4	3.21	4.38	8.045105	10.97743
5	3.27	4.46	8.195481	11.17793
6	3.32	4.53	8.320794	11.35337

Selisih rata-rata antar perlakuan :

P	P_2	P_3	P_4	P_5	P_1
P_2	-	-	-	-	-
P_3	12.02**	-	-	-	-
P_4	14.5**	2.48	-	-	-
P_5	19.89**	7.87	5.39	-	-
P_1	20.11**	8.09	5.61	0.22	-
P_0	27.73**	15.71**	13.23**	7.84	7.62

Lampiran 11. Konsentrasi gula pereduksi (glukosa) dalam medium air kelapa

Tabel 36. Perhitungan konsentrasi glukosa

X	Y	X^2	XY
0.2	0.035	0.04	0.007
0.4	0.07	0.16	0.028
0.6	0.11	0.36	0.066
0.8	0.14	0.64	0.112
1	0.18	1	0.18

$\sum X = 3 \quad \sum Y = 0.535 \quad \sum X^2 = 2.2 \quad \sum XY = 0.393$

$\overline{X} = 0.6 \quad \overline{Y} = 0.107$

Keterangan :
X : konsentrasi glukosa (mg/100ml)
Y : absorbansi larutan pada $\lambda = 520$ nm

Persamaan Kurva $y = a + bx$

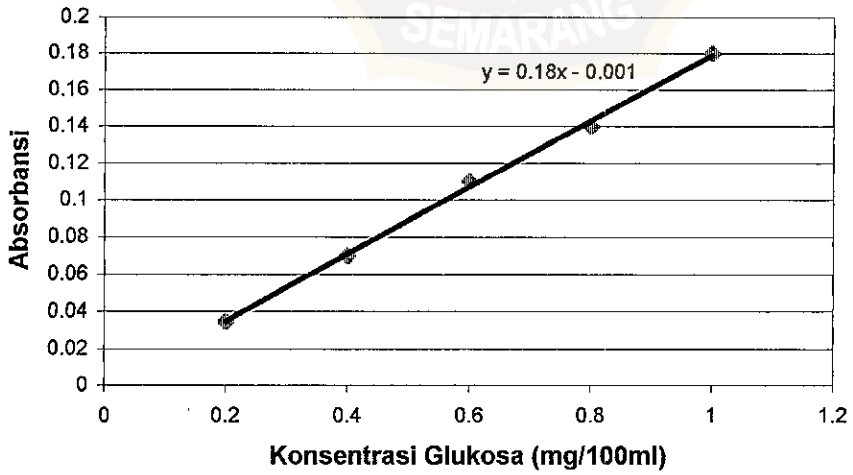
$$b = \frac{n\sum XY - \sum X \sum Y}{n\sum X^2 - (\sum X)^2}$$

$$b = \frac{5x0.393 - 3x0.535}{5x2.2 - (3)^2} = 0.18$$

$y = a + bx$

$a = y - bx$

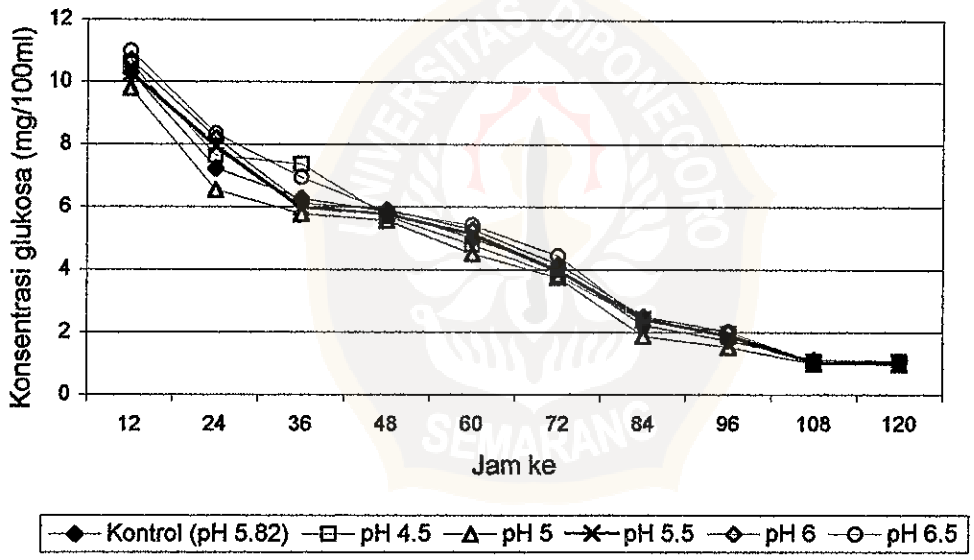
$a = 0.035 - 0.18x0.2 = -0.001$



Dengan persamaan kurva diatas maka konsentrasi glukosa dapat dihitung sebagai berikut :

	pH 4.5		pH 5.0		pH 5.5		pH 5.82		pH 6.0		pH 6.5	
Jam ke	A	Kons	A	Kons	A	Kons	A	Kons	A	Kons	A	Kons
12	1.9	10.56	1.763	9.797	1.85	10.28	1.85	10.28	1.925	10.7	1.975	10.98
24	1.375	7.644	1.175	6.533	1.425	7.922	1.3	7.228	1.475	8.2	1.5	8.339
36	1.325	7.367	1.038	5.769	1.075	5.978	1.125	6.256	1.1	6.117	1.25	6.95
48	1.025	5.7	1	5.561	1.038	5.769	1.05	5.839	1.063	5.908	1.05	5.839
60	0.863	4.797	0.813	4.519	0.925	5.144	0.9	5.006	0.95	5.283	0.975	5.422
72	0.688	3.825	0.675	3.756	0.713	3.964	0.725	4.033	0.75	4.172	0.8	4.45
84	0.425	2.367	0.338	1.881	0.438	2.436	0.4	2.228	0.45	2.506	0.425	2.367
96	0.35	1.95	0.275	1.533	0.338	1.881	0.313	1.742	0.363	2.019	0.363	2.019
108	0.193	1.075	0.18	1.006	0.185	1.033	0.2	1.117	0.19	1.061	0.19	1.061
120	0.19	1.061	0.175	0.978	0.18	1.006	0.195	1.089	0.185	1.033	0.19	1.061

Keterangan :
A : Absorbansi pada $\lambda = 520$ nm
Kons : konsentrasi gula pereduksi (glukosa) (mg / 100 ml)



Gambar 07. Grafik konsumsi gula pereduksi (glukosa) oleh *P. rhodozyma*

Lampiran 12 Evolusi pH medium air kelapa

Umur (jam)	Evolusi pH Medium					
	pH 4.5	pH 5.0	pH 5.5	pH 5.82	pH 6.0	pH 6.5
0	4.50	5.00	5.50	5.92	6.00	6.50
12	3.11	3.82	4.57	4.77	4.98	5.52
24	3.23	3.52	4.32	4.46	4.76	4.97
36	2.29	3.20	3.44	3.64	4.08	4.26
48	1.97	2.56	3.23	3.39	3.51	3.83
60	2.35	3.38	3.42	3.74	3.89	4.19
72	2.62	3.64	4.16	4.37	4.64	4.72
84	2.94	3.87	4.25	4.56	4.78	4.96
96	3.18	4.18	4.57	4.82	4.94	5.20
108	3.42	4.07	4.65	4.78	5.15	5.18
120	3.56	4.26	4.78	4.92	5.10	5.32

Lampiran 13. Kandungan C dan N total medium air kelapa
(Data primer : Dwi Rina Suryani, 2001)

FAKULTAS TEKNOLOGI PERTANIAN – UGM
JURUSAN TEKNOLOGI PENGOLAHAN HASIL PERTANIAN
Bulaksumur, Yogyakarta, 55281 – Telp. 549650

HASIL ANALISA
No. /PS/ /

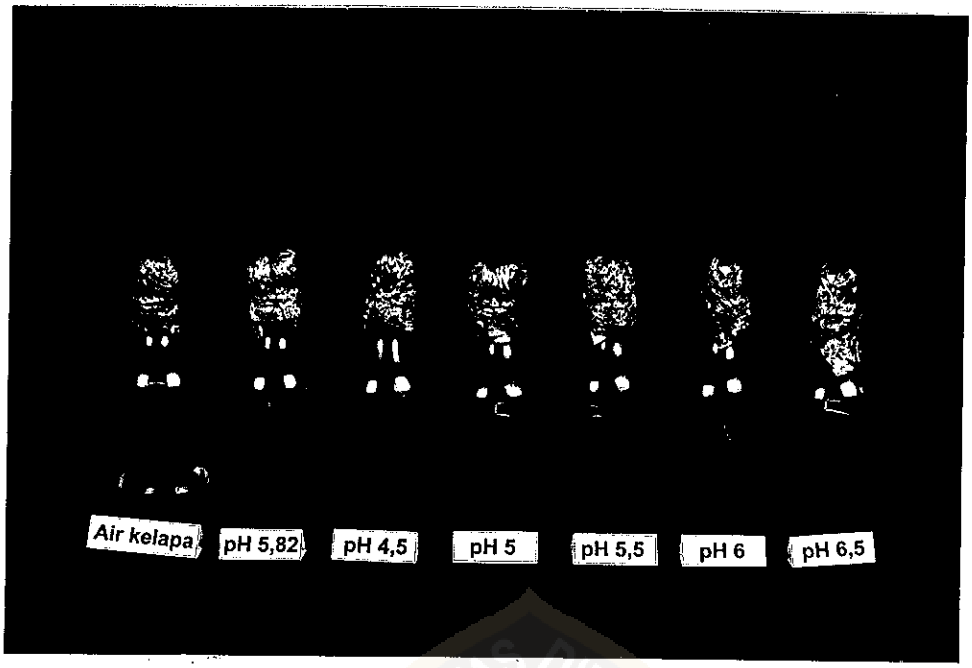
No.	Sampel/Kode	Macam Analisa	Hasil Analisa
1	Air kelapa	Kadar Nitrogen	0,01800 % 0,0182016 %
		Kadar Carbon	6,23176 % 6,21428 %
		Bahan Organik	10,7444 % 10,71427 %

Catatan :
1. Hasil analisa tidak untuk diumumkan
2. Berlaku pada waktu sampel dianalisa

Yogyakarta, 25 Mei 2001
Penanggung Jawab Analisa

Slamet Rahardjo

Lampiran 14. Foto-foto penelitian



Gambar 09. Kultur cair *P. rhodozyma* pada medium air kelapa dengan pH awal yang berbeda pada umur 72 jam.

Gambar 10. Morfologi sel *P. rhodozyma* (perbesaran 10 x 100 kali)