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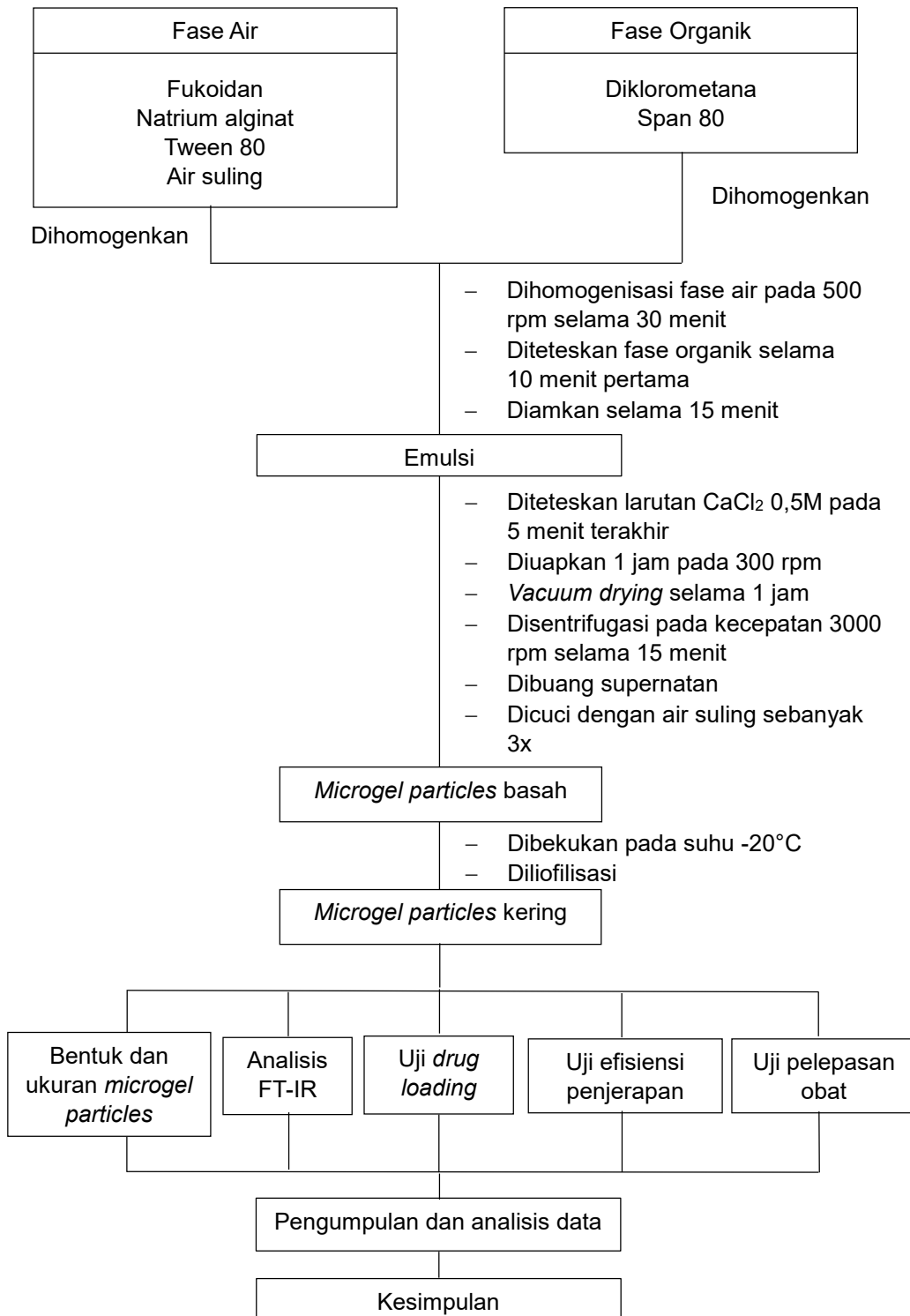
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LAMPIRAN

Lampiran 1. Skema Kerja Penelitian



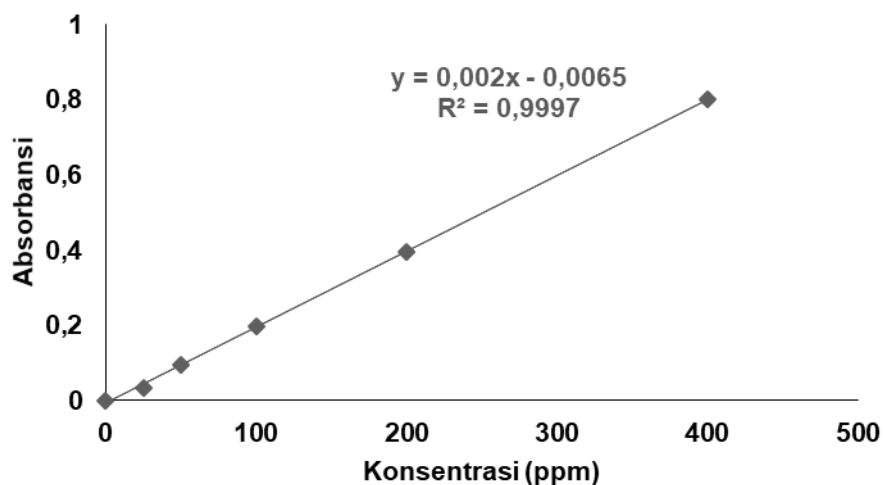
Lampiran 2. Komposisi Formula *Microgel Particles* Fukoidan

Bahan	Fungsi	Komposisi					
		F1	F1B	F2	F2B	F3	F3B
Fase Air							
Fukoidan (mg)	Zat Aktif	30	-	60	-	90	-
Natrium alginat (mg)	Polimer	100	100	200	200	300	300
Tween 80 (mg)	Surfaktan	20	20	20	20	20	20
Air suling (mL)	Pelarut	10	10	10	10	10	10
Fase Organik							
Span 80 (mg)	Surfaktan	60	60	60	60	60	60
Diklorometana (mL)	Pelarut	3	3	3	3	3	3
Crosslinking Agent							
CaCl ₂ 0,5 M (mL)	<i>Crosslinking Agent</i>	3	3	3	3	3	3

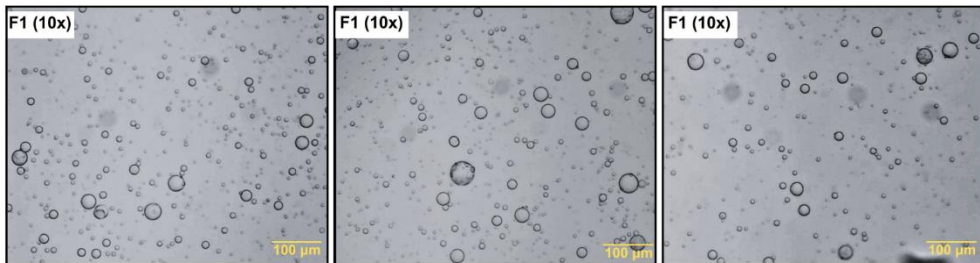
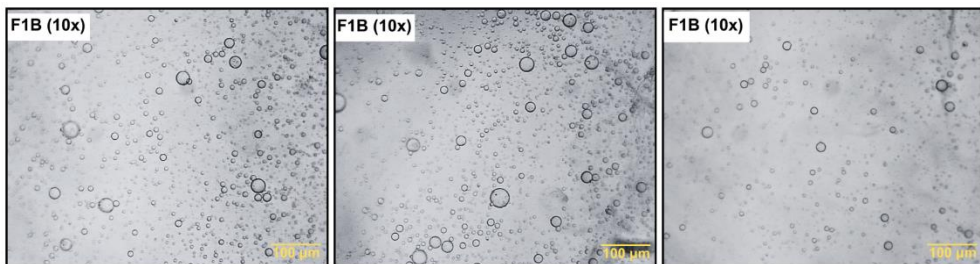
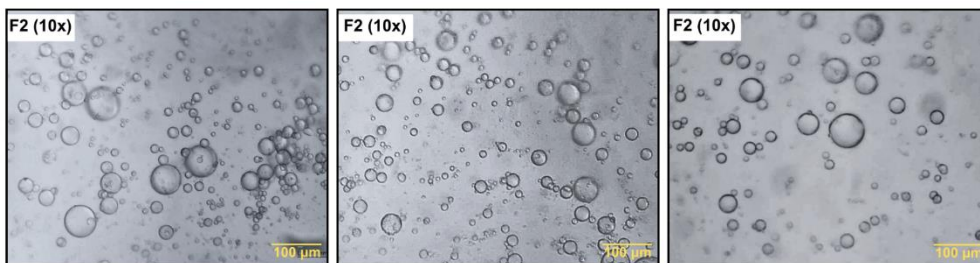
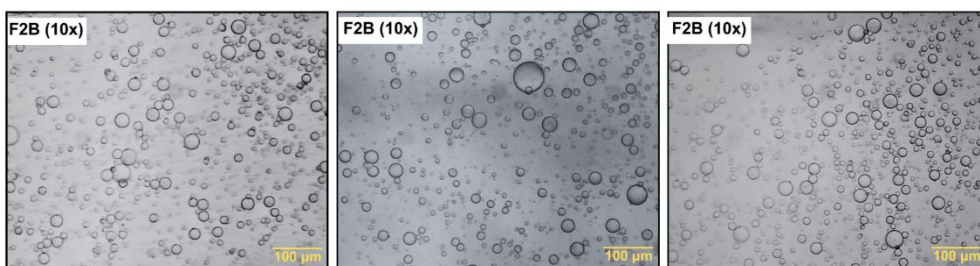
Lampiran 3. Kurva Baku Fukoidan

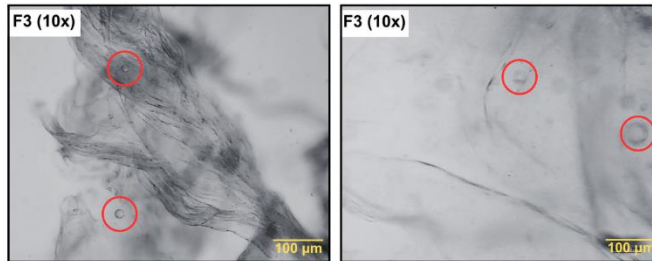
Tabel 5. Kurva baku fukoidan

Konsentrasi (ppm)	Absorbansi
25	0,035
50	0,095
100	0,199
200	0,395
400	0,802

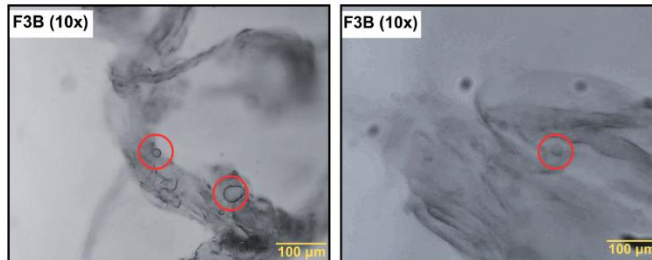


Gambar 9. Kurva baku fukoidan

Lampiran 4. Hasil Pengamatan Mikroskopik *Microgel Particles***Gambar 10.** Pengamatan mikroskopik formula F1 perbesaran 10x (n=3)**Gambar 11.** Pengamatan mikroskopik formula F1B perbesaran 10x (n=3)**Gambar 12.** Pengamatan mikroskopik formula F2 perbesaran 10x (n=3)**Gambar 13.** Pengamatan mikroskopik formula F2B perbesaran 10x (n=3)

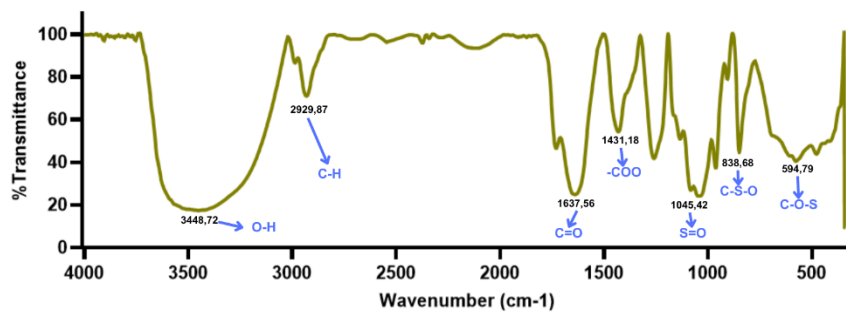


Gambar 14. Pengamatan mikroskopik formula F3 perbesaran 10x (n=3)

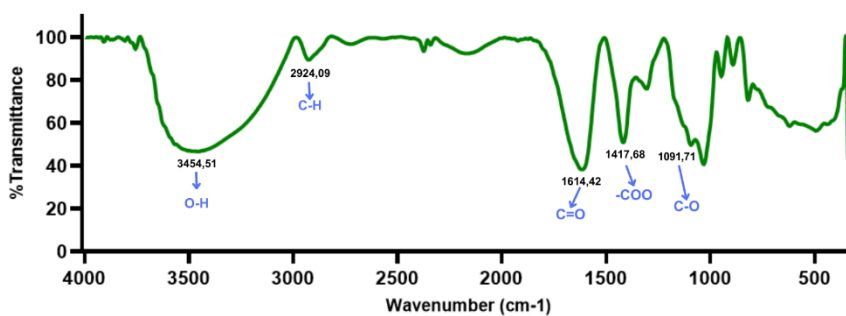


Gambar 15. Pengamatan mikroskopik formula F3b perbesaran 10x (n=3)

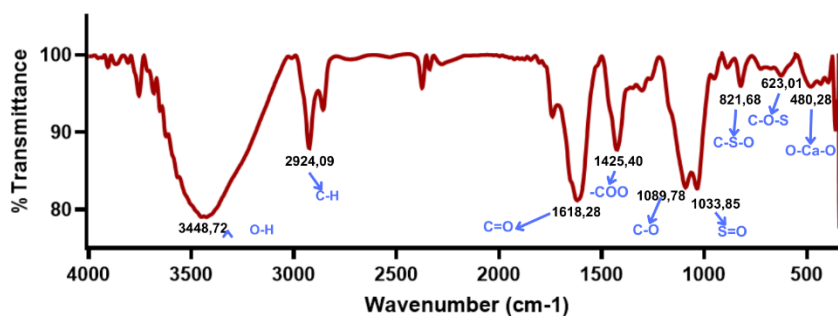
Lampiran 5. Spektra Hasil Analisis FT-IR



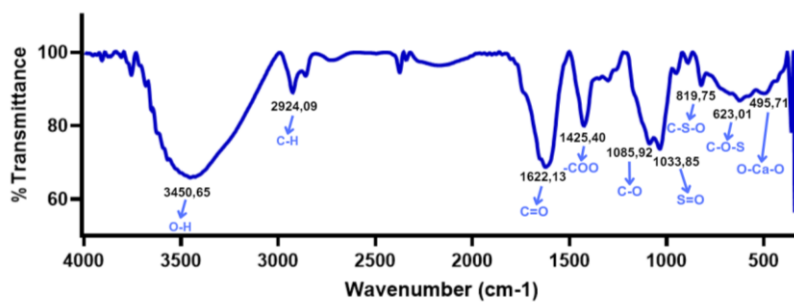
Gambar 16. Spektra FT-IR fukoidan



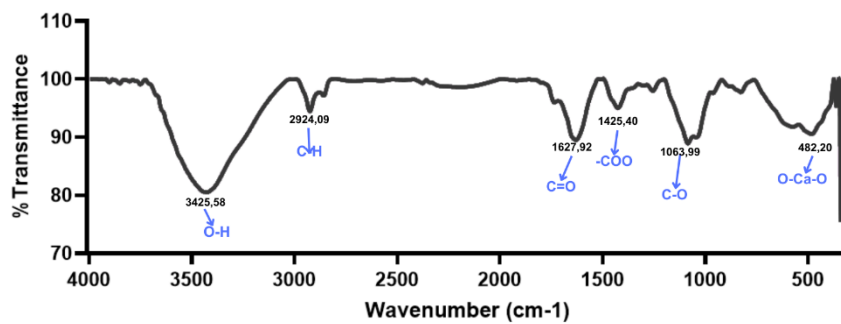
Gambar 17. Spektra FT-IR natrium alginat



Gambar 18. Spektra FT-IR F1



Gambar 19. Spektra FT-IR F2



Gambar 20. Spektra FT-IR blanko

Lampiran 6. Perhitungan Data

Lampiran 6.1 Perhitungan Data Uji *Drug Loading*

Diketahui: Absorbansi F1 Replikasi 1 = 0,155
 Faktor pengenceran (Fp) = 1
 Jumlah *microgel particles* = 40 mg
 Volume larutan = 100 mL
 Persamaan kurva baku $y = 0,002x - 0,0065$

Ditanyakan: *Drug loading* (mg fukoidan/mg *microgel particles*)?

Penyelesaian:

$$y = 0,002x - 0,0065$$

$$0,155 = 0,002x - 0,0065$$

$$0,002x = 0,155 + 0,0065$$

$$x = \frac{0,1615}{0,002}$$

$$x = 80,750 \mu\text{g/mL} = 0,08075 \text{ mg/mL}$$

$$\text{Drug loading} = \frac{0,08075 \text{ mg} \times 1 \times 100 \text{ mL}}{40 \text{ mg}} = 0,202 \text{ mg fukoidan/mg } \textit{microgel particles}$$

Jadi, *drug loading* sediaan F1 replikasi 1 sebesar 0,202 mg fukoidan/mg *microgel particles*

Lampiran 6.2 Perhitungan Data Uji Efisiensi Penjerapan

Diketahui: Absorbansi F1 Replikasi 1 = 0,155
 Faktor pengenceran (Fp) = 1
 Jumlah *microgel particles* ditimbang = 40 mg
 Jumlah *yield microgel particles* = 130 mg
 Jumlah fukoidan F1 = 30 mg
 Volume larutan = 100 mL
 Persamaan kurva baku $y = 0,002x - 0,0065$

Ditanyakan: % Efisiensi penjerapan?

Penyelesaian:

$$y = 0,002x - 0,0065$$

$$0,155 = 0,002x - 0,0065$$

$$0,002x = 0,155 + 0,0065$$

$$x = \frac{0,1615}{0,002}$$

$$x = 80,750 \mu\text{g/mL} = 0,08075 \text{ mg/mL}$$

$$\text{Jumlah aktual fukoidan} = \frac{0,08075 \text{ mg} \times 1 \times 100 \text{ mL}}{40 \text{ mg}} = 0,202 \text{ mg/mg } \textit{microgel particles}$$

$$\text{Jumlah fukoidan } \textit{yield} = \frac{30 \text{ mg fukoidan}}{130 \text{ mg } \textit{microgel particles}} = \frac{9,23 \text{ mg}}{40 \text{ mg}} = 0,231 \text{ mg/mg } \textit{microgel particles}$$

$$\text{Efisiensi penjerapan} = \frac{0,202 \text{ mg/mg } \textit{microgel particles}}{0,231 \text{ mg/mg } \textit{microgel particles}} \times 100\% = 87,446\%$$

Jadi, *efisiensi penjerapan* sediaan F1 replikasi 1 sebesar 87,446%

Lampiran 6.3 Perhitungan Data Uji Pelepasan Obat

Diketahui:	Absorbansi F1 Rep 1 Jam ke-4	= 0,019
	Faktor pengenceran (Fp)	= 1
	Jumlah <i>microgel particles</i>	= 20 mg
	Volume media	= 50 mL
	Persamaan kurva baku	$y = 0,002x - 0,0065$
Ditanyakan:	% Pelepasan obat?	

Penyelesaian:

$$\begin{aligned}
 y &= 0,002x - 0,0065 \\
 0,019 &= 0,002x - 0,0065 \\
 0,002x &= 0,019 + 0,0065 \\
 x &= \frac{0,0255}{0,002} \\
 x &= 12,75 \mu\text{g/mL}
 \end{aligned}$$

Konsentrasi obat pada jam ke-4 dalam 50 mL media:

$$\begin{aligned}
 &= \text{kadar terukur} \times \text{volume media} \times Fp \\
 &= 12,75 \mu\text{g} \times 50 \text{ mL} \times 1 \\
 &= 637,5 \mu\text{g/mL} \\
 &= 0,638 \text{ mg}
 \end{aligned}$$

$$\begin{aligned}
 \text{Faktor koreksi} &= \text{Konsentrasi obat pada jam ke-1} + \text{Konsentrasi obat pada jam ke-2} \\
 &= 3,750 \mu\text{g} + 9,750 \mu\text{g} \\
 &= 13,5 \mu\text{g} \\
 &= 0,014 \text{ mg}
 \end{aligned}$$

$$\begin{aligned}
 \text{Jumlah obat yang terlepas} &= \text{konsentrasi obat dalam media} + \text{faktor koreksi} \\
 &= 0,638 \text{ mg} + 0,014 \text{ mg} \\
 &= 0,652 \text{ mg}
 \end{aligned}$$

$$\begin{aligned}
 \text{Jumlah obat yang sebenarnya} &= \text{Jumlah drug loading F1} \times \text{jumlah microgel particles} \\
 &= 0,20 \text{ mg} \times 20 \text{ mg} \\
 &= 4 \text{ mg}
 \end{aligned}$$

$$\begin{aligned}
 \% \text{Pelepasan Obat} &= \frac{\text{Jumlah obat yang terlepas}}{\text{Total kandungan obat yang sebenarnya dalam 20 mg mikropartikel}} \times 100\% \\
 &= \frac{0,652 \text{ mg}}{4 \text{ mg}} \\
 &= 16,300\%
 \end{aligned}$$

Jadi, jumlah pelepasan obat pada jam ke-4 formula F1 replikasi 1 sebesar 16,300%

Lampiran 7. Tabel Hasil Uji

Lampiran 7.1 Tabel Hasil Uji *Drug Loading*

Tabel 6. Data hasil uji *drug loading*

Formula	Absorbansi	Konsentrasi ($\mu\text{g/ml}$)	DL (mg/mg <i>microgel</i> <i>particles</i>)	Rata-Rata \pm SD
F1	0,155	80,750	0,202	0,20 \pm 0,00
	0,149	77,750	0,194	
	0,153	79,750	0,199	
F2	0,161	83,750	0,209	0,21 \pm 0,01
	0,160	83,250	0,208	
	0,171	88,750	0,222	

Lampiran 7.2 Tabel Hasil Uji Efisiensi Penjerapan

Tabel 7. Data hasil uji efisiensi penjerapan

Formula	Absorbansi	Konsentrasi ($\mu\text{g/ml}$)	EE (%)	Rata-Rata \pm SD
F1	0,155	80,750	87,446	85,86 \pm 1,75
	0,149	77,750	83,983	
	0,153	79,750	86,147	
F2	0,161	83,750	90,476	92,21 \pm 3,38
	0,160	83,250	90,043	
	0,171	88,750	96,104	

Lampiran 7.3 Tabel Hasil Uji Pelepasan Obat

Tabel 8. Data pelepasan obat sediaan *microgel particles* fukoidan F1

Waktu (Jam)	Abs	Konsentrasi (µg/ml)	Faktor Pengenceran	Jumlah yang Terukur (mg) dalam 50 mL	Faktor Koreksi (mg)	Total Fukoidan yang Terlepas (mg)	%Pelepasan Fukoidan	Rata-rata ± SD
1	0,001	3,750	1	0,188	0,000	0,188	4,700	6,58 ± 1,88
	0,004	5,250	1	0,263	0,000	0,263	6,575	
	0,007	6,750	1	0,338	0,000	0,338	8,450	
2	0,013	9,750	1	0,488	0,004	0,492	12,300	14,63 ± 3,44
	0,023	14,750	1	0,738	0,005	0,743	18,575	
	0,014	10,250	1	0,513	0,007	0,520	13,000	
4	0,019	12,750	1	0,638	0,014	0,652	16,300	21,79 ± 4,79
	0,031	18,750	1	0,938	0,020	0,958	23,950	
	0,033	19,750	1	0,988	0,017	1,005	25,125	
8	0,026	16,250	1	0,813	0,026	0,839	20,975	25,55 ± 3,98
	0,037	21,750	1	1,088	0,039	1,127	28,175	
	0,036	21,250	1	1,063	0,037	1,100	27,500	
24	0,046	26,250	1	1,313	0,043	1,356	33,900	32,51 ± 1,34
	0,041	23,750	1	1,188	0,061	1,249	31,225	
	0,043	24,750	1	1,238	0,058	1,296	32,400	

Ket: 20 mg *microgel particles* formula F1 = 4 mg fukoidan

Tabel 9. Data pelepasan obat sediaan *microgel particles* fukoidan F2

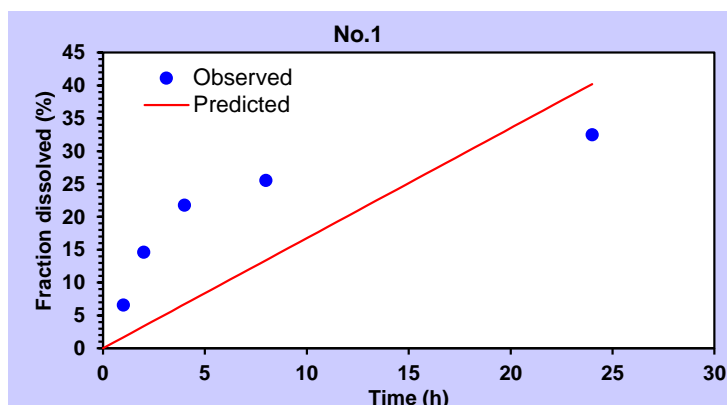
Waktu (Jam)	Abs	Konsentrasi ($\mu\text{g/ml}$)	Faktor Pengenceran	Jumlah yang Terukur (mg) dalam 50 mL	Faktor Koreksi (mg)	Total Fukoidan yang Terlepas (mg)	%Pelepasan Fukoidan	Rata-rata \pm SD
1	0,009	7,750	1	0,388	0,000	0,388	9,226	7,44 \pm 1,57
	0,004	5,250	1	0,263	0,000	0,263	6,250	
	0,005	5,750	1	0,288	0,000	0,288	6,845	
2	0,011	8,750	1	0,438	0,008	0,446	10,607	13,15 \pm 2,22
	0,017	11,750	1	0,588	0,005	0,593	14,107	
	0,018	12,250	1	0,613	0,006	0,619	14,726	
4	0,024	15,250	1	0,763	0,017	0,780	18,560	21,54 \pm 4,66
	0,025	15,750	1	0,788	0,017	0,805	19,155	
	0,038	22,250	1	1,113	0,018	1,131	26,917	
8	0,043	24,750	1	1,238	0,032	1,270	30,226	30,89 \pm 5,18
	0,036	21,250	1	1,063	0,033	1,096	26,083	
	0,053	29,750	1	1,488	0,040	1,528	36,369	
24	0,055	30,750	1	1,538	0,057	1,595	37,964	42,41 \pm 4,17
	0,069	37,750	1	1,888	0,054	1,942	46,226	
	0,063	34,750	1	1,738	0,070	1,808	43,036	

Ket: 20 mg *microgel particles* formula F2 = 4,2 mg fukoidan

Lampiran 8. Model Kinetika Pelepasan Obat *Microgel Particles* Fukoidan

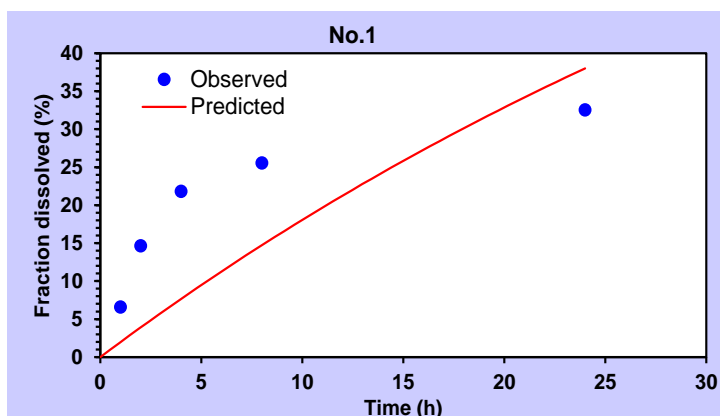
Lampiran 8.1 Model Kinetika Pelepasan Obat Formula F1

Goodness of Fit	
Parameter	No.1
N_observed	5
DF	4
R_obs-pre	0,846
Rsqr	-0,467
Rsqr_adj	-0,467
MSE	146,441
MSE_root	12,101
Weighting	1
SS	585,764
WSS	585,764
AIC	33,865
MSC	-0,783



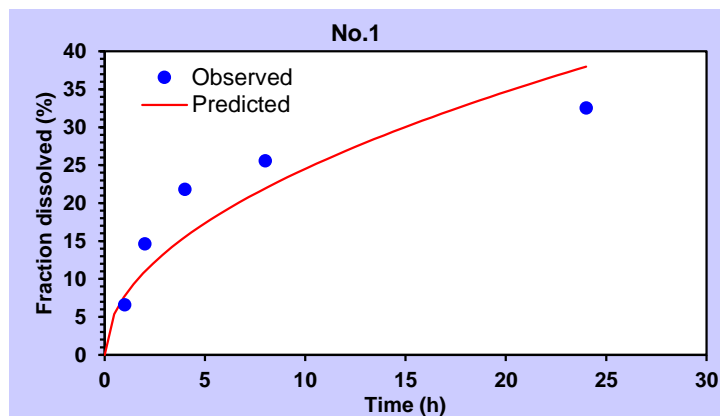
Gambar 21. Model kinetika pelepasan obat Zero-Order formula F1

Goodness of Fit	
Parameter	No.1
N_observed	5
DF	4
R_obs-pre	0,869
Rsqr	-0,210
Rsqr_adj	-0,210
MSE	120,802
MSE_root	10,991
Weighting	1
SS	483,208
WSS	483,208
AIC	32,902
MSC	-0,591



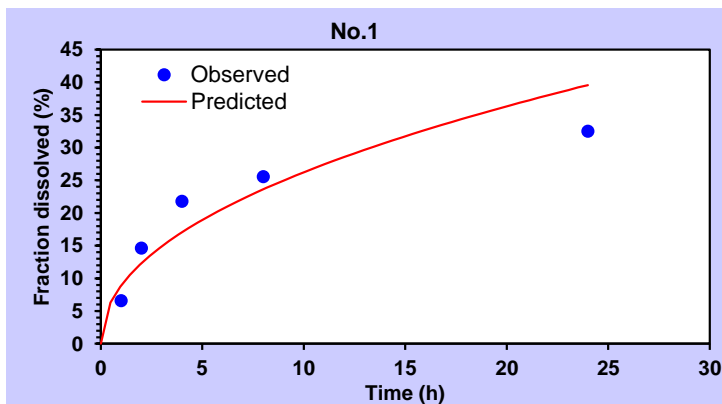
Gambar 22. Model kinetika pelepasan obat First-Order formula F1

Goodness of Fit	
Parameter	No.1
N_observed	5
DF	4
R_obs-pre	0,924
Rsqr	0,756
Rsqr_adj	0,756
MSE	24,339
MSE_root	4,933
Weighting	1
SS	97,355
WSS	97,355
AIC	24,892
MSC	1,011



Gambar 23. Model kinetika pelepasan obat Higuchi formula F1

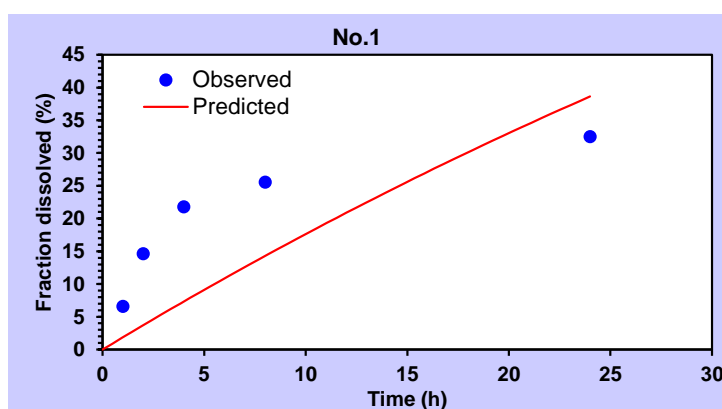
Goodness of Fit	
Parameter	No.1
N_observed	5
DF	3
R_obs-pre	0,929
Rsqr	0,783
Rsqr_adj	0,710
MSE	28,900
MSE_root	5,376
Weighting	1
SS	86,701
WSS	86,701
AIC	26,312
MSC	0,727



Best-fit Values				
Parameter	No.1	Mean	SD	RSD(%)
kKP	8,888	8,888		
n	0,470	0,470		

Gambar 24. Model kinetika pelepasan obat Korsmeyer-Peppas formula F1

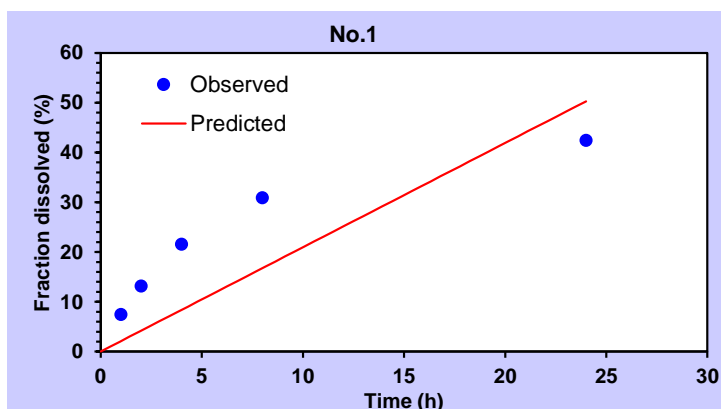
Goodness of Fit	
Parameter	No.1
N_observed	5
DF	4
R_obs-pre	0,862
Rsqr	-0,291
Rsqr_adj	-0,291
MSE	128,807
MSE_root	11,349
Weighting	1
SS	515,229
WSS	515,229
AIC	33,223
MSC	-0,655



Gambar 25. Model kinetika pelepasan obat Hixson-Crowell formula F1

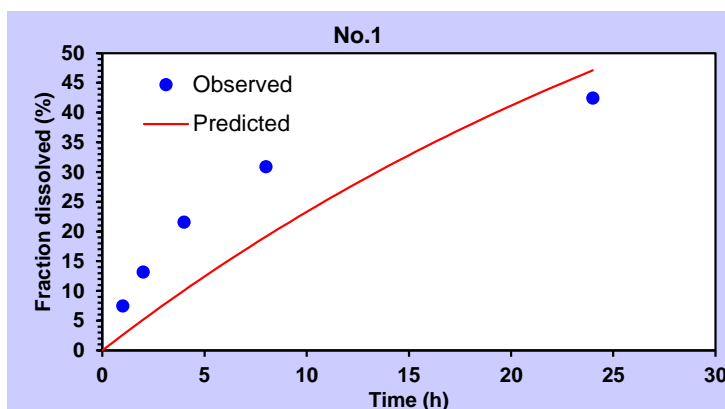
Lampiran 8.2 Model Kinetika Pelepasan Obat Formula F2

Goodness of Fit	
Parameter	No.1
N_observed	5
DF	4
R_obs-pre	0,918
Rsqr	0,303
Rsqr_adj	0,303
MSE	135,908
MSE_root	11,658
Weighting	1
SS	543,630
WSS	543,630
AIC	33,491
MSC	- 0,039



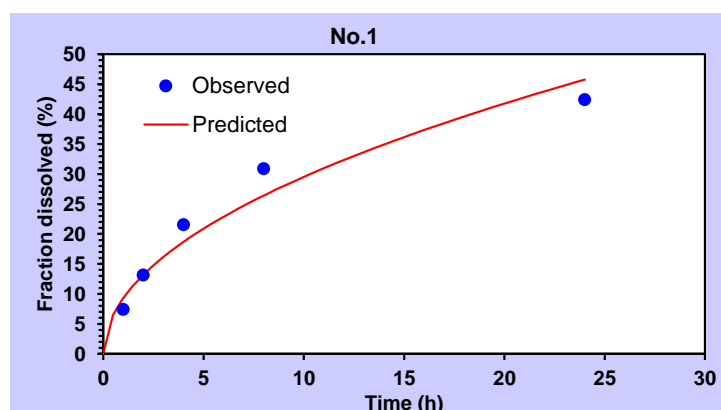
Gambar 26. Model kinetika pelepasan obat Zero-Order formula F2

Goodness of Fit	
Parameter	No.1
N_observed	5
DF	4
R_obs-pre	0,943
Rsqr	0,514
Rsqr_adj	0,514
MSE	94,794
MSE_root	9,736
Weighting	1
SS	379,174
WSS	379,174
AIC	31,690
MSC	0,322



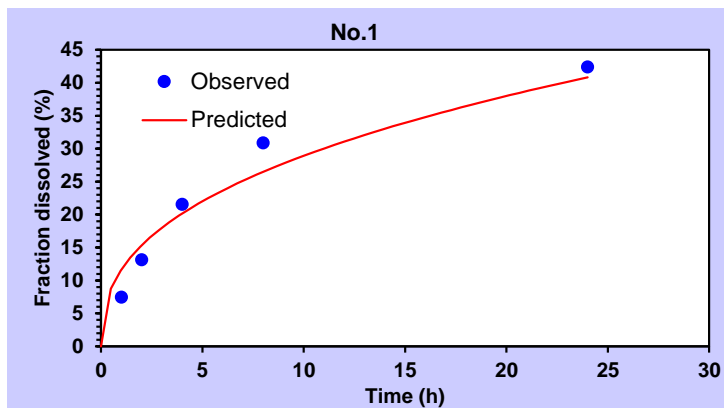
Gambar 27. Model kinetika pelepasan obat First-Order formula F2

Goodness of Fit	
Parameter	No.1
N_observed	5
DF	4
R_obs-pre	0,974
Rsqr	0,945
Rsqr_adj	0,945
MSE	10,749
MSE_root	3,279
Weighting	1
SS	42,995
WSS	42,995
AIC	20,805
MSC	2,499



Gambar 28. Model kinetika pelepasan obat Higuchi formula F2

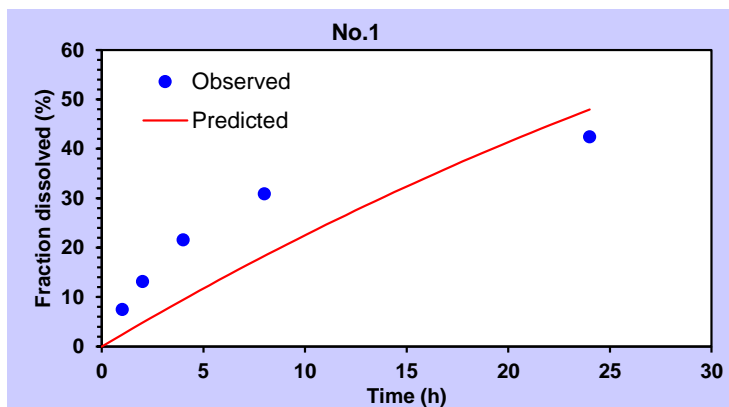
Goodness of Fit	
Parameter	No.1
N_observed	5
DF	3
R_obs-pre	0,983
Rsqr	0,940
Rsqr_adj	0,920
MSE	15,516
MSE_root	3,939
Weighting	1
SS	46,547
WSS	46,547
AIC	23,202
MSC	2,019



Best-fit Values				
Parameter	No.1	Mean	SD	RSD(%)
kKP	11,675	11,675		
n	0,394	0,394		

Gambar 29. Model kinetika pelepasan obat Korsmeyer-Peppas formula F2

Goodness of Fit	
Parameter	No.1
N_observed	5
DF	4
R_obs-pre	0,935
Rsqr	0,450
Rsqr_adj	0,450
MSE	107,347
MSE_root	10,361
Weighting	1
SS	429,390
WSS	429,390
AIC	32,312
MSC	0,197



Gambar 30. Model kinetika pelepasan obat Hixson-Crowell formula F2

Lampiran 9. Data Hasil Analisis Statistika

Lampiran 9.1 Hasil Analisis Statistika Uji *Drug Loading*

Tests of Normality

	Formula	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
DL	F1	.232	3	.	.980	3	.726
	F2	.362	3	.	.803	3	.122

a. Lilliefors Significance Correction

Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Drug Loading	Based on Mean	2.685	1	4	.177
	Based on Median	.205	1	4	.675
	Based on Median and with adjusted df	.205	1	2.477	.688
	Based on trimmed mean	2.264	1	4	.207

Independent Samples Test

		Levene's Test for Equality of Variances				t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Drug Loading	Equal variances assumed	2.685	.177	-2.889	4	.045	-.014667	.005077	-.028763	-.000570
	Equal variances not assumed			-2.889	2.999	.063	-.014667	.005077	-.030826	.001493

Lampiran 9.2 Hasil Analisis Statistika Uji Efisiensi Penjerapan

Tests of Normality

	Formula	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
EE	F1	.232	3	.	.980	3	.726
	F2	.362	3	.	.803	3	.122

a. Lilliefors Significance Correction

Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Efisiensi Penjerapan	Based on Mean	2.686	1	4	.177
	Based on Median	.205	1	4	.674
	Based on Median and with adjusted df	.205	1	2.477	.688
	Based on trimmed mean	2.265	1	4	.207

Independent Samples Test

		Levene's Test for Equality of Variances				t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Efisiensi Penjerapan	Equal variances assumed	2.686	.177	-2.889	4	.045	-6.349000	2.197982	-12.451577	-.246423
	Equal variances not assumed			-2.889	2.999	.063	-6.349000	2.197982	-13.345080	.647080

Lampiran 9.3 Data Hasil Analisis Statistika Uji Pelepasan Obat

Tests of Normality

		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
Formula		Statistic	df	Sig.	Statistic	df	Sig.
DR	F1	.199	3	.	.995	3	.866
	F2	.227	3	.	.983	3	.749

a. Lilliefors Significance Correction

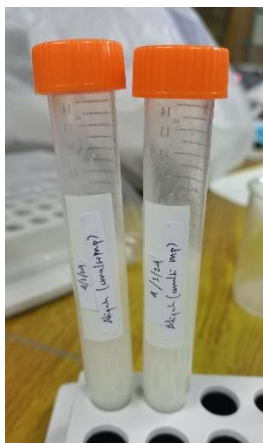
Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Pelepasan Obat	Based on Mean	2.646	1	4	.179
	Based on Median	1.446	1	4	.296
	Based on Median and with adjusted df	1.446	1	2.376	.335
	Based on trimmed mean	2.561	1	4	.185

Independent Samples Test

		Levene's Test for Equality of Variances				t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Pelepasan Obat	Equal variances assumed	2.646	.179	-3.918	4	.017	-9.900333	2.527056	-16.916564	-2.884102
	Equal variances not assumed			-3.918	2.410	.044	-9.900333	2.527056	-19.180206	-.620461

Lampiran 10. Dokumentasi



Gambar 31. Proses orientasi formula *microgel particles*



Gambar 32. Proses pembuatan partikel *microgel particles*



Gambar 33. Pengamatan bentuk dan ukuran *microgel particles*



Gambar 34. Proses pembuatan kurva baku



Gambar 35. Proses uji *drug loading*



Gambar 36. Proses uji efisiensi penyerapan



Gambar 37. Proses uji pelepasan obat



Gambar 38. Hasil formulasi setelah freeze drying



Gambar 39. Alat homogenizer



Gambar 40. Alat vacuum drying



Gambar 41. Spektrofotometer UV-vis



Gambar 42. Alat mikroskop



Gambar 43. Alat sentrifus



Gambar 44. Alat *thermo shaker*



Gambar 45. Alat *magnetic stirrer*



Gambar 46. Alat *vortex mixer*