

BAB V

KESIMPULAN DAN SARAN

A. Kesimpulan

Dari hasil penelitian dapat disimpulkan bahwa ibuprofen dapat dibuat sediaan lepas lambat, dan kombinasi matriks HPMC dan MC berpengaruh terhadap mutu fisik tablet serta pelepasan ibuprofen. Proporsi yang menghasilkan tablet lepas lambat ibuprofen dengan mutu fisik yang maksimum adalah formula yang mengandung 30% HPMC : 70% MC.

B. Saran

1. Perlu dilakukan penelitian lebih lanjut untuk membuat tablet lepas lambat ibuprofen menggunakan matriks hidrofilik yang lain.
2. Perlu dilakukan penelitian pembuatan tablet lepas lambat ibuprofen menggunakan pengikat dalam formulanya misalnya polivinilpirolidon.

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Lampiran 1. Perhitungan dosis ibuprofen dalam tablet lepas lambat

Dosis lazim ibuprofen = 200 mg tiap kali minum

Volum disolusi dalam tubuh (Vd) = 20 L = 20.000 mL

Konsentrasi terapeutik (Cp) = 10 µg / mL

Waktu disolusi yang diharapkan (t) = 6 jam

Waktu paro ibuprofen (t_{1/2}) = 2 jam

$$K = \frac{0,693}{t_{1/2}} = \frac{0,693}{2} = 0,3465 \text{ /jam}$$

Clt = K x Vd = 0,3465 x 20 = 6,912 L/jam

Dosis ibuprofen = Cp x Clt x t

$$= 10 \text{ µg / mL} \times 6,912 \text{ L/jam} \times 1000 \times 6 \text{ jam} = 415 \text{ mg}$$

Dosis ibuprofen dalam tablet dibulatkan menjadi = 400 mg / tablet

Lampiran 2. Kecepatan alir granul

$$\text{Rumus kecepatan alir} = \frac{\text{bobot granul}}{\text{waktu}}$$

Formula I

Bobot (g)	Waktu (detik)	Kecepatan alir (g/detik)
10,061	1,2	8,38
	1,2	8,38
	1,2	8,38
	1,1	9,15
	1,1	9,15
Rata-rata		8,68
SD		0,42

Formula II

Bobot (g)	Waktu (detik)	Kecepatan alir (g/detik)
10,091	1,2	8,41
	1,1	9,17
	1,2	8,41
	1,1	9,17
	1,1	9,17
Rata-rata		8,86
SD		0,28

Formula III

Bobot (g)	Waktu (detik)	Kecepatan alir (g/detik)
10,092	1,2	8,41
	1,2	8,41
	1,3	7,76
	1,2	8,41
	1,3	7,76
Rata-rata		8,15
SD		0,29

Lampiran 3. Sudut diam

$$\text{Rumus sudut diam} = \text{arctan} \frac{\text{jari-jari}}{\text{tinggi}}$$

Formula I

Tinggi (cm)	Jari-jari (cm)	Sudut diam
1,3	3,35	21,21
1,3	3,30	21,50
1,4	3,35	22,68
1,3	3,35	21,21
1,3	3,40	20,92
Rata-rata		21,50
SD		0,69

Formula II

Tinggi (cm)	Jari-jari (cm)	Sudut diam
1,6	3,40	25,20
1,6	3,45	24,88
1,6	3,40	25,20
1,5	3,35	24,12
1,6	3,40	25,20
Rata-rata		24,92
SD		0,47

Formula III

Tinggi (cm)	Jari-jari (cm)	Sudut diam
1,6	3,50	24,56
1,7	3,45	26,23
1,6	3,50	24,57
1,6	3,50	24,57
1,6	3,45	24,88
Rata-rata		24,96
SD		0,72

Lampiran 4. Kompaktibilitas

Replikasi	Formula I	Formula II	Formula III
1	6,4	9,0	11,5
2	6,5	8,0	10,0
3	6,5	10,0	11,5
4	6,7	8,9	9,8
5	8	8,1	11,5
Rata-rata	6,82	8,80	10,86
SD	0,67	0,81	0,88

Lampiran 5. Penentuan panjang gelombang maksimum dan pembuatan kurva baku ibuprofen

Penentuan panjang gelombang maksimum

Panjang gelombang (nm)	Absorbansi
215	0,304
216	0,307
217	0,311
218	0,316
219	0,317
220	0,332
221	0,342
222	0,348
223	0,352
224	0,350
225	0,346
226	0,336
227	0,318
228	0,292
229	0,266
230	0,231

Panjang gelombang maksimum ibuprofen adalah 223 nm

Pembuatan larutan induk ibuprofen

Penimbangan bahan

Ketas timbang + zat = 0,1771 g

Kertas timbang + sisa = 0,1371 g -

Bobot zat = 0,040 g

Kadar ibuprofen = $0,040 \text{ g} / 100 \text{ ml} = 40 \text{ mg/ml} = 0,4 \text{ mg/ml}$

Data kurva baku ibuprofen

Kadar (mg/ml)	Absorbansi
0,008	0,352
0,010	0,425
0,012	0,511
0,014	0,599
0,016	0,684

Data regresi linier

$$A = 0,0114$$

$$B = 41,9$$

$$r = 0,9995$$

$$\text{Persamaan regresi linier } y = 0,0114 + 41,9x$$

Lampiran 6. Perhitungan kadar ibuprofen

Rumus perhitungan kadar ibuprofen: $\frac{\text{kadar (mg/ml)} \times \text{volum media disolusi} \times \text{fx}}{\text{dosis ibuprofen dalam 1 tablet}} \times 100\%$

Volum media disolusi : 900 ml
 Dosis ibuprofen 1 tablet : 400 mg
 Fx : faktor pengenceran

Formula I Replikasi 1

Waktu (menit)	Absorbansi	Kadar (mg/ml)	Kadar dalam 900 ml	fx	Kadar (%)
30	0.371	0.008582339	7.724105012	5	9.66
60	0.442	0.01027685	9.249164678	5	11.56
90	0.519	0.012114558	10.90310263	5	13.63
120	0.783	0.018415274	16.57374702	5	20.72
150	0.536	0.012520286	11.26825776	8.33	23.47
180	0.602	0.014095465	12.68591885	8.33	26.42
210	0.645	0.015121718	13.60954654	8.33	28.34
240	0.697	0.016362768	14.72649165	8.33	30.67
270	0.731	0.017174224	15.45680191	8.33	32.19
300	0.760	0.017866348	16.0797136	8.33	33.49
330	0.824	0.019393795	17.45441527	8.33	36.35
360	0.850	0.02001432	18.01288783	8.33	37.51

Formula I Replikasi 2

Waktu (menit)	Absorbansi	Kadar (mg/ml)	kadar dalam 900 ml	fx	Kadar (%)
30	0.375	0.008677804	7.810023866	5	9.76
60	0.438	0.010181384	9.163245823	5	11.45
90	0.500	0.011661098	10.49498807	5	13.12
120	0.735	0.017269690	15.54272076	5	19.43
150	0.537	0.012544153	11.28973747	8.33	23.51
180	0.585	0.013689737	12.32076372	8.33	25.66
210	0.633	0.014835322	13.35178998	8.33	27.81
240	0.680	0.015957041	14.36133652	8.33	29.91
270	0.722	0.016959427	15.26348449	8.33	31.79
300	0.755	0.017747017	15.97231504	8.33	33.26
330	0.822	0.019346062	17.41145585	8.33	36.26
360	0.824	0.019393795	17.45441527	8.33	36.35

Formula I Replikasi 3

Waktu (menit)	Absorbansi	Kadar (mg/ml)	Kadar dalam 900 ml	fx	Kadar (%)
30	0.370	0.008558473	7.702625298	5	9.63
60	0.439	0.010205251	9.184725537	5	11.48
90	0.515	0.012019093	10.81718377	5	13.52
120	0.752	0.017675418	15.90787589	5	19.88
150	0.530	0.012377088	11.13937947	8.33	23.20
180	0.600	0.014047733	12.64295943	8.33	26.33
210	0.649	0.015217184	13.69546539	8.33	28.52
240	0.690	0.016195704	14.57613365	8.33	30.35
270	0.733	0.017221957	15.49976134	8.33	32.28
300	0.759	0.017842482	16.05823389	8.33	33.44
330	0.800	0.018821002	16.93890215	8.33	35.28
360	0.823	0.019369928	17.43293556	8.33	36.30

Rata-rata kadar ibuprofen formula I

Replikasi 1	Replikasi 2	Replikasi 3	Rata-rata kadar (%)
9.66	9.76	9.63	9.68
11.56	11.45	11.48	11.50
13.63	13.12	13.52	13.42
20.72	19.43	19.88	20.01
23.47	23.51	23.20	23.39
26.42	25.66	26.33	26.14
28.34	27.81	28.52	28.22
30.67	29.91	30.35	30.31
32.19	31.79	32.28	32.09
33.49	33.26	33.44	33.40
36.35	36.26	35.28	35.96
37.51	36.35	36.30	36.72

Formula II Replikasi 1

Waktu (menit)	Absorbansi	Kadar (mg/ml)	Kadar dalam 900 ml	fx	Kadar (%)
30	0.264	0.00602864	5.425775656	8.33	11.30
60	0.36	0.008319809	7.487828162	8.33	15.59
90	0.438	0.010181384	9.163245823	8.33	19.08
120	0.536	0.012520286	11.26825776	8.33	23.47
150	0.69	0.016195704	14.57613365	10	36.44
180	0.712	0.016720764	15.04868735	10	37.62
210	0.76	0.017866348	16.07971360	10	40.20
240	0.65	0.015241050	13.71694511	12.5	42.87
270	0.676	0.015861575	14.27541766	12.5	44.61
300	0.696	0.016338902	14.70501193	12.5	45.95
330	0.712	0.016720764	15.04868735	12.5	47.03
360	0.746	0.017532220	15.77899761	12.5	49.31

Formula II Replikasi 2

Waktu (menit)	Absorbansi	Kadar (mg/ml)	Kadar dalam 900 ml	fx	Kadar (%)
30	0.259	0.005909308	5.318377088	8.33	11.08
60	0.376	0.008701671	7.831503580	8.33	16.31
90	0.456	0.010610979	9.549880668	8.33	19.89
120	0.57	0.013331742	11.99856802	8.33	24.99
150	0.604	0.014143198	12.72887828	10	31.82
180	0.694	0.016291169	14.66205251	10	36.66
210	0.755	0.017747017	15.97231504	10	39.93
240	0.653	0.015312649	13.78138425	12.5	43.07
270	0.669	0.015694511	14.12505967	12.5	44.14
300	0.696	0.016338902	14.70501193	12.5	45.95
330	0.725	0.017031026	15.32792363	12.5	47.90
360	0.739	0.017365155	15.62863962	12.5	48.84

Formula III Replikasi 3

Waktu (menit)	Absorbansi	Kadar (mg/ml)	Kadar dalam 900 ml	fx	Kadar (%)
30	0.245	0.005575179	5.017661098	8.33	10.45
60	0.365	0.008439141	7.595226730	8.33	15.82
90	0.45	0.010467780	9.421002387	8.33	19.62
120	0.532	0.012424821	11.18233890	8.33	23.29
150	0.595	0.013928401	12.53556086	10	31.34
180	0.676	0.015861575	14.27541766	10	35.69
210	0.749	0.017603819	15.84343675	10	39.61
240	0.637	0.014930788	13.43770883	12.5	41.99
270	0.659	0.015455847	13.91026253	12.5	43.47
300	0.693	0.016267303	14.64057279	12.5	45.75
330	0.722	0.016959427	15.26348449	12.5	47.70
360	0.73	0.017150358	15.43532220	12.5	48.24

Rata- rata kadar formula III

Replikasi 1	Replikasi 2	Replikasi 3	Rata-rata kadar (%)
11.3	11.08	10.45	10.94
15.59	16.31	15.82	15.91
19.08	19.89	19.62	19.53
23.47	24.99	23.29	23.92
36.44	31.82	31.34	33.20
37.62	36.66	35.69	36.66
40.2	39.93	39.61	39.91
42.87	43.07	41.99	42.64
44.61	44.14	43.47	44.07
45.95	45.95	45.75	45.88
47.03	47.9	47.7	47.54
49.31	48.84	48.24	48.80

Formula III Replikasi 1

Waktu (menit)	Absorbansi	Kadar (mg/ml)	Kadar dalam 900 ml	fx	Kadar (%)
30	0.647	0.015169451	13.65250597	12.5	42.66
60	0.693	0.016267303	14.64057279	12.5	45.75
90	0.77	0.018105012	16.29451074	12.5	50.92
120	0.456	0.010610979	9.549880668	25	59.69
150	0.495	0.011541766	10.38758950	25	64.92
180	0.598	0.014000000	12.60000000	25	78.75
210	0.656	0.015384248	13.84582339	25	86.54
240	0.68	0.015957041	14.36133652	25	89.76
270	0.71	0.016673031	15.00572792	25	93.79
300	0.721	0.016935561	15.24200477	25	95.26
330	0.728	0.017102625	15.39236277	25	96.20
360	0.732	0.017198091	15.47828162	25	96.74

Formula III Replikasi 2

Waktu (menit)	Absorbansi	Kadar (mg/ml)	Kadar dalam 900 ml	fx	Kadar (%)
30	0.6	0.014047733	12.64295943	12.5	39.51
60	0.687	0.016124105	14.51169451	12.5	45.35
90	0.788	0.018534606	16.68114558	12.5	52.13
120	0.439	0.010205251	9.184725537	25	57.40
150	0.5	0.011661098	10.49498807	25	65.59
180	0.583	0.013642005	12.27780430	25	76.74
210	0.642	0.015050119	13.54510740	25	84.66
240	0.684	0.016052506	14.44725537	25	90.30
270	0.709	0.016649165	14.98424821	25	93.65
300	0.716	0.016816229	15.13460621	25	94.59
330	0.725	0.017031026	15.32792363	25	95.80
360	0.727	0.017078759	15.37088305	25	96.07

Formula III Replikasi 3

Waktu (menit)	Absorbansi	Kadar (mg/ml)	Kadar dalam 900 ml	fx	Kadar (%)
30	0.623	0.014596659	13.13699284	12.5	41.05
60	0.722	0.016959427	15.26348449	12.5	47.70
90	0.796	0.018725537	16.85298329	12.5	52.67
120	0.455	0.010587112	9.528400955	25	59.55
150	0.512	0.011947494	10.75274463	25	67.20
180	0.576	0.013474940	12.1274463	25	75.80
210	0.639	0.014978520	13.48066826	25	84.25
240	0.689	0.016171838	14.55465394	25	90.97
270	0.713	0.016744630	15.07016706	25	94.19
300	0.722	0.016959427	15.26348449	25	95.40
330	0.728	0.017102625	15.39236277	25	96.20
360	0.73	0.017150358	15.43532220	25	96.47

Rata-rata kadar formula III

Replikasi 1	Replikasi 2	Replikasi 3	Rata-rata kadar (%)
42.66	39.51	41.05	41.07
45.75	45.35	47.7	46.27
50.92	52.13	52.67	51.91
59.69	57.4	59.55	58.88
64.92	65.59	67.2	65.90
78.75	76.74	75.8	77.10
86.54	84.66	84.25	85.15
89.76	90.3	90.97	90.34
93.79	93.65	94.19	93.88
95.26	94.59	95.4	95.08
96.2	95.8	96.2	96.07
96.74	96.07	96.47	96.43

Persamaan Regresi linier waktu dan kadar

Formula	Persamaan regresi linier	r
Formula I	$Y = 8,21 + 0,086X$	0,981
Formula II	$Y = 10,95 + 0,118X$	0,968
Formula III	$Y = 38,120 + 0,188X$	0,970

Lampiran 7. Analisis pola pelepasan ibuprofen

a. Analisis kinetika orde nol

Waktu (menit)	% Pelepasan		
	Formula I	Formula II	Formula III
30	9.6	10.94	41.07
60	11.5	15.91	46.27
90	13.42	19.53	51.91
120	20.01	23.92	58.88
150	23.39	33.2	65.90
180	26.14	36.66	77.10
210	28.22	39.91	85.15
240	30.31	42.64	90.34
270	32.09	44.07	93.88
300	33.4	45.88	95.08
330	35.96	47.54	96.07
360	36.72	48.8	96.43

Persamaan regresi linier % pelepasan dan waktu

Formula	Persamaan regresi linier	r
Formula I	$Y = 8,21 + 0,086X$	0,981
Formula II	$Y = 10,95 + 0,118X$	0,968
Formula III	$Y = 38,120 + 0,188X$	0,970

b. Analisis kinetika orde satu

Waktu (menit)	Log % pelepasan		
	Formula I	Formula II	Formula III
30	0.98	1.04	1.61
60	1.06	1.2	1.67
90	1.13	1.29	1.72
120	1.3	1.38	1.77
150	1.37	1.52	1.82
180	1.42	1.56	1.89
210	1.45	1.6	1.93
240	1.48	1.63	1.96
270	1.51	1.64	1.97
300	1.52	1.66	1.98
330	1.56	1.68	1.98
360	1.57	1.69	1.99

Persamaan regresi linier Log % pelepasan dan waktu

Formula	Persamaan regresi linier	r
Formula I	$Y = 1,019 + 0,002X$	0,944
Formula II	$Y = 1,133 + 0,002X$	0,927
Formula III	$Y = 1,625 + 0,001X$	0,955

c. Analisis kinetika model higuchi

Akar waktu	% Pelepasan		
	Formula I	Formula II	Formula III
5.48	9.60	10.94	41.07
7.75	11.50	15.91	46.27
9.47	13.42	19.53	51.91
10.96	20.01	23.92	58.88
12.25	23.39	33.20	65.90
13.42	26.14	36.66	77.10
14.49	28.22	39.91	85.15
15.49	30.31	42.64	90.34
16.43	32.09	44.07	93.88
17.32	33.4	45.88	95.08
18.17	35.96	47.54	96.07
18.97	36.72	48.80	96.43

Persamaan regresi linier % pelepasan dan akar waktu

Formula	Persamaan regresi linier	r
Formula I	$Y = -4,421 + 2,209X$	0,991
Formula II	$Y = -6,781 + 3,061X$	0,988
Formula III	$Y = 10,456 + 4,823X$	0,982

d. Mekanisme pelepasan Power Law

Log waktu	Log % pelepasan		
	Formula I	Formula II	Formula III
1.48	0.98	1.04	1.61
1.78	1.06	1.20	1.67
1.95	1.13	1.29	1.72
2.08	1.3	1.38	1.77
2.18	1.37	1.52	1.82
2.26	1.42	1.56	1.89
2.32	1.45	1.60	1.93
2.38	1.48	1.63	1.96
2.43	1.51	1.64	1.97
2.48	1.52	1.66	1.98
2.52	1.56	1.68	1.98
2.56	1.57	1.69	1.99

Persamaan regresi linier Log % pelepasan dan Log waktu

Formula	Persamaan regresi linier	r
Formula I	$Y = 0,028 + 0,606X$	0,985
Formula II	$Y = 0,069 + 0,646X$	0,991
Formula III	$Y = 0,969 + 0,404X$	0,980

Lampiran 8. Penentuan formula optimum

a. Respon kecepatan alir

$$\text{Respon (Y)} = 8.68A + 8.15 B + 1.76 A B$$

Proporsi	Respon kecepatan alir
100% A : 0% B	8.68
90% A : 10% B	8.79
80% A : 20% B	8.86
70% A : 30% B	8.89
60% A : 40% B	8.89
50% A : 50% B	8.86
40% A : 60% B	8.78
30% A : 70% B	8.68
20% A : 80% B	8.54
10% A : 90% B	8.36
0% A : 100% B	8.15

Keterangan : A = proporsi HPMC
B = proporsi MC

Perhitungan normalitas kecepatan alir

$$N = \frac{X - X \text{ min}}{X \text{ max} - X \text{ min}}$$

$$X \text{ min} = 8$$

$$X \text{ max} = 9$$

Proporsi	Normalitas kecepatan alir
100% A : 0% B	0.6800
90% A : 10% B	0.7854
80% A : 20% B	0.8556
70% A : 30% B	0.8906
60% A : 40% B	0.8904
50% A : 50% B	0.8550
40% A : 60% B	0.7884
30% A : 70% B	0.6786
20% A : 80% B	0.5376
10% A : 90% B	0.3614
0% A : 100% B	0.1500

b. Respon kompaktilitas

$$\text{Respon (Y)} = 6.82 A + 10.86 B - 0.16 A B$$

Proporsi	Respon kompaktilitas
100% A : 0% B	6.82
90% A : 10% B	7.22
80% A : 20% B	7.63
70% A : 30% B	8.03
60% A : 40% B	8.43
50% A : 50% B	8.84
40% A : 60% B	9.24
30% A : 70% B	9.64
20% A : 80% B	10.05
10% A : 90% B	10.45
0% A : 100% B	10.86

Keterangan : A = proporsi HPMC
B = proporsi MC

Perhitungan normalitas kompaktilitas

$$N = \frac{X - X \text{ min}}{X \text{ max} - X \text{ min}}$$

$$X \text{ min} = 6$$

$$X \text{ max} = 12$$

Proporsi	Normalitas kompaktilitas
100% A : 0% B	0.1367
90% A : 10% B	0.2038
80% A : 20% B	0.2709
70% A : 30% B	0.3381
60% A : 40% B	0.4054
50% A : 50% B	0.4727
40% A : 60% B	0.5400
30% A : 70% B	0.6074
20% A : 80% B	0.6749
10% A : 90% B	0.7424
0% A : 100% B	0.8100

c. Respon disolusi

$$\text{Respon (Y)} = 0.086A + 0.188B - 0.072AB$$

Proporsi	Respon disolusi
100% A : 0% B	0.086
90% A : 10% B	0.090
80% A : 20% B	0.095
70% A : 30% B	0.101
60% A : 40% B	0.110
50% A : 50% B	0.119
40% A : 60% B	0.130
30% A : 70% B	0.142
20% A : 80% B	0.156
10% A : 90% B	0.171
0% A : 100% B	0.188

Keterangan : A = proporsi HPMC
B = proporsi MC

Perhitungan normalitas disolusi

$$N = \frac{X - X \min}{X \max - X \min}$$

$$X \min = 0,07$$

$$X \max = 0,2$$

Proporsi	Normalitas disolusi
100% A : 0% B	0.1231
90% A : 10% B	0.1517
80% A : 20% B	0.1914
70% A : 30% B	0.2422
60% A : 40% B	0.3040
50% A : 50% B	0.3769
40% A : 60% B	0.4609
30% A : 70% B	0.5560
20% A : 80% B	0.6622
10% A : 90% B	0.7794
0% A : 100% B	0.9077

d. Perhitungan respon total

Pembagian proporsi : kecepatan alir = 0,4

Kompaktibilitas = 0,35

Disolusi = 0,25

R total = R kecepatan alir + R kompaktibilitas + R disolusi

Proporsi	R kecepatan alir	R kompaktibilitas	R Disolusi	R Total
100% A : 0% B	0.2720	0.0478	0.0308	0.3506
90% A : 10% B	0.3142	0.0713	0.0379	0.4234
80% A : 20% B	0.3422	0.0948	0.0478	0.4849
70% A : 30% B	0.3562	0.1183	0.0605	0.5351
60% A : 40% B	0.3562	0.1419	0.0760	0.5740
50% A : 50% B	0.3420	0.1654	0.0942	0.6017
40% A : 60% B	0.3138	0.1890	0.1152	0.6180
30% A : 70% B	0.2714	0.2126	0.1390	0.6230
20% A : 80% B	0.2150	0.2362	0.1655	0.6168
10% A : 90% B	0.1446	0.2598	0.1948	0.5993
0% A : 100% B	0.0600	0.2835	0.2269	0.5704

Formula optimum adalah formula yang mengandung 30% HPMC – 70% MC

Lampiran 9. Uji sifat fisik granul dan tablet formula optimum

a. Kandungan lembab

Replikasi	Bobot awal (g)	Bobot akhir (g)	Kandungan lembab (%)
1	2,00	1,95	2,50
2	2,00	1,95	2,50
3	2,01	1,96	2,49
Rata-rata			2,50

b. Kecepatan alir

Bobot (g)	Waktu (detik)	Kecepatan alir (g/detik)
20,069	2,3	8,73
	2,3	8,73
	2,3	8,73
	2,3	8,73
	2,4	8,36
Rata-rata		8,65
SD		0,16

c. Sudut Diam

Tinggi (cm)	Jari-jari (cm)	Sudut diam
2,1	4,54	24,84
2,2	4,70	25,07
2,2	4,68	25,17
2,1	4,56	24,74
2,1	4,51	24,98
Rata-rata		24,96
SD		0,17

d. Kompaktibilitas

Replikasi	Kompaktibilitas (kg)
1	8,5
2	8,2
3	9,1
4	12,5
5	10
6	9,5
7	9,8
8	9,2
9	10,2
10	9,6
Rata-rata	9,66
SD	1,18

e. Keseragaman bobot

Tablet	Bobot (mg)
1	802
2	805
3	800
4	792
5	796
6	804
7	793
8	803
9	797
10	804
11	800
12	796
13	803
14	800
15	794
16	793
17	807
18	802
19	804
20	799
Rata-rata	799,7
SD	4,5
CV	0,56%

f. Kerapuhan

Bobot awal = 15,962 gram

Bobot akhir = 15,930 gram

$$\% \text{ Kerapuhan} = \frac{15,962 - 15,930}{15,962} \times 100\% = 0,2 \%$$

g. Uji disolusi formula optimum

Replikasi 1

Waktu (menit)	Absorbansi	Kadar (mg/ml)	Kadar dalam 900 ml	fx	Kadar (%)
30	0.662	0.015527446	13.97470167	10	34.94
60	0.762	0.017914081	16.12267303	10	40.31
90	0.842	0.019823389	17.84105012	10	44.60
120	0.782	0.018391408	16.5522673	12.5	51.73
150	0.834	0.019632458	17.66921241	12.5	55.22
180	0.451	0.010491647	9.4424821	25	59.02
210	0.482	0.011231504	10.10835322	25	63.18
240	0.523	0.012210024	10.98902148	25	68.68
270	0.557	0.01302148	11.71933174	25	73.25
300	0.574	0.013427208	12.08448687	25	75.53
330	0.591	0.013832936	12.449642	25	77.81
360	0.605	0.014167064	12.750358	25	79.69

Replikasi 2

Waktu (menit)	Absorbansi	Kadar (mg/ml)	Kadar dalam 900 ml	fx	Kadar (%)
30	0.670	0.015718377	14.14653938	10	35.37
60	0.770	0.018105012	16.29451074	10	40.74
90	0.848	0.019966587	17.9699284	10	44.92
120	0.789	0.018558473	16.7026253	12.5	52.20
150	0.840	0.019775656	17.79809069	12.5	55.62
180	0.453	0.010539379	9.485441527	25	59.28
210	0.487	0.011350835	10.21575179	25	63.85
240	0.530	0.012377088	11.13937947	25	69.62
270	0.565	0.013212411	11.89116945	25	74.32
300	0.582	0.013618138	12.25632458	25	76.60
330	0.593	0.013880668	12.49260143	25	78.08
360	0.615	0.014405728	12.96515513	25	81.03

Replikasi 3

Waktu (menit)	Absorbansi	Kadar (mg/ml)	Kadar dalam 900 ml	fx	Kadar (%)
30	0.671	0.015742243	14.16801909	10	35.42
60	0.760	0.017866348	16.0797136	10	40.20
90	0.845	0.019894988	17.90548926	10	44.76
120	0.790	0.018582339	16.72410501	12.5	52.26
150	0.845	0.019894988	17.90548926	12.5	55.95
180	0.441	0.010252983	9.227684964	25	57.67
210	0.489	0.011398568	10.25871122	25	64.12
240	0.539	0.012591885	11.3326969	25	70.83
270	0.566	0.013236277	11.91264916	25	74.45
300	0.579	0.013546539	12.19188544	25	76.20
330	0.599	0.014023866	12.62147971	25	78.88
360	0.610	0.014286396	12.85775656	25	80.36

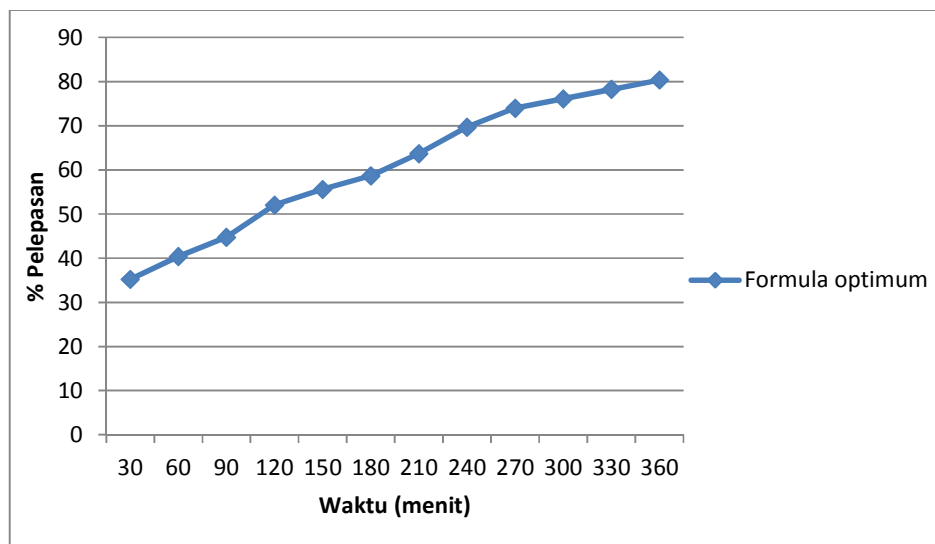
Rata-rata kadar formula optimum

Waktu (menit)	kadar (%)
30	35.24
60	40.42
90	44.76
120	52.06
150	55.6
180	58.66
210	63.72
240	69.71
270	74.01
300	76.11
330	78.26
360	80.36

Lampiran 10. Analisis kinetika formula optimum

a. Analisis kinetika orde nol

Waktu (menit)	kadar (%)
30	35.24
60	40.42
90	44.76
120	52.06
150	55.6
180	58.66
210	63.72
240	69.71
270	74.01
300	76.11
330	78.26
360	80.36



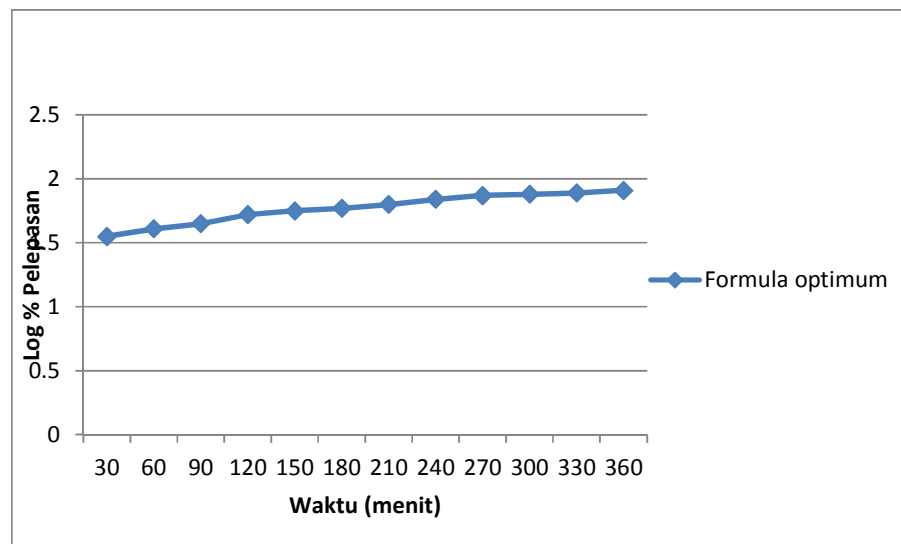
Persamaan regresi linier waktu dan %pelepasan

$$Y = 33,164 + 0,141X$$

$$R = 0,992$$

b. Analisis kinetika orde satu

Waktu (menit)	Log Pelepasan (%)
30	1.55
60	1.61
90	1.65
120	1.72
150	1.75
180	1.77
210	1.8
240	1.84
270	1.87
300	1.88
330	1.89
360	1.91



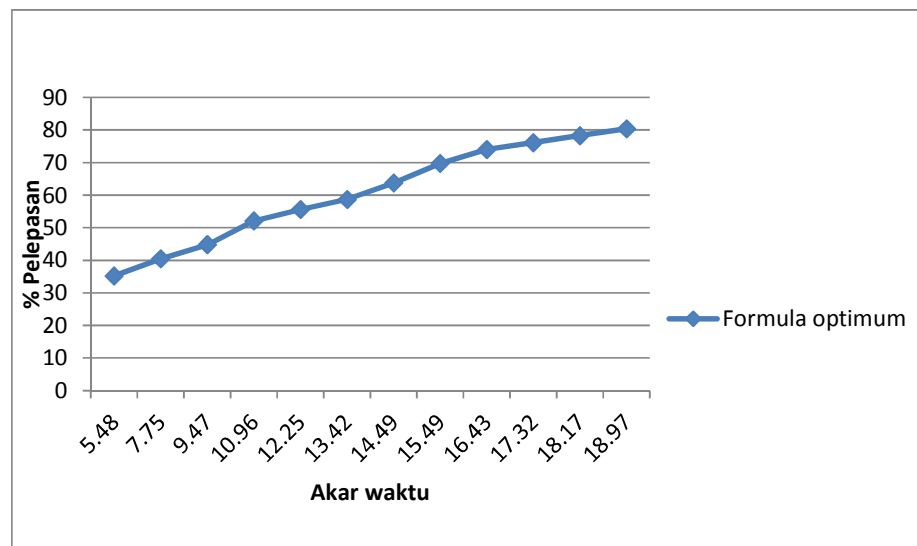
Persamaan regresi linier Log pelepasan dan waktu

$$Y = 1,562 + 0,001X$$

$$R = 0,976$$

c. Analisis kinetika model Higuchi

Akar waktu (menit)	Pelepasan (%)
5.48	35.24
7.75	40.42
9.47	44.76
10.96	52.06
12.25	55.6
13.42	58.66
14.49	63.72
15.49	69.71
16.43	74.01
17.32	76.11
18.17	78.26
18.97	80.36



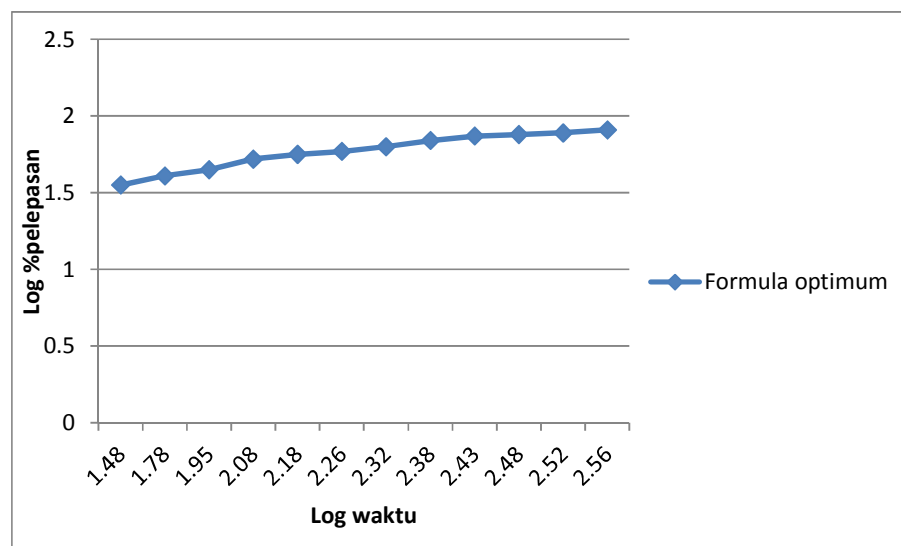
Persamaan regresi linier % Pelepasan dan akar waktu

$$Y = 12,846 + 3,588X$$

$$R = 0,995$$

d. Mekanisme pelepasan Power Law

Log waktu (menit)	Log Pelepasan (%)
30	1.55
60	1.61
90	1.65
120	1.72
150	1.75
180	1.77
210	1.8
240	1.84
270	1.87
300	1.88
330	1.89
360	1.91



Persamaan regresi linier Log % pelepasan dan Log waktu

$$Y = 0,989 + 0,355X$$

$$R = 0,987$$

Lampiran 11. Analisis Statistik

a. Kecepatan alir

NPar Tests

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
kecepatanalir	10	8.6680	.11104	8.36	8.73

One-Sample Kolmogorov-Smirnov Test

		kecepatanalir
N		10
Normal	Mean	8.6680
Parameters(a,b)	Std. Deviation	.11104
Most Extreme	Absolute	.443
Differences	Positive	.288
	Negative	-.443
Kolmogorov-Smirnov Z		1.401
Asymp. Sig. (2-tailed)		.039

a Test distribution is Normal.

b Calculated from data.

T-Test

Group Statistics

		N	Mean	Std. Deviation	Std. Error Mean
kecepatanalir	formula percobaan	5	8.6560	.16547	.07400
	prediksi	5	8.6800	.00000	.00000

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	Lower	Upper	Lower	Upper	Lower	Upper	Lower
kecepatanalir	Equal variances assumed	7.111	.029	-.324	8	.754	-.02400	.07400	-.19464	.14664
	Equal variances not assumed			-.324	4.000	.762	-.02400	.07400	-.22946	.18146

b. Kompaktibilitas

NPar Tests

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
kompaktibilitas	20	9.6500	.81195	8.20	12.50

One-Sample Kolmogorov-Smirnov Test

		kompaktibilitas
N		20
Normal Parameters(a,b)	Mean	9.6500
	Std. Deviation	.81195
Most Extreme Differences	Absolute	.305
	Positive	.305
	Negative	-.227
Kolmogorov-Smirnov Z		1.364
Asymp. Sig. (2-tailed)		.049

a Test distribution is Normal.

b Calculated from data.

T-Test**Group Statistics**

formula	N	Mean	Std. Deviation	Std. Error Mean
kompaktibilitas percobaan	10	9.6600	1.17964	.37304
prediksi	10	9.6400	.00000	.00000

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	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
kompaktibilitas	Equal variances assumed	8.171	.010	.054	18	.958	.02000	.37304	-.76372	.80372	
	Equal variances not assumed			.054	9.000	.958	.02000	.37304	-.82387	.86387	

c. Disolusi

NPar Tests**Descriptive Statistics**

	N	Mean	Std. Deviation	Minimum	Maximum
slope	6	.14183	.000983	.140	.143

One-Sample Kolmogorov-Smirnov Test

		slope
N		6
Normal Parameters(a,b)	Mean	.14183
	Std. Deviation	.000983
Most Extreme Differences	Absolute	.401
	Positive	.266
	Negative	-.401
Kolmogorov-Smirnov Z		.981
Asymp. Sig. (2-tailed)		.291

a Test distribution is Normal.

b Calculated from data.

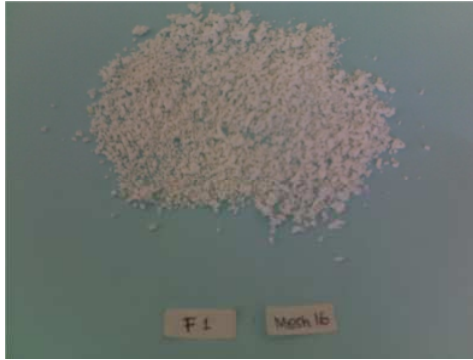
T-Test

Group Statistics

		N	Mean	Std. Deviation	Std. Error Mean
slope percobaan	formula	3	.14167	.001528	.000882
prediksi		3	.14200	.000000	.000000

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	Lower	Upper	Lower	Upper	Lower	Upper	Lower
slope	Equal variances assumed	7.692	.050	-.378	4	.725	-.000333	.000882	-.002782	.002115
	Equal variances not assumed			-.378	2.000	.742	-.000333	.000882	-.004128	.003461

Lampiran 12. Gambar granul mesh 16

Formula I



Formula II



Formula III



Formula Optimum

Lampiran 13. Gambar granul mesh 18

Formula I



Formula II



Formula III



Formula optimum

Lampiran 14. Gambar tablet



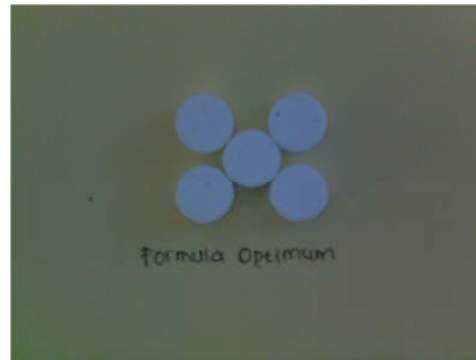
Formula I



Formula II



Formula III



Formula optimum