

## **BAB V**

### **KESIMPULAN DAN SARAN**

#### **A. Kesimpulan**

Dari hasil penelitian dapat disimpulkan bahwa ibuprofen dapat dibuat sediaan lepas lambat, dan kombinasi matriks HPMC K4M dan Na CMC berpengaruh terhadap mutu fisik tablet serta pelepasan ibuprofen. Formula optimum yang dihasilkan dalam penelitian ini adalah 60% HPMC K4M : 40% Na CMC.

#### **B. Saran**

1. Perlu dilakukan penelitian lebih lanjut untuk membuat tablet lepas lambat ibuprofen menggunakan matriks yang lain.
2. Perlu dilakukan penelitian pembuatan tablet lepas lambat ibuprofen menggunakan metode pembuatan tablet yang lain.

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## Lampiran 1. Surat keterangan bantuan bahan



Sukoharjo, 08 Juni 2012

Nomor : 004/KX-RP/VI/12  
Hal. : Bahan Baku  
Lamp. : Ibuprofen 100 gr beserta CA-nya

Kepada :  
Yth. Dekan Fakultas Farmasi  
Universitas Setia Budi  
Jl. Let. Jend. Sutoyo  
Solo – 57127

Up. Ibu Prof. Dr. R.A. Oetari, SU., MM., Apt.

Dengan Hormat,

Sehubungan dengan surat Ibu nomor : 505.01/FF.0/A/SPM/V/2012 tertanggal 01 Mei 2012, perihal Permohonan bahan penelitian Ibuprofen 100 (seratus) gram, guna penelitian bagi mahasiswa :

Nama Mahasiswa	NIM
Cintia Novita	14103036 A

melalui surat ini kami berikan Ibuprofen 100 (seratus) gram beserta CA-nya. Demikian, agar diterima dengan baik.

Hormat kami,  
PT. KONIMEX



Drs. J. Sunarto, Apt.  
Apoteker Penanggung Jawab

file : file/ik

PT. KONIMEX  
PHARMACEUTICAL LABORATORIES



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3143542, 3143575  
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P.O. BOX 1403, JAKARTA - INDONESIA

## Lampiran 2. Sertifikat analisa ibuprofen

 <b>BASF</b> The Chemical Company	<b>Certificate of Analysis</b> BASF Corporation																																																										
Please note that the certificate of analysis are also conveniently available online and around the clock at <a href="http://www.worldaccount.basf.com">www.worldaccount.basf.com</a>																																																											
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Ibuprofen 25 50KG Fibre drum Purchase Order/Customer Product# 2011000590 50909135	<table border="0"> <tr><td>Material</td><td>50909135</td></tr> <tr><td>Order</td><td>0110868375 000010</td></tr> <tr><td>Delivery</td><td>0121275813 000010</td></tr> <tr><td>Lot</td><td>IB1U0721</td></tr> <tr><td>Lot/Qty</td><td>3100.000 KG</td></tr> <tr><td>Total</td><td>4000.000 KG</td></tr> <tr><td>Transport</td><td>0000000000173637600</td></tr> </table>	Material	50909135	Order	0110868375 000010	Delivery	0121275813 000010	Lot	IB1U0721	Lot/Qty	3100.000 KG	Total	4000.000 KG	Transport	0000000000173637600																																												
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<small>The aforementioned data shall constitute the agreed contractual quality of the product at the time of passing of risk. The data are controlled at regular intervals as part of our quality assurance program. Neither these data nor the properties of product specimens shall imply any legally binding guarantee of certain properties or of fitness for a specific purpose. No liability of ours can be derived therefrom.</small>																																																											
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PAGE : 1 OF 2		 <b>GLOBAL CHEMINDO MEGATRADING</b> reliable partner in raw material business																																																									

### Lampiran 3. Sertifikat analisa ibuprofen



### Certificate of Analysis

BASF Corporation

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PT.GLOBAL CHEMINDO MEGATRADING

2011-06-29

No.08 KIP, CAKUNG

BASF CORPORATION

JAKARTA TIMUR, DKI JAKARTA RAYA

Certificate No 6637

Indonesia

Page 2 of 2

#### Certificate of Analysis according to DIN 55350-18-4.2.2

Ibuprofen 25

Material

50909135

50KG Fibre drum

Order 0110866375 000010

Purchase Order/Customer Product#

Delivery 0121275913 000010

2011000590

Lot IB1U0721

50909135

Lot/Qty 3100.000 KG

Total 4000.000 KG

Transport 00000000000173837600

Characteristic/Method	UOM	Result	Specification
Unspecified Impurities	%	0.02	<=0.05
Total Impurities	%	0.1	<=0.2
Ph Eur Impurity F	%	0.00	<=0.10
Phosphorus	ppm	< 1	<=1
Median Particle Size	µm	28	20-33
Retest Date (MM/DD/YYYY)		06/25/2014	

Manufacturing Date: 25.06.2011

Product corresponds with the requirements of Ph. Eur., USP, JP, and Certificate of Suitability CEP 2000-087

\*OVI's are not tested since no OVI substances are used in the synthesis. Manufacturing Site Address: Highway 77 South, Bishop, TX 78343 USA Manufacturing Site Telephone: ,361-584-6603

THIS CERTIFICATE OF ANALYSIS HAS BEEN PRODUCED ELECTRONICALLY AND IS VALID WITHOUT A SIGNATURE.

The aforementioned data shall constitute the agreed contractual quality of the product at the time of passing of risk. The data are controlled at regular intervals as part of our quality assurance program. Neither these data nor the properties of product specimens shall imply any legally binding guarantee of certain properties or of fitness for a specific purpose. No liability of ours can be derived therefrom.

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#### Lampiran 4. 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 µg / mL x 1000) x 6.912 L/jam x 6 jam  
 = 415 mg



### Lampiran 5. Pembuatan dapar fosfat pH 7,2

$\text{KH}_2\text{PO}_4$  ( 0,2 N )

$$M = \frac{n}{v}$$

$$0,2 = \frac{n}{0,05}$$

$$n = 0,01 \text{ mol}$$

Massa = n x BM

$$= 0,01 \times 136$$

$$= 1,36 \text{ gram (dalam 200 ml dapar)}$$

Massa dalam 1liter dapar = 1,36 x 5

$$= 6,8 \text{ gram}$$

NaOH (0,2 N)

M = 0,2 x valensi

$$= 0,2 \times 1$$

$$= 0,2 \text{ mol}$$

n= M x 0,0347

$$= 0,00694 \text{ mol}$$

Massa = n x BM

$$= 0,00694 \times 40$$

$$= 0,2776 \text{ gram ( dalam 200 ml dapar)}$$

Massa 1 liter dapar = 0,2776 x 5

$$= 1,388 \text{ gram}$$

**Lampiran 6. Penentuan panjang gelombang serapan maksimum dan kurva baku ibuprofen**

**a. Panjang gelombang maksimum**

A	Absorbansi
211	0.279
212	0.271
213	0.272
214	0.272
215	0.272
216	0.274
217	0.278
218	0.283
219	0.292
220	0.300
221	0.308
222	0.314
223	0.319
<b>224</b>	<b>0.320</b>
225	0.316
226	0.308
227	0.292
228	0.271
229	0.247
230	0.216
231	0.185

Panjang gelombang maksimum ibu profen adalah 224 nm

**b. Kurva baku**

Konsentrasi (ppm)	Absorbansi
4	0.168
8	0.314
12	0.490
14	0.556
18	0.577

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Regresi linier

$$a = 0.0702$$

$$b = 31.318$$

$$r = 0.966$$

Persamaan regresi linier  $y = 0.0702 + 31.318x$

**Lampiran 7. Hasil pemeriksaan kecepatan alir**

Waktu alir (detik)			
	Formula I	Formula II	Formula III
	8.6685	8.3010	9.0857
	9.2906	9.1105	8.9711
	8.0906	8.3821	8.7730
	8.7730	8.4475	8.5745
	8.1641	8.0394	9.0112
<b>X</b>	8.5974	8.4561	8.8831
<b>SD</b>	0.2077	0.4902	0.3973

Kecepatan alir (gram/detik)			
	Formula I	Formula II	Formula III
	11.5306	12.0467	11.0063
	10.7636	10.9764	11.1469
	12.3600	11.9302	11.3986
	11.3986	11.8378	11.6625
	12.2488	12.4387	11.0973
<b>X</b>	11.6614	11.8460	11.2623
<b>SD</b>	0.6565	0.5374	0.2668

**Lampiran 8. Hasil pemeriksaan keseragaman bobot dan perhitungan menurut persyaratan FI III**

Keseragaman Bobot			
	Formula I	Formula II	Formula III
	805	810	800
	812	812	810
	803	809	800
	799	786	800
	789	779	799
	816	811	795
	800	795	789
	803	800	802
	815	812	812
	800	792	789
	807	790	806
	810	802	801
	807	799	791
	807	804	790
	802	821	790
	809	800	802
	798	810	800
	798	802	812
	801	814	801
	811	811	810
<b>X</b>	804.6	802.95	800.05
<b>SD</b>	6.6046	10.5754	7.5636
<b>CV</b>	0.8209	1.3171	0.9454

Perhitungan keseragaman bobot tablet ibuprofen menurut farmakope Indonesia edisi III untuk bobot tablet 800 mg :

### 1. Formula I

Bobot rata-rata 20 tablet = 804.6 mg

a. Untuk penyimpangan 5% =  $\frac{5}{100} \times 804.6 \text{ mg} = 40.23 \text{ mg}$

Jadi berat tablet ibuprofen 800  $\pm$  40.23 mg (764.37 mg – 844.83 mg)

b. Untuk penyimpangan 10% =  $\frac{10}{100} \times 804.6 \text{ mg} = 80.46 \text{ mg}$

Jadi berat tablet ibuprofen 800  $\pm$  80.46 mg (724.14 mg – 855.06 mg)

### 2. Formula II

Bobot rata-rata 20 tablet = 802.95 mg

a. Untuk penyimpangan 5% =  $\frac{5}{100} \times 802.95 \text{ mg} = 40.1475 \text{ mg}$

Jadi berat tablet ibuprofen 800  $\pm$  40.1475 mg (759.85 mg – 840.15 mg)

b. Untuk penyimpangan 10% =  $\frac{10}{100} \times 802.95 \text{ mg} = 80.295 \text{ mg}$

Jadi berat tablet ibuprofen 800  $\pm$  80.295 mg (722.66 mg – 883.245 mg)

### 3. Formula III

Bobot rata-rata 20 tablet = 800.05 mg

a. Untuk penyimpangan 5% =  $\frac{5}{100} \times 800.05 \text{ mg} = 40.0475 \text{ mg}$

Jadi berat tablet ibuprofen 800  $\pm$  40.0475mg (760.00 mg – 840.10 mg)

b. Untuk penyimpangan 10% =  $\frac{10}{100} \times 800.05 \text{ mg} = 80.005 \text{ mg}$

Jadi berat tablet ibuprofen 800  $\pm$  80.005 mg (720.05 mg – 880.06 mg)

**Lampiran 9. Hasil pemeriksaan kekerasan tablet**

Kekerasan Tablet (Kg)			
	Formula I	Formula II	Formula III
	8	7	6
	7	7	7
	8	7	7
	7.5	9	8
	8	8	7
	7	9	7
	8	8	6
	7	7	7
	7	7	7
	8	8	8
<b>X</b>	7.55	7.7	7.35
<b>SD</b>	0.4975	0.8233	0.7835

**Lampiran 10. Hasil pemeriksaan kerapuhan tablet**

Bobot Tablet	Formula I	Formula II	Formula III
Sebelum	16.053	16.078	16.038
Sesudah	16.037	16.075	16.008
Kerapuhan (%)	0.10%	0.02%	0.19%



### Lampiran 11. 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)	fx	Kadar (%)
30	0.202	0.0042	10	9.45
60	0.248	0.0057	10	12.825
90	0.290	0.007	10	15.75
120	0.401	0.0106	10	23.85
150	0.230	0.0051	25	28.6875
180	0.251	0.0058	25	32.625
210	0.249	0.006	25	33.75
240	0.275	0.0065	25	36.5625
270	0.325	0.0081	25	45.5625
300	0.365	0.0094	25	52.875
330	0.392	0.0102	25	57.375
360	0.399	0.0105	25	59.0625

**Formula I Replikasi 2**

Waktu (menit)	Absorbansi	Kadar (mg/ml)	fx	Kadar (%)
30	0.210	0.0045	10	10.125
60	0.215	0.0046	10	10.35
90	0.301	0.0074	10	16.65
120	0.438	0.0117	10	26.325
150	0.220	0.0048	25	27
180	0.251	0.0058	25	32.625
210	0.368	0.0068	25	38.25
240	0.288	0.007	25	39.375
270	0.311	0.0077	25	43.3125
300	0.377	0.0098	25	55.125
330	0.383	0.01	25	56.25
360	0.420	0.0112	25	63

**Formula I Replikasi 3**

Waktu (menit)	Absorbansi	Kadar (mg/ml)	fx	Kadar (%)
30	0.205	0.0043	10	9.675
60	0.210	0.0045	10	10.125
90	0.336	0.0085	10	19.125
120	0.417	0.0111	10	24.975
150	0.225	0.0049	25	27.5625
180	0.230	0.0051	25	28.6875
210	0.270	0.0037	25	20.8125
240	0.290	0.007	25	39.375
270	0.320	0.008	25	45
300	0.348	0.0089	25	50.0625
330	0.391	0.0102	25	57.375
360	0.403	0.0106	25	59.625

**Rata-rata kadar ibuprofen formula I**

Replikasi1	Replikasi 2	Replikasi 3	Rata-rata kadar (%)
9.45	10.125	9.675	9.75
12.825	10.35	10.125	11.1
15.75	16.65	19.125	17.175
23.85	26.325	24.975	25.05
28.6875	27	27.5625	27.75
32.625	32.625	28.6875	31.3125
33.75	38.25	20.8125	30.9375
36.5625	39.375	39.375	38.4375
45.5625	43.3125	45	44.625
52.875	55.125	50.0625	52.6875
57.375	56.25	57.375	57
59.0625	63	59.625	60.5625

**Formula II Replikasi 1**

Waktu (menit)	Absorbansi	Kadar (mg/ml)	fx	Kadar (%)
30	0.441	0.0118	10	26.55
60	0.479	0.0131	10	29.475
90	0.330	0.0083	25	46.6875
120	0.351	0.009	25	50.625
150	0.388	0.0101	25	56.8125
180	0.389	0.0102	25	57.375
210	0.399	0.0105	25	59.0625
240	0.425	0.0113	25	63.5625
270	0.435	0.0116	25	65.25
300	0.480	0.0131	25	73.6875
330	0.501	0.0138	25	77.625
360	0.532	0.0147	25	82.6875

**Formula II Replikasi 2**

Waktu (menit)	Absorbansi	Kadar (mg/ml)	fx	Kadar (%)
30	0.461	0.0125	10	28.125
60	0.485	0.0132	10	29.7
90	0.208	0.0044	25	24.75
120	0.357	0.0095	25	53.4375
150	0.391	0.0102	25	57.375
180	0.401	0.0106	25	59.625
210	0.411	0.0109	25	61.3125
240	0.419	0.0111	25	62.4375
270	0.441	0.0119	25	66.9375
300	0.493	0.0135	25	75.9375
330	0.500	0.0137	25	77.0625
360	0.530	0.0147	25	82.6875

**Formula III Replikasi 3**

Waktu (menit)	Absorbansi	Kadar (mg/ml)	fx	Kadar (%)
30	0.435	0.0116	10	26.1
60	0.491	0.0134	10	30.15
90	0.289	0.007	25	39.375
120	0.360	0.0093	25	52.3125
150	0.390	0.0102	25	57.375
180	0.398	0.0105	25	59.0625
210	0.420	0.0111	25	62.4375
240	0.430	0.0115	25	64.6875
270	0.437	0.0117	25	65.8125
300	0.489	0.0134	25	75.375
330	0.499	0.0137	25	77.0625
360	0.527	0.0146	25	82.125

**Rata- rata kadar formula II**

Replikasi 1	Replikasi 2	Replikasi 3	Rata-rata kadar (%)
26.55	28.125	26.1	26.925
29.475	29.7	30.15	29.775
46.6875	24.75	39.375	36.9375
50.625	53.4375	52.3125	52.125
56.8125	57.375	57.375	57.1875
57.375	59.625	59.0625	58.6875
59.0625	61.3125	62.4375	60.9375
63.5625	62.4375	64.6875	63.5625
65.25	66.9375	65.8125	66
73.6875	75.9375	75.375	75
77.625	77.0625	77.0625	77.25
82.6875	82.6875	82.125	82.5



**Formula III Replikasi 1**

Waktu (menit)	Absorbansi	Kadar (mg/ml)	fx	Kadar (%)
30	0.572	0.016	10	36
60	0.593	0.0167	10	37.575
90	0.600	0.0169	10	38.025
120	0.623	0.0176	10	39.6
150	0.308	0.0076	25	42.75
180	0.314	0.0078	25	43.875
210	0.328	0.0082	25	46.125
240	0.341	0.0086	25	48.375
270	0.430	0.0087	25	48.9375
300	0.466	0.0126	25	70.875
330	0.501	0.0138	25	77.625
360	0.537	0.0149	25	83.8125

**Formula III Replikasi 2**

Waktu (menit)	Absorbansi	Kadar (mg/ml)	fx	Kadar (%)
30	0.561	0.0157	10	35.325
60	0.563	0.0157	10	35.325
90	0.590	0.0166	10	37.35
120	0.630	0.0179	10	40.275
150	0.314	0.0078	25	43.875
180	0.319	0.0079	25	44.4375
210	0.339	0.0086	25	48.375
240	0.345	0.0088	25	49.5
270	0.410	0.0108	25	60.75
300	0.467	0.0127	25	71.4375
330	0.510	0.014	25	78.75
360	0.544	0.0151	25	84.9375

**Formula III Replikasi 3**

Waktu (menit)	Absorbansi	Kadar (mg/ml)	fx	Kadar (%)
30	0.567	0.0159	10	35.775
60	0.577	0.0162	10	36.45
90	0.587	0.0165	10	37.125
120	0.638	0.0181	10	40.725
150	0.310	0.0077	25	43.3125
180	0.314	0.0078	25	43.875
210	0.325	0.0081	25	45.5625
240	0.329	0.0083	25	46.6875
270	0.437	0.0117	25	65.8125
300	0.472	0.0128	25	72
330	0.512	0.0141	25	79.3125
360	0.549	0.0153	25	86.0625

**Rata-rata kadar formula III**

Replikasi 1	Replikasi 2	Replikasi 3	Rata-rata kadar (%)
36	35.325	35.775	35.7
37.575	35.325	36.45	36.45
38.025	37.35	37.125	37.5
39.6	40.275	40.725	40.2
42.75	43.875	43.3125	43.3125
43.875	44.4375	43.875	44.0625
46.125	48.375	45.5625	46.6875
48.375	49.5	46.6875	48.1875
48.9375	60.75	65.8125	58.5
70.875	71.4375	72	71.4375
77.625	78.75	79.3125	78.5625
83.8125	84.9375	86.0625	84.9375

**Uji Anova****a. Kecepatan alir****NPar Tests****Descriptive Statistics**

	N	Mean	Std. Deviation	Minimum	Maximum
Kecepatanalir	15	11.589894	.5381031	10.7636	12.4387

**One-Sample Kolmogorov-Smirnov Test**

		Kecepatanalir
N		15
Normal Parameters <sup>a,b</sup>	Mean	11.589894
	Std. Deviation	.5381031
Most Extreme Differences	Absolute	.128
	Positive	.128
	Negative	-.090
Kolmogorov-Smirnov Z		.496
Asymp. Sig. (2-tailed)		.966

**Oneway****Test of Homogeneity of Variances**

kecepatanalir			
Levene Statistic	df1	df2	Sig.
1.360	2	12	.294

## ANOVA

kecepatanalir

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.890	2	.445	1.688	.226
Within Groups	3.164	12	.264		
Total	4.054	14			

## b. kekerasan

## NPar Tests

## Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
kekerasan	30	7.5333	.70629	6.00	9.00

## One-Sample Kolmogorov-Smirnov Test

		kekerasan
N		30
Normal Parameters <sup>a,b</sup>	Mean	7.5333
	Std. Deviation	.70629
Most Extreme Differences	Absolute	.242
	Positive	.242
	Negative	-.212
Kolmogorov-Smirnov Z		1.323
Asymp. Sig. (2-tailed)		.060

a. Test distribution is Normal.

b. Calculated from data.

## Oneway

## Test of Homogeneity of Variances

kekerasan

Levene Statistic	df1	df2	Sig.
1.750	2	27	.193

## ANOVA

Kekerasan

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.617	2	.308	.601	.555
Within Groups	13.850	27	.513		
Total	14.467	29			

## c. Disolusi

## NPar Tests

## Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
disolusi	36	47.744792	19.7977207	9.7500	84.9375

## One-Sample Kolmogorov-Smirnov Test

		disolusi
N		36
Normal Parameters <sup>a,b</sup>	Mean	47.744792
	Std. Deviation	19.7977207
Most Extreme Differences	Absolute	.070
	Positive	.070
	Negative	-.069
Kolmogorov-Smirnov Z		.419
Asymp. Sig. (2-tailed)		.995

a. Test distribution is Normal.

b. Calculated from data.

## Oneway

## Test of Homogeneity of Variances

Disolusi

Levene Statistic	df1	df2	Sig.
.003	2	33	.997

## ANOVA

Disolusi

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3624.189	2	1812.094	5.924	.006
Within Groups	10094.052	33	305.880		
Total	13718.241	35			

Hasil uji-t formula 1 dengan formula 2

T-Test

## Group Statistics

	formula	N	Mean	Std. Deviation	Std. Error Mean
disolusi	formula1	12	33.865625	17.1821104	4.9600480
	formula2	12	57.240625	18.0857719	5.2209126

## Independent Samples Test

	Levene's Test for Equality of Variances	t-test for Equality of Means								
								95% Confidence Interval of the Difference		
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
disolusi	Equal variances assumed	.001	.976	-3.246	22	.004	-23.3750000	7.2013891	-38.3097670	-8.4402330
	Equal variances not assumed			-3.246	21.942	.004	-23.3750000	7.2013891	-38.3120383	-8.4379617

Hasil uji-t formula 1 dengan formula 3

T-Test

## Group Statistics

	formula	N	Mean	Std. Deviation	Std. Error Mean
disolusi	formula1	12	33.865625	17.1821104	4.9600480
	formula3	12	52.128125	17.1849078	4.9608556



**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
disolusi	Equal variances assumed	.002	.966	-2.603	22	.016	-18.2625000	7.0151382	-32.8110062	-3.7139938
	Equal variances not assumed			-2.603	22.000	.016	-18.2625000	7.0151382	-32.8110063	-3.7139937

### Hasil uji-t formula 2 dengan formula 3

#### T-Test

#### Group Statistics

formula		N	Mean	Std. Deviation	Std. Error Mean
disolusi	formula2	12	57.240625	18.0857719	5.2209126
	formula3	12	52.128125	17.1849078	4.9608556

**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
disolusi	Equal variances assumed	.005	.945	.710	22	.485	5.1125000	7.2019453	-9.8234205	20.0484205
	Equal variances not assumed			.710	21.943	.485	5.1125000	7.2019453	-9.8256776	20.0506776

## Lampiran 12. Analisis pola pelepasan ibuprofen

### a. Analisis kinetika orde nol

Waktu (menit)	% Pelepasan		
	Formula I	Formula II	Formula III
30	9.75	26.925	35.7
60	11.1	29.775	36.45
90	17.175	36.9375	37.5
120	25.05	52.125	40.2
150	27.75	57.1875	43.3125
180	31.3125	58.6875	44.0625
210	30.9375	60.9375	46.6875
240	38.4375	63.5625	48.1875
270	44.625	66	58.5
300	52.6875	75	71.4375
330	57	77.25	78.5625
360	60.5625	82.5	84.9375

### Persamaan regresi linier % pelepasan dan waktu

Formula	Persamaan regresi linier	r
Formula I	$Y = 3.180 + 1,513X$	0,991
Formula II	$Y = 25.518 + 0,163X$	0,973
Formula III	$Y = 23.334 + 0,149X$	0,929

**b. Analisis kinetika orde satu**

Waktu (menit)	Log % pelepasan		
	Formula I	Formula II	Formula III
30	0.99	1.43	1.55
60	1.05	1.47	1.56
90	1.23	1.57	1.57
120	1.40	1.72	1.60
150	1.44	1.76	1.64
180	1.50	1.77	1.64
210	1.49	1.78	1.67
240	1.58	1.80	1.68
270	1.65	1.82	1.77
300	1.72	1.88	1.85
330	1.76	1.89	1.90
360	1.78	1.92	1.93

**Persamaan regresi linier Log % pelepasan dan waktu**

Formula	Persamaan regresi linier	r
Formula I	$Y = 1.007 + 0,002X$	0,968
Formula II	$Y = 1,463 + 0,001X$	0,938
Formula III	$Y = 1,468 + 0,001X$	0,959

**c. Analisis kinetika model higuchi**

Akar waktu	% Pelepasan		
	Formula I	Formula II	Formula III
5.48	9.75	26.925	35.7
7.75	11.1	29.775	36.45
9.47	17.175	36.9375	37.5
10.96	25.05	52.125	40.2
12.25	27.75	57.1875	43.3125
13.42	31.3125	58.6875	44.0625
14.49	30.9375	60.9375	46.6875
15.49	38.4375	63.5625	48.1875
16.43	44.625	66	58.5
17.32	52.6875	75	71.4375
18.17	57	77.25	78.5625
18.97	60.5625	82.5	84.9375

**Persamaan regresi linier % pelepasan dan akar waktu**

Formula	Persamaan regresi linier	r
Formula I	$Y = -18.821 + 3.941X$	0,976
Formula II	$Y = 2.866 + 4.109X$	0,987
Formula III	$Y = 5.343 + 3.504X$	0,872

### Lampiran 13. Penentuan formula optimum

#### a. Respon kecepatan alir

$$\text{Respon } Y = 11,66 (A) + 11,26 (B) + 1,56 (A)(B)$$

Proporsi	Respon kecepatan alir
100% A : 0%B	11.66
90% A : 10% B	11.76
80% A : 20%B	11.83
70% A : 30%B	11.87
60% A : 40%B	11.87
50% A : 50%B	11.85
40% A : 60%B	11.79
30% A : 70%B	11.71
20% A : 80%B	11.59
10% A : 90%B	11.44
0% A : 100%B	11.26

Keterangan : A = proporsi HPMC

B = proporsi Na CMC

Perhitungan normalitas kecepatan alir

$$N = \frac{X - X \text{ min}}{X \text{ Max} - X \text{ Min}}$$

$$X \text{ min} = 11$$

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

Proporsi	Normalitas kecepatan alir
100% A : 0%B	0.66
90% A : 10% B	0.76
80% A : 20%B	0.83
70% A : 30%B	0.87
60% A : 40%B	0.87
50% A : 50%B	0.85
40% A : 60%B	0.79
30% A : 70%B	0.71
20% A : 80%B	0.59
10% A : 90%B	0.44
0% A : 100%B	0.26

**b. Respon kekerasan**

$$\text{Respon } Y = 7,55 (A) + 7,35 (B) - 1 (A)(B).$$

Proporsi	Respon kekerasan
100% A : 0%B	7.55
90% A : 10% B	7.62
80% A : 20%B	7.67
70% A : 30%B	7.7
60% A : 40%B	7.71
50% A : 50%B	7.7
40% A : 60%B	7.67
30% A : 70%B	7.62
20% A : 80%B	7.55
10% A : 90%B	7.46
0% A : 100%B	7.35

Keterangan : A = proporsi HPMC

B = proporsi Na CMC

Perhitungan normalitas kompatibilitas

$$N = \frac{X - X \text{ min}}{X \text{ Max} - X \text{ Min}}$$

$$X \text{ min} = 6.8$$

$$X \text{ max} = 7.9$$

Proporsi	Normalitas kekerasan
100% A : 0%B	0.6818
90% A : 10% B	0.7455
80% A : 20%B	0.7909
70% A : 30%B	0.8182
60% A : 40%B	0.8273
50% A : 50%B	0.8182
40% A : 60%B	0.7909
30% A : 70%B	0.7455
20% A : 80%B	0.6818
10% A : 90%B	0.6000
0% A : 100%B	0.5000



**c. Respon disolusi**

$$\text{Respon } Y = 0,991 (A) + 0,929 (B) - 0,052 (A)(B).$$

Proporsi	Respon disolusi
100% A : 0% B	0.991
90% A : 10% B	0.989
80% A : 20% B	0.987
70% A : 30% B	0.983
60% A : 40% B	0.979
50% A : 50% B	0.973
40% A : 60% B	0.966
30% A : 70% B	0.959
20% A : 80% B	0.950
10% A : 90% B	0.940
0% A : 100% B	0.929

Keterangan : A = proporsi HPMC

B = proporsi Na CMC

Perhitungan normalitas disolusi

$$N = \frac{X - X \text{ min}}{X \text{ Max} - X \text{ Min}}$$

$$X \text{ min} = 0.9$$

$$X \text{ max} = 1.0$$

Proporsi	Normalitas disolusi
100% A : 0%B	0.91
90% A : 10% B	0.8948
80% A : 20%B	0.8692
70% A : 30%B	0.8332
60% A : 40%B	0.7868
50% A : 50%B	0.73
40% A : 60%B	0.6628
30% A : 70%B	0.5852
20% A : 80%B	0.4972
10% A : 90%B	0.3988
0% A : 100%B	0.29

**d. Perhitungan respon total**

Pembagian proporsi : Kecepatan alir = 0,3

Kekerasan = 0,6

Disolusi = 0,1

R total = R kecepatan alir + R kekerasan + R disolusi

Proporsi	R kecepatan alir	R kekerasan	R Disolusi	R Total
100% A : 0% B	0.198	0.40908	0.091	0.6981
90% A : 10% B	0.228	0.44730	0.08948	0.7648
80% A : 20% B	0.249	0.47454	0.08692	0.8105
70% A : 30% B	0.261	0.49092	0.08332	0.8352
<b>60% A : 40% B</b>	<b>0.261</b>	<b>0.49638</b>	<b>0.07868</b>	<b>0.8361</b>
50% A : 50% B	0.255	0.49092	0.073	0.8189
40% A : 60% B	0.237	0.47454	0.06628	0.7778
30% A : 70% B	0.213	0.44730	0.05852	0.7188
20% A : 80% B	0.177	0.40908	0.04972	0.6358
10% A : 90% B	0.132	0.36000	0.03988	0.5319
0% A : 100% B	0.078	0.30000	0.029	0.4070

Formula optimum adalah formula yang mengandung 60% HPMC – 40% Na CMC

### Lampiran 14. Uji sifat fisik granul dan tablet formula optimum

#### a. Kecepatan alir

Kecepatan alir (gram/detik)		
bobot	waktu	Kecepatan alir
100	8.30	12.0482
	8.12	12.3152
	8.14	12.2850
	9.01	11.0988
	8.23	12.1507
$\bar{X}$		11.9796
SD		0.5039

#### b. Kekerasan

Replikasi	Kekerasan (kg)
1	7.6
2	8.9
3	8
4	7
5	8.3
6	7.1
7	7.5
8	8
9	8.2
10	7
Rata-rata	7.76
SD	0.631

**c. Keseragaman bobot**

Tablet	Bobot (mg)
1	800
2	800
3	795
4	801
5	799
6	786
7	801
8	800
9	786
10	799
11	803
12	811
13	798
14	788
15	801
16	800
17	806
18	794
19	804
20	811
Rata-rata	799.15
SD	6.8616
CV	0.858612

**d. Kerapuhan**

Bobot awal = 15,983 gram

Bobot akhir = 15,969 gram

$$\% \text{ Kerapuhan} = \frac{15,983 - 15,969}{15,983} \times 100\% = 0,08 \%$$

**e. Uji disolusi formula optimum**

Replikasi 1

Waktu (menit)	Absorbansi	Kadar (mg/ml)	fx	Kadar (%)
30	0.36	0.0093	10	20.9250
60	0.45	0.0121	10	27.2250
90	0.48	0.0131	10	29.4750
120	0.507	0.0139	10	31.2750
150	0.319	0.0079	25	44.4375
180	0.362	0.0093	25	52.3125
210	0.398	0.0105	25	59.0625
240	0.41	0.0108	25	60.7500
270	0.436	0.0117	25	65.8125
300	0.44	0.0118	25	66.3750
330	0.49	0.0134	25	75.3750
360	0.511	0.0141	25	79.3125

Persamaan regresi linier waktu dan % kadar

$$Y = 15.522 + 0.182X$$

$$R = 0.987$$

## Replikasi 2

Waktu (menit)	Absorbansi	Kadar (mg/ml)	fx	Kadar (%)
30	0.385	0.0101	10	22.7250
60	0.429	0.0115	10	25.8750
90	0.498	0.0137	10	30.8250
120	0.522	0.0144	10	32.4000
150	0.31	0.0077	25	43.3125
180	0.38	0.0098	25	55.1250
210	0.399	0.0105	25	59.0625
240	0.417	0.0111	25	62.4375
270	0.429	0.0115	25	64.6875
300	0.44	0.0118	25	66.3750
330	0.489	0.0134	25	75.3750
360	0.511	0.0141	25	79.3125

Persamaan regresi linier waktu dan % kadar

$$Y = 16.469 + 0.179X$$

$$R = 0.985$$

## Replikasi 3

Waktu (menit)	Absorbansi	Kadar (mg/ml)	fx	Kadar (%)
30	0.377	0.0098	10	22.0500
60	0.438	0.0117	10	26.3250
90	0.479	0.0131	10	29.4750
120	0.509	0.014	10	31.5000
150	0.315	0.0078	25	43.8750
180	0.371	0.0096	25	54.0000
210	0.405	0.0107	25	60.1875
240	0.422	0.0112	25	63.0000
270	0.438	0.0117	25	65.8125
300	0.452	0.0122	25	68.6250
330	0.474	0.0129	25	72.5625
360	0.492	0.0135	25	75.9375

Persamaan regresi linier waktu dan % kadar

$$Y = 16.661 + 0.177X$$

$$R = 0.980$$



**Rata-rata kadar formula optimum**

Waktu (menit)	kadar (%)
30	21.9000
60	26.4750
90	29.9250
120	31.7250
150	43.8750
180	53.8125
210	59.4375
240	62.0625
270	65.4375
300	67.1250
330	74.4375
360	78.1875

Persamaan regresi linier waktu dan % kadar

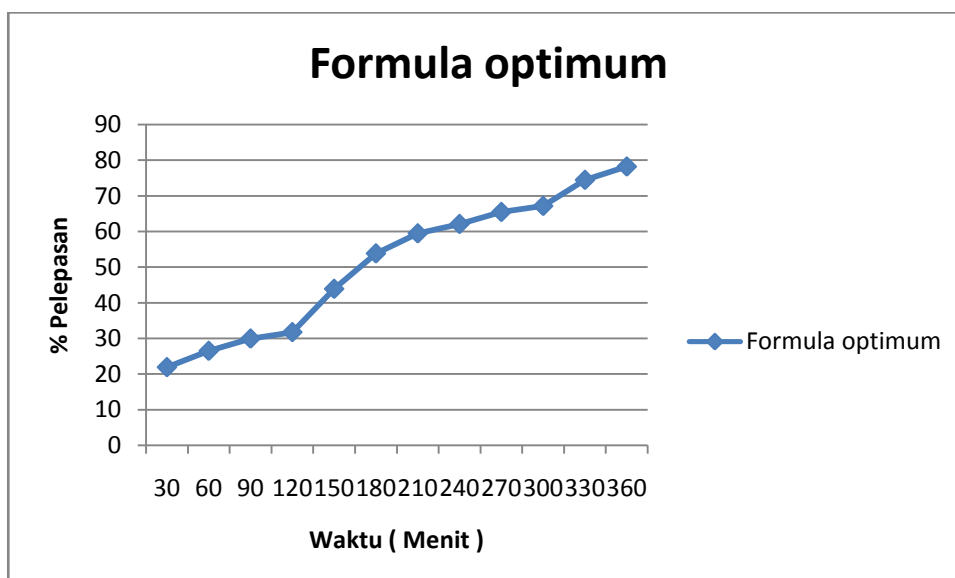
$$Y = 16.201 + 0.179X$$

$$R = 0.985$$

## Lampiran 15. Analisis kinetika formula optimum

### a. Analisis kinetika orde nol

Waktu (menit)	kadar (%)
30	21.9000
60	26.4750
90	29.9250
120	31.7250
150	43.8750
180	53.8125
210	59.4375
240	62.0625
270	65.4375
300	67.1250
330	74.4375
360	78.1875



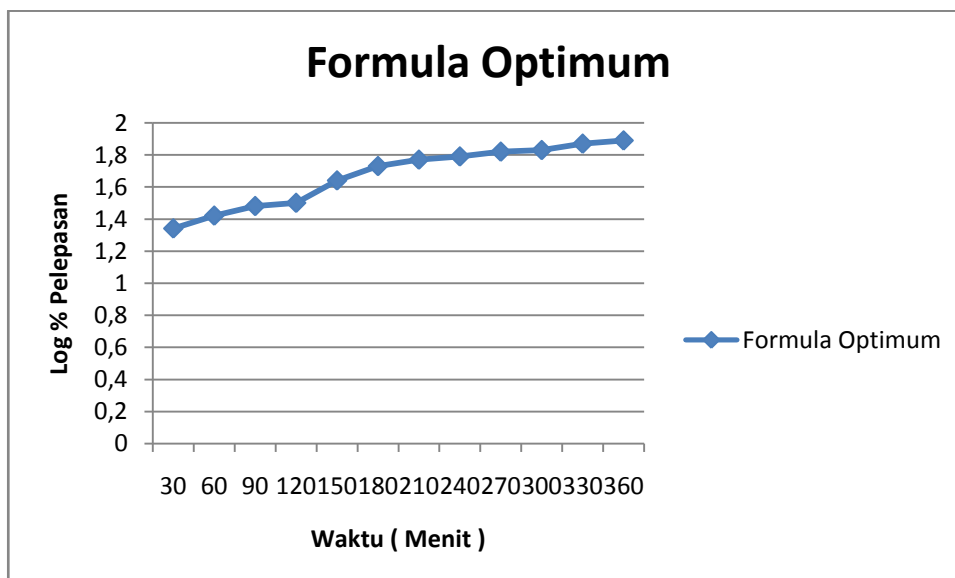
Persamaan regresi linier waktu dan %pelepasan

$$Y = 16.201 + 0.179X$$

$$R = 0.985$$

**b. Analisis kinetika orde satu**

Waktu (menit)	Log Pelepasan (%)
30	1.34
60	1.42
90	1.48
120	1.50
150	1.64
180	1.73
210	1.77
240	1.79
270	1.82
300	1.83
330	1.87
360	1.89



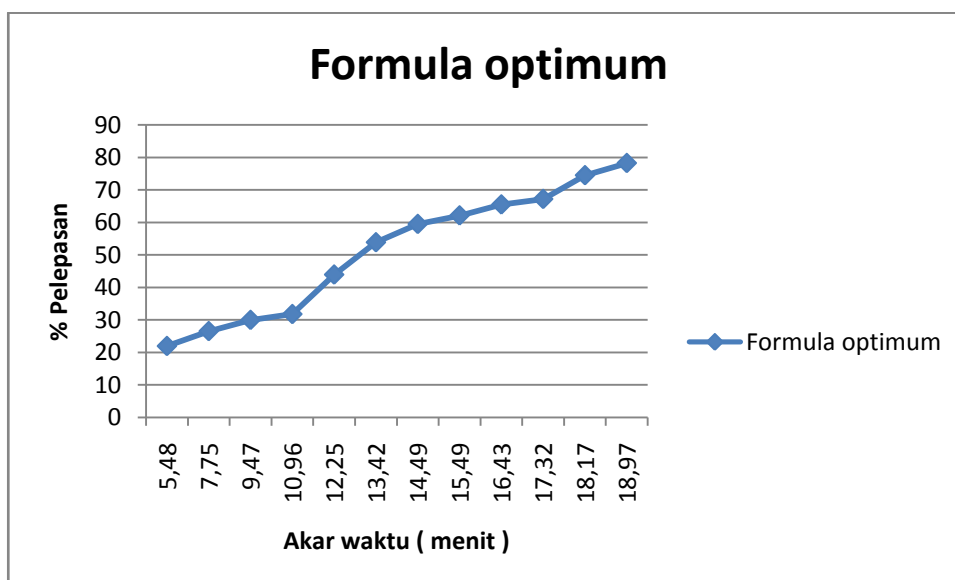
Persamaan regresi linier Log pelepasan dan waktu

$$Y = 1.341 + 0,002X$$

$$R = 0.966$$

**c. Analisis kinetika model Higuchi**

Akar waktu (menit)	Pelepasan (%)
5.48	21.9000
7.75	26.4750
9.47	29.9250
10.96	31.7250
12.25	43.8750
13.42	53.8125
14.49	59.4375
15.49	62.0625
16.43	65.4375
17.32	67.1250
18.17	74.4375
18.97	78.1875



Persamaan regresi linier % Pelepasan dan akar waktu

$$Y = -9.115 + 4.521X$$

$$R = 0.981$$

## Lampiran 16. Analisis Statistik

### a. Kecepatan alir

#### NPar Tests

##### Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
kecepatanalir	10	11.8260	.43503	11.05	12.32

##### One-Sample Kolmogorov-Smirnov Test

		kecepatanalir
N		10
Normal Parameters <sup>a..b</sup>	Mean	11.8260
	Std. Deviation	.43503
Most Extreme Differences	Absolute	.340
	Positive	.160
	Negative	-.340
Kolmogorov-Smirnov Z		1.076
Asymp. Sig. (2-tailed)		.197

a. Test distribution is Normal.

b. Calculated from data.

#### T-Test

##### Group Statistics

	formula	N	Mean	Std. Deviation	Std. Error Mean
kecepatanalir	prediksi	5	11.8700	.00000	.00000
	percobaan	5	11.7820	.64882	.29016

### 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
kecepatanalir Equal variances assumed	75.840	.000	.303	8	.769	.08800	.29016	-.58111	.75711
Equal variances not assumed			.303	4.000	.777	.08800	.29016	-.71762	.89362

## b. Kekerasan

### NPar Tests

#### Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
kekerasan	20	7.7350	.43507	7.00	8.90

#### One-Sample Kolmogorov-Smirnov Test

		kekerasan
N		20
Normal Parameters <sup>a,b</sup>	Mean	7.7350
	Std. Deviation	.43507
Most Extreme Differences	Absolute	.273
	Positive	.273
	Negative	-.227
Kolmogorov-Smirnov Z		1.220
Asymp. Sig. (2-tailed)		.102

a. Test distribution is Normal.

b. Calculated from data.

### T-Test

#### Group Statistics

formula	N	Mean	Std. Deviation	Std. Error Mean
kekerasan prediksi	10	7.7100	.00000	.00000
percobaan	10	7.7600	.63105	.19956

**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	
kekemasan	27.655	.000	-.251	18	.805	-.05000	.19956	-.46925	.36925	
			-.251	9.000	.808	-.05000	.19956	-.50142	.40142	

Equal variances assumed  
Equal variances not assumed



### c. Disolusi

#### NPar Tests

##### Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
dissolusi	6	.98150	.003564	.979	.987

##### One-Sample Kolmogorov-Smirnov Test

		dissolusi
N		6
Normal Parameters <sup>a,b</sup>	Mean	.98150
	Std. Deviation	.003564
Most Extreme Differences	Absolute	.330
	Positive	.330
	Negative	-.241
Kolmogorov-Smirnov Z		.808
Asymp. Sig. (2-tailed)		.532

a. Test distribution is Normal.

b. Calculated from data.

#### T-Test

##### Group Statistics

	formula	N	Mean	Std. Deviation	Std. Error Mean
dissolusi	prediksi	3	.97900	.000000	.000000
	percobaan	3	.98400	.003606	.002082

## 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	Lower	Upper
dissolusi	Equal variances assumed	9.143	.039	-2.402	4	.074	-.005000	.002082	-.010780	.000780
	Equal variances not assumed			-2.402	2.000	.138	-.005000	.002082	-.013957	.003957