BAB V
KESIMPULAN DAN SARAN

A. Kesimpulan

Berdasarkan hasil penelitian yang telah dilakukan maka dapat disimpulkan bahwa :

1. Sediaan gel dispersi padat ibuprofen dengan gelling agent HPMC dan Karbopol 940 memiliki mutu fisik yang baik meliputi daya lekat, daya sebar, pH, organoletis, homogenitas serta stabilitas yang baik.
2. Formula optimum gel dispersi padat ibuprofen diperoleh proporsi HPMC 1,73455% dan karbopol 940 0,26545%.

B. Saran

1. Perlu diadakan penelitian lebih lanjut dalam optimasi formulasi gel dispersi padat ibuprofen – PEG 6000 1:1,5 dengan pemilihan variabel lain.
2. Perlu dilakukan uji penetrasi gel secara *in vitro* agar dapat diketahui jumlah obat yang terpenetrasi dalam pemakaian.

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L A M P I R A N

Lampiran 1. Sertifikat analisis ibuprofen

IOL CHEMICALS AND PHARMACEUTICALS LIMITED

CERTIFICATE OF ANALYSIS

Product Name : **IBUPROFEN BP**
Date of Mfg. : Nov. - 2018
Date of Expiry : Oct. - 2023
Drug Lic No. : 1689-OSP
Dispatch Qty : 1000 Kg

Batch No. : 4001/1201/18/A-4151
Date of Analysis : 27/11/2018
A .R No. : 4001/1151/1118/A-4151/10667
Batch Qty : 1000 Kg
Packing : 20 X 50 Kg

Sr. No	TEST	SPECIFICATIONS	RESULTS
1.	Appearance	White or almost White Crystalline Powder or Colourless Crystals	White crystalline powder.
2.	Solubility	Practically insoluble in water, freely soluble in Acetone, Methanol, and Methylene chloride. It dissolves in dilute solution of alkali hydroxide and carbonate	Complies
3.	Identification 1st Identification A,C 2nd Identification A,B,D	A) Melting Point 75-78°C B) By UV Exhibits 2 absorption maxima, at 264 nm and 272 nm. The ratio of the absorbance measured at the maximum at 264 nm to that measured at the shoulder at 258 nm is 1.20 to 1.30. The ratio of the absorbance measured at the maximum at 272 nm to that measured at the shoulder at 258 nm is 1.00 to 1.10. C) By IR The infra-red absorbance spectrum obtained from the sample should be concordant with spectrum obtained from the standard. D) By TLC The principal spot in the chromatogram obtained with the test solution is similar in position, color and size to the principal spot in the chromatogram obtained with the reference solution.	76°C Omitted as per pharmacopoeia Complies. Omitted as per pharmacopoeia

Page 1/2

Head Office : 85, Industrial Area 'A', Ludhiana. 141 003 (Pb.) India CIN - L24116PB1986PLC007030
Ph. : +91-161-2225531-35 Fax : +91-161-2226929, 2608784 email : contact@iolcp.com Website : iolcp.com
Works : Village Fatehgarh Channa, Mansa Road, District - Barnala, 148101 State - Punjab, INDIA.
Ph. : +91-1679 -285285-86, Fax : +91-1679-285292

Lampiran 2. Gambar alat penelitian

Neraca analitik

Alat – alat gelas

Water bath

Ice bath

Spektrofotometer UV-Vis

Spektroskopi inframerah

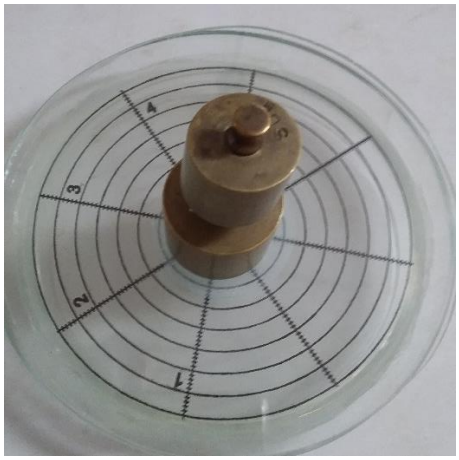
pH meter

Viskometer

Alat homogenitas

Alat uji daya lekat

Alat uji daya sebar



Oven

Pompa hidrolik

Mortir stamper

Desikator

Lampiran 3. Penimbangan pembuatan dispersi padat dan penetapan kadar dispersi padat

A. Penimbangan pembuatan dispersi padat

Kertas timbang + ibuprofen = 40,236 g

Kertas timbang + sisa = 0,236 g –

Ibuprofen = 40 g

PEG 6000 = 60 g +

Total = 100 g

B. Penimbangan kurva baku

Kertas timbang + ibuprofen = 0,3675 g

Kertas timbang + sisa = 0,2641 g –

Ibuprofen = 0,1034 g = 103,4 mg/100 ml = 1034 ppm

Pengenceran kurva baku

V1 x C1 = V2 x C2

10 ml x **150 ppm** = V2 x 1000 ppm

V2 = 1,5 ml

V1 x C1 = V2 x C2

10 ml x **200 ppm** = V2 x 1000 ppm

V2 = 2 ml

V1 x C1 = V2 x C2

10 ml x **250 ppm** = V2 x 1000 ppm

V2 = 2,5 ml

V1 x C1 = V2 x C2

10 ml x **300 ppm** = V2 x 1000 ppm

V2 = 3 ml

V1 x C1 = V2 x C2

10 ml x **350 ppm** = V2 x 1000 ppm

V2 = 3,5 ml

V1 x C1 = V2 x C2

10 ml x **400 ppm** = V2 x 1000 ppm

V2 = 4 ml

V1 x C1 = V2 x C2

10 ml x **450 ppm** = V2 x 1000 ppm

V2 = 4,5 ml

Lampiran 4. Foto hasil peleburan, pembekuan, dispersi padat kasar dan halus

Peleburan PEG 6000 dan Ibuprofen

Pembekuan leburan dispersi padat

Dispersi padat kasar

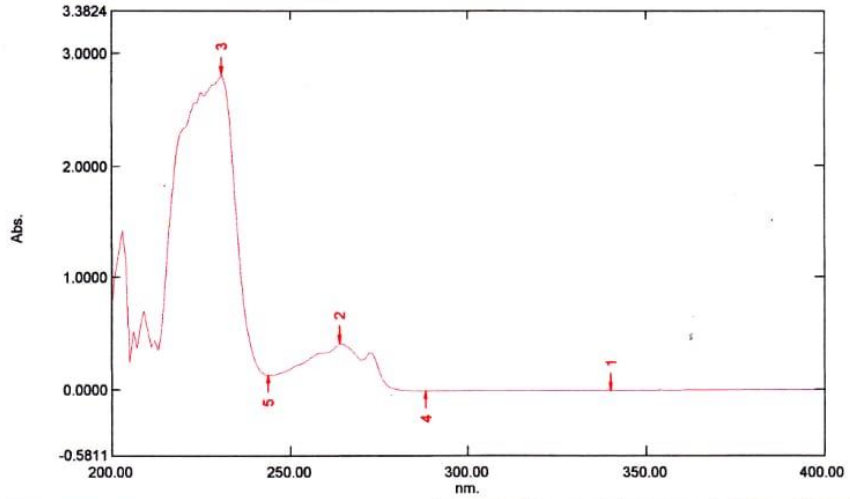
Dispersi padat halus

Lampiran 5. Hasil penentuan panjang gelombang maksimum ibuprofen

Spectrum Peak Pick Report

02/01/2020 10:30:15 AM

Data Set: File_200201_102832 - RawData



[Measurement Properties]
Wavelength Range (nm.): 200.00 to 400.00
Scan Speed: Medium
Sampling Interval: 1.0
Auto Sampling Interval: Disabled
Scan Mode: Single

[Instrument Properties]
Instrument Type: UV-1800 Series
Measuring Mode: Absorbance
Slit Width: 1.0 nm
Light Source Change Wavelength: 340.0 nm
S/R Exchange: Normal

[Attachment Properties]
Attachment: None

[Operation]
Threshold: 0.0010000
Points: 4
InterPolate: Disabled
Average: Disabled

[Sample Preparation Properties]
Weight:
Volume:
Dilution:
Path Length:
Additional Information:

No.	P/V	Wavelength	Abs.	Description
1	●	340.00	-0.0081	
2	●	264.00	0.4073	
3	●	231.00	2.8152	
4	▼	288.00	-0.0140	
5	▼	244.00	0.1251	

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Lampiran 6. Hasil penetapan *operating time*

Kinetics Data Print Report

02/03/2020 01:08:45 PM

Time (Minute)	RawData ...
0.000	0.568
1.000	0.568
2.000	0.569
3.000	0.569
4.000	0.569
5.000	0.570
6.000	0.570
7.000	0.569
8.000	0.569
9.000	0.570
10.000	0.569
11.000	0.569
12.000	0.569
13.000	0.568
14.000	0.569
15.000	0.569
16.000	0.569
17.000	0.568
18.000	0.568
19.000	0.568
20.000	0.568
21.000	0.569
22.000	0.569
23.000	0.569
24.000	0.569
25.000	0.569
26.000	0.569
27.000	0.569
28.000	0.569
29.000	0.569
30.000	0.569

Lampiran 7. Perhitungan % *recovery* ibuprofen dalam dispersi padat

a = 0,0324

b = 0,0018

r = 0,9993

Y = a + bx

= 0,0324 + 0,0018x

A. Replikasi 1

Dispersi padat ibuprofen yang ditimbang:

Kertas timbang + dispersi = 0,3077 g

Kertas timbang + sisa = 0,2782 g –

Dispersi = 32,1 mg

Abs = 0,231

Dalam 32,1 mg dispersi padat mengandung ibuprofen sebanyak:

$$\frac{100\ gram\ dispersi\ padat}{40\ gram\ ibuprofen} = \frac{32{,}1\ mg\ dispersi\ padat}{x\ mg\ ibuprofen}$$

x = 12,84 mg ibuprofen

Kadar 12,84 mg ibuprofen yaitu:

$$\frac{12{,}84\ mg\ ibuprofen}{100\ ml\ lar.NaOH\ 0{,}1\ N}\ x\ 1000\ ppm = 128{,}4\ ppm$$

Kadar percobaan dengan spektrofotometer Uv-Vis:

Y = a + bx

0,231 = 0,0324 + 0,0018x

$x = \frac{0{,}231 - 0{,}0324}{0{,}0018}$

= 110,33 ppm

$$\%Recovery = \frac{110{,}33\ ppm}{124{,}4\ ppm}\ x\ 100\% = 88{,}6897\%$$

B. Replikasi 2

Dispersi padat ibuprofen yang ditimbang:

Kertas timbang + dispersi = 0,3014 g

Kertas timbang + sisa = 0,2782 g –

Dispersi = 29,4 mg

Abs = 0,222

Dalam 32,1 mg dispersi padat mengandung ibuprofen sebanyak:

$$\frac{100\ gram\ dispersi\ padat}{40\ gram\ ibuprofen} = \frac{29{,}4\ mg\ dispersi\ padat}{x\ mg\ ibuprofen}$$

x = 11,76 mg ibuprofen

Kadar 12,84 mg ibuprofen yaitu:

$$\frac{11{,}76\ mg\ ibuprofen}{100\ ml\ lar.NaOH\ 0{,}1\ N}\ x\ 1000\ ppm = 117{,}6\ ppm$$

Kadar percobaan dengan spektrofotometer Uv-Vis:

Y = a + bx

0,222 = 0,0324 + 0,0018x

x = $\frac{0{,}222 - 0{,}0324}{0{,}0018}$

= 105,33 ppm

$$\%Recovery = \frac{105{,}33\ ppm}{124{,}4\ ppm}\ x\ 100\% = 84{,}67\%$$

C. Replikasi 3

Dispersi padat ibuprofen yang ditimbang:

Kertas timbang + dispersi = 0,3077 g

Kertas timbang + sisa = 0,2792 g –

Dispersi = 30,1 mg

Abs = 0,224

Dalam 32,1 mg dispersi padat mengandung ibuprofen sebanyak:

$$\frac{100\ gram\ dispersi\ padat}{40\ gram\ ibuprofen} = \frac{30{,}1\ mg\ dispersi\ padat}{x\ mg\ ibuprofen}$$

x = 12,04 mg ibuprofen

Kadar 12,84 mg ibuprofen yaitu:

$$\frac{12{,}04\ mg\ ibuprofen}{100\ ml\ lar.NaOH\ 0{,}1\ N}\ x\ 1000\ ppm = 120{,}4\ ppm$$

Kadar percobaan dengan spektrofotometer Uv-Vis:

Y = a + bx

0,224 = 0,0324 + 0,0018x

x = $\frac{0{,}224 - 0{,}0324}{0{,}0018}$

= 106,44 ppm

$$\%Recovery = \frac{106{,}44\ ppm}{124{,}4\ ppm}\ x\ 100\% = 85{,}562\%$$

Rata-rata *% recovery* $= \frac{88{,}6897 + 84{,}67 + 85{,}562}{3} = 86{,}307\%$

SD $= \sqrt{\frac{(86{,}307 - 88{,}6897)^2 + (86{,}307 - 84{,}67)^2 + (86{,}307 - 85{,}562)^2}{3-1}}$

$= \sqrt{\frac{5{,}677 + 2{,}6797 + 0{,}555}{2}} = 2{,}1106$

CV $= \frac{2{,}1106}{86{,}307}\ x\ 100\% = 2{,}44\%$

Lampiran 8. Perhitungan Penggunaan Ibuprofen dalam Formula Gel

Perbandingan ibuprofen : PEG 6000 = 1 : 1,5

Dalam 100 gram sediaan gel mengandung 2,5 gram dispersi padat ibuprofen-PEG 6000 terdiri atas 1 gram ibuprofen dan 1,5 gram PEG 6000. %*Recovery* ibuprofen dalam dispersi padat 86,307% sehingga dalam 2,5 gram dispersi padat mengandung 0,86307 gram ibuprofen.

Pada formulasi 100 gram sediaan gel diinginkan mengandung 1 gram ibuprofen.

$$\frac{2{,}5\ gram\ dispersi\ padat}{x\ gram\ dispersi\ padat} = \frac{0{,}86307\ \ gram\ ibuprofen}{1\ gram\ ibuprofen}$$

x = 2,896 gram dispersi padat

Sehingga dapat disimpulkan bahwa dalam formulasi 100 gram sediaan gel mengandung 2,896% dispersi padat ibuprofen yang setara dengan 1% ibuprofen.

Lampiran 9. Foto larutan stok, penetapan % *recovery*, dan akurasi

Larutan stok

Larutan penetapan %*recovery*

Larutan penetapan akurasi

Lampiran 10. Verifikasi metode analisis

A. Linearitas

V1 x N1 = V2 x N2

1,5 ml x 1034 ppm = 10 ml x N2

N2 = 155,1 ppm

V1 x N1 = V2 x N2

2 ml x 1034 ppm = 10 ml x N2

N2 = 206,8 ppm

V1 x N1 = V2 x N2

2,5 ml x 1034 ppm = 10 ml x N2

N2 = 258,5 ppm

V1 x N1 = V2 x N2

3 ml x 1034 ppm = 10 ml x N2

N2 = 310,2 ppm

V1 x N1 = V2 x N2

3,5 ml x 1034 ppm = 10 ml x N2

N2 = 361,9 ppm

V1 x N1 = V2 x N2

4 ml x 1034 ppm = 10 ml x N2

N2 = 413,6 ppm

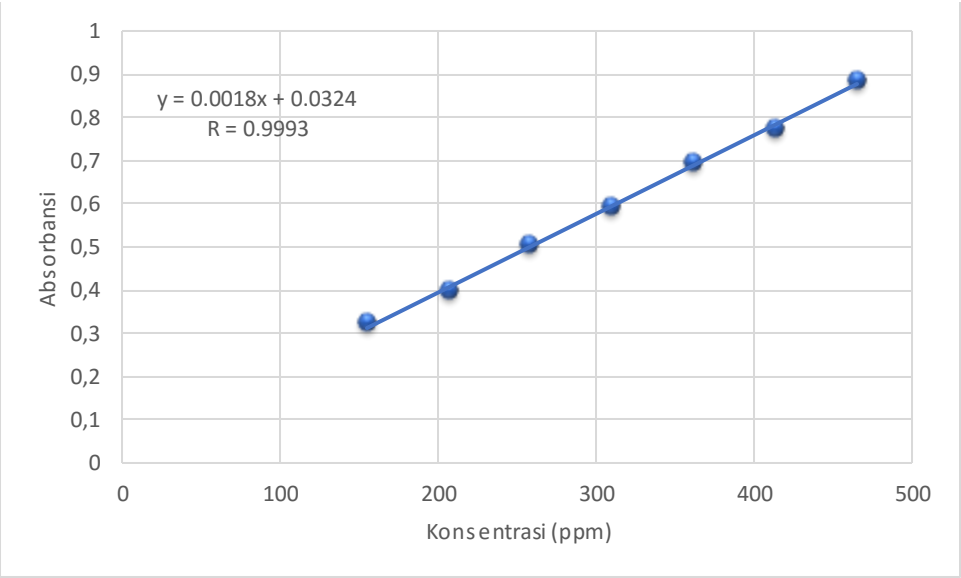
V1 x N1 = V2 x N2

4,5 ml x 1034 ppm = 10 ml x N2

N2 = 465,3 ppm

Konsentrasi	Absorbansi
155.1	0.322
206.8	0.397
258.5	0.504
310.2	0.591
361.9	0.694
413.6	0.773
465.3	0.883

a	0.0324
b	0.0018
r	0.9993



B. Akurasi

Pengambilan larutan:

$$80\% \rightarrow \frac{80}{100} \text{ x } 310{,}2 = 248{,}16 \text{ ppm} \rightarrow \frac{248{,}16 \text{ ppm x } 10 \text{ ml}}{1034 \text{ ppm}} = 2{,}48 \text{ ml} \approx 2{,}5 \text{ ml}$$

$$100\% \rightarrow \frac{100}{100} \text{ x } 310{,}2 = 310{,}2 \text{ ppm} \rightarrow \frac{310{,}2 \text{ ppm x } 10 \text{ ml}}{1034 \text{ ppm}} = 3 \text{ ml}$$

$$120\% \rightarrow \frac{120}{100} \text{ x } 310{,}2 = 372{,}24 \text{ ppm} \rightarrow \frac{372{,}24 \text{ ppm x } 10 \text{ ml}}{1034 \text{ ppm}} = 3{,}6 \text{ ml} \approx 3{,}5 \text{ ml}$$

Konsentrasi	Replikasi	Abs	Konsentrasi	Ppm Sebenarnya	%	Rata-Rata	Recovery
80%	1	0.491	252.9262	258.5	98%	99.34%	99.09%
	2	0.497	256.2350	258.5	99%		
	3	0.506	261.1982	258.5	101%		
100%	1	0.589	306.9700	310.2	99%	98.84%	
	2	0.588	306.4185	310.2	99%		
	3	0.588	306.4185	310.2	99%		
120%	1	0.676	354.9476	361.9	98%	99.35%	
	2	0.69	362.6681	361.9	100%		
	3	0.687	361.0137	361.9	100%		

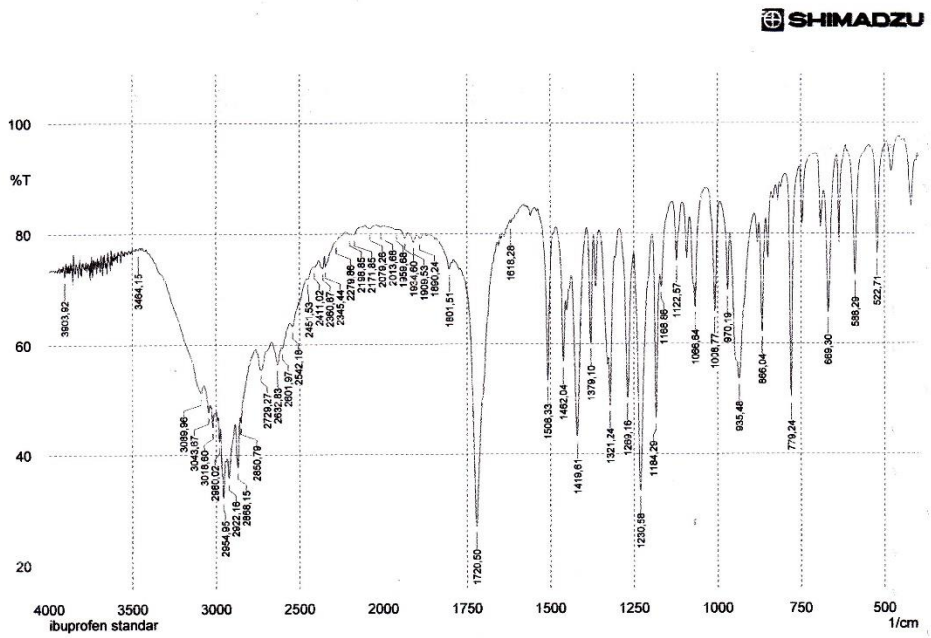
C. Presisi

REPLIKASI	ABSORBANSI	KONSENTRASI
1	0.267	129.3977
2	0.272	132.1550
3	0.266	128.8462
4	0.271	131.6036
5	0.273	132.7065
6	0.268	129.9492
7	0.27	131.0521
8	0.274	133.2580
9	0.267	129.3977
10	0.272	132.1550

SD	1.559783
RATA-RATA	131.0521
CV	1.190201

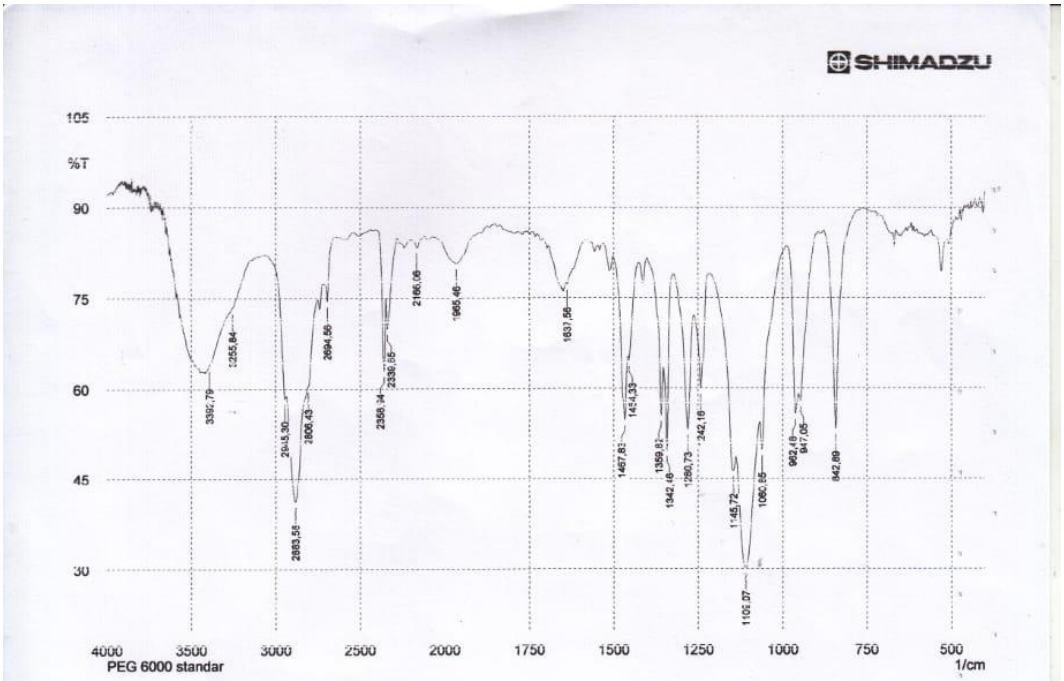
Lampiran 11. Hasil spektra IR

a. Ibuprofen



	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	522,71	76,352	19,952	545,85	493,78	2,072	1,231
2	588,29	72,492	23,266	615,29	547,78	3,011	1,757
3	669,3	65,632	24,135	680,87	644,22	3,168	1,685
4	779,24	50,13	41,196	796,6	756,1	3,829	2,257
5	866,04	62,106	19,629	873,75	856,39	2,447	0,94
6	935,48	53,583	5,99	941,26	889,18	8,15	0,41
7	970,19	69,662	11,443	991,41	964,41	2,698	0,45
8	1008,77	65,887	20,865	1031,92	993,34	3,665	1,321
9	1066,64	66,635	5,788	1070,49	1033,85	3,129	0,145
10	1122,57	75,089	10,604	1134,14	1105,21	2,529	0,588
11	1168,86	70,298	2,202	1170,79	1136,07	3,216	0,063
12	1184,29	46,441	29,934	1193,94	1172,72	4,282	1,712
13	1230,58	33,377	44,276	1249,87	1195,87	12,387	6,613
14	1269,16	50,184	27,89	1292,31	1251,8	6,815	2,504
15	1321,24	48,719	12,755	1325,1	1309,67	3,332	0,613
16	1379,1	60,118	20,15	1390,68	1371,39	2,816	0,981
17	1419,61	43,251	32,481	1436,97	1392,61	9,099	4
18	1462,04	56,709	13,513	1481,33	1456,26	3,936	0,612
19	1508,33	53,193	28	1537,27	1494,83	5,739	2,063
20	1618,28	81,9	0,643	1620,21	1581,63	2,987	0,044
21	1720,5	26,896	48,728	1768,72	1658,78	26,391	13,24
22	1801,51	73,554	2,616	1840,09	1789,94	5,899	0,232
23	1890,24	79,113	0,708	1899,88	1878,67	2,113	0,039
24	1909,53	78,414	1,443	1924,96	1901,81	2,329	0,075
25	1934,6	79,203	1,171	1953,89	1926,89	2,6	0,055
26	1959,68	80,784	0,086	1984,75	1955,82	2,651	0,01
27	2013,68	81,181	0,359	2038,76	2000,18	3,451	0,036
28	2079,26	80,872	0,65	2106,27	2056,12	4,549	0,099
29	2171,85	79,891	0,102	2173,78	2144,84	2,714	0,008
30	2198,85	79,907	0,156	2223,92	2193,06	2,976	0,011
31	2279,86	78,544	0,154	2283,72	2225,85	5,766	0,009
32	2345,44	74,07	2,047	2349,3	2285,65	7,403	0,289
33	2360,87	73,768	2,033	2385,95	2351,23	4,441	0,231

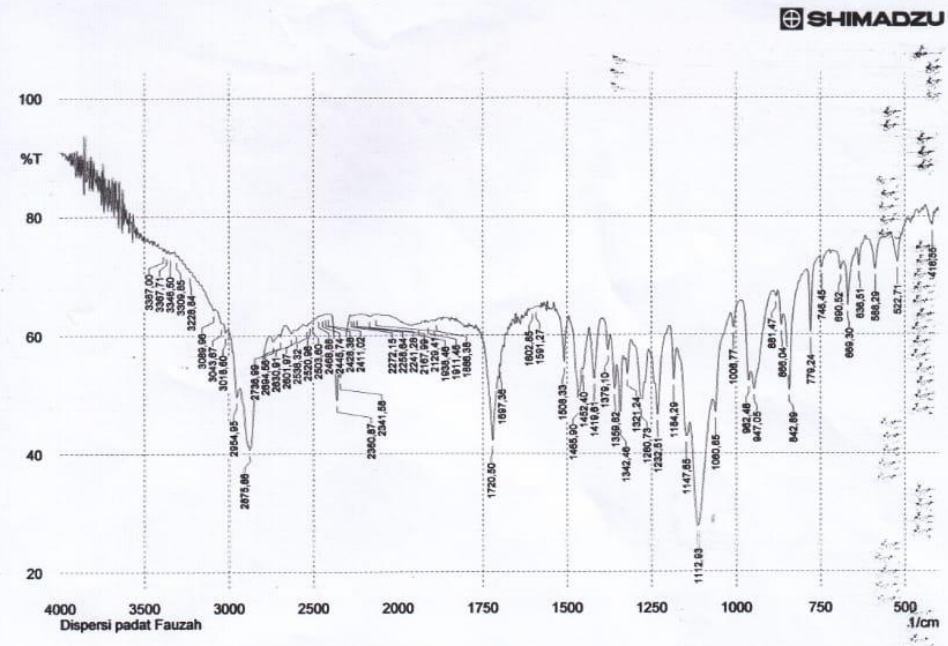
b. PEG 6000



	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	842,89	53,193	34,094	875,68	781,17	10,137	4,812
2	947,05	57,822	2,801	950,91	894,97	7,181	0,11
3	962,48	55,698	10,165	987,55	952,84	5,72	0,618
4	1060,85	49,705	0,718	1066,64	989,48	11,28	0,33
5	1109,07	30,145	20,841	1138	1068,56	28,241	8,21
6	1145,72	46,241	4,307	1215,15	1139,93	13,932	0,406
7	1242,16	59,936	15,195	1261,45	1217,08	6,98	1,619
8	1280,73	53,134	21,024	1321,24	1263,37	10,005	2,887
9	1342,46	49,62	18,745	1352,1	1323,17	5,108	0,996
10	1359,82	55,445	10,301	1400,32	1354,03	6,597	0,417
11	1454,33	64,638	2,715	1458,18	1427,32	4,096	0,105
12	1467,83	54,715	14,444	1500,62	1458,18	7,119	1,343
13	1637,56	77,214	0,523	1639,49	1581,63	5,176	0,021
14	1965,46	80,72	4,8	2056,12	1894,1	12,736	1,694
15	2166,06	83,36	1,361	2183,42	2121,7	4,56	0,193
16	2339,65	69,892	6,112	2347,37	2283,72	6,985	0,793
17	2358,94	62,909	14,027	2405,23	2349,3	6,331	1,265
18	2694,56	74,425	3,834	2702,27	2646,34	4,883	0,173
19	2806,43	60,399	0,535	2808,36	2752,42	9,106	0,054
20	2883,58	41,212	18,289	2937,59	2808,36	38,316	9,308
21	2945,3	58,35	1,655	3047,53	2939,52	14,027	0,101
22	3255,84	73,344	0,191	3257,77	3145,9	12,285	0,026
23	3392,79	63,75	0,145	3394,72	3277,06	19,352	0,022

Date/Time; 18/02/2020 15:44:17
No. of Scans; 10
Resolution; 4 [1/cm]

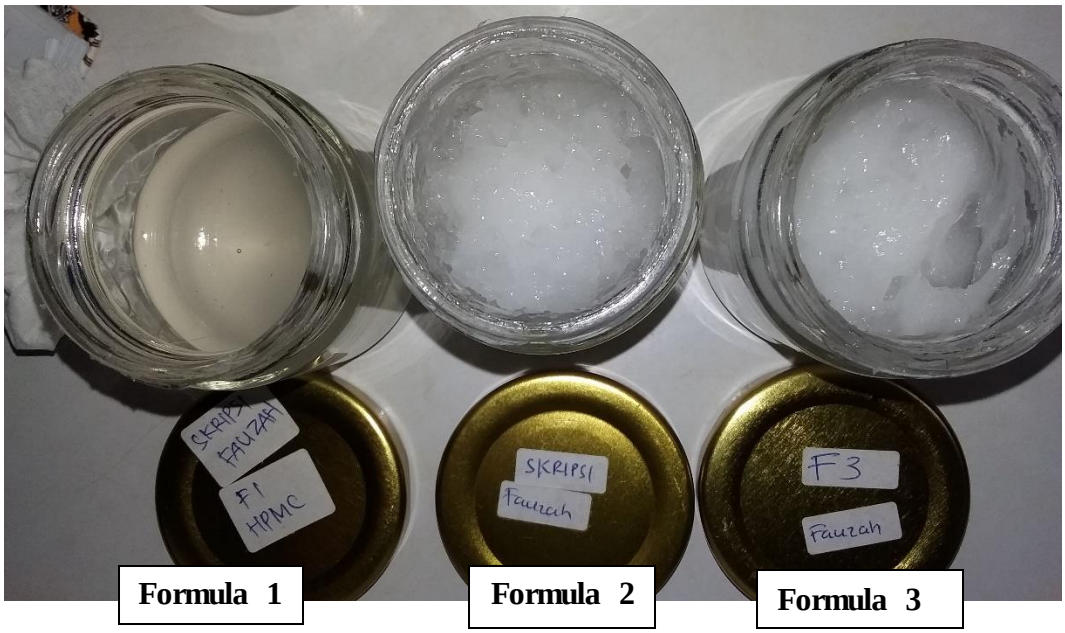
c. Dispersi padat



	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	418,55	78,515	2,103	437,84	414,7	2,265	0,153
2	522,71	72,256	4,804	545,85	511,14	4,314	0,387
3	588,29	71,074	5,238	609,51	565,14	5,615	0,411
4	636,51	71,586	3,142	640,37	617,22	2,935	0,126
5	669,3	64,879	8,163	680,87	642,3	5,691	0,543
6	690,52	70,985	2	704,02	682,8	2,965	0,085
7	746,45	71,343	2,011	752,24	725,23	3,674	0,099
8	779,24	60,372	11,228	788,89	754,17	5,473	0,549
9	842,89	50,615	14,49	858,32	790,81	12,972	1,39
10	866,04	61,592	3,487	873,75	860,25	2,673	0,151
11	881,47	66,487	0,934	889,18	875,68	2,35	0,038
12	947,05	50,716	4,965	956,69	891,11	15,027	0,799
13	962,48	52,143	3,305	983,7	958,62	5,76	0,176
14	1008,77	61,253	2,831	1014,56	985,62	5,6	0,154
15	1060,85	46,866	4,304	1068,56	1016,49	12,663	0,234
16	1112,93	27,703	18,801	1136,07	1070,49	28,292	6,846
17	1147,65	42,831	5,632	1174,65	1138	11,204	0,575
18	1184,29	52,387	6,745	1195,87	1176,58	4,732	0,357
19	1232,51	46,458	6,529	1238,3	1197,79	10,36	0,516
20	1280,73	48,07	9,794	1300,02	1259,52	11,114	1,479
21	1321,24	53,28	3,479	1325,1	1311,59	3,386	0,16
22	1342,46	44,888	10,718	1352,1	1334,74	5,05	0,625
23	1359,82	50,774	5,726	1371,39	1354,03	4,56	0,321
24	1379,1	57,364	3,469	1392,61	1373,32	4,271	0,166
25	1419,61	52,542	9,314	1435,04	1400,32	8,243	1,027
26	1452,4	54,14	1,48	1456,26	1436,97	4,666	0,069
27	1465,9	48,67	7,898	1494,83	1456,26	9,817	0,834
28	1508,33	55,34	8,106	1531,48	1496,76	7,45	0,632
29	1591,27	64,758	0,04	1593,2	1581,63	2,181	0,003
30	1602,85	64,375	0,069	1604,77	1593,2	2,195	0,001
31	1697,36	52,673	1,765	1701,22	1689,64	2,88	0
32	1720,5	42,161	12,844	1755,22	1705,07	14,566	2,03
33	1886,38	62,621	0,123	1888,31	1876,74	2,34	0,004

Lampiran 12. Foto hasil uji mutu fisik gel dispersi padat ibuprofen

a. Pengamatan organoleptis



Formula 1 **Formula 2** **Formula 3**

b. Pengamatan homogenitas

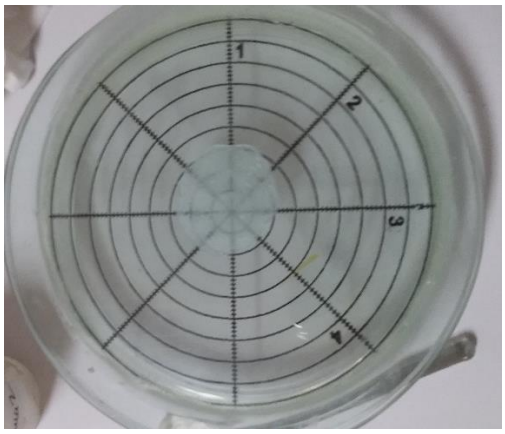
Formula 1

Formula 2

Formula 2

Lampiran 13. Foto uji daya sebar dan daya lekat

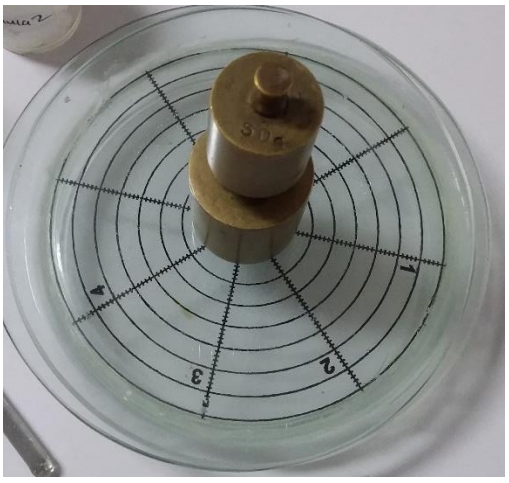
Tanpa beban



Beban 50 gram

Beban 100 gram

Beban 150 gram



Alat uji daya lekat

Lampiran 14. Uji daya lekat dan daya sebar

Uji	Formula	Replikasi	Hasil	Rata-rata
Viskositas (dpa's)	1	1	110	103,33
		2	110	
		3	100	
	2	1	345	341,67
		2	350	
		3	350	
	3	1	300	306,67
		2	310	
		3	310	
Daya Lekat (detik)	1	1	0,98	0,99
		2	1	
		3	1	
	2	1	1,19	1,18
		2	1,19	
		3	1,18	
	3	1	0,86	0,87
		2	0,89	
		3	0,88	

Daya sebar

Replikasi	Tanpa beban			50 g			100 g			150 g		
Replikasi	F1	F2	F3	F1	F2	F3	F1	F2	F3	F1	F2	F3
1	3,6	3,3	2,9	3,9	3,4	3	5,3	3,9	3,7	5,5	4,2	3,8
2	3,5	3,2	2,7	4,1	3,6	3,1	5,1	3,9	3,5	5,7	4,0	3,9
3	3,8	3,2	2,9	3,8	3,6	3,2	5,2	3,9	3,6	5,6	4,1	3,9
Rata-rata	3,6	3,2	2,8	3,95	3,5	3,1	5,2	3,9	3,55	5,6	4,1	3,8

Replikasi	Tanpa beban			50 g			100 g			150 g		
	F1	F2	F3	F1	F2	F3	F1	F2	F3	F1	F2	F3
1	3,6	3,3	2,9	3,9	3,4	3,6	5,1	3,9	3,7	5,5	4,2	3,8
2	3,5	3,2	2,7	3,8	3,4	3,1	5,3	3,9	3,5	5,7	4,1	3,9
3	3,8	3,2	2,9	3,9	3,5	3,2	5,2	3,9	3,6	5,5	4,3	3,7
Rata-rata	3,6	3,2	2,8	3,9	3,5	3,1	5,2	3,9	3,6	5,5	4,2	3,8

Replikasi	Tanpa beban			50 g			100 g			150 g		
	F1	F2	F3	F1	F2	F3	F1	F2	F3	F1	F2	F3
	3,5	3,3	2,9	3,9	3,3	3,4	5,5	3,8	3,8	5,7	4,0	4,0
3	3,5	3,3	2,9	4,1	3,6	3,1	5,1	3,6	3,5	5,7	4,3	3,9
	3,8	3,4	2,6	3,8	3,7	3,2	5,5	3,8	3,6	5,7	4,2	3,9
	3,6	3,4	2,8	3,9	3,5	3,1	5,4	4	3,5	5,3	3,9	3,8
Rata-rata	3,7	3,35	2,8	3,9	3,5	3,2	5,4	3,8	3,6	5,6	4,1	3,9

Lampiran 15. Data analisis *One Way* ANOVA

a. Daya sebar

One-Sample Kolmogorov-Smirnov Test

		dayasebar
N		9
Normal Parameters[a,b]	Mean	4,4889
	Std. Deviation	,79443
Most Extreme Differences	Absolute	,309
	Positive	,309
	Negative	-,232
Kolmogorov-Smirnov Z		,926
Asymp. Sig. (2-tailed)		,358

a. Test distribution is Normal.

b. Calculated from data.

Test of Homogeneity of Variances

Dayasebar

Levene Statistic	df1	df2	Sig.
,364	2	6	,709

ANOVA

Dayasebar

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5,016	2	2,508	451,400	,000
Within Groups	,033	6	,006		
Total	5,049	8			

b. Daya lekat

One-Sample Kolmogorov-Smirnov Test

		dayalekat
N		9
Normal Parameters[a,b]	Mean	1,0189
	Std. Deviation	,13596
Most Extreme Differences	Absolute	,222
	Positive	,222
	Negative	-,215
Kolmogorov-Smirnov Z		,666
Asymp. Sig. (2-tailed)		,767

a. Test distribution is Normal.

b. Calculated from data.

Test of Homogeneity of Variances

Dayalekat

Levene Statistic	df1	df2	Sig.
1,556	2	6	,286

ANOVA

Dayalekat

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	,147	2	,074	551,583	,000
Within Groups	,001	6	,000		
Total	,148	8			

c. Viskositas

One-Sample Kolmogorov-Smirnov Test

		viskositas
N		9
Normal Parameters[a,b]	Mean	250,56
	Std. Deviation	111,760
Most Extreme Differences	Absolute	,338
	Positive	,229
	Negative	-,338
Kolmogorov-Smirnov Z		1,013
Asymp. Sig. (2-tailed)		,257

a. Test distribution is Normal.

b. Calculated from data.

Test of Homogeneity of Variances

viskositas

Levene Statistic	df1	df2	Sig.
4,106	2	6	,075

ANOVA

viskositas

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	53843,056	2	26921,528	3,505	,098
Within Groups	46079,167	6	7679,861		
Total	99922,222	8			

Lampiran 16. Penentuan formula optimum

Select	Std	Run	Component 1 A:hpmc	Component 2 B:karbopol 940	Response 1 daya sebar cm	Response 2 daya lekat detik	Response 3 viskositas dpa's
	2	1	2	0	5,6	1	100
	5	2	2	0	5,5	0,98	110
	4	3	2	0	5,6	1	100
	1	4	1	1	4,2	1,19	330
	7	5	1	1	4,1	1,19	350
	6	6	1	1	4,1	1,18	345
	3	7	0	2	3,8	0,86	300
	9	8	0	2	3,8	0,89	320
	8	9	0	2	3,9	0,88	300

Lampiran 17. Hasil *ANOVA Simplex Lattice Design*

a. Daya sebar

Transform | Fit Summary | Model | ANOVA

Use your mouse to right click on individual cells for definitions.

Response 1 daya sebar

ANOVA for Quadratic Mixture model

***** Mixture Component Coding is L_Pseudo. *****

Analysis of variance table [Partial sum of squares - Type III]

Source	Sum of Squares	df	Mean Square	F Value	p-value Prob > F	
Model	5,15	2	2,57	772,33	< 0.0001	significant
1 Linear Mixtu	*4,51*	*1*	*4,51*	*1352,00*	*< 0.0001*	
AB	*0,64*	*1*	*0,64*	*192,67*	*< 0.0001*	
Pure Error	0,020	6	3,333E-003			
Cor Total	5,17	8				

1 Inference for linear mixtures uses Type I sums of squares.

The Model F-value of 772,33 implies the model is significant. There is only a 0,01% chance that an F-value this large could occur due to noise.

Values of "Prob > F" less than 0,0500 indicate model terms are significant.
In this case A, B, AB are significant model terms.
Values greater than 0.1000 indicate the model terms are not significant.
If there are many insignificant model terms (not counting those required to support hierarchy), model reduction may improve your model.

Std. Dev.	0,058	R-Squared	0,9961
Mean	4,51	Adj R-Squared	0,9948
C.V. %	1,28	Pred R-Square	0,9913
PRESS	0,045	Adeq Precisior	52,000
-2 Log Likeliho	-29,44	BIC	-25,05
		AICc	-23,44

The "Pred R-Squared" of 0,9913 is in reasonable agreement with the "Adj R-Squared" of 0,9948; i.e. the difference is less than 0.2.

"Adeq Precision" measures the signal to noise ratio. A ratio greater than 4 is desirable. Your ratio of 52,000 indicates an adequate signal. This model can be used to navigate the design space.

Component	Coefficient Estimate	df	Standard Error	95% CI Low	95% CI High	VIF
A-hpmc	5,57	1	0,033	5,49	5,65	1,25
B-karbopol 94(	3,83	1	0,033	3,75	3,91	1,25
AB	-2,27	1	0,16	-2,67	-1,87	1,50

b. Daya lekat

Transform | Fit Summary | Model | ANOVA

Use your mouse to right click on individual cells for definitions.

Response 2 daya lekat

ANOVA for Quadratic Mixture model

***** Mixture Component Coding is L_Pseudo. *****

Analysis of variance table [Partial sum of squares - Type III]

Source	Sum of Squares	df	Mean Square	F Value	p-value Prob > F	
Model	0,15	2	0,074	551,58	< 0.0001	significant
1 Linear Mixtu	*0,020*	*1*	*0,020*	*153,12*	*< 0.0001*	
AB	*0,13*	*1*	*0,13*	*950,04*	*< 0.0001*	
Pure Error	8,000E-004	6	1,333E-004			
Cor Total	0,15	8				

1 Inference for linear mixtures uses Type I sums of squares.

The Model F-value of 551,58 implies the model is significant. There is only a 0,01% chance that an F-value this large could occur due to noise.

Values of "Prob > F" less than 0,0500 indicate model terms are significant.
In this case A, B, AB are significant model terms.
Values greater than 0.1000 indicate the model terms are not significant.
If there are many insignificant model terms (not counting those required to support hierarchy), model reduction may improve your model.

Std. Dev.	0,012	R-Squared	0,9946
Mean	1,02	Adj R-Squared	0,9928
C.V. %	1,13	Pred R-Square	0,9878
PRESS	1,800E-003	Adeq Precisior	46,500
-2 Log Likeliho	-58,41	BIC	-54,02
		AICc	-52,41

The "Pred R-Squared" of 0,9878 is in reasonable agreement with the "Adj R-Squared" of 0,9928; i.e. the difference is less than 0.2.

"Adeq Precision" measures the signal to noise ratio. A ratio greater than 4 is desirable. Your ratio of 46,500 indicates an adequate signal. This model can be used to navigate the design space.

Component	Coefficient Estimate	df	Standard Error	95% CI Low	95% CI High	VIF
A-hpmc	0,99	1	6,667E-003	0,98	1,01	1,25
B-karbopol 94(	0,88	1	6,667E-003	0,86	0,89	1,25
AB	1,01	1	0,033	0,93	1,09	1,50

c. Viskositas

Transform | Fit Summary | Model | ANOVA

Use your mouse to right click on individual cells for definitions.

Response 3 viskositas

ANOVA for Quadratic Mixture model

***** Mixture Component Coding is L_Pseudo. *****

Analysis of variance table [Partial sum of squares - Type III]

Source	Sum of Squares	df	Mean Square	F Value	p-value Prob > F	
Model	99372,22	2	49686,11	542,03	< 0.0001	significant
1 Linear Mixtu	*62016,67*	*1*	*62016,67*	*676,55*	*< 0.0001*	
AB	*37355,56*	*1*	*37355,56*	*407,52*	*< 0.0001*	
Pure Error	550,00	6	91,67			
Cor Total	99922,22	8				

1 Inference for linear mixtures uses Type I sums of squares.

The Model F-value of 542,03 implies the model is significant. There is only a 0,01% chance that an F-value this large could occur due to noise.

Values of "Prob > F" less than 0,0500 indicate model terms are significant.
In this case A, B, AB are significant model terms.
Values greater than 0.1000 indicate the model terms are not significant.
If there are many insignificant model terms (not counting those required to support hierarchy), model reduction may improve your model.

Std. Dev.	9,57	R-Squared	0,9945
Mean	250,56	Adj R-Squared	0,9927
C.V. %	3,82	Pred R-Square	0,9876
PRESS	1237,50	Adeq Precisior	43,116
-2 Log Likeliho	62,56	BIC	66,95
		AICc	68,56

The "Pred R-Squared" of 0,9876 is in reasonable agreement with the "Adj R-Squared" of 0,9927; i.e. the difference is less than 0.2.

"Adeq Precision" measures the signal to noise ratio. A ratio greater than 4 is desirable. Your ratio of 43,116 indicates an adequate signal. This model can be used to navigate the design space.

Component	Coefficient Estimate	df	Standard Error	95% CI Low	95% CI High	VIF
A-hpmc	103,33	1	5,53	89,81	116,86	1,25
B-karbopol 94(	306,67	1	5,53	293,14	320,19	1,25
AB	546,67	1	27,08	480,40	612,93	1,50

Lampiran 18. Foto hasil gel dispersi padat dari formula optimum

Lampiran 19. Data uji viskositas, daya lekat, dan daya sebar formula optimum

Uji	Replikasi	Hasil	Rata-rata
Viskositas (dpa's)	1	300	301,67
	2	305	
	3	300	
Daya Lekat (detik)	1	1,46	1,316
	2	1,35	
	3	1,14	

Daya sebar

Beban	Replikasi 1 (cm)	Replikasi 2 (cm)	Replikasi 3 (cm)	Rata-rata
Tanpa beban	2,3	2,4	2,4	2,4
50 g	2,5	2,5	2,7	2,6
100 g	2,9	2,8	3	2,9
150 g	3,2	3,3	3,2	3,2

Lampiran 20. Data analisis *one sample t-test*

a. Daya sebar

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean

One-Sample Test

	Test Value = 5.07					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
dayasebar	1,900	2	,198	,06333	-,0801	,2068

b. Daya lekat

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean

One-Sample Test

	Test Value = 1.09					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
dayalekat	2,082	2	,173	,13000	-,1387	,3987

c. Viskositas

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
viskositas	3	203,3333	5,77350	3,33333

One-Sample Test

	Test Value = 193.286					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
viskositas	3,014	2	,095	10,04733	-4,2948	24,3895

Lampiran 21. Foto hasil stabilitas dari formula optimum

Siklus 1

Siklus 2

Siklus 3

Siklus 4

Siklus 5

Siklus 6