BAB V
KESIMPULAN DAN SARAN

A. Kesimpulan

Berdasarkan hasil penelitian optimasi Tween 60 dan Span 60 pada sediaan krim *sunscreen* naringenin dengan metode *simplex lattice design* dapat disimpulkan :

1. Krim *sunscreen* naringenin dengan kombinasi emulgator tween 60 dan span 60 dalam perbedaan konsentrasi ternyata memberikan perbedaan bermakna pada mutu fisik yang meliputi parameter uji daya lekat, daya sebar, pH, dan viskositas. Untuk uji organoleptis, homogenitas, dan stabilitas menghasilkan hasil yang baik.
2. Formula optimum krim *sunscreen* naringenin diperoleh proporsi 8,2% Tween 60 dan 5,8% Span 60. Formula optimum tersebut memiliki nilai SPF sebesar 26,8210 termasuk dalam kategori ultra.

B. Saran

Saran dari penelitian berdasarkan hasil penelitian optimasi formulasi krim *sunscreen* naringenin dengan variasi kombinasi emulgator tween 60 dan span 60 secara *simplex lattice design* yaitu :

1. Perlu dilakukan uji invivo pada formula optimum terhadap kandungan antioksidannya.
2. Perlu dilakukan penelitian lebih lanjut dengan variasi basis lainnya yang digunakan saat optimasi untuk mendapatkan formula krim yang baik dan hasil data HLB yang optimum.

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Lampiran 1. Certificate Of Analysis (CO-A) Naringenin

泽世化学 THANEN CHEMICALS
ADDRESS: RM1707, BLDG 5, CHANGFA, 101-1# TAIHU ROAD, 213022, P.R.CHINA
TEL: +86 519 89880626 FAX: +86-519-89880629 Email:tcc@thanenchem.com

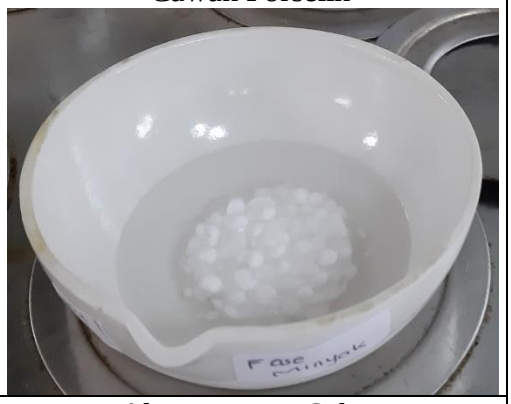
CERTIFICATE OF ANALYSIS

Product Name	Naringenin	**Code**	BPBE-622-A
Botanical Source	Citrus Grandis (L.) Obsbeck	**Used Part**	Fruit
Batch No.	H020862217A	**Mfg. Date**	Aug. 15, 2017
Packing	25kg/Drum	**Retest Date**	Aug. 14, 2019
Quantity	25g	**Report Date**	Aug. 21, 2017
Specification	98%(HPLC)		

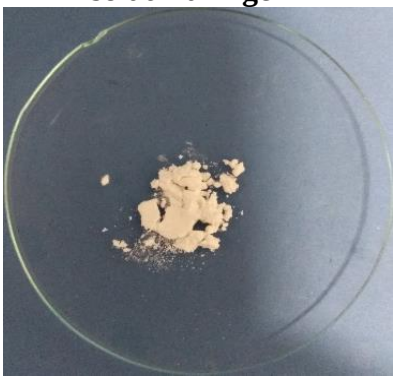
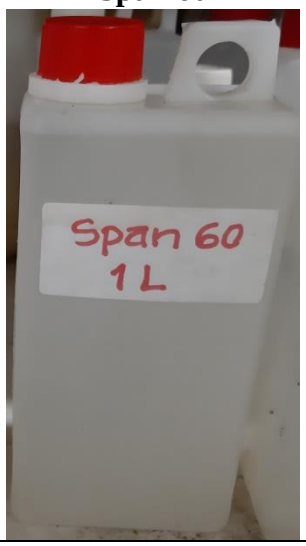
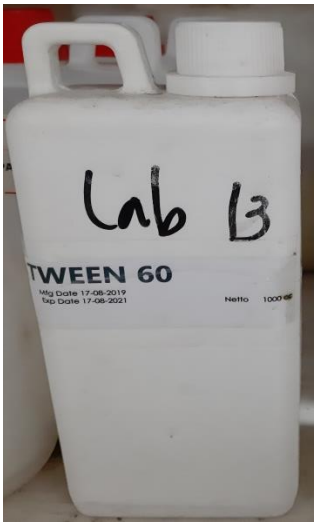
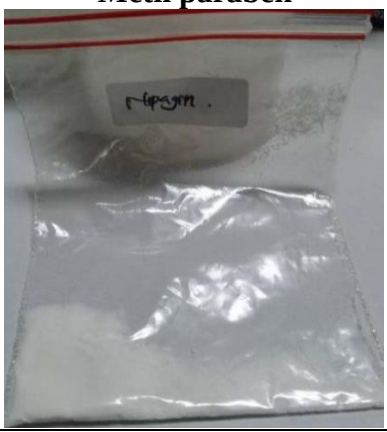
ITEM	SPECIFICATION	RESULT
Assay(HPLC)	≥98.0%	98.23%
Appearance	White powder	Complies
Odor	Characteristic	Complies
Particle Size	NLT 95% pass 80 mesh	Complies
Loss on Drying	≤5.0%	0.53%
Sulphated Ash	≤0.1%	0.05%
Heavy Metals	≤10ppm	Complies
-Pb	≤1ppm	Complies
-As	≤1ppm	Complies
-Cd	≤1ppm	Complies
-Hg	≤0.1ppm	Complies
Total Plate Count	≤1000cfu/g	Complies
-Yeast & Mold	≤100cfu/g	Complies
-E.Coli	Negative	Negative
-Salmonella	Negative	Negative
Conclusion	Comply with the Specification.	
Storage	Preserve in tight containers, protected from strong light and high heat. Store in dry cool place.	

Analyst: QC Manager: QA:

Lampiran 2. Gambar alat dan bahan penelitian

<table>
<tr><td colspan="2">Alat</td></tr>
<tr><td>Spektrofotometri UV-Vis
  </td><td>Water Bath
  </td></tr>
<tr><td>Mortir + Samper
  </td><td>Cawan Porselin
  </td></tr>
<tr><td>Alat Uji Daya Lekat
  </td><td>Alat Uji Daya Sebar
  </td></tr>
</table>

Alat Uji Viskositas 	pH meter 
Alat Uji Homogenitas 	Timbangan Analitik Digital 
Oven 	Alat-alat Gelas 
Kompor 	Wadah Krim 

<table>
<tr><th colspan="2">Bahan</th></tr>
<tr><td>Isolat Naringenin
  </td><td>Span 60
 
</td></tr>
<tr><td>Tween 60
 
</td><td>Gliserin
 
</td></tr>
<tr><td>Setil Alkohol
  </td><td>Metil paraben
  </td></tr>
</table>

Propil paraben 	**Asam stearate** 
Aquadest 	

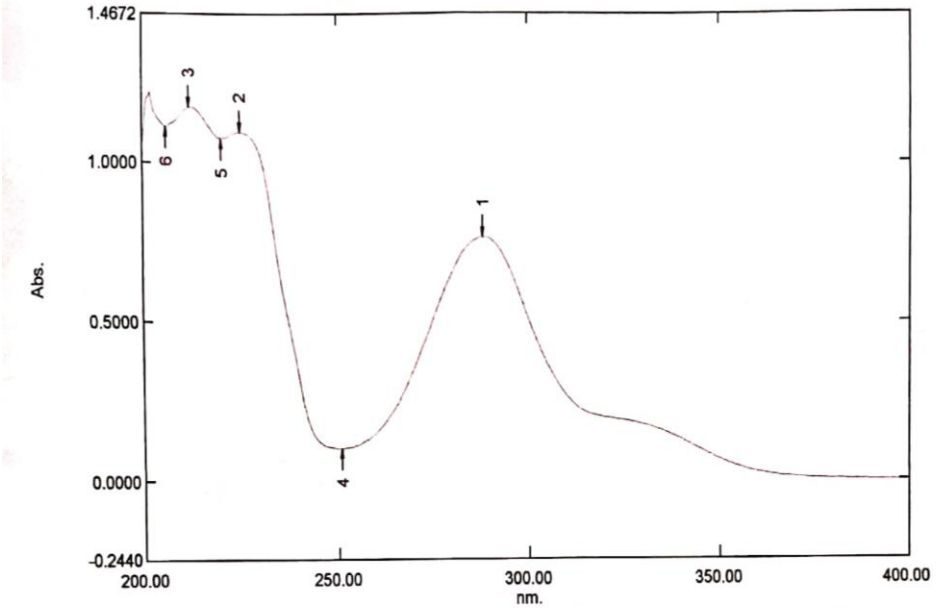
Lampiran 3. Hasil uji flavonoid

Lampiran 4. Kurva serapan naringenin dan penentuan panjang gelombang maksimum naringenin dengan pelarut metanol *p.a*

Spectrum Peak Pick Report

02/20/2020 01:24:00 PM

Data Set: File_200220_131829 - RawData



No.	P/V	Wavelength	Abs.	Description
1	↑	288.00	0.7681	
2	↑	225.00	1.0996	
3	↑	212.00	1.1769	
4	↓	251.00	0.1034	
5	↓	220.00	1.0802	
6	↓	206.00	1.1136	

[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:

Lampiran 5. Hasil penetapan *operating time*

Kinetics Data Print Report

02/20/2020 03:22:45 PM

Time (Minute)	RawData ...
0.000	0.878
1.000	0.880
2.000	0.880
3.000	0.880
4.000	0.881
5.000	0.883
6.000	0.884
7.000	0.884
8.000	0.885
9.000	0.886
10.000	0.886
11.000	0.887
12.000	0.888
13.000	0.889
14.000	0.889
15.000	0.890
16.000	0.890
17.000	0.891
18.000	0.891
19.000	0.892
20.000	0.893
21.000	0.893
22.000	0.893
23.000	0.894
24.000	0.894
25.000	0.895
26.000	0.896
27.000	0.897
28.000	0.897
29.000	0.897
30.000	0.898

Lampiran 6. Hasil perhitungan larutan stok kurva kalibrasi naringenin pelarut metanol *p.a*

A. Penimbangan kurva baku

Kertas timbang + naringenin = 0,3268 g
Kertas timbang + sisa = 0,2768 g –
Naringenin = 0,05 g = 50 mg/50 ml = 1000 ppm

Larutan Induk = 1000 ppm
Larutan Stok = V1 x N1 = V2 x N2
10 ml x 1000 ppm = 100ml x C2
C2 = 100 ppm

B. Pengenceran kurva baku

V1 x N1 = V2 x N2
V1 x 100 ppm = 10 ml x **4 ppm**
V1 = 0,4 ml

V1 x N1 = V2 x N2
V1 x 100 ppm = 10 ml x **6 ppm**
V1 = 0,6 ml

V1 x N1 = V2 x N2
V1 x 100 ppm = 10 ml x **8 ppm**
V1 = 0,8 ml

V1 x N1 = V2 x N2
V1 x 100 ppm = 10 ml x **10 ppm**
V1 = 1 ml

V1 x N1 = V2 x N2
V1 x 100 ppm = 10 ml x **12 ppm**
V1 = 1,2 ml

V1 x N1 = V2 x N2
V1 x 100 ppm = 10 ml x **14 ppm**
V1 = 1,4 ml

C. Hasil pengukuran absorbansi baku naringenin

Konsentrasi (ppm)	Abs
4	0,244
6	0,370
8	0,473
10	0,582
12	0,690
14	0,796

Lampiran 7. Validasi metode analisis

Metanol *p.a*

a. Linearitas

V1 x N1 = V2 x N2
V1 x 100 ppm = 10 ml x **4 ppm**
V1 = 0,4 ml

V1 x N1 = V2 x N2
V1 x 100 ppm = 10 ml x **6 ppm**
V1 = 0,6 ml

V1 x N1 = V2 x N2
V1 x 100 ppm = 10 ml x **8 ppm**
V1 = 0,8 ml

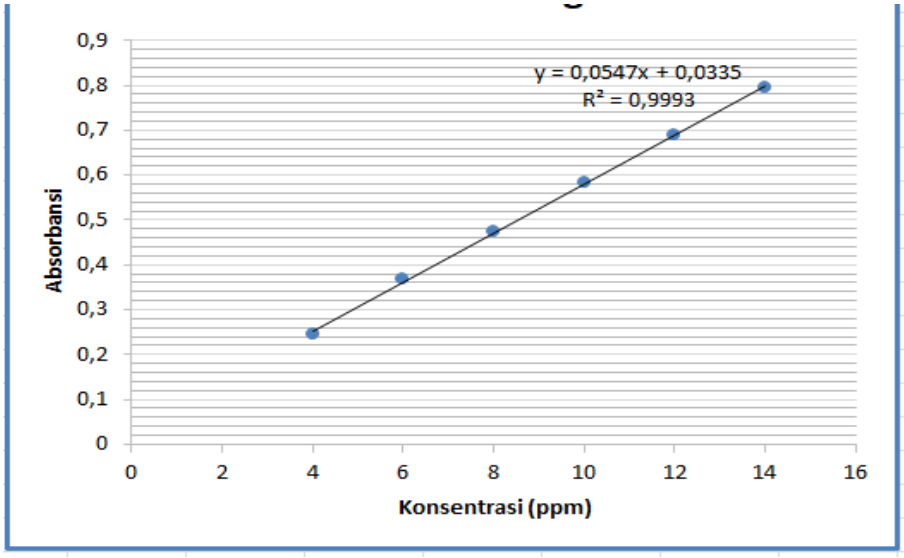
V1 x N1 = V2 x N2
V1 x 100 ppm = 10 ml x **10 ppm**
V1 = 1 ml

V1 x N1 = V2 x N2
V1 x 100 ppm = 10 ml x **12 ppm**
V1 = 1,2 ml

V1 x N1 = V2 x N2
V1 x 100 ppm = 10 ml x **14 ppm**
V1 = 1,4 ml

Konsentrasi (ppm)	Absorbansi
4	0,244
6	0,370
8	0,473
10	0,582
12	0,690
14	0,796

a	0,0477
b	0,05345
r	0.9999



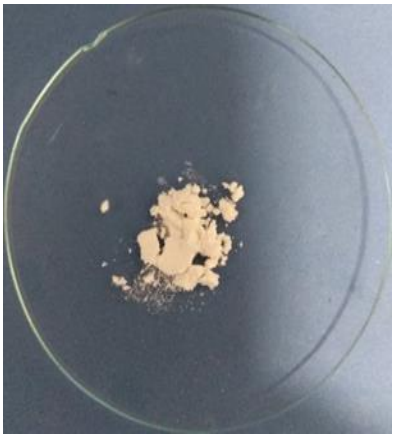
b. Akurasi

Konsentrasi	Replikasi	Absorbansi	Konsentrasi	Kons. Sebenarnya	% Recovery	Rata-Rata
80%	1	0,367	6,0963	6	102%	100,49%
	2	0,359	5,9500	6	99%	
	3	0,364	6,0414	6	101%	
100%	1	0,462	7,8330	8	98%	100,57%
	2	0,484	8,2352	8	103%	
	3	0,488	8,3083	8	104%	
120%	1	0,570	9,8074	10	98%	99,29%
	2	0,582	10,0268	10	100%	
	3	0,578	9,9537	10	100%	
					% Recovery	**100,45%**

c. Presisi

Replikasi	Absorbansi	Konsentrasi
1	0,490	8,3449
2	0,497	8,4729
3	0,487	8,2901
4	0,468	7,9427
5	0,473	8,0341
6	0,473	8,0341
7	0,474	8,0524
8	0,494	8,4180
9	0,483	8,2169
10	0,493	8,3998
SD	0,191506	
Rata-rata	8,2206	
CV	0,023296	

Lampiran 8. Foto hasil formulasi krim *sunscreen* naringenin

Peleburan basis air dan basis minyak 	**Aquadest hangat** 
Hasil peleburan basis air dan basis minyak, dan aquadest hangat 	**Hasil pencampuran basis air dan basis minyak dengan mortir panas** 
Zat aktif naringenin yang akan dimasukkan kedalam basis 	**Hasil krim *sunscreen* naringenin** 

Lampiran 9. Foto hasil uji mutu fisik krim *sunscreen* naringenin

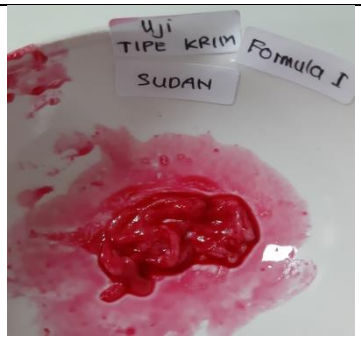
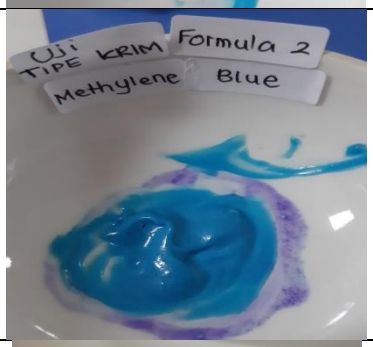
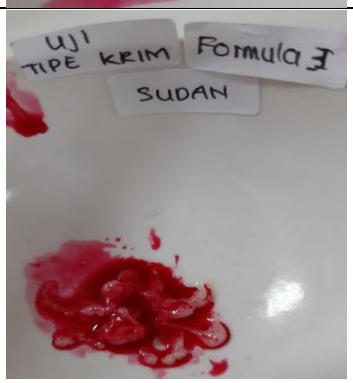
<table>
<tr><td colspan="3">Pengujian homogenitas</td></tr>
<tr><td>Formula 1
 
</td><td>Formula 2
 
</td><td>Formula 3
 
</td></tr>
<tr><td colspan="2">Formula 4
 
</td><td>Formula 5
 
</td></tr>
</table>

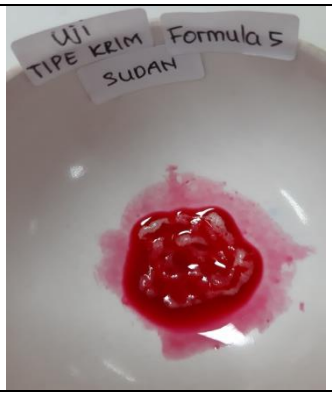
Pengujian organoleptis

F1 F2 F3 F4 F5

Lampiran 10. Uji tipe krim *sunscreen* naringenin

a. Hasil foto uji tipe krim

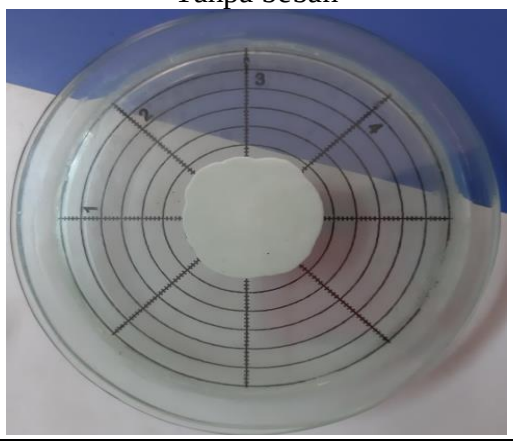
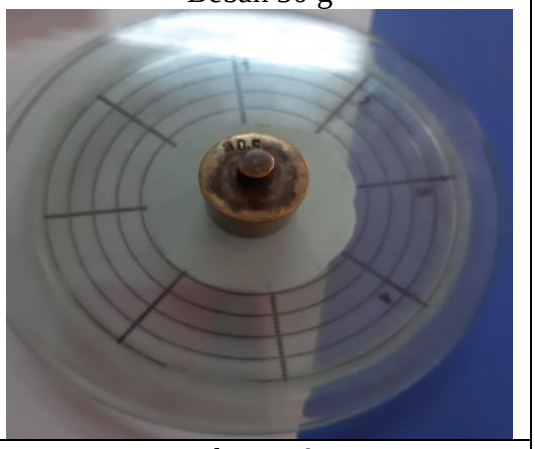
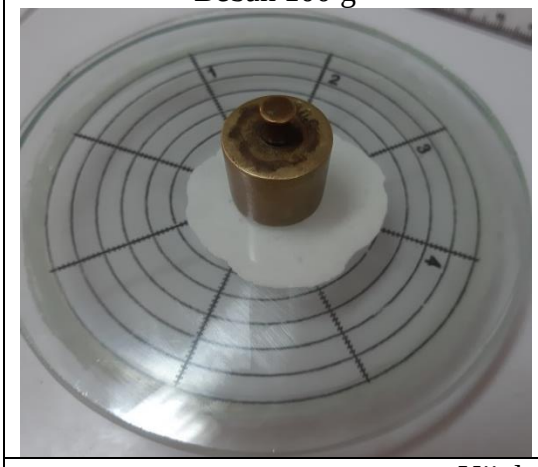
Formula	Methylene Blue	Sudan III
1		
2		
3		
4		

5		

b. Perhitungan nilai HLB campuran

Formula 1 **HLB = Tween 60 + Span 60** $HLB = \left(\frac{9}{14} x\ 14.9\right) + \left(\frac{5}{14} x\ 4.7\right)$ = 9.58 + 1.68 **= 11.26**	**Formula 2** **HLB = Tween 60 + Span 60** $HLB = \left(\frac{8}{14} x\ 14.9\right) + \left(\frac{6}{14} x\ 4.7\right)$ = 8.51 + 2.01 **= 10.52**
Formula 3 **HLB = Tween 60 + Span 60** $HLB = \left(\frac{7}{14} x\ 14.9\right) + \left(\frac{7}{14} x\ 4.7\right)$ = 7.45 + 2.35 **= 17.51**	**Formula 4** **HLB = Tween 60 + Span 60** $HLB = \left(\frac{6}{14} x\ 14.9\right) + \left(\frac{8}{14} x\ 4.7\right)$ = 6.39 + 2.69 **= 9.08**
Formula 5 **HLB = Tween 60 + Span 60** $HLB = \left(\frac{5}{14} x\ 14.9\right) + \left(\frac{9}{14} x\ 4.7\right)$ = 5.32 + 3.02 **= 8.34**	**Setelah optimasi** **HLB = Tween 60 + Span 60** $HLB = \left(\frac{8.2}{14} x\ 14.9\right) + \left(\frac{5.8}{14} x\ 4.7\right)$ = 8.73 + 1.95 **= 10.68**

Lampiran 11. Foto uji daya sebar dan daya lekat

<table>
<tr><td colspan="2">Uji daya sebar</td></tr>
<tr><td>Tanpa beban
  </td><td>Beban 50 g
  </td></tr>
<tr><td>Beban 100 g
  </td><td>Beban 150 g
  </td></tr>
<tr><td colspan="2">Uji daya lekat
  </td></tr>
</table>

Lampiran 12. Data uji viskositas, daya lekat, dan daya sebar

Uji	Formula	Replikasi	Hasil	Rata-rata
Viskositas (dpa's)	1	1	260	261,67
		2	260	
		3	265	
	2	1	245	243,33
		2	240	
		3	245	
	3	1	210	211,67
		2	210	
		3	215	
	4	1	170	171,67
		2	175	
		3	170	
	5	1	150	155
		2	160	
		3	155	

Uji	Formula	Replikasi	Hasil	Rata-rata
Daya Lekat (detik)	1	1	2.41	2.43
		2	2.44	
		3	2.43	
	2	1	2.11	2.12
		2	2.11	
		3	2.13	
	3	1	1.85	1.85
		2	1.85	
		3	1.84	
	4	1	1.50	1.51
		2	1.52	
		3	1.52	
	5	1	1.34	1.34
		2	1.36	
		3	1.32	

pH

Uji	Formula	Replikasi	Hasil	Rata-rata
pH	1	1	4.63	4.63
		2	4.63	
		3	4.63	
	2	1	4.83	4.83
		2	4.84	
		3	4.83	
	3	1	4.99	4.99
		2	4.99	
		3	4.98	
	4	1	5.23	5.23
		2	5.22	
		3	5.24	
	5	1	5.55	5.55
		2	5.55	
		3	5.54	

Daya Sebar

Replikasi	Tanpa beban					50					100					150				
1	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5
	3,1	3,2	3,9	3,4	3,3	4,3	4	4,8	4,2	4,6	4,5	4,2	5,3	4,7	5,3	4,8	5	5,6	5,3	5,8
	3,3	3	3,6	3,5	3,5	4,5	3,7	4,4	4,1	4,8	4,8	4,3	4,9	4,7	5,4	5	4,8	5,3	5,3	6,1
	3,3	3,2	3,9	3,5	4	4,4	3,8	4,5	4,2	4,9	4,8	4,4	4,9	4,9	5,5	5	4,8	5,3	5,4	6,1
	3,7	3,4	3,8	3,5	4,2	4,3	4	4,6	4,1	4,5	4,5	4,7	5,2	4,7	5,7	4,9	5,1	5,5	5,4	5,5
Rata-rata	3,4	3,2	3,8	3,5	3,8	4,4	3,9	4,6	4,2	4,7	4,7	4,4	5,1	4,8	5,5	4,9	4,9	5,4	5,4	5,9

Replikasi	Tanpa beban					50					100					150				
2	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5
	3,4	3,3	3,5	3,4	3,3	4,2	4,5	4,2	4,4	4,2	4,5	5	4,8	5,1	5	5	5,4	5,3	5,5	5,5
	3,5	3,2	3,5	3,7	3,5	4,2	4,5	4,1	4,5	4,1	4,6	4,9	4,7	5,1	5,2	5	5,2	5,2	5,6	5,7
	3,6	3,4	3,7	3,6	4	4,4	4,7	4,5	4,3	4,6	4,8	5	5	4,9	5,4	5,2	5,4	5,4	5,3	5,8
	3,5	3,4	3,7	3,5	4,2	4,2	4,8	4,4	4,2	4,8	4,4	5,1	4,9	4,8	5,6	4,9	5,5	5,3	5,2	5,9
Rata-rata	3,5	3,3	3,6	3,6	3,8	4,3	4,6	4,3	4,4	4,4	4,6	5	4,9	5	5,3	5	5,4	5,3	5,4	5,7

Replikasi	Tanpa beban					50					100					150				
3	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5
	3,3	3,4	3,6	3,3	3,4	4,6	4	4,3	4,5	4,6	4,8	4,7	4,8	5	5,2	4,9	5,2	5,1	5,4	5,7
	3,4	3,4	3,9	3,2	4,2	4,7	4,1	4,6	4,5	4,8	4,9	4,9	4,9	4,9	5,5	5,1	5,4	5,3	5,4	6
	3,5	3,3	3,8	3,4	4	4,4	3,9	4,5	4,7	4,3	4,6	4,6	4,9	5	5,1	5	5,1	5,3	5,6	5,8
	3,5	3,4	3,4	3,4	3,9	4,5	4	4,1	4,8	4,7	4,7	4,6	4,5	5,1	5,4	5	5	5,2	5,4	6
Rata-rata	3,4	3,4	3,7	3,3	3,9	4,6	4	4,4	4,5	4,6	4,8	4,7	4,8	5	5,3	5	5,2	5,2	5,5	5,9

Lampiran 13. Data analisis *One Way* ANOVA

a. pH

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
pH	15	5.0453	.32943	4.63	5.55

One-Sample Kolmogorov-Smirnov Test

		pH
N		15
Normal Parameters[a,b]	Mean	5.0453
	Std. Deviation	.32943
Most Extreme Differences	Absolute	.167
	Positive	.167
	Negative	-.133
Kolmogorov-Smirnov Z		.646
Asymp. Sig. (2-tailed)		.799

a. Test distribution is Normal.

b. Calculated from data.

Test of Homogeneity of Variances

pH

Levene Statistic	df1	df2	Sig.
2.000	4	10	.171

ANOVA

pH

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.519	4	.380	9493.583	.000
Within Groups	.000	10	.000		
Total	1.519	14			

b. Daya sebar

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
DayaSebar	15	5.340	.3225	4.9	5.9

One-Sample Kolmogorov-Smirnov Test

		DayaSebar
N		15
Normal Parameters[a,b]	Mean	5.340
	Std. Deviation	.3225
Most Extreme Differences	Absolute	.160
	Positive	.160
	Negative	-.107
Kolmogorov-Smirnov Z		.618
Asymp. Sig. (2-tailed)		.840

a. Test distribution is Normal.

b. Calculated from data.

Test of Homogeneity of Variances

DayaSebar

Levene Statistic	df1	df2	Sig.
2.138	4	10	.150

ANOVA

DayaSebar

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.269	4	.317	17.000	.000
Within Groups	.187	10	.019		
Total	1.456	14			

c. Daya lekat

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
DayaLekat	15	1.8493	.40824	1.32	2.44

One-Sample Kolmogorov-Smirnov Test

		DayaLekat
N		15
Normal Parameters[a,b]	Mean	1.8493
	Std. Deviation	.40824
Most Extreme Differences	Absolute	.190
	Positive	.190
	Negative	-.138
Kolmogorov-Smirnov Z		.736
Asymp. Sig. (2-tailed)		.650

a. Test distribution is Normal.

b. Calculated from data.

Test of Homogeneity of Variances

DayaLekat

Levene Statistic	df1	df2	Sig.
.394	4	10	.809

ANOVA

DayaLekat

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.331	4	.583	2914.117	.000
Within Groups	.002	10	.000		
Total	2.333	14			

d. Viskositas

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Viskositas	15	208.67	42.193	150	265

One-Sample Kolmogorov-Smirnov Test

		Viskositas
N		15
Normal Parameters[a,b]	Mean	208.67
	Std. Deviation	42.193
Most Extreme Differences	Absolute	.188
	Positive	.188
	Negative	-.171
Kolmogorov-Smirnov Z		.726
Asymp. Sig. (2-tailed)		.667

a. Test distribution is Normal.

b. Calculated from data.

Test of Homogeneity of Variances

Viskositas

Levene Statistic	df1	df2	Sig.
.308	4	10	.866

ANOVA

Viskositas

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	24806.667	4	6201.667	531.571	.000
Within Groups	116.667	10	11.667		
Total	24923.333	14			

Lampiran 14. Penentuan formula optimum

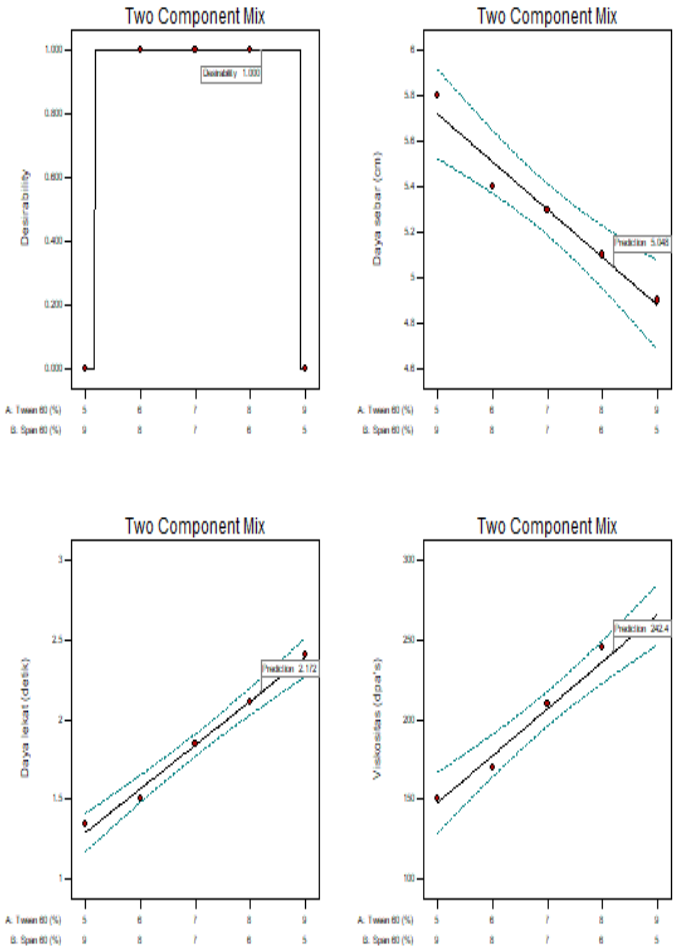
Select	Std	Run	Component 1 A:Tween 60 %	Component 2 B:Span 60 %	Response 1 Daya sebar cm	Response 2 Daya lekat detik	Response 3 Viskositas dpa's
	1	1	5	9	5.8	1.34	150
	5	2	7	7	5.3	1.85	210
	2	3	8	6	5.1	2.11	245
	4	4	9	5	4.9	2.41	260
	3	5	6	8	5.4	1.5	170

Lampiran 15. Hasil *contour plot* dari formula optimum

Response	A	B			
Daya sebar	4.88	5.72			
p=	0.0036	0.0036			
Daya lekat	2.392	1.292			
p=	0.0004	0.0004			
Viskositas	266	148			
p=	0.0012	0.0012			
Legend		p <.01	.01<= p <.05	.05<= p <.10	p >=.10

Design-Expert® Software
Component Coding: Actual
All Responses
♦ Design Points

X1 = A: Tween 60
X2 = B: Span 60



Lampiran 16. 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 Linear 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	0.44	1	0.44	69.63	0.0036	significant
1 Linear Mixtu	*0.44*	*1*	*0.44*	*69.63*	*0.0036*	
Residual	0.019	3	6.333E-003			
Cor Total	0.46	4				

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

The Model F-value of 69.63 implies the model is significant. There is only a 0.36% chance that an F-value this large could occur due to noise.

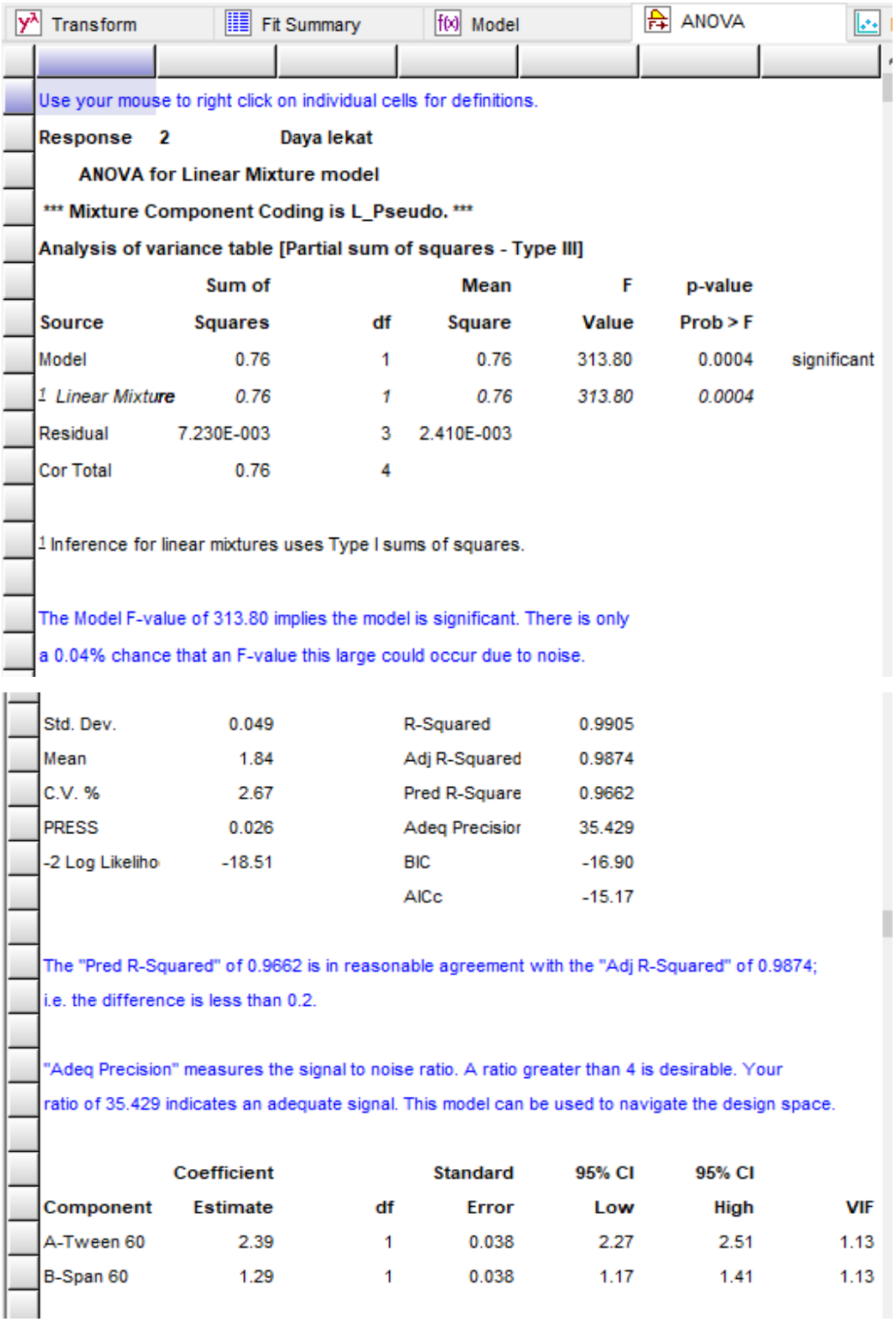
Std. Dev.	0.080	R-Squared	0.9587
Mean	5.30	Adj R-Squared	0.9449
C.V. %	1.50	Pred R-Square	0.8535
PRESS	0.067	Adeq Precisior	16.689
-2 Log Likeliho	-13.67	BIC	-12.06
		AICc	-10.34

The "Pred R-Squared" of 0.8535 is in reasonable agreement with the "Adj R-Squared" of 0.9449; 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 16.689 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-Tween 60	4.88	1	0.062	4.68	5.08	1.13
B-Span 60	5.72	1	0.062	5.52	5.92	1.13

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 Linear 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	0.76	1	0.76	313.80	0.0004	significant
1 Linear Mixture	*0.76*	*1*	*0.76*	*313.80*	*0.0004*	
Residual	7.230E-003	3	2.410E-003			
Cor Total	0.76	4				

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

The Model F-value of 313.80 implies the model is significant. There is only a 0.04% chance that an F-value this large could occur due to noise.

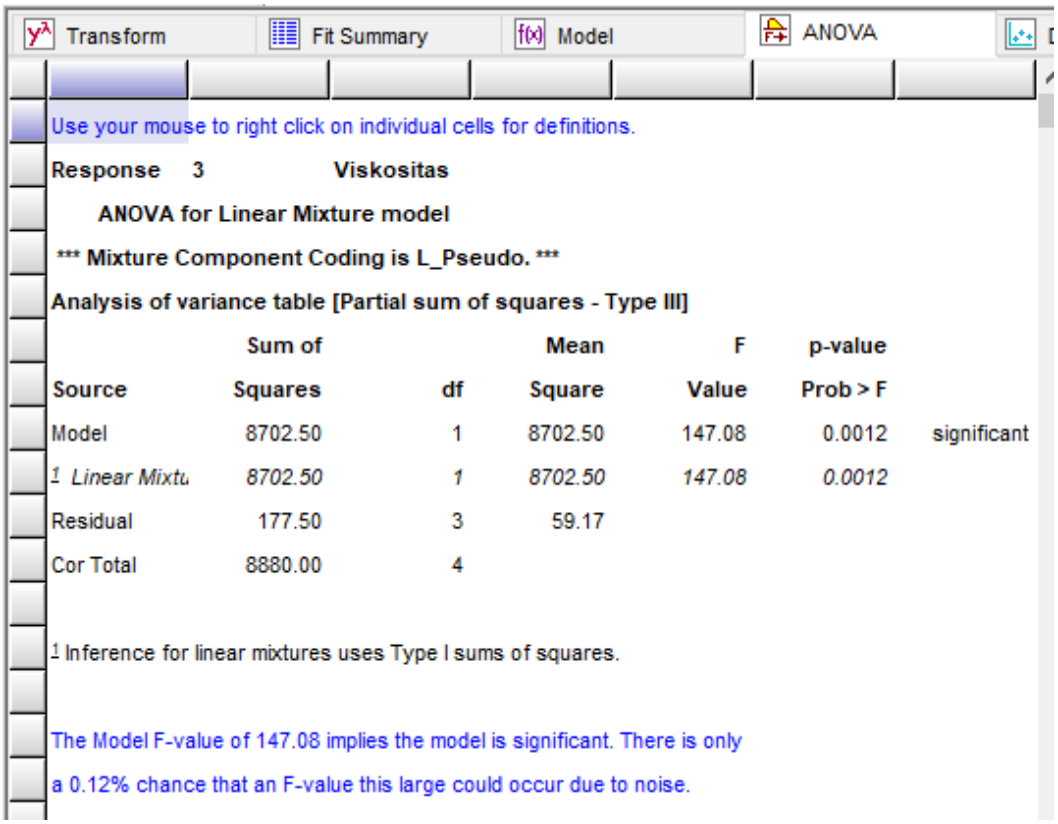
Std. Dev.	0.049	R-Squared	0.9905
Mean	1.84	Adj R-Squared	0.9874
C.V. %	2.67	Pred R-Square	0.9662
PRESS	0.026	Adeq Precisior	35.429
-2 Log Likeliho	-18.51	BIC	-16.90
		AICc	-15.17

The "Pred R-Squared" of 0.9662 is in reasonable agreement with the "Adj R-Squared" of 0.9874; 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 35.429 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-Tween 60	2.39	1	0.038	2.27	2.51	1.13
B-Span 60	1.29	1	0.038	1.17	1.41	1.13

C. Viskositas



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

Response 3 Viskositas

ANOVA for Linear 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	8702.50	1	8702.50	147.08	0.0012	significant
[1] *Linear Mixtu*	*8702.50*	*1*	*8702.50*	*147.08*	*0.0012*	
Residual	177.50	3	59.17			
Cor Total	8880.00	4				

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

The Model F-value of 147.08 implies the model is significant. There is only a 0.12% chance that an F-value this large could occur due to noise.

Std. Dev.	7.69	R-Squared	0.9800
Mean	207.00	Adj R-Squared	0.9733
C.V. %	3.72	Pred R-Square	0.9407
PRESS	526.31	Adeq Precisior	24.256
-2 Log Likeliho	32.04	BIC	33.65
		AICc	35.37

The "Pred R-Squared" of 0.9407 is in reasonable agreement with the "Adj R-Squared" of 0.9733; 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 24.256 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-Tween 60	266.00	1	5.96	247.04	284.96	1.13
B-Span 60	148.00	1	5.96	129.04	166.96	1.13

Lampiran 17. Foto hasil krim *sunscreen* naringenin dari formula optimum

Sebelum uji stabilitas

Setelah uji stabilitas

Lampiran 18. Data uji viskositas, daya lekat, dan daya sebar formula optimum

Uji	Replikasi	Hasil	Rata-rata
Viskositas (dpa's)	1	242	243
	2	245	
	3	242	
Daya Lekat (detik)	1	2.14	2.1567
	2	2.18	
	3	2.15	

Daya sebar

Beban	Replikasi 1 (cm)	Replikasi 2 (cm)	Replikasi 3 (cm)	Rata-rata
Tanpa beban	4,2	3,6	3,5	3,8
50 g	4,4	4,5	4,5	4,5
100 g	4,7	4,9	4,8	4.8
150 g	5	5,2	5,1	5,1

Lampiran 19. uji *one-sample t-test*

A. Daya sebar

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
DayaSebar	3	5.100	.1000	.0577

One-Sample Test

	Test Value = 5.048					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
DayaSebar	.901	2	.463	.0520	-.196	.300

B. Daya lekat

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
DayaLekat	3	2.1567	.02082	.01202

One-Sample Test

	Test Value = 2.172					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
DayaLekat	-1.276	2	.330	-.01533	-.0670	.0364

C. Viskositas

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Viskositas	3	243.00	1.732	1.000

One-Sample Test

	Test Value = 242.400					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Viskositas	.600	2	.609	.600	-3.70	4.90

Lampiran 20. Foto hasil stabilitas dari formula optimum

Siklus 1 	**Siklus 2** 
Siklus 3 	**Siklus 4** 
Siklus 5 	**Siklus 6** 

Lampiran 21. Uji nilai SPF

a. Krim *sunscreen* naringenin formula optimum konsentrasi 0,04%

Panjang Gelombang	Absorbansi		
	Replikasi 1	Replikasi 2	Replikasi 3
290	2,7476	2,7774	2,8191
295	2,6475	2,6676	2,6935
300	2,6262	2,6479	2,6249
305	2,6538	2,6596	2,6509
310	2,7134	2,6937	2,7349
315	2,7976	2,8224	2,7988
320	2,9172	2,8970	2,8761

290 = Replikasi 1 = 10 x 0,0150 x 2,7476 = 0,4121

Replikasi 2 = 10 x 0,0150 x 2,7774 = 0,4161

Replikasi 3 = 10 x 0,0150 x 2,8191 = 0,4229

295 = Replikasi 1 = 10 x 0,0817 x 2,6475 = 2,1630

Replikasi 2 = 10 x 0,0817 x 2,6676 = 2,1794

Replikasi 3 = 10 x 0,0817 x 2,6935 = 2,2008

300 = Replikasi 1 = 10 x 0,2874 x 2,6262 = 7,5477

Replikasi 2 = 10 x 0,2874 x 2,6479 = 7,6100

Replikasi 3 = 10 x 0,2874 x 2,6249 = 7,5439

305 = Replikasi 1 = 10 x 0,3278 x 2,6538 = 8,6991

Replikasi 2 = 10 x 0,3278 x 2,6596 = 8,7182

Replikasi 3 = 10 x 0,3278 x 2,6509 = 8,6897

310 = Replikasi 1 = 10 x 0,1864 x 2,7134 = 5,0578

Replikasi 2 = 10 x 0,1864 x 2,6937 = 5,0210

Replikasi 3 = 10 x 0,1864 x 2,7349 = 5,0978

315 = Replikasi 1 = 10 x 0,0839 x 2,7976 = 2,3472

Replikasi 2 = 10 x 0,0839 x 2,8224 = 2,3679

Replikasi 3 = 10 x 0,0839 x 2,7988 = 2,3482

320 = Replikasi 1 = 10 x 0,0180 x 2,9172 = 0,5250

Replikasi 2 = 10 x 0,0180 x 2,8970 = 0,5215

Replikasi 3 = 10 x 0,0180 x 2,8761 = 0,5177

- Total nilai SPF replikasi 1 = 26,7519
- Total nilai SPF replikasi 2 = 26,8341
- Total nilai SPF replikasi 3 = 26,8210

$$Rata - rata\ nilai\ SPf\ formula\ optimum = \frac{\text{Total nilai SPF replikasi 1 + replikasi 2 + replikasi 3}}{3}$$

$$= \frac{26{,}7519 + 26{,}8341 + 26{,}8210}{3}$$

$$= \frac{80{,}407}{3}$$

$$= 26{,}8023$$

Rata-rata nilai SPF formula optimum ± SD = 26,8023 ± 0,2549

b. Kontrol Positif

Panjang Gelombang	Absorbansi		
	Replikasi 1	Replikasi 2	Replikasi 3
290	3,4756	3,2840	3,4527
295	3,6058	3,3483	3,3636
300	3,5450	3,3300	3,3465
305	3,6478	3,2693	3,4030
310	3,6431	3,3094	3,3596
315	3,5988	3,4989	3,4702
320	3,8257	3,2879	3,5335

290 = Replikasi 1 = 10 x 0,0150 x 3,4756 = 0,5213

Replikasi 2 = 10 x 0,0150 x 3,2840 = 0,4926

Replikasi 3 = 10 x 0,0150 x 3,4527 = 0,5179

295 = Replikasi 1 = 10 x 0,0817 x 3,6058 = 2,9459

Replikasi 2 = 10 x 0,0817 x 3,3483 = 2,7472

Replikasi 3 = 10 x 0,0817 x 3,3636 = 2,7472

300 = Replikasi 1 = 10 x 0,2874 x 3,5450 = 10,1883

Replikasi 2 = 10 x 0,2874 x 3,3300 = 9,5704

Replikasi 3 = 10 x 0,2874 x 3,7714 = 9,6178

305 = Replikasi 1 = 10 x 0,3278 x 3,7359 = 11,9575

Replikasi 2 = 10 x 0,3278 x 3,7653 = 10,7168

Replikasi 3 = 10 x 0,3278 x 3,465 = 11,1550

310 = Replikasi 1 = 10 x 0,1864 x 3,6431 = 6,7907

Replikasi 2 = 10 x 0,1864 x 3,3094 = 6,1687

Replikasi 3 = 10 x 0,1864 x 3,3596 = 6,2623

315 = Replikasi 1 = 10 x 0,0839 x 3,5988 = 3,0193

Replikasi 2 = 10 x 0,0839 x 3,4989 = 2,9356

Replikasi 3 = 10 x 0,0839 x 3,4702 = 2,9115

320 = Replikasi 1 = 10 x 0,0180 x 3,8257 = 0,6886

Replikasi 2 = 10 x 0,0180 x 3,2879 = 0,5918

Replikasi 3 = 10 x 0,0180 x 3,5335 = 0,6360

- Total nilai SPF replikasi 1 = 36,1116
- Total nilai SPF replikasi 2 = 33,2115
- Total nilai SPF replikasi 3 = 33,8477

$$Rata-rata\ nilai\ SPf\ formula\ optimum = \frac{\text{Total nilai SPF replikasi 1 + replikasi 2 + replikasi 3}}{3}$$

$$= \frac{36{,}1116 + 33{,}2115 + 33{,}8477}{3}$$

$$= \frac{113{,}0873}{3}$$

$$= 34{,}3902$$

Rata-rata nilai SPF formula optimum ± SD = 34,3902 ± 0,8800

c. Basis

Panjang Gelombang	Absorbansi		
	Replikasi 1	Replikasi 2	Replikasi 3
290	0,0266	0,0329	0,0527
295	0,0217	0,0244	0,0387
300	0,0183	0,0189	0,0294
305	0,0158	0,0150	0,0225
310	0,0141	0,0126	0,0179
315	0,0126	0,0103	0,0146
320	0,0116	0,0093	0,0129

290 = Replikasi 1 = 10 x 0,0150 x 0,0266 = 0,0040

Replikasi 2 = 10 x 0,0150 x 0,0329 = 0,0050

Replikasi 3 = 10 x 0,0150 x 0,0527 = 0,0080

295 = Replikasi 1 = 10 x 0,0817 x 0,0217 = 0,0177

Replikasi 2 = 10 x 0,0817 x 0,0244 = 0,0199

Replikasi 3 = 10 x 0,0817 x 0,0387 = 0,0316

300 = Replikasi 1 = 10 x 0,2874 x 0,0183 = 0,0526

Replikasi 2 = 10 x 0,2874 x 0,0189 = 0,0543

Replikasi 3 = 10 x 0,2874 x 0,0294 = 0,0845

305 = Replikasi 1 = 10 x 0,3278 x 0,0158 = 0,0518

Replikasi 2 = 10 x 0,3278 x 0,0150 = 0,0492

Replikasi 3 = 10 x 0,3278 x 0,0225 = 0,0738

310 = Replikasi 1 = 10 x 0,1864 x 0,0141 = 0,0263

Replikasi 2 = 10 x 0,1864 x 0,0126 = 0,0235

Replikasi 3 = 10 x 0,1864 x 0,0179 = 0,0333

315 = Replikasi 1 = 10 x 0,0839 x 0,0126 = 0,0156

Replikasi 2 = 10 x 0,0839 x 0,0103 = 0,0086

Replikasi 3 = 10 x 0,0839 x 0,0146 = 0,0122

320 = Replikasi 1 = 10 x 0,0180 x 0,0116 = 0,0021

Replikasi 2 = 10 x 0,0180 x 0,0093 = 0,0017

Replikasi 3 = 10 x 0,0180 x 0,0129 = 0,0023

- Total nilai SPF replikasi 1 = 0,1701
- Total nilai SPF replikasi 2 = 0,1622
- Total nilai SPF replikasi 3 = 0,2457

$$Rata - rata\ nilai\ SPf\ formula\ optimum = \frac{\text{Total nilai SPF replikasi 1 + replikasi 2 + replikasi 3}}{3}$$

$$= \frac{0{,}1701 + 0{,}1622 + 0{,}2457}{3}$$

$$= \frac{0{,}578}{3}$$

$$= 0{,}1927$$

Rata-rata nilai SPF formula optimum ± SD = 0,1927 ± 0,0266