BAB V

PENUTUP

A. Kesimpulan

Kesimpulan dari hasil penelitian ini adalah :

1. Variasi konsentrasi Carbopol$^®$ 940P dan HPMC K15M tidak berpengaruh teradap sifat fisik tablet yang meliputi keseragaman sediaan, kekerasan dan kerapuhan, tetapi peningkatan konsentrasi Carbopol$^®$ 940P dapat berpengaruh terhadap peningkatan kekuatan *mucoadhesive* tablet salbutamol sulfat.

2. Proporsi kombinasi matriks Carbopol$^®$ 940P 25 mg dan HPMC K15M 70 mg dapat menurunkan jumlah obat yang dilepaskan.

B. Saran

1. Perlu dilakukan uji kestabilan untuk mengetahui stabilitas sifat fisik tablet *mucoadhesive* salbutamol sulfat.

2. Perlu dilakukan penelitian secara *in vivo* untuk mengetahui kekuatan melekat tablet *mucoadhesive* salbutamol sulfat.
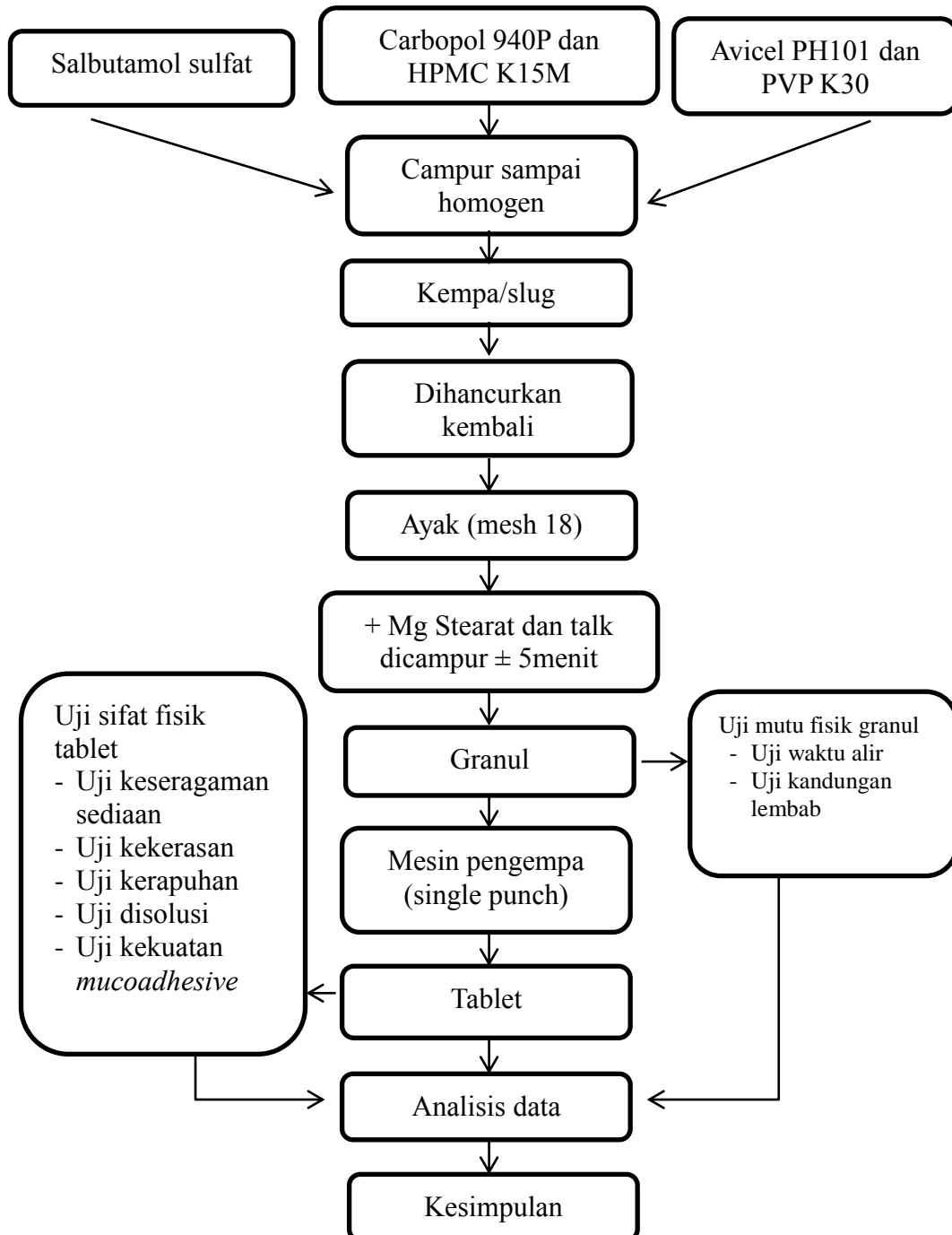
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Lampiran 1. Skema Jalannya Penelitian

```
┌──────────────────┐   ┌──────────────────┐   ┌──────────────────┐
│ Salbutamol sulfat│   │ Carbopol 940P dan│   │ Avicel PH101 dan │
│                  │   │   HPMC K15M      │   │    PVP K30       │
└──────────────────┘   └──────────────────┘   └──────────────────┘
            ↘                   ↓                   ↙
                  ┌──────────────────────┐
                  │   Campur sampai      │
                  │     homogen          │
                  └──────────────────────┘
                           ↓
                  ┌──────────────────────┐
                  │     Kempa/slug       │
                  └──────────────────────┘
                           ↓
                  ┌──────────────────────┐
                  │    Dihancurkan       │
                  │     kembali          │
                  └──────────────────────┘
                           ↓
                  ┌──────────────────────┐
                  │    Ayak (mesh 18)    │
                  └──────────────────────┘
                           ↓
                  ┌──────────────────────┐
                  │ + Mg Stearat dan talk│
                  │ dicampur ± 5menit    │
                  └──────────────────────┘
                           ↓
```

Uji sifat fisik tablet
- Uji keseragaman sediaan
- Uji kekerasan
- Uji kerapuhan
- Uji disolusi
- Uji kekuatan *mucoadhesive*

Granul → Uji mutu fisik granul
- Uji waktu alir
- Uji kandungan lembab

Mesin pengempa (single punch)

Tablet

Analisis data

Kesimpulan

Lampiran 2. Data uji Kandungan lembab

Replikasi	Kandungan Lembab (%)				
	F1	F2	F3	F4	F5
1	5	5	5.4	6	8.9
2	4.8	5.9	5.6	5.7	7.8
3	5.2	5.4	5.2	6.3	8.1
Rata-rata	5	5.4	5.4	6.0	8.3
SD	0.20	0.45	0.20	0.30	0.57

Keterangan :
Formula 1 : 10 mg Carbopol[®] 940P dan 100 mg HPMC
Formula 2 : 20 mg Carbopol[®] 940P dan 80 mg HPMC
Formula 3 : 25 mg Carbopol[®] 940P dan 70 mg HPMC
Formula 4 : 30 mg Carbopol[®] 940P dan 60 mg HPMC
Formula 5 : 40 mg Carbopol[®] 940P dan 50 mg HPMC

Lampiran 3. Hasil statistik uji kandungan lembab

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Kandungan Lembab	15	6.0200	1.24911	4.80	8.90

One-Sample Kolmogorov-Smirnov Test

		Kandungan Lembab
N		15
Normal Parameters[a,b]	Mean	6.0200
	Std. Deviation	1.24911
Most Extreme Differences	Absolute	.240
	Positive	.240
	Negative	-.164
Kolmogorov-Smirnov Z		.928
Asymp. Sig. (2-tailed)		.355

a. Test distribution is Normal.

b. Calculated from data.

Test of Homogeneity of Variances

Kandungan Lembab

Levene Statistic	df1	df2	Sig.
1.375	4	10	.310

ANOVA

Kandungan Lembab

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	20.451	4	5.113	36.694	.000
Within Groups	1.393	10	.139		
Total	21.844	14			

Multiple Comparisons

Kandungan Lembab

LSD

(I) Formula	(J) Formula	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Formula 1	Formula 2	-.43333	.30478	.186	-1.1124	.2458
	Formula 3	-.40000	.30478	.219	-1.0791	.2791
	Formula 4	-1.00000*	.30478	.008	-1.6791	-.3209
	Formula 5	-3.26667*	.30478	.000	-3.9458	-2.5876
Formula 2	Formula 1	.43333	.30478	.186	-.2458	1.1124
	Formula 3	.03333	.30478	.915	-.6458	.7124
	Formula 4	-.56667	.30478	.093	-1.2458	.1124
	Formula 5	-2.83333*	.30478	.000	-3.5124	-2.1542
Formula 3	Formula 1	.40000	.30478	.219	-.2791	1.0791
	Formula 2	-.03333	.30478	.915	-.7124	.6458
	Formula 4	-.60000	.30478	.077	-1.2791	.0791
	Formula 5	-2.86667*	.30478	.000	-3.5458	-2.1876
Formula 4	Formula 1	1.00000*	.30478	.008	.3209	1.6791
	Formula 2	.56667	.30478	.093	-.1124	1.2458
	Formula 3	.60000	.30478	.077	-.0791	1.2791
	Formula 5	-2.26667*	.30478	.000	-2.9458	-1.5876
Formula 5	Formula 1	3.26667*	.30478	.000	2.5876	3.9458
	Formula 2	2.83333*	.30478	.000	2.1542	3.5124
	Formula 3	2.86667*	.30478	.000	2.1876	3.5458
	Formula 4	2.26667*	.30478	.000	1.5876	2.9458

*. The mean difference is significant at the 0.05 level.

Lampiran 4. Data uji waktu alir granul

Replikasi	Waktu alir				
	F1	F2	F3	F4	F5
1	5.75	5.3	5.58	6.01	6.47
2	4.58	5.47	5.83	6.3	7.05
3	4.58	5.26	5	6.15	7.41
4	4	6.17	5.08	7.13	8.47
5	3.3	5.5	5.41	6.42	8.52
6	3.75	5.12	5.28	7.01	7.47
Rata-rata	4.33	5.47	5.36	6.50	7.57
SD	0.85	0.46	0.31	0.46	0.80

Keterangan :
Formula 1 : 10 mg Carbopol® 940P dan 100 mg HPMC
Formula 2 : 20 mg Carbopol® 940P dan 80 mg HPMC
Formula 3 : 25 mg Carbopol® 940P dan 70 mg HPMC
Formula 4 : 30 mg Carbopol® 940P dan 60 mg HPMC
Formula 5 : 40 mg Carbopol® 940P dan 50 mg HPMC

Lampiran 5. Hasil uji statistik waktu alir

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Wakt Alir	30	5.8457	1.25304	3.30	8.52

One-Sample Kolmogorov-Smirnov Test

		Wakt Alir
N		30
Normal Parameters[a,b]	Mean	5.8457
	Std. Deviation	1.25304
Most Extreme Differences	Absolute	.084
	Positive	.084
	Negative	-.083
Kolmogorov-Smirnov Z		.460
Asymp. Sig. (2-tailed)		.984

a. Test distribution is Normal.

b. Calculated from data.

Test of Homogeneity of Variances

Wakt Alir

Levene Statistic	df1	df2	Sig.
2.093	4	25	.112

ANOVA

Wakt Alir

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	36.419	4	9.105	24.973	.000
Within Groups	9.114	25	.365		
Total	45.533	29			

Multiple Comparisons

Wakt Alir

LSD

(I) Formula	(J) Formula	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Formula 1	Formula 2	-1.14333*	.34860	.003	-1.8613	-.4254
	Formula 3	-1.03667*	.34860	.006	-1.7546	-.3187
	Formula 4	-2.17667*	.34860	.000	-2.8946	-1.4587
	Formula 5	-3.23833*	.34860	.000	-3.956	-2.5204
Formula 2	Formula 1	1.14333*	.34860	.003	.4254	1.8613
	Formula 3	.10667	.34860	.762	-.6113	.8246
	Formula 4	-1.03333*	.34860	.007	-1.7513	-.3154
	Formula 5	-2.09500*	.34860	.000	-2.8130	-1.3770
Formula 3	Formula 1	1.03667*	.34860	.006	.3187	1.7546
	Formula 2	-.10667	.34860	.762	-.8246	.6113
	Formula 4	-1.14000*	.34860	.003	-1.8580	-.4220
	Formula 5	-2.20167*	.34860	.000	-2.9196	-1.4837
Formula 4	Formula 1	2.17667*	.34860	.000	1.4587	2.8946
	Formula 2	1.03333*	.34860	.007	.3154	1.7513
	Formula 3	1.14000*	.34860	.003	.4220	1.8580
	Formula 5	-1.06167*	.34860	.005	-1.7796	-.3437
Formula 5	Formula 1	3.23833*	.34860	.000	2.5204	3.9563
	Formula 2	2.09500*	.34860	.000	1.3770	2.8130
	Formula 3	2.20167*	.34860	.000	1.4837	2.9196
	Formula 4	1.06167*	.34860	.005	.3437	1.7796

*. The mean difference is significant at the 0.05 level.
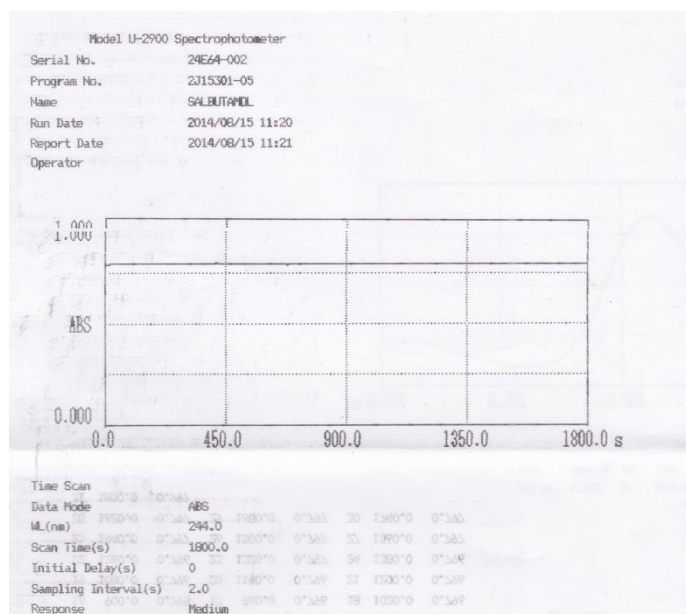
Lampiran 6. Pembuatan kurva kalibrasi dan validasi metode analisis

a. Penentuan panjang gelombang maksimum
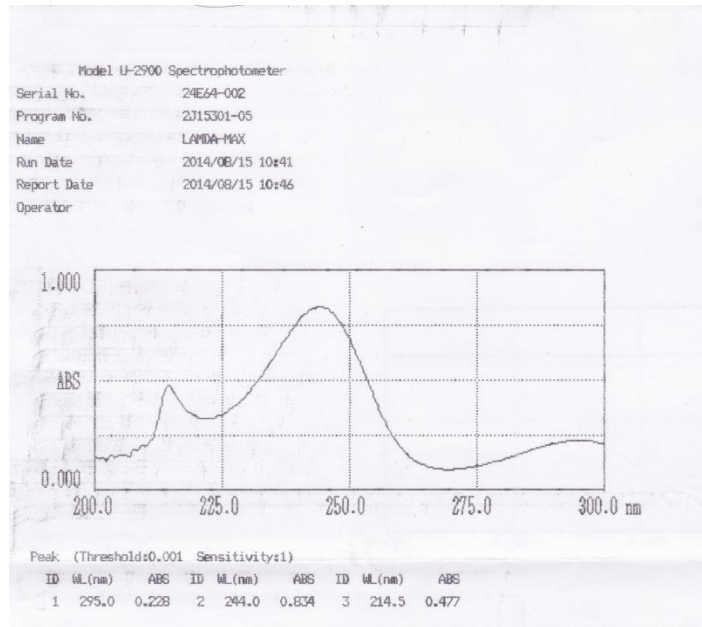
Panjang gelombang maksimum yang diperoleh dari *scanning* larutan salbutamol sulfat 16 µg/ml diperoleh panjang gelombang maksimum sebesar 244 nm dengan serapan 0,834.

b. Penentuan *operating time*

```
Data List (List Interval(s):60.0)
   ID TIME(s)   ABS   ID TIME(s)   ABS   ID TIME(s)   ABS
    1    0.0   0.795   2   60.0   0.796   3   120.0   0.798
    4  180.0   0.797   5  240.0   0.797   6   300.0   0.797
    7  360.0   0.796   8  420.0   0.802   9   480.0   0.796
   10  540.0   0.796  11  600.0   0.796  12   660.0   0.796
   13  720.0   0.795  14  780.0   0.795  15   840.0   0.795
   16  900.0   0.795  17  960.0   0.796  18  1020.0   0.796
   19 1080.0   0.796  20 1140.0   0.796  21  1200.0   0.796
   22 1260.0   0.796  23 1320.0   0.797  24  1380.0   0.796
   25 1440.0   0.797  26 1500.0   0.797  27  1560.0   0.797
   28 1620.0   0.797  29 1680.0   0.797  30  1740.0   0.797
   31 1800.0   0.797
```

Hasil *Scanning operating time* memberikan absorbansi yang stabil, itu

menunjukkan bahwa larutan salbutamol sulfat adalah stabil.

c. Kurva kalibrasi

Konsentrasi (µg/ml)	Absorbansi
4	0.198
6	0.307
8	0.419
10	0.537
12	0.629
14	0.742

Persamaan regresi linear antara konsentrasi (µg/ml) dan serapan diperoleh

nilai:

a = -0,0171

b = 0,0543   y = -0,0171 + 0,0543 x

r = 0,999   Keterangan: x = konsentrasi (µg/ml)
                            y = serapan

d. Penentuan LOD dan LOQ

Konsentrasi (µg/ml)	absorbansi (y)	y'	|y-y'|	|y-y'|2
4	0,198	0,2001	-0,0021	0,00000441
6	0,307	0,3087	-0,0017	0,00000289
8	0,419	0,4173	0,0017	0,00000289
10	0,537	0,5259	0,0111	0,00012321
12	0,629	0,6345	-0,0055	0,00003025
14	0,742	0,7431	-0,0011	0,00000121
Jumlah total				0,00016486

Nilai $\hat{y}$ diperoleh dari substitusi konsentrasi dalam persamaan $\hat{y} = 0,0543x + 0,0171$

dengan x adalah konsentrasi (µg/ml) dan y adalah serapan

$$S_{x/y} = \sqrt{\frac{\sum |y - \hat{y}|^2}{N-2}}$$

$S_{x/y}$ = simpangan baku residual

N = jumlah data

$\sum |y - \hat{y}|^2$ = jumlah kuadrat total residual

$$S_{x/y} = \sqrt{\frac{0,00016486}{6-2}} = 0,006419891$$

$LOD = 3,3 \text{ x } \frac{S_{x/y}}{b}$ $LOQ = 10 \text{ x } \frac{S_{x/y}}{b}$

$LOD = 3,3 \text{ x } \frac{0,006419891}{0,0543}$ $LOQ = 10 \text{ x } \frac{0,006419891}{0,0543}$

LOD = 0,39016 µg/ml   LOQ = 1,18230 µg/ml

Serapan LOD = 0,004   Serapan LOQ = 0,047

e. Penentuan perolehan kembali

Penambahan salbutamol sulfat (mg)	Serapan				Kadar (µg/ml)	Jumlah terukur (mg)	Recovery (%)
	Replikasi 1	Replikasi 2	Replikasi 3	Rata-rata			
12,6	0,499	0,495	0,495	0,496	9,449	11,812	93,74
	0,489	0,49	0,493	0,491	9,357	11,697	92,83
	0,503	0,499	0,498	0,500	9,523	11,904	94,47
9,8	0,389	0,392	0,39	0,390	7,497	9,372	95,63
	0,394	0,394	0,395	0,394	7,571	9,464	96,57
	0,401	0,398	0,4	0,400	7,681	9,602	97,98
14,4	0,601	0,598	0,6	0,600	11,365	14,206	98,65
	0,597	0,601	0,599	0,599	11,346	14,183	98,49
	0,586	0,584	0,584	0,585	11,088	13,860	96,25
Rata-rata (%)							96,07
Simpangan baku (SD)							2,09
Simpangan baku Relatif (RSD)							2,18

Persamaan regresi linear kurva kalibrasi y = -0,0171 + 0,0543 x

Kadar = (rata-rata serapan – (-0,0171) / 0,0543

Jumlah terukur $= \frac{kadar}{1000}$ x volume pembuatan x faktor pengenceran

volume pembuatan = 50 ml, faktor pengenceran = 25

Contoh:

% $recovery = \frac{jumlah\ terukur\ (mg)}{penambahan\ salbutamol\ sulfat}$ x 100%

Kadar = 0,496 – (-0,0171) / 0,0543

  = 9,449 µg/ml

Jumlah terukur $= \frac{9,449}{1000}$ x 50 x 25 = 11,812 mg

Recovery (%) $= \frac{9,449}{12,6}$ x 100 % = 93,74%

Lampiran 7. Pemeriksaan sifat fisik tablet

a. Kekerasan tablet

Replikasi	Kekerasan tablet (kg)				
	F1	F2	F3	F4	F5
1	11	12,5	13,5	13,7	15
2	13	12,3	13,9	14	14,5
3	11	13	14	14	13
4	12	12,2	14	12,5	14
5	13	12	14	14,5	14,5
6	12,5	12,5	12,9	15	14
Rata-rata	12,08	12,42	13,72	13,84	14,17
SD	0,92	0,34	0,44	0,90	0,68

Hasil uji statistik kekerasan

Descriptive Statistics

	N	Mean	Std, Deviation	Minimum	Maximum
Kekerasan	30	17,6167	24,08160	11,00	145,00

One-Sample Kolmogorov-Smirnov Test

		Kekerasan
N		30
Normal Parameters[a,b]	Mean	17,6167
	Std, Deviation	24,08160
Most Extreme Differences	Absolute	,510
	Positive	,510
	Negative	-,392
Kolmogorov-Smirnov Z		2,793
Asymp, Sig, (2-tailed)		,000

a, Test distribution is Normal,

b, Calculated from data,

Data uji kekerasan tidak terdistribusi normal, maka tidak dapat dilanjutkan dengan uji *ANOVA*, tetapi dilanjutkan dengan uji *Kruskal-Wallis* untuk mengetahui kemaknaan perbedaan.

Ranks

	Formula	N	Mean Rank
Kekerasan	Formula 1	6	7.00
	Formula 2	6	7.50
	Formula 3	6	18.50
	Formula 4	6	21.33
	Formula 5	6	23.17
	Total	30	

Test Statistics[a,b]

	Kekerasan
Chi-square	18.764
df	4
Asymp. Sig.	.001

a. Kruskal Wallis Test

b. Grouping Variable: Formula

Harga signifikansi $0,001 < 0,05$ maka H_0 ditolak, berarti kekerasan tablet tablet *mucoadhesive* salbutamol sulfat pada 5 formula tidak ada perbedaan bermakna.

b. Kerapuhan

Replikasi	Kerapuhan (%)				
	F1	F2	F3	F4	F5
1	0,14	0,20	0,14	0,17	0,12
2	0,23	0,14	0,19	0,15	0,1
3	0,19	0,17	0,17	0,12	0,164
Rata-rata	0,19	0,17	0,17	0,15	0,13
SD	0,05	0,03	0,03	0,03	0,03

Hasil SPSS Uji Kerapuhan

One-Sample Kolmogorov-Smirnov Test

		Kerapuhan
N		15
Normal Parameters[a,b]	Mean	,1596
	Std, Deviation	,03455
Most Extreme Differences	Absolute	,115
	Positive	,115
	Negative	-,085
Kolmogorov-Smirnov Z		,446
Asymp, Sig, (2-tailed)		,989

a, Test distribution is Normal,

b, Calculated from data,

Test of Homogeneity of Variances

Kerapuhan

Levene Statistic	df1	df2	Sig,
,337	4	10	,847

ANOVA

Kerapuhan

	Sum of Squares	df	Mean Square	F	Sig,
Between Groups	,006	4	,002	1,463	,284
Within Groups	,011	10	,001		
Total	,017	14			

c. **Penetapan kadar**

Formula 1

Replikasi	Absorbansi	Kadar (µg/ml)	Faktor pengenceran	Terukur (mg)
1	0,543	10,31	25	12,89
2	0,501	9,54	25	11,93
3	0,449	8,58	25	10,73
Rata-rata				11,85
SD				1,08

Formula 2

Replikasi	Absorbansi	Kadar (µg/ml)	Faktor pengenceran	Terukur (mg)
1	0,487	9,28361	25	11,60
2	0,512	9,744015	25	12,18
3	0,497	9,467772	25	11,83
Rata-rata				11,87
SD				0,29

Formula 3

Replikasi	Absorbansi	Kadar (µg/ml)	Faktor pengenceran	Terukur (mg)
1	0,454	9,504604	25	11,88
2	0,512	9,744015	25	12,18
3	0,485	9,246777	25	11,56
Rata-rata				11,88
SD				0,31

Formula 4

Replikasi	Absorbansi	Kadar (µg/ml)	Faktor pengenceran	Terukur (mg)
1	0,542	10,30	25	12,87
2	0,501	9,54	25	11,93
3	0,448	8,56	25	10,71
Rata-rata				11,83
SD				1,08

Formula 5

Replikasi	Absorbansi	Kadar (µg/ml)	Faktor pengenceran	Terukur (mg)
1	0,496	9,45	25	11,81
2	0,503	9,58	25	11,97
3	0,506	9,63	25	12,04
Rata-rata				11,94
SD				0,12

Contoh perhitungan penetapan kadar tablet salbutamol sulfat :

Keterangan :

Persamaan regresi linear kurva kalibrasi y = -0,0171 + 0,0543 x

Volume pembuatan : 50 ml

fx (faktor pengenceran) : 25

Kadar (µg/ml) = (absorbansi – (-0,0171) / 0,0543

$$\text{Terukur (mg)} = \frac{\text{Kadar (µg/ml)}}{1000} \text{ x volume pembuatan x faktor pengenceran}$$

Contoh:

Kadar = (0,543+0,0171) / 0,0543 = 10,31 µg/ml

$$\text{Terukur (mg)} = \frac{10,31}{1000} \text{ x 50 x 25} = 12,89 \text{ mg}$$

d. Keseragaman sediaan

1. Keseragaman bobot

Tablet	Bobot tablet (mg)				
	F1	F2	F3	F4	F5
1	199	199	197	198	203
2	202	199	202	196	199
3	199	202	199	198	202
4	200	199	202	199	201
5	204	200	196	197	202
6	202	197	200	199	205
7	200	198	199	199	201
8	204	199	202	200	204
9	202	198	197	199	202
10	199	200	197	198	202
11	203	201	200	200	200
12	199	199	201	201	203
13	194	199	203	202	201
14	199	198	200	200	205
15	200	198	203	203	203
16	203	200	200	201	202
17	202	201	200	199	201
18	201	202	203	202	200
19	202	200	200	202	199
20	200	198	200	201	202
Rata-rata	200,7	199,35	200,05	199,7	201,85
SD	2,3	1,4	2,1	1,8	1,7
CV	1,16	0,70	1,06	0,92	0,84

Hasil perhitungan rentang keseragaman bobot

Formula	Kolom A		Kolom B	
	Maksimal	Minimal	Maksimal	Minimal
Formula I	185,65	215,75	170,60	230,81
Formula II	184,40	214,30	169,45	229,25
Formula III	185,05	215,05	170,04	230,06
Formula IV	184,72	214,68	169,75	229,66
Formula V	186,71	216,99	171,57	232,13

Keterangan :
Kolom A : penyimpangan 7,5% dari bobot rata-rata
Kolom B : penyimpangan 15% dari bobot rata-rata

2. **Keseragaman kandungan**

   Formula 1

Tablet	Serapan	Kadar (µg/ml)	Jumlah (mg)	Bobot (mg)	Kandungan (mg)	Kandungan (%)
1	0,470	8,97	11,21	197	11,04	93,21
2	0,466	8,89	11,11	199	11,06	93,32
3	0,476	9,07	11,34	199	11,29	95,25
4	0,490	9,34	11,68	197	11,51	97,10
5	0,490	9,34	11,67	199	11,62	98,02
6	0,474	9,04	11,30	200	11,30	95,34
7	0,504	9,59	11,99	200	11,99	101,17
8	0,479	9,14	11,42	198	11,31	95,41
9	0,488	9,30	11,63	202	11,74	99,10
10	0,500	9,52	11,90	198	11,78	99,39
Rata-rata					11,46	96,73
SD					0,32	2,67
CV					2,76	2,76

   Formula 2

Tablet	Serapan	Kadar (µg/ml)	Jumlah (mg)	Bobot (mg)	Kandungan (mg)	Kandungan (%)
1	0,489	9,33	11,66	197	11,48	96,74
2	0,461	8,80	11,00	203	11,16	94,05
3	0,497	9,47	11,83	198	11,72	98,71
4	0,503	9,58	11,98	203	12,16	102,44
5	0,492	9,37	11,71	199	11,65	98,18
6	0,497	9,47	11,83	203	12,01	101,20
7	0,501	9,55	11,93	201	11,99	101,05
8	0,491	9,36	11,70	198	11,59	97,62
9	0,481	9,17	11,47	201	11,52	97,08
10	0,474	9,04	11,31	200	11,31	95,24
Rata-rata					11,66	98,23
SD					0,32	2,69
CV					2,74	2,74

Formula 3

Tablet	Serapan	Kadar (µg/ml)	Jumlah (mg)	Bobot (mg)	Kandungan (mg)	Kandungan (%)
1	0,433	8,29	10,36	203	10,52	88,60
2	0,501	9,54	11,93	199	11,87	99,98
3	0,439	8,40	10,50	199	10,45	88,01
4	0,501	9,54	11,93	197	11,75	98,97
5	0,489	9,32	11,65	199	11,59	97,66
6	0,462	8,82	11,03	200	11,03	92,91
7	0,496	9,45	11,81	200	11,81	99,51
8	0,485	9,25	11,56	198	11,44	96,40
9	0,434	8,31	10,38	202	10,49	88,36
10	0,504	9,60	12,00	198	11,88	100,05
Rata-rata					11,28	95,05
SD					0,60	5,09
CV					5,36	5,36

Formula 4

Tablet	Serapan	Kadar (µg/ml)	Jumlah (mg)	Bobot (mg)	Kandungan (mg)	Kandungan (%)
1	0,455	8,70	10,88	200	10,88	91,93
2	0,458	8,76	10,94	200	10,94	92,52
3	0,438	8,39	10,48	199	10,43	88,18
4	0,447	8,55	10,68	198	10,58	89,41
5	0,492	9,38	11,73	201	11,79	99,63
6	0,475	9,06	11,33	200	11,33	95,76
7	0,488	9,30	11,63	199	11,57	97,80
8	0,472	9,01	11,27	202	11,38	96,19
9	0,469	8,95	11,18	200	11,18	94,53
10	0,438	8,38	10,48	197	10,32	87,23
Rata-rata					11,04	93,32
SD					0,49	4,17
CV					4,47	4,47

Formula 5

Tablet	Serapan	Kadar (µg/ml)	Jumlah (mg)	Bobot (mg)	Kandungan (mg)	Kandungan (%)
1	0,434	8,31	10,38	199	10,33	86,54
2	0,423	8,10	10,13	202	10,23	85,70
3	0,457	8,73	10,91	197	10,75	90,04
4	0,433	8,29	10,36	200	10,36	86,78
5	0,43	8,23	10,29	199	10,24	85,77
6	0,448	8,57	10,71	203	10,87	91,02
7	0,450	8,60	10,75	197	10,59	88,71
8	0,434	8,31	10,38	200	10,38	86,97
9	0,444	8,49	10,61	201	10,67	89,34
10	0,428	8,20	10,25	200	10,25	85,82
Rata-rata					10,47	87,67
SD					0,23	1,95
CV					2,22	2,22

Keterangan

Persamaan regresi linear kurva kalibrasi y = -0,0171 + 0,0543 x
Volume pembuatan   : 50 ml
fx (faktor pengenceran)   : 25
bobot tablet sampel   : 200 mg

Kadar = (absorbansi- (-0,0171)) / 0,0543

$$\text{Jumlah (mg)} = \frac{\text{Kadar (µg/ml)}}{1000} \times \text{volume pembuatan} \times \text{faktor pengenceran}$$

$$\text{Kandungan salbutamol sulfat dalam tablet} = \frac{\text{bobot tablet uji}}{\text{bobot tablet sampel}} \times \text{jumlah (mg)}$$

$$\% \text{ Kandungan salbutamol sulfat dalam tablet} = \frac{\text{Kandungan}}{\text{hasil penetapan kadar}} \times 100\%$$

Contoh Perhitungan:

Diketahui:

Volume pembuatan   : 50 ml

Fx (faktor pengenceran)   : 25

Bobot tablet uji   : 197 mg

Bobot tablet sampel   : 200 mg

Penetapan kadar F1   : 11,85 mg

Kadar   = (0,470 + 0,0171) / 0,0543 = 8,97 µg/ml

Jumlah (mg) = $\frac{8,97}{1000}$ x 50 x 25 = 11,21 mg

Kandungan salbutamol sulfat dalam tablet = $\frac{197}{200}$ x 11,21 = 11,04 mg

% Kandungan salbutamol sulfat dalam tablet = $\frac{11,04}{11,85}$ x 100% = 93,21 %

Lampiran 8. Uji Disolusi

Formula 1

Replikasi 1
Bobot tablet 202 mg (mengandung salbutamol sulfat 11,97 mg)
Kadar adisi = 6,476 µg/ml

Waktu (menit)	Serapan	Kadar sampel (µg/ml)	Kadar-adisi	FP	Kadar (µg/ml)	Jumlah (mg)	Koreksi (mg)	Total koreksi (mg)	Jumlah terdisolusi (mg)	Disolusi (%)
5	0,349	6,742	0,266	5	1,331	1,198	0	0	1,198	**10,01**
15	0,354	6,834	0,358	5	1,791	1,612	0,01	0,01	1,63	**13,58**
30	0,363	7,000	0,524	5	2,620	2,358	0,02	0,03	2,39	**19,96**
60	0,374	7,203	0,727	5	3,633	3,270	0,03	0,06	3,33	**27,79**
90	0,383	7,368	0,892	5	4,462	4,015	0,04	0,09	4,11	**34,33**
120	0,392	7,534	1,058	5	5,290	4,761	0,04	0,14	4,90	**40,93**
180	0,140	2,893	3,114	2,5	7,785	7,007	0,05	0,19	7,20	**55,98**
240	0,176	3,556	3,483	2,5	8,706	7,836	0,08	0,27	8,10	**69,05**
300	0,195	3,906	3,722	2,5	9,305	8,374	0,09	0,36	8,73	**76,37**
360	0,213	4,238	3,943	2,5	9,857	8,872	0,09	0,45	9,32	**83,41**

Kecepatan pelepasan = 0,2109 mg/menit
Koefisien korelasi = 0,990

Replikasi 2
Bobot tablet 200 mg (mengandung salbutamol sulfat 11,85 mg)
Kadar adisi = 6,476 µg/ml

Waktu (menit)	Serapan	Kadar sampel (µg/ml)	Kadar-adisi	FP	Kadar (µg/ml)	Jumlah (mg)	Koreksi (mg)	Total koreksi (mg)	Jumlah terdisolusi (mg)	Disolusi (%)
5	0,341	6,595	0,119	5	0,594	0,535	0	0	0,535	**4,51**
15	0,351	6,773	0,297	5	1,484	1,336	0,01	0,01	1,34	**11,32**
30	0,361	6,963	0,487	5	2,436	2,192	0,01	0,02	2,21	**18,68**
60	0,371	7,153	0,677	5	3,387	3,049	0,02	0,05	3,09	**26,11**
90	0,380	7,313	0,837	5	4,185	3,767	0,03	0,08	3,85	**32,45**
120	0,390	7,497	1,021	5	5,106	4,596	0,04	0,12	4,72	**39,80**
180	0,135	2,795	2,795	2,5	6,987	6,289	0,05	0,17	6,46	**54,52**
240	0,176	3,556	3,556	2,5	8,890	8,001	0,07	0,24	8,24	**69,56**
300	0,194	3,882	3,882	2,5	9,704	8,733	0,09	0,33	9,06	**76,49**
360	0,211	4,207	4,207	2,5	10,517	9,465	0,10	0,43	9,89	**83,49**

Kecepatan pelepasan = 0,2405 mg/menit
Koefisien korelasi = 0,978

Replikasi 3
Bobot tablet 201 mg (mengandung salbutamol sulfat 11,91 mg)
Kadar adisi = 6,476 µg/ml

Waktu (menit)	Serapan	Kadar sampel (µg/ml)	Kadar-adisi	FP	Kadar (µg/ml)	Jumlah (mg)	Koreksi (mg)	Total koreksi (mg)	Jumlah terdisolusi (mg)	Disolusi (%)
5	0,349	6,736	0,260	5	1,300	1,170	0	0	1,170	**9,82**
15	0,355	6,859	0,383	5	1,914	1,723	0,01	0,01	1,74	**14,57**
30	0,364	7,025	0,549	5	2,743	2,468	0,02	0,03	2,50	**21,00**
60	0,376	7,239	0,763	5	3,817	3,435	0,03	0,06	3,49	**29,34**
90	0,385	7,399	0,923	5	4,615	4,154	0,04	0,10	4,25	**35,70**
120	0,394	7,577	1,101	5	5,505	4,955	0,05	0,14	5,10	**42,81**
180	0,144	2,973	2,973	2,5	7,432	6,689	0,06	0,20	6,89	**57,84**
240	0,175	3,532	3,532	2,5	8,829	7,946	0,07	0,27	8,22	**69,01**
300	0,191	3,839	3,839	2,5	9,596	8,637	0,09	0,36	9,00	**75,55**
360	0,212	4,213	4,213	2,5	10,533	9,479	0,10	0,46	9,94	**83,43**

Kecepatan pelepasan = 0,2074 mg/menit
Koefisien korelasi = 0,975

Formula2

Replikasi1
Bobot tablet 201 mg (mengandung salbutamol sulfat 11,93 mg)
Kadar adisi = 9,503µg/ml

Waktu (menit)	Serapan	Kadar sampel (µg/ml)	Kadar-adisi	FP	Kadar (µg/ml)	Jumlah (mg)	Koreksi (mg)	Total koreksi (mg)	Jumlah terdisolusi (mg)	Disolusi (%)
5	0,509	9,689	0,186	5	0,929	0,836	0	0	0,836	**7,01**
15	0,515	9,799	0,296	5	1,481	1,333	0,01	0,01	1,34	**11,25**
30	0,52	9,891	0,388	5	1,942	1,748	0,01	0,02	1,77	**14,85**
60	0,534	10,149	0,646	5	3,231	2,908	0,02	0,04	2,95	**24,74**
90	0,546	10,370	0,867	5	4,336	3,902	0,03	0,08	3,98	**33,35**
120	0,56	10,628	1,125	5	5,625	5,062	0,04	0,12	5,18	**43,43**
180	0,131	2,727	2,727	2,5	6,819	6,137	0,06	0,18	6,31	**52,91**
240	0,146	3,004	3,004	2,5	7,509	6,758	0,07	0,24	7,00	**58,69**
300	0,161	3,280	3,280	2,5	8,200	7,380	0,08	0,32	7,70	**64,53**
360	0,181	3,648	3,648	2,5	9,121	8,209	0,08	0,40	8,61	**72,16**

Kecepatan pelepasan = 0,1824 mg/menit
Koefisien korelasi = 0,972

Replikasi 2
Bobot tablet 199 mg (mengandung salbutamol sulfat 11,75 mg)
Kadar adisi = 9,503 µg/ml

Waktu (menit)	Serapan	Kadar sampel (µg/ml)	Kadar-adisi	FP	Kadar (µg/ml)	Jumlah (mg)	Koreksi (mg)	Total koreksi (mg)	Jumlah terdisolusi (mg)	Disolusi (%)
5	0,513	9,756	0,253	5	1,266	1,140	0	0	1,140	**9,70**
15	0,519	9,867	0,364	5	1,819	1,637	0,01	0,01	1,65	**14,04**
30	0,528	10,039	0,536	5	2,678	2,411	0,02	0,03	2,44	**20,78**
60	0,534	10,155	0,652	5	3,262	2,935	0,03	0,06	2,99	**25,47**
90	0,547	10,389	0,886	5	4,428	3,985	0,03	0,09	4,08	**34,68**
120	0,560	10,634	1,131	5	5,656	5,090	0,04	0,13	5,22	**44,46**
180	0,125	2,611	2,611	2,5	6,527	5,874	0,06	0,19	6,07	**51,62**
240	0,139	2,869	2,869	2,5	7,172	6,454	0,07	0,26	6,71	**57,11**
300	0,155	3,169	3,169	2,5	7,924	7,131	0,07	0,33	7,46	**63,48**
360	0,177	3,581	3,581	2,5	8,952	8,057	0,08	0,41	8,46	**72,03**

Kecepatan pelepasan   = 0,1688 mg/menit
Koefisien korelasi   = 0,975

Replikasi 3
Bobot tablet 200 mg (mengandung salbutamol sulfat 11,87 mg)
Kadar adisi = 9,503 µg/ml

Waktu (menit)	Serapan	Kadar sampel (µg/ml)	Kadar-adisi	FP	Kadar (µg/ml)	Jumlah (mg)	Koreksi (mg)	Total koreksi (mg)	Jumlah terdisolusi (mg)	Disolusi (%)
5	0,508	9,670	0,167	5	0,837	0,753	0	0	0,753	**6,34**
15	0,517	9,842	0,339	5	1,696	1,527	0,01	0,01	1,53	**12,93**
30	0,525	9,983	0,480	5	2,402	2,162	0,02	0,03	2,19	**18,43**
60	0,531	10,100	0,597	5	2,985	2,687	0,02	0,05	2,74	**23,05**
90	0,543	10,321	0,818	5	4,090	3,681	0,03	0,08	3,76	**31,68**
120	0,556	10,560	1,057	5	5,287	4,759	0,04	0,12	4,88	**41,10**
180	0,123	2,580	2,580	2,5	6,450	5,805	0,05	0,17	5,98	**50,36**
240	0,136	2,826	2,826	2,5	7,064	6,358	0,06	0,24	6,60	**55,56**
300	0,149	3,065	3,065	2,5	7,663	6,896	0,07	0,31	7,20	**60,70**
360	0,173	3,495	3,495	2,5	8,737	7,863	0,08	0,38	8,25	**69,49**

Kecepatan pelepasan   = 0,1691 mg/menit
Koefisien korelasi   = 0,974

Formula 3
Replikasi 1
Bobot tablet 204 mg (mengandung salbutamol sulfat 12,12 mg)
Kadar adisi = 9,769 µg/ml

Waktu (menit)	Serapan	Kadar sampel (µg/ml)	Kadar-adisi	FP	Kadar (µg/ml)	Jumlah (mg)	Koreksi (mg)	Total koreksi (mg)	Jumlah terdisolusi (mg)	Disolusi (%)
5	0,519	9,867	0,098	5	0,489	0,440	0	0	0,440	**3,63**
15	0,527	10,014	0,245	5	1,226	1,103	0,00	0,00	1,11	**9,14**
30	0,535	10,161	0,392	5	1,962	1,766	0,01	0,02	1,78	**14,71**
60	0,552	10,481	0,712	5	3,558	3,202	0,02	0,04	3,24	**26,73**
90	0,558	10,591	0,822	5	4,111	3,700	0,04	0,07	3,77	**31,12**
120	0,094	2,040	2,040	2,5	5,100	4,590	0,04	0,11	4,70	**38,81**
180	0,113	2,396	2,396	2,5	5,990	5,391	0,05	0,16	5,56	**45,84**
240	0,130	2,709	2,709	2,5	6,773	6,095	0,06	0,22	6,32	**52,14**
300	0,148	3,041	3,041	2,5	7,601	6,841	0,07	0,29	7,13	**58,86**
360	0,158	3,231	3,231	2,5	8,077	7,269	0,08	0,37	7,64	**63,02**

Kecepatan pelepasan = 0,1605 mg/menit
Koefisien korelasi = 0,962

Replikasi 2
Bobot tablet mg 202 (mengandung salbutamol sulfat 12 mg)
Kadar adisi = 9,769 µg/ml

Waktu (menit)	Serapan	Kadar sampel (µg/ml)	Kadar-adisi	FP	Kadar (µg/ml)	Jumlah (mg)	Koreksi (mg)	Total koreksi (mg)	Jumlah terdisolusi (mg)	Disolusi (%)
5	0,528	10,039	0,270	5	1,348	1,214	0	0	1,214	**10,11**
15	0,535	10,168	0,399	5	1,993	1,794	0,01	0,01	1,81	**15,06**
30	0,540	10,266	0,497	5	2,484	2,236	0,02	0,03	2,27	**18,91**
60	0,555	10,530	0,761	5	3,804	3,423	0,02	0,06	3,48	**29,01**
90	0,562	10,665	0,896	5	4,479	4,031	0,04	0,10	4,13	**34,40**
120	0,098	2,120	2,120	2,5	5,299	4,769	0,04	0,14	4,91	**40,92**
180	0,115	2,427	2,427	2,5	6,067	5,460	0,05	0,19	5,65	**47,12**
240	0,122	2,562	2,562	2,5	6,404	5,764	0,06	0,25	6,02	**50,15**
300	0,139	2,881	2,881	2,5	7,202	6,482	0,06	0,32	6,80	**56,67**
360	0,147	3,022	3,022	2,5	7,555	6,800	0,07	0,39	7,19	**59,92**

Kecepatan pelepasan = 0,1346 mg/menit
Koefisien korelasi = 0,955

Replikasi 3
Bobot tablet 200 mg (mengandung salbutamol sulfat 11,88 mg)
Kadar adisi = 9,769 µg/ml

Waktu (menit)	Serapan	Kadar sampel (µg/ml)	Kadar-adisi	FP	Kadar (µg/ml)	Jumlah (mg)	Koreksi (mg)	Total koreksi (mg)	Jumlah terdisolusi (mg)	Disolusi (%)
5	0,521	9,910	0,141	5	0,704	0,633	0	0	0,633	**5,33**
15	0,526	9,996	0,227	5	1,134	1,020	0,01	0,01	1,03	**8,65**
30	0,540	10,254	0,485	5	2,423	2,180	0,01	0,02	2,20	**18,51**
60	0,551	10,456	0,687	5	3,436	3,092	0,02	0,04	3,13	**26,39**
90	0,560	10,634	0,865	5	4,326	3,893	0,03	0,08	3,97	**33,42**
120	0,103	2,212	2,212	2,5	5,529	4,977	0,04	0,12	5,10	**42,90**
180	0,116	2,457	2,457	2,5	6,143	5,529	0,06	0,18	5,70	**48,02**
240	0,125	2,623	2,623	2,5	6,558	5,902	0,06	0,24	6,14	**51,67**
300	0,139	2,881	2,881	2,5	7,202	6,482	0,07	0,30	6,78	**57,11**
360	0,151	3,090	3,090	2,5	7,724	6,952	0,07	0,37	7,33	**61,67**

Kecepatan pelepasan = 0,15134 mg/menit
Koefisien korelasi = 0,942

Formula 4
Replikasi1
Bobot tablet 200 mg (mengandung salbutamol sulfat 11,83 mg)
Kadar adisi = 9,503 µg/ml

Waktu (menit)	Serapan	Kadar sampel (µg/ml)	Kadar-adisi	FP	Kadar (µg/ml)	Jumlah (mg)	Koreksi (mg)	Total koreksi (mg)	Jumlah terdisolusi (mg)	Disolusi (%)
5	0,502	9,560	0,057	5	0,284	0,256	0	0	0,256	**2,16**
15	0,511	9,726	0,223	5	1,113	1,002	0,00	0,00	1,00	**8,49**
30	0,520	9,891	0,388	5	1,942	1,748	0,01	0,01	1,76	**14,89**
60	0,536	10,186	0,683	5	3,415	3,074	0,02	0,03	3,11	**26,26**
90	0,545	10,352	0,849	5	4,244	3,819	0,03	0,07	3,89	**32,86**
120	0,553	10,499	0,996	5	4,980	4,482	0,04	0,11	4,59	**38,82**
180	0,124	2,599	2,599	2,5	6,496	5,847	0,05	0,16	6,01	**50,77**
240	0,143	2,948	2,948	2,5	7,371	6,634	0,06	0,22	6,86	**57,98**
300	0,150	3,077	3,077	2,5	7,693	6,924	0,07	0,30	7,22	**61,05**
360	0,168	3,409	3,409	2,5	8,522	7,670	0,08	0,38	8,05	**68,01**

Kecepatan pelepasan = 0,1778 mg/menit
Koefisien korelasi = 0,962

Replikasi 2
Bobot tablet 201 mg (mengandung salbutamol sulfat 11,89 mg)
Kadar adisi = 9,503 µg/ml

Waktu (menit)	Serapan	Kadar sampel (µg/ml)	Kadar-adisi	FP	Kadar (µg/ml)	Jumlah (mg)	Koreksi (mg)	Total koreksi (mg)	Jumlah terdisolusi (mg)	Disolusi (%)
5	0,506	9,640	0,137	5	0,683	0,615	0	0	0,615	**5,17**
15	0,514	9,775	0,272	5	1,359	1,223	0,01	0,01	1,23	**10,34**
30	0,524	9,959	0,456	5	2,279	2,051	0,01	0,02	2,07	**17,43**
60	0,540	10,254	0,751	5	3,753	3,377	0,02	0,04	3,42	**28,77**
90	0,551	10,468	0,965	5	4,827	4,344	0,04	0,08	4,42	**37,22**
120	0,561	10,653	1,150	5	5,748	5,173	0,05	0,13	5,30	**44,59**
180	0,125	2,611	2,611	2,5	6,527	5,874	0,06	0,19	6,06	**50,97**
240	0,136	2,826	2,826	2,5	7,064	6,358	0,07	0,25	6,61	**55,59**
300	0,154	3,151	3,151	2,5	7,878	7,090	0,07	0,32	7,41	**62,34**
360	0,170	3,452	3,452	2,5	8,630	7,767	0,08	0,40	8,17	**68,69**

Kecepatan pelepasan = 0,1684 mg/menit
Koefisien korelasi = 0,952

Replikasi 3
Bobot tablet 199 mg (mengandung salbutamol sulfat 11,77 mg)
Kadar adisi = 9,503 µg/ml

Waktu (menit)	Serapan	Kadar sampel (µg/ml)	Kadar-adisi	FP	Kadar (µg/ml)	Jumlah (mg)	Koreksi (mg)	Total koreksi (mg)	Jumlah terdisolusi (mg)	Disolusi (%)
5	0,506	9,634	0,131	5	0,653	0,587	0	0	0,587	**4,99**
15	0,520	9,897	0,394	5	1,972	1,775	0,01	0,01	1,78	**14,98**
30	0,526	9,996	0,493	5	2,464	2,217	0,02	0,03	2,24	**18,87**
60	0,542	10,290	0,787	5	3,937	3,543	0,02	0,05	3,59	**30,23**
90	0,553	10,505	1,002	5	5,011	4,510	0,04	0,09	4,60	**38,69**
120	0,565	10,714	1,211	5	6,055	5,449	0,05	0,14	5,59	**47,01**
180	0,131	2,727	2,727	2,5	6,819	6,137	0,06	0,20	6,34	**53,30**
240	0,140	2,893	2,893	2,5	7,233	6,510	0,07	0,27	6,78	**57,01**
300	0,147	3,022	3,022	2,5	7,555	6,800	0,07	0,34	7,14	**60,06**
360	0,168	3,403	3,403	2,5	8,507	7,656	0,08	0,42	8,07	**67,90**

Kecepatan pelepasan = 0,1595 mg/menit
Koefisien korelasi = 0,936

Formula 5
Replikasi1
Bobot tablet 199 mg (mengandung salbutamol sulfat 11,88 mg)
Kadar adisi = 6,476µg/ml

Waktu (menit)	Serapan	Kadar sampel (µg/ml)	Kadar-adisi	FP	Kadar (µg/ml)	Jumlah (mg)	Koreksi (mg)	Total koreksi (mg)	Jumlah terdisolusi (mg)	Disolusi (%)
5	0,337	6,521	0,045	5	0,226	0,203	0	0	0,203	**1,71**
15	0,351	6,779	0,303	5	1,515	1,364	0,00	0,00	1,37	**11,50**
30	0,362	6,982	0,506	5	2,528	2,275	0,02	0,02	2,29	**19,30**
60	0,374	7,203	0,727	5	3,633	3,270	0,03	0,04	3,31	**27,88**
90	0,384	7,387	0,911	5	4,554	4,098	0,04	0,08	4,18	**35,16**
120	0,396	7,608	1,132	5	5,659	5,093	0,05	0,12	5,22	**43,92**
180	0,152	3,114	3,114	2,5	7,785	7,007	0,06	0,18	7,19	**60,51**
240	0,172	3,483	3,483	2,5	8,706	7,836	0,08	0,26	8,09	**68,14**
300	0,185	3,722	3,722	2,5	9,305	8,374	0,09	0,35	8,72	**73,40**
360	0,197	3,943	3,943	2,5	9,857	8,872	0,09	0,44	9,31	**78,37**

Kecepatan pelepasan = 0,2099 mg/menit
Koefisien korelasi = 0,966

Replikasi 2
Bobot tablet mg 201 (mengandung salbutamol sulfat 12 mg)
Kadar adisi = 6,476 µg/ml

Waktu (menit)	Serapan	Kadar sampel (µg/ml)	Kadar-adisi	FP	Kadar (µg/ml)	Jumlah (mg)	Koreksi (mg)	Total koreksi (mg)	Jumlah terdisolusi (mg)	Disolusi (%)
5	0,341	6,595	0,119	5	0,594	0,535	0	0	0,535	**4,46**
15	0,351	6,785	0,309	5	1,546	1,391	0,01	0,01	1,40	**11,64**
30	0,361	6,963	0,487	5	2,436	2,192	0,02	0,02	2,21	**18,45**
60	0,368	7,092	0,616	5	3,080	2,772	0,02	0,05	2,82	**23,48**
90	0,380	7,313	0,837	5	4,185	3,767	0,03	0,08	3,84	**32,03**
120	0,390	7,491	1,015	5	5,075	4,568	0,04	0,12	4,69	**39,05**
180	0,146	3,010	3,010	2,5	7,525	6,772	0,05	0,17	6,94	**57,84**
240	0,170	3,440	3,440	2,5	8,599	7,739	0,08	0,24	7,98	**66,53**
300	0,189	3,802	3,802	2,5	9,504	8,554	0,09	0,33	8,88	**74,04**
360	0,198	3,955	3,955	2,5	9,888	8,899	0,10	0,43	9,32	**77,71**

Kecepatan pelepasan = 0,2099 mg/menit
Koefisien korelasi = 0,979

Replikasi 3
Bobot tablet 200 mg (mengandung salbutamol sulfat 11,94 mg)
Kadar adisi = 6,476 µg/ml

Waktu (menit)	Serapan	Kadar sampel (µg/ml)	Kadar-adisi	FP	Kadar (µg/ml)	Jumlah (mg)	Koreksi (mg)	Total koreksi (mg)	Jumlah terdisolusi (mg)	Disolusi (%)
5	0,342	6,613	0,137	5	0,686	0,618	0	0	0,618	**5,17**
15	0,351	6,779	0,303	5	1,515	1,364	0,01	0,01	1,37	**11,48**
30	0,359	6,932	0,456	5	2,282	2,054	0,02	0,02	2,08	**17,39**
60	0,367	7,068	0,592	5	2,958	2,662	0,02	0,04	2,71	**22,67**
90	0,382	7,350	0,874	5	4,370	3,933	0,03	0,07	4,01	**33,56**
120	0,391	7,510	1,034	5	5,168	4,651	0,04	0,12	4,77	**39,94**
180	0,146	2,998	2,998	2,5	7,494	6,744	0,05	0,17	6,91	**57,91**
240	0,171	3,458	3,458	2,5	8,645	7,780	0,07	0,24	8,03	**67,21**
300	0,189	3,789	3,789	2,5	9,474	8,526	0,09	0,33	8,86	**74,18**
360	0,196	3,931	3,931	2,5	9,827	8,844	0,09	0,43	9,27	**77,64**

Kecepatan pelepasan = 0,2105 mg/menit
Koefisien korelasi = 0,978

Rata-rata disolusi

Waktu (menit)	Rata-rata terdisolusi (%)				
	F1	F2	F3	F4	F5
5	8,11	7,68	6,36	4,11	3,78
15	13,16	12,74	10,95	11,27	11,54
30	19,88	18,02	17,38	17,06	18,38
60	27.75	24.42	27.38	28.42	24.68
90	34.16	33.24	32.98	36.25	33.58
120	41.18	43.00	40.88	43.47	40.97
180	56.11	51.63	46.99	51.68	58.75
240	69.21	57.12	51.32	56.86	67.29
300	76,14	62,90	57,55	61,15	73,87
360	83,44	71,23	61,53	68,20	77,90

Simpangan baku disolusi

Waktu	Simpangan baku (%)				
(menit)	F1	F2	F3	F4	F5
5	3,12	1,78	3,36	1,69	1,83
15	1,67	1,40	3,57	3,35	0,09
30	1,16	2,98	2,32	2,01	0,96
60	1,62	1,24	1,43	2,01	2,80
90	1,63	1,50	1,68	3,03	1,57
120	1,52	1,72	2,05	4,21	2,59
180	1,66	1,27	1,10	1,41	1,52
240	0,31	1,56	1,04	1,20	0,81
300	0,51	1,98	1,15	1,14	0,41
360	0,04	1,51	1,55	0,43	0,41

Keterangan :
fp = faktor pengenceran sampel
kadar sampel = kadar salbutamol sulfat dalam sampel (μg/ml)
kadar = kadar salbutamol sulfat dalam larutan disolusi (μg/ml)
jumlah = banyaknya salbutamol sulfat dalam medium disolusi (900 ml)
koreksi = jumlah salbutamol sulfat dalam cuplikan sampel (mg)
total koreksi = jumlah kumulatif koreksi (mg)
jumlah terdisolusi = jumlah obat yang terlarut (mg)
% disolusi = persentase jumlah salbutamol sulfat yang terlarut (%)

Rata-rata *Dissolution efficiency* (DE_{120}) (%)

Replikasi	DE_{120} (%)				
	F1	F2	F3	F4	F5
1	9,41	9,60	8,74	8,96	9,89
2	9,03	9,89	9,41	10,23	8,89
3	9,81	9,10	9,54	10,71	9,19
Rata-rata	9,42	9,53	9,23	9,97	9,32
SD	0,39	0,40	0.43	0,43	0,51

Rata-rata *Dissolution efficiency* (Q_{360}) (%)

Replikasi	DE_{360} (%)				
	F1	F2	F3	F4	F5
1	52,74	47,10	42,37	45,02	52,59
2	51,90	47,26	42,97	46,50	50,70
3	53,42	44,99	43,19	47,48	50,96
Rata-rata	52,71	46,45	42,84	46,33	51,42
SD	0,79	1,27	0,42	1,24	1,02

Lampiran 9. Contoh perhitungan disolusi

X	= Kadar salbutamol sulfat (μg/ml)
A	= Serapan sampel
Fp	= Faktor pengenceran
W	= Jumlah obat yang terdisolusi (mg)
Medium disolusi	= 900 ml HCl 0,1N
Volume sampling	= 10 ml
K	= Koreksi (mg)
W_{n-1}	= jumlah obat terdisolusi pada pengambilan sampling sebelumnya (mg)
TKW	= Total koreksi (mg)
TKW_{n-1}	= total koreksi pada sampling sebelumnya (mg)
Q	= jumlah obat yang terdisolusi total (mg)
%W	= persen disolusi (%)

Persamaan regresi linear kurva kalibrasi y = -0,0171 + 0,0543 x

$$\text{Kandungan obat} = \frac{\text{bobot tablet}}{\text{bobot total tablet dalam formula}} \text{x hasil penetapan kadar}$$

$$\text{Kadar (X)} = \frac{(A+0,0171)}{0.0543} \text{ x Fp}$$

Jumlah obat yang terdisolusi (mg) (W) = X x volume medium disolusi

$$\text{Koreksi (K)} = \frac{\text{Volume sampling}}{\text{volume medium disolusi}} \text{ x Wn-1}$$

Total koreksi (TKW) = TKW n-1 + K

Jumlah obat yang terdisolusi total (mg) (Q) = W+TKW

$$\text{\% dissolusi} = \%W = \frac{W \text{ tot}}{\text{kandungan salbutamol sulfat}} \text{ x 100\%}$$

Contoh perhitungan:

Diketahui:

Bobot tablet = 202 mg

Bobot tablet tiap formula = 200 mg

Penetapan kadar F3 = 11,88 mg

Volume medium = 0,9 L

Faktor pengenceran = 5

Volume sampling = 10 ml

Kadar adisi = 9,769 µg/ml

Kandungan obat = $\frac{202}{200}$ x 11,88 = 12 mg

Kadar	Kadar-adisi	Kadar ppm (X)	Jumlah (mg) (W)
$X_5 = \frac{0,528+0,0171}{0,0543} = 10,039$	10,039-9,769 = 0,270	0,270 x 5 = 1,35 mg	1,35 x 0,9 = 1,21
$X_{15} = \frac{0,535+0,0171}{0,0543} = 10,168$	10,168-9,769 = 0,399	0,399 x 5 = 1,99 mg	1,99 x 0,9 = 1,79
$X_{30} = \frac{0,540+0,0171}{0,0543} = 10,266$	10,266-9,769 = 0,497	0,497 x 5 = 2,48 mg	2,48 x 0,9 = 2,24

Koreksi (mg) (K)	Total koreksi (TKW)	Jumlah terdisolusi	% Disolusi
$K_5 = 0$	TKW = 0	$Q_5 = 1,21 + 0 = 1,21$ mg	1,21/12*100=10,08%
$K_{15} = 10/900$ x 1,21 = 0,01	$TKW_{15} = 0,03+0 = 0,03$	$Q_{15} = 1,79 + 0,03 = 1,82$	1,82/12 x100=15,16%

Lampiran 10. Analisa kinetika pelepasan tablet *mucoadhesive* salbutamol sulfat

Analisa kinetika pelepasan orde 0

regresi linier antara waktu dengan rata-rata terdisolusi (%)

Waktu (menit)	Rata-rata terdisolusi (%)				
	F1	F2	F3	F4	F5
5	8,11	7,68	6,36	4,11	3,78
15	13,16	12,74	10,95	11,27	11,54
30	19,88	18,02	17,38	17,06	18,38
60	27,75	24,42	27,38	28,42	24,68
90	34,16	33,24	32,98	36,25	33,58
120	41,18	43,00	40,88	43,47	40,97
180	56,11	51,63	46,99	51,68	58,75
240	69,21	57,12	51,32	56,86	67,29
300	76,14	62,90	57,55	61,15	73,87
360	83,44	71,23	61,53	68,20	77,90
r	0,989	0,974	0,954	0,952	0,975

Analisa kinetika orde 1

regresi linier antara waktu dengan log rata-rata terdisolusi (%)

Waktu (menit)	log % terdisolusi (%)				
	F1	F2	F3	F4	F5
5	0,91	0,89	0,80	0,61	0,58
15	1,12	1,11	1,04	1,05	1,06
30	1,30	1,26	1,24	1,23	1,26
60	1,44	1,39	1,44	1,45	1,39
90	1,53	1,52	1,52	1,56	1,53
120	1,61	1,63	1,61	1,64	1,61
180	1,75	1,71	1,67	1,71	1,77
240	1,84	1,76	1,71	1,75	1,83
300	1,88	1,80	1,76	1,79	1,87
360	1,92	1,85	1,79	1,83	1,89
r	0,907	0,887	0,844	0,810	0,844

Analisa kinetika Higuchi

regresi linier antara akar waktu dengan rata-rata terdisolusi (%)

√Waktu	Rata-rata terdisolusi (%)				
	F1	F2	F3	F4	F5
2,24	8,11	7,68	6,36	4,11	3,78
3,87	13,16	12,74	10,95	11,27	11,54
5,48	19,88	18,02	17,38	17,06	18,38
7,75	27,75	24,42	27,38	28,42	24,68
9,49	34,16	33,24	32,98	36,25	33,58
10,95	41,18	43,00	40,88	43,47	40,97
13,42	56,11	51,63	46,99	51,68	58,75
15,49	69,21	57,12	51,32	56,86	67,29
17,32	76,14	62,90	57,55	61,15	73,87
18,97	83,44	71,23	61,53	68,20	77,90
r	0,995	0,997	0,995	0,994	0,995

Mekanisme pelepasan Korsmeyyer-Peppas

Regresi linier antara log t dengan log terdisolusi (%)

Log Waktu (menit)	log terdisolusi (%)				
	F1	F2	F3	F4	F5
0,699	-1,09	-1,11	-1,20	-1,39	-1,42
1,176	-0,88	-0,89	-0,96	-0,95	-0,94
1,477	-0,70	-0,74	-0,76	-0,77	-0,74
1,778	-0,56	-0,61	-0,56	-0,55	-0,61
1,954	-0,47	-0,48	-0,48	-0,44	-0,47
2,079	-0,39	-0,37	-0,39	-0,36	-0,39
2,255	-0,25	-0,29	-0,33	-0,29	-0,23
2,380	-0,16	-0,24	-0,29	-0,25	-0,17
2,477	-0,12	-0,20	-0,24	-0,21	-0,13
2,556	-0,08	-0,15	-0,21	-0,17	-0,11
r	0,997	0,997	0,996	0,990	0,993
n	0,559	0,590	0,604	0,643	0,661

Lampiran 11. Hasil *swelling index*

Waktu	*Swelling index* (%)				
(menit)	F1	F2	F3	F4	F5
30	86,18	90,54	96,46	98,06	100,81
60	95,15	103,11	110,65	116,83	115,06
90	123,11	124,95	134,91	139,54	132,11
120	136,85	143,48	139,83	183,68	141,12
150	155,86	160,51	160,03	215,77	147,75
180	207,09	178,54	184,94	235,21	182,47
240	295,52	249,80	228,62	249,86	256,36
300	402,78	290,16	262,99	275,76	265,56
360	463,95	378,18	284,69	290,15	274,57

Keterangan

% *swelling index* = penambahan volume tablet *mucoadhesive* salbutamol sulfat

Lampiran 12 . Hasil uji statistik *swelling index*

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Swelling index	15	94.4067	5.54102	85.46	101.63

One-Sample Kolmogorov-Smirnov Test

		Swelling index
N		15
Normal Parameters[a,b]	Mean	94.4067
	Std. Deviation	5.54102
Most Extreme Differences	Absolute	.236
	Positive	.143
	Negative	-.236
Kolmogorov-Smirnov Z		.913
Asymp. Sig. (2-tailed)		.375

a. Test distribution is Normal.

b. Calculated from data.

Test of Homogeneity of Variances

Swelling index

Levene Statistic	df1	df2	Sig.
6.466	4	10	.008

ANOVA

Swelling index

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	423.434	4	105.859	165.227	.000
Within Groups	6.407	10	.641		
Total	429.841	14			

Multiple Comparisons

Swelling index

LSD

(I) Formula	(J) Formula	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Formula 1	Formula 2	-4.36333*	.65355	.000	-5.8195	-2.9071
	Formula 3	-10.28000*	.65355	.000	-11.7362	-8.8238
	Formula 4	-11.87667*	.65355	.000	-13.3329	-10.4205
	Formula 5	-14.63000*	.65355	.000	-16.0862	-13.1738
Formula 2	Formula 1	4.36333*	.65355	.000	2.9071	5.8195
	Formula 3	-5.91667*	.65355	.000	-7.3729	-4.4605
	Formula 4	-7.51333*	.65355	.000	-8.9695	-6.0571
	Formula 5	-10.26667*	.65355	.000	-11.7229	-8.8105
Formula 3	Formula 1	10.28000*	.65355	.000	8.8238	11.7362
	Formula 2	5.91667*	.65355	.000	4.4605	7.3729
	Formula 4	-1.59667*	.65355	.035	-3.0529	-.1405
	Formula 5	-4.35000*	.65355	.000	-5.8062	-2.8938
Formula 4	Formula 1	11.87667*	.65355	.000	10.4205	13.3329
	Formula 2	7.51333*	.65355	.000	6.0571	8.9695
	Formula 3	1.59667*	.65355	.035	.1405	3.0529
	Formula 5	-2.75333*	.65355	.002	-4.2095	-1.2971
Formula 5	Formula 1	14.63000*	.65355	.000	13.1738	16.0862
	Formula 2	10.26667*	.65355	.000	8.8105	11.7229
	Formula 3	4.35000*	.65355	.000	2.8938	5.8062
	Formula 4	2.75333*	.65355	.002	1.2971	4.2095

*. The mean difference is significant at the 0.05 level.

Lampiran 13 . Hasil uji kekuatan *mucoadhesive*

Replikasi	Daya lekat (menit)				
	Formula 1	Formula 2	Formula 3	Formula 4	Formula 5
I	8,12	8,17	8,49	9,00	9,30
II	8,50	8,70	8,55	9,09	9,45
III	8,40	8,59	8,33	8,56	9,12
Rata-rata	8,34	8,49	8,46	8,88	9,29
SD	0,20	0,28	0,11	0,28	0,17

Lampiran 14. Hasil uji statistik kekuatan *mucoadhesive*

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Kekuatan mucoadhesive	15	8.6827	.40847	8.12	9.45

One-Sample Kolmogorov-Smirnov Test

		Kekuatan mucoadhesive
N		15
Normal Parameters[a,b]	Mean	8.6827
	Std. Deviation	.40847
Most Extreme Differences	Absolute	.256
	Positive	.256
	Negative	-.115
Kolmogorov-Smirnov Z		.993
Asymp. Sig. (2-tailed)		.278

a. Test distribution is Normal.

b. Calculated from data.

Test of Homogeneity of Variances

Kekuatan mucoadhesive

Levene Statistic	df1	df2	Sig.
1.215	4	10	.364

ANOVA

Kekuatan mucoadhesive

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.905	4	.476	11.043	.001
Within Groups	.431	10	.043		
Total	2.336	14			

Multiple Comparisons

Kekuatan mucoadhesive

LSD

(I) Formula	(J) Formula	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Formula 1	Formula 2	-.11667	.16955	.507	-.4944	.2611
	Formula 3	-.10333	.16955	.556	-.4811	.2744
	Formula 4	-.54333*	.16955	.009	-.9211	-.1656
	Formula 5	-.95000*	.16955	.000	-1.3278	-.5722
Formula 2	Formula 1	.11667	.16955	.507	-.2611	.4944
	Formula 3	.01333	.16955	.939	-.3644	.3911
	Formula 4	-.42667*	.16955	.031	-.8044	-.0489
	Formula 5	-.83333*	.16955	.001	-1.2111	-.4556
Formula 3	Formula 1	.10333	.16955	.556	-.2744	.4811
	Formula 2	-.01333	.16955	.939	-.3911	.3644
	Formula 4	-.44000*	.16955	.027	-.8178	-.0622
	Formula 5	-.84667*	.16955	.001	-1.2244	-.4689
Formula 4	Formula 1	.54333*	.16955	.009	.1656	.9211
	Formula 2	.42667*	.16955	.031	.0489	.8044
	Formula 3	.44000*	.16955	.027	.0622	.8178
	Formula 5	-.40667*	.16955	.037	-.7844	-.0289
Formula 5	Formula 1	.95000*	.16955	.000	.5722	1.3278
	Formula 2	.83333*	.16955	.001	.4556	1.2111
	Formula 3	.84667*	.16955	.001	.4689	1.2244
	Formula 4	.40667*	.16955	.037	.0289	.7844

*. The mean difference is significant at the 0.05 level.

Lampiran 15. Sertifikat analisis salbutamol sulfat

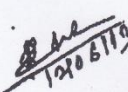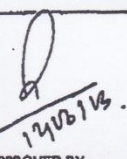# SUPRIYA LIFESCIENCE LTD.
(Formerly known as Supriya Chemicals)
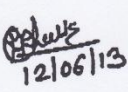
CERTIFICATE OF ANALYSIS

Name	:	Salbutamol Sulphate BP			
Batch No.	:	SLL/SS/0613030	A.R.Number	:	SLL/QC/FP/13/0401
Batch Size	:	775.00 kgs	Dispatch Quantity	:	02 x 25 kg = 50 kg
Manufacturing Date	:	April-2013	Expiry Date	:	Mar-2018

Tests	Specification & Limits	Results
Description	White or almost white crystalline powder	White crystalline powder
Solubility	Freely soluble in water,very slightly soluble in ethanol(96%) and in methylene chloride	Freely soluble in water,very slightly soluble in ethanol(96%) and in methylene chloride
Identification		
A) UV Absorption	Specific absorbance at 276 nm, should be range within 55 to 61	Absorbance is 59
B) Infrared Absorption	The infra red absorption spectrum should be concordant with the reference spectrum of salbutamol sulphate .	The infra red absorption spectrum is concordant with the reference spectrum of salbutamol sulphate
C) TLC	The principal spot in the chromatogram obtained with the test solution should be similar in position, colour and size to the principal spot in the chromatogram obtained with the reference solution	The principal spot in the chromatogram obtained with the test solution is similar in position, colour and size to the principal spot in the chromatogram obtained with the reference solution
D) Colour Test	Orange-red colour develops	Orange-red colour develops
E) Sulfate Test	It give reaction of sulfate	It give reaction of sulfate
Appearance of solution	Solution should be clear and not more coloured than BY6	Solution is clear and not more coloured than BY6
Optical rotation	-0.10° to +0.10°	-0.0003°
Acidity or alkalinity	Not more than 0.4ml of 0.01 M HCl required	0.20ml of 0.01 M HCl is required
Related substances		
Impurity D	Not more than 0.3%	Not detected
Impurity F	Not more than 0.3%	Not detected
Impurity C	Not more than 0.2%	Not detected
Impurity N	Not more than 0.2%	Not detected
Impurity O	Not more than 0.2%	Not detected
Unspecified impurity	Not more than . 0.10%	0.07%
Total Impurities	Not more than 0.9 %	0.07%
Boron	Not more than 50ppm	31 ppm
Loss on drying	Not more than 0.5%	0.22%
Sulphate Ash	Not more than 0.1%	0.05%
Assay (on dried basis)	98.0% to 101.0%	99.78%
Residual Solvents		
Methanol	Not more than 3000 ppm	999 ppm
Acetone	Not more than 5000 ppm	Not detected
Methylene Dichloride	Not more than 600 ppm	Not detected
Ethyl Acetate	Not more than 5000 ppm	Not detected

Date of Release : 12/06/2013

REMARKS: Salbutamol sulphate complies /~does not comply~ with respect to above mentioned test as per BP 2013 Specification

12/06/13

PREPARED BY

12/06/13

REVIEWED BY

12/06/13

APPROVED BY

Customer Name: Shinkeo Drug Co. Ltd.

Ref.SOP.No.SOP/SLL/QC/065

SQC/F/108-03

GOVT. RECOGNISED EXPORT HOUSE

Lampiran 16. Perhitungan dosis salbutamol sulfat

Perhitungan dosis salbutamol tiap tablet adalah sebagai berikut :

Parameter farmakokimia salbutamol adalah sebagai berikut :

- Waktu paruh ($t\frac{1}{2}$)   : 4 jam
- Konstanta kecepatan eliminasi (Kel)   : 0,17325/jam
- Dosis lazim salbutamol sulfat sebesar   : 6 - 16 mg
- Bioavailabilitas   : 50 %
- Cp   : 0,0179 mg/L

                                                    (Moffat 2011)

Volume distribusi salbutamol sulfat : 156 L

maka : *Rate in* (keceparan pelepasan obat dari sediaan) = *Rate out* (kecepatan hilangnya obat dari badan),

Rate in = Kr = Cp x Vd xKel

$$= 0,0179 \text{ mg/L x } 156 \text{ L x } 0,17325/\text{jam}$$

$$= 0,484 \text{ mg/jam}$$

Jumlah salbutamol yang harus dilepaskan dari sediaan (R) dalam waktu 12 jam

adalah : $\mathbf{R = \dfrac{Kr}{f} x\ 12\ jam}$

$$= \frac{0,484 \ mg/jam}{0,5} \text{ x 12 jam}$$

$$= 11,616 \text{ mg} \sim 12 \text{ mg}$$