

## **BAB V**

### **KESIMPULAN DAN SARAN**

#### **A. Kesimpulan**

1. Kombinasi matriks karbopol 940P dan HPMC K15M dapat digunakan untuk mengendalikan pelepasan obat. Interaksi antara matriks karbopol 940P dan HPMC K15M meningkatkan waktu alir dan kekerasan, serta menurunkan nilai kerapuhan dan pelepasan obat.
2. Formula optimum tablet *sustained release* kaptopril diperoleh pada proporsi kombinasi matriks 30,25 mg karbopol 940P dan 39,75 mg HPMC K15M. Profil formula optimum dianalisis dengan menggunakan kinetika orde nol, orde satu, dan model Higuchi, dengan nilai koefisien korelasi masing – masing yaitu sebesar 0,9566, 0,8821, dan 0,9929. Dari analisis tersebut dapat disimpulkan bahwa pelepasan obat pada formula optimum mengikuti kinetika orde nol dan profil pelepasan mengikuti mekanisme difusi.

#### **B. Saran**

1. Perlu dilakukan pengembangan pembuatan tablet *sustained release* kaptopril dengan menggunakan matriks lain dengan rentang perbedaan matriks antar formula yang signifikan.
2. Perlu dilakukan penelitian pembuatan tablet *sustained release* kaptopril dengan menggunakan metode yang lain.

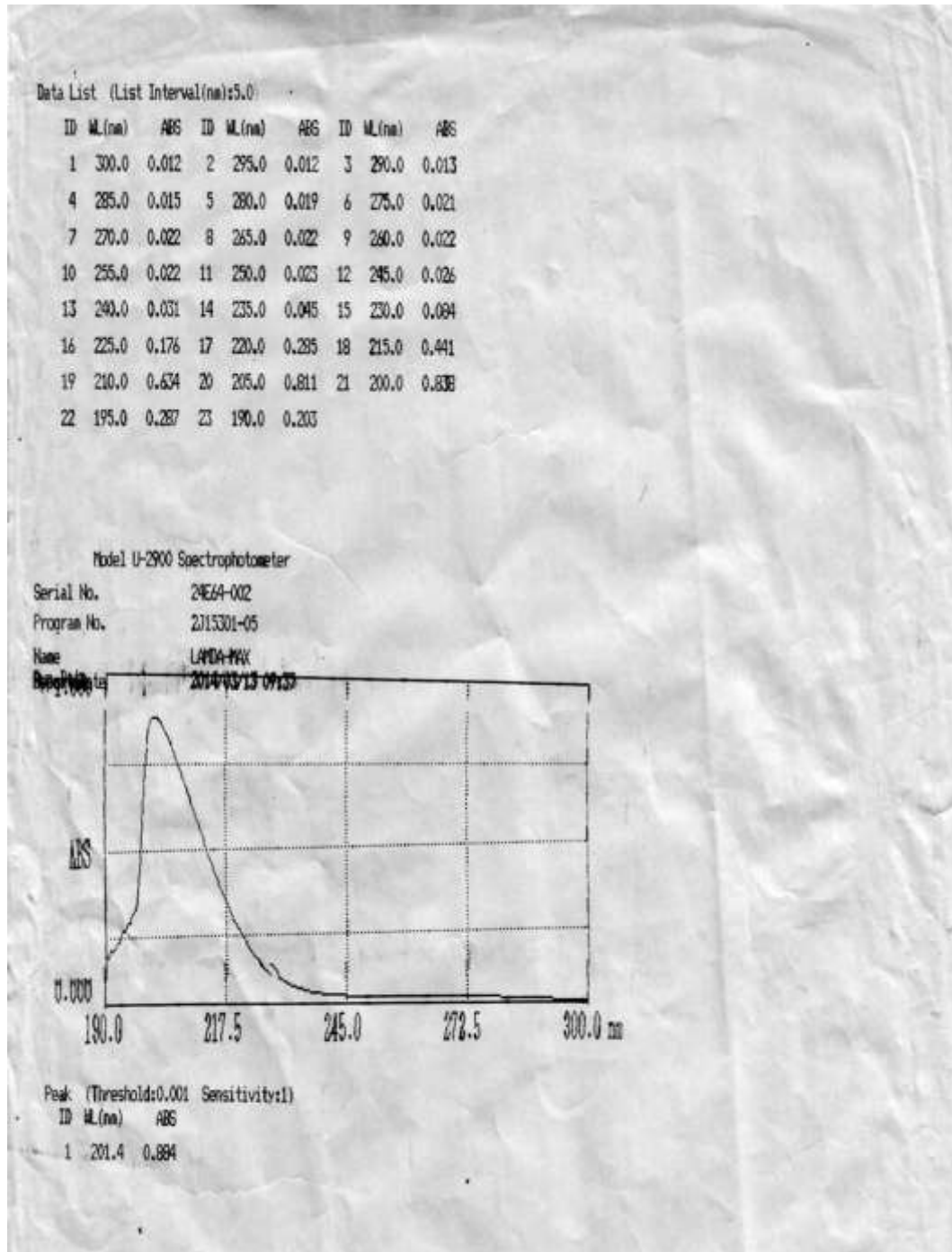
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## Lampiran 2. Panjang gelombang maksimum



Lampiran 3. Operating time

13	700.0	0.787	14	750.0	0.794	15	800.0	0.782
16	850.0	0.779	17	900.0	0.777	18	950.0	0.775
19	1000.0	0.775	20	1050.0	0.772	21	1100.0	0.770
22	1150.0	0.769	23	1200.0	0.767	24	1250.0	0.766
25	1300.0	0.765	26	1350.0	0.763	27	1400.0	0.762
28	1450.0	0.761	29	1500.0	0.760	30	1550.0	0.759
31	1600.0	0.758						

ID	TDE(s)	ABS	ID	TDE(s)	ABS	ID	TDE(s)	ABS
1	0.0	0.983	2	60.0	0.999	3	120.0	0.992
4	180.0	0.995	5	240.0	0.998	6	300.0	0.993
7	360.0	0.999	8	420.0	0.994	9	480.0	0.989
10	540.0	0.796	11	600.0	0.793	12	660.0	0.790
13	720.0	0.787	14	780.0	0.784	15	840.0	0.782
16	900.0	0.779	17	960.0	0.777	18	1020.0	0.775
19	1080.0	0.775	20	1140.0	0.772	21	1200.0	0.770
22	1260.0	0.769	23	1320.0	0.767	24	1380.0	0.766
25	1440.0	0.765	26	1500.0	0.763	27	1560.0	0.762
28	1620.0	0.761	29	1680.0	0.760	30	1740.0	0.759
31	1800.0	0.758						

Model: U-1950 Spectrophotometer

Serial No.: 2424-002

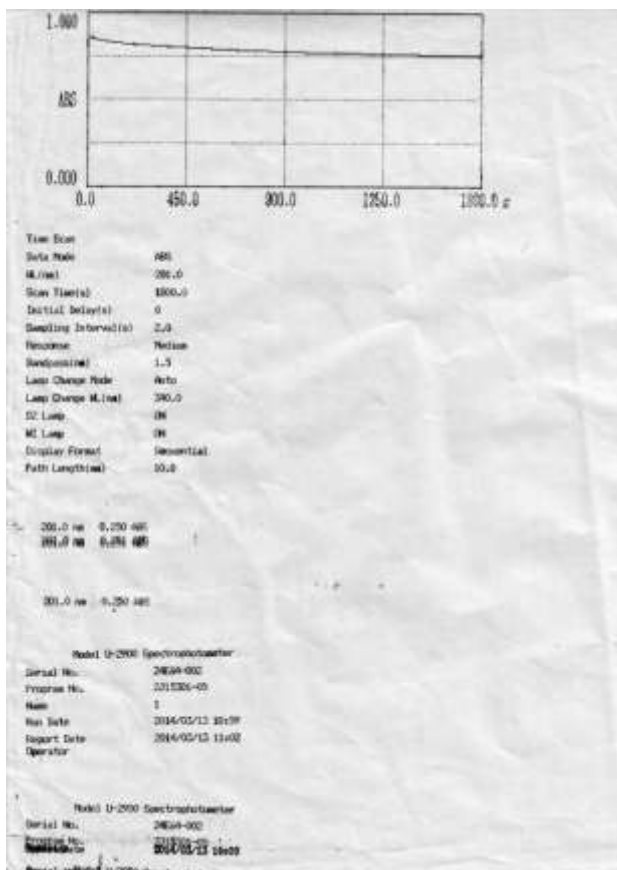
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Report Date: 2014/05/13 16:29

Operator:



**Lampiran 4. Waktu alir dan sudut diam**

formula	replikasi	waktu alir (detik/100 gram)	rata – rata (detik/100 gram)	SD
	1	9,88		
1	2	10,2	10,17	0,28
	3	10,44		
	1	8,68		
2	2	8,76	9,01	0,51
	3	9,6		
	1	7,88		
3	2	8,92	8,66	0,68
	3	9,17		
	1	7,44		
4	2	7,48	7,48	0,04
	3	7,52		
	1	7,24		
5	2	7,32	7,32	0,08
	3	7,4		

formula	Replikasi	Diameter (cm)	jari – jari (cm)	Tinggi (cm)	sudut diam (°)	rata – rata (°)	SD
	1	8,865	4,4325	2,235	26,75862		
1	2	8,45	4,225	2,26	28,14283	27,71089	0,825876
	3	8,605	4,3025	2,31	28,23122		
	1	8,82	4,41	2,23	26,82431		
2	2	8,655	4,3275	2,21	27,05283	27,27392	0,591973
	3	8,615	4,3075	2,285	27,94461		
	1	9,15	4,575	2,185	25,52894		
3	2	8,955	4,4775	2,225	26,42412	27,08644	1,97384
	3	8,195	4,0975	2,3	29,30628		
	1	9,25	4,625	2,245	25,89219		
4	2	9,015	4,5075	2,27	26,73006	26,60426	0,658248
	3	9,11	4,555	2,34	27,19053		
	1	8,8	4,4	2,05	24,98124		
5	2	8,675	4,3375	2,05	25,29647	25,80913	1,171602
	3	8,97	4,485	2,3	27,14968		

Perhitungan sudut diam:

$$\tan \alpha = \frac{\text{tinggi kerucut granul}}{\text{jari-jari permukaan dasar kerucut}}$$

$$\tan \alpha = \frac{2,185 \text{ cm}}{4,575 \text{ cm}}$$

$$= 0,4776$$

$\alpha$  (sudut diam) = anti tangen 0,4776

$$= 25,52894^\circ$$

$$\text{Rata - rata sudut diam} = \frac{\Sigma x}{3}$$

$$= \frac{81,25934}{3}$$

$$= 27,08644^\circ$$



**Lampiran 5. Keseragaman bobot**

Keseragaman bobot	formula 1 (mg)	formula 2 (mg)	formula 3 (mg)	formula 4 (mg)	formula 5 (mg)
	298	299	299	300	300
	302	303	300	299	303
	302	299	299	301	303
	299	298	299	299	303
	303	301	301	303	299
	300	300	298	303	303
	302	299	303	301	302
	302	302	300	300	303
	301	299	299	300	300
	302	302	302	298	302
	303	300	302	300	303
	302	299	299	303	301
	302	302	299	301	301
	298	299	300	304	301
	299	302	301	298	302
	301	300	300	302	301
	300	298	300	299	302
	298	299	299	302	303
	298	301	303	302	298
	300	299	298	302	303
rata – rata (mg)	300,6	300,05	300,05	300,85	301,65
SD	1,76	1,50	1,50	1,76	1,50
CV (%)	0,59	0,50	0,50	0,58	0,50

**Penyimpangan bobot rata – rata tablet**

penyimpangan	formula 1	formula 2	formula 3	formula 4	formula 5
Range 5% (mg)	15,03	15,00	15,00	15,04	15,08
Range 5% BB (mg)	285,57	285,05	285,05	285,81	286,57
Range 5 % BA (mg)	315,63	315,05	315,05	315,89	316,73
Range 10% (mg)	30,06	30,01	30,01	30,09	30,17
Range 10% BB (mg)	270,54	270,05	270,05	270,77	271,49
Range 10 % BA (mg)	330,66	330,06	330,06	330,94	331,82

Perhitungan keseragaman bobot tablet:

$$\begin{aligned} \text{Rata - rata} &= \frac{\Sigma x}{20} \\ &= \frac{6,012 \text{ mg}}{20} \\ &= 300,6 \text{ mg} \end{aligned}$$

$$\begin{aligned} \text{CV} &= \frac{SD}{\text{rata-rata}} \times 100 \% \\ &= \frac{1,76}{300,6 \text{ mg}} \times 100 \% \\ &= 0,59 \% \end{aligned}$$

$$\begin{aligned} \text{Penyimpangan bobot 5 \%} &= \frac{5}{100} \times \text{bobot rata - rata tablet} \\ &= \frac{5}{100} \times 300,6 \text{ mg} \\ &= 15,03 \text{ mg} \end{aligned}$$

Batas bawah penyimpangan bobot 5 % :

$$\begin{aligned} &= \text{bobot rata - rata tablet} - \text{penyimpangan bobot 5 \%} \\ &= 300,6 \text{ mg} - 15,03 \text{ mg} = 285,57 \text{ mg} \end{aligned}$$

Batas atas penyimpangan bobot 5 % :

$$\begin{aligned} &= \text{bobot rata - rata tablet} + \text{penyimpangan bobot 5 \%} \\ &= 300,6 \text{ mg} + 15,03 \text{ mg} = 315,63 \text{ mg} \end{aligned}$$

$$\begin{aligned} \text{Penyimpangan bobot 10 \%} &= \frac{10}{100} \times \text{bobot rata - rata tablet} \\ &= \frac{5}{100} \times 300,6 \text{ mg} \\ &= 30,06 \text{ mg} \end{aligned}$$

Batas bawah penyimpangan bobot 10 % :

$$\begin{aligned} &= \text{bobot rata - rata tablet} - \text{penyimpangan bobot 10 \%} \\ &= 300,6 \text{ mg} - 30,06 \text{ mg} = 270,54 \text{ mg} \end{aligned}$$

Batas atas penyimpangan bobot 10 % :

= bobot rata – rata tablet + penyimpangan bobot 5 %

= 300,6 mg + 30,06 mg = 330,66 mg

### Lampiran 6. Kekerasan tablet

formula	replikasi	kekerasan (kg)	rata - rata (kg)	SD
1	1	15	15,03	0,15
	2	15,2		
	3	14,9		
2	1	14,2	14,23	0,25
	2	14,5		
	3	14		
3	1	13,6	13,63	0,15
	2	13,5		
	3	13,8		
4	1	12,8	12,87	0,12
	2	13		
	3	12,8		
5	1	13,5	13,57	0,12
	2	13,5		
	3	13,7		

Perhitungan kekerasan tablet

$$\begin{aligned}
 \text{Rata - rata} &= \frac{\Sigma x}{3} \\
 &= \frac{45,1 \text{ kg}}{20} \\
 &= 15,03 \text{ kg}
 \end{aligned}$$

## Lampiran 7. Kerapuhan tablet

formula	replikasi	bobot awal (mg)	bobot akhir (mg)	kerapuhan (%)	rata - rata (%)
1	1	6,012	5,999	0,22	0,21
	2	5,998	5,986	0,20	
	3	6,014	6,002	0,20	
2	1	5,944	5,936	0,13	0,11
	2	5,936	5,93	0,10	
	3	5,942	5,937	0,08	
3	1	6,048	6,042	0,10	0,10
	2	6,049	6,042	0,12	
	3	6,046	6,04	0,10	
4	1	6,033	6,027	0,10	0,09
	2	6,028	6,022	0,10	
	3	6,035	6,03	0,08	
5	1	5,995	5,993	0,03	0,04
	2	5,965	5,962	0,05	
	3	5,976	5,973	0,05	

Perhitungan kerapuhan:

$$\text{Kerapuhan} = \frac{(\text{bobot awal} - \text{bobot akhir})}{\text{bobot awal}} \times 100 \%$$

$$= \frac{(5,995 - 5,993)}{5,993} \times 100 \%$$

$$= 0,03 \%$$

$$\text{Rata - rata} = \frac{\sum x}{3}$$

$$= \frac{0,13}{3}$$

$$= 0,04 \%$$

## Lampiran 8. Keseragaman kandungan

	formula 1		formula 2		formula 3		formula 4		formula 5	
	Abs	% kadar	abs	% kadar	abs	% kadar	abs	% kadar	abs	% kadar
	0,423	90,16	0,409	86,32	0,449	97,31	0,449	97,31	0,467	102,25
	0,445	96,21	0,447	96,76	0,443	95,66	0,421	89,62	0,426	90,99
	0,442	95,38	0,433	92,91	0,411	86,87	0,412	87,14	0,427	91,26
	0,422	89,89	0,451	97,86	0,425	90,71	0,452	98,13	0,439	94,56
	0,464	101,43	0,423	90,16	0,445	96,21	0,421	89,62	0,427	91,26
	0,437	94,01	0,409	86,32	0,419	89,07	0,413	87,42	0,448	97,03
	0,416	88,24	0,425	90,71	0,435	93,46	0,442	95,38	0,448	97,03
	0,419	89,07	0,435	93,46	0,459	100,05	0,412	87,14	0,436	93,74
	0,414	87,69	0,414	87,69	0,42	89,34	0,445	96,21	0,442	95,38
	0,418	88,79	0,438	94,29	0,426	90,99	0,424	90,44	0,415	87,97
rata - rata (%)		92,09		91,65		92,97		91,84		94,15
SD		4,49		4,11		4,24		4,43		4,07
CV (%)		4,88		4,48		4,56		4,82		4,32

$$A = 0,0948$$

$$B = 0,0364$$

Perhitungan persen kadar keseragaman kandungan:

$$0,423 = 0,0948 + 0,0364 \times x$$

$$x = \frac{0,423 - 0,0948}{0,0364}$$

$$= 9,0165 \text{ ppm}$$

$$\text{Kadar} = \frac{\text{konsentrasi (ppm)}}{1000} \times \text{faktor pembuatan} \times \text{faktor pengenceran}$$

$$= \frac{9,0165}{1000} \times 100 \times 50$$

$$= 45,08 \text{ mg}$$

$$\% \text{ kadar} = \frac{\text{kadar (mg)}}{\text{kadar zat aktif dalam tablet}} \times 100 \%$$

$$= \frac{45,08}{50} \times 100 \%$$

$$= 90,16 \%$$

$$\begin{aligned}\text{Rata - rata} &= \frac{\Sigma x}{10} \\ &= \frac{920,87}{10} \\ &= 92,09 \%\end{aligned}$$

$$\begin{aligned}\text{CV} &= \frac{SD}{\text{rata-rata}} \times 100 \% \\ &= \frac{4,49}{92,09} \times 100 \% \\ &= 4,88 \%\end{aligned}$$

**Lampiran 9. Kadar kaptopril terdisolusi**

Formula 1

Replikasi 1

Waktu (menit)	absorbansi	fp	kadar sampel	kadar (ppm)	jumlah (mg)	koreksi	total koreksi	Q	% disolusi
0	0	0	0	0	0	0	0	0	<b>0</b>
5	0,267	1	4,731	4,731	4,258	0,00	0,00	4,26	<b>8,52</b>
10	0,326	1	6,352	6,352	5,716	0,05	0,05	5,76	<b>11,53</b>
15	0,434	1	9,319	9,319	8,387	0,06	0,11	8,50	<b>17,00</b>
30	0,612	1	14,209	14,209	12,788	0,07	0,18	12,93	<b>25,86</b>
60	0,769	1	18,522	18,522	16,670	0,14	0,32	16,95	<b>33,90</b>
120	0,632	2	14,758	29,516	26,565	0,19	0,51	27,03	<b>54,06</b>
180	0,679	2	16,049	32,099	28,889	0,30	0,81	29,65	<b>59,30</b>
240	0,723	2	17,258	34,516	31,065	0,32	1,13	32,15	<b>64,30</b>
300	0,765	2	18,412	36,824	33,142	0,35	1,48	34,57	<b>69,14</b>
360	0,792	2	19,154	38,308	34,477	0,37	1,85	36,27	<b>72,55</b>

Replikasi 2

Waktu (menit)	absorbansi	fp	kadar sampel	kadar (ppm)	jumlah (mg)	koreksi	total koreksi	Q	% disolusi
0	0	0	0	0	0	0	0	0	<b>0</b>
5	0,306	1	5,802	5,802	5,222	0,00	0,00	1,96	<b>10,44</b>
10	0,374	1	7,670	7,670	6,903	0,06	0,06	4,01	<b>13,92</b>
15	0,452	1	9,813	9,813	8,832	0,08	0,13	6,05	<b>17,93</b>
30	0,512	1	11,462	11,462	10,315	0,07	0,20	10,45	<b>20,90</b>
60	0,773	1	18,632	18,632	16,769	0,11	0,31	17,02	<b>34,03</b>
120	0,625	2	14,566	29,132	26,219	0,19	0,40	26,65	<b>53,30</b>
180	0,676	2	15,967	31,934	28,741	0,29	0,69	29,47	<b>58,93</b>
240	0,719	2	17,148	34,297	30,867	0,32	1,01	31,91	<b>63,82</b>
300	0,762	2	18,330	36,659	32,993	0,34	1,35	34,38	<b>68,76</b>
360	0,786	2	18,989	37,978	34,180	0,37	1,72	35,93	<b>71,87</b>



## Replikasi 3

Waktu (menit)	absorbansi	fp	kadar sampel	kadar (ppm)	jumlah (mg)	koreksi	total koreksi	Q	% disolusi
0	0	0	0	0	0	0	0	0	<b>0</b>
5	0,279	1	5,060	5,060	4,554	0,00	0,00	2,08	<b>9,11</b>
10	0,37	1	7,560	7,560	6,804	0,05	0,05	3,96	<b>13,71</b>
15	0,451	1	9,786	9,786	8,807	0,08	0,13	5,88	<b>17,87</b>
30	0,611	1	14,181	14,181	12,763	0,06	0,19	12,89	<b>25,79</b>
60	0,771	1	18,577	18,577	16,719	0,14	0,33	16,99	<b>33,99</b>
120	0,601	2	13,907	27,813	25,032	0,19	0,52	25,49	<b>50,98</b>
180	0,653	2	15,335	30,670	27,603	0,28	0,80	28,34	<b>56,68</b>
240	0,686	2	16,242	32,484	29,235	0,31	1,11	30,28	<b>60,56</b>
300	0,728	2	17,396	34,791	31,312	0,32	1,43	32,68	<b>65,36</b>
360	0,756	2	18,165	36,330	32,697	0,35	1,78	34,41	<b>68,83</b>

## Formula 2

## Replikasi 1

Waktu (menit)	absorbansi	fp	kadar sampel	kadar (ppm)	jumlah (mg)	koreksi	total koreksi	Q	% disolusi
0	0	0	0	0	0	0	0	0	<b>0</b>
5	0,223	1	3,522	3,522	3,170	0,00	0,00	3,17	<b>6,34</b>
10	0,305	1	5,775	5,775	5,197	0,04	0,04	5,23	<b>10,46</b>
15	0,372	1	7,615	7,615	6,854	0,06	0,10	6,95	<b>13,89</b>
30	0,592	1	13,659	13,659	12,293	0,09	0,19	12,50	<b>24,99</b>
60	0,775	1	18,687	18,687	16,818	0,14	0,33	17,16	<b>34,32</b>
120	0,515	2	11,544	23,088	20,779	0,19	0,52	21,31	<b>42,61</b>
180	0,612	2	14,209	28,418	25,576	0,23	0,75	26,33	<b>52,67</b>
240	0,671	2	15,830	31,659	28,493	0,28	1,03	29,54	<b>59,07</b>
300	0,761	2	18,302	36,604	32,944	0,32	1,35	34,30	<b>68,61</b>
360	0,768	2	18,495	36,989	33,290	0,37	1,72	35,02	<b>70,03</b>

## Replikasi 2

Waktu (menit)	absorbansi	fp	kadar sampel	kadar (ppm)	jumlah (mg)	koreksi	total koreksi	Q	% disolusi
0	0	0	0	0	0	0	0	0	<b>0</b>
5	0,313	1	5,995	5,995	5,395	0,00	0,00	5,22	<b>10,79</b>
10	0,351	1	7,038	7,038	6,335	0,06	0,06	6,96	<b>12,79</b>
15	0,437	1	9,401	9,401	8,461	0,07	0,13	8,97	<b>17,18</b>
30	0,611	1	14,181	14,181	12,763	0,10	0,23	13,00	<b>25,99</b>
60	0,782	1	18,879	18,879	16,991	0,14	0,37	17,37	<b>34,73</b>
120	0,494	2	10,967	21,934	19,741	0,19	0,56	20,30	<b>40,61</b>
180	0,565	2	12,918	25,835	23,252	0,22	0,78	24,03	<b>48,07</b>
240	0,667	2	15,720	31,440	28,296	0,26	1,04	29,34	<b>58,67</b>
300	0,741	2	17,753	35,505	31,955	0,31	1,36	33,31	<b>66,62</b>
360	0,758	2	18,220	36,440	32,796	0,36	1,71	34,51	<b>69,01</b>

## Replikasi 3

Waktu (menit)	absorbansi	fp	kadar sampel	kadar (ppm)	jumlah (mg)	koreksi	total koreksi	Q	% disolusi
0	0	0	0	0	0	0	0	0	<b>0</b>
5	0,294	1	5,473	5,473	4,925	0,00	0,00	4,55	<b>9,85</b>
10	0,361	1	7,313	7,313	6,582	0,05	0,05	6,86	<b>13,27</b>
15	0,433	1	9,291	9,291	8,362	0,07	0,12	8,93	<b>16,98</b>
30	0,572	1	13,110	13,110	11,799	0,10	0,22	12,02	<b>24,05</b>
60	0,744	1	17,835	17,835	16,052	0,13	0,36	16,41	<b>32,81</b>
120	0,498	2	11,077	22,154	19,938	0,18	0,53	20,47	<b>40,94</b>
180	0,613	2	14,236	28,473	25,625	0,22	0,76	26,38	<b>52,76</b>
240	0,709	2	16,874	33,747	30,373	0,28	1,04	31,41	<b>62,82</b>
300	0,731	2	17,478	34,956	31,460	0,34	1,38	32,84	<b>65,68</b>
360	0,765	2	18,412	36,824	33,142	0,35	1,73	34,87	<b>69,74</b>

## Formula 3

## Replikasi 1

Waktu (menit)	absorbansi	fp	kadar sampel	kadar (ppm)	jumlah (mg)	koreksi	total koreksi	Q	% disolusi
0	0	0	0	0	0	0	0	0	<b>0</b>
5	0,22	1	3,440	3,440	3,096	0,00	0,00	3,17	<b>6,19</b>
10	0,29	1	5,363	5,363	4,826	0,03	0,03	5,23	<b>9,72</b>
15	0,348	1	6,956	6,956	6,260	0,05	0,08	6,95	<b>12,70</b>
30	0,503	1	11,214	11,214	10,093	0,08	0,16	10,26	<b>20,52</b>
60	0,688	1	16,297	16,297	14,667	0,11	0,27	14,95	<b>29,90</b>
120	0,486	2	10,747	21,495	19,345	0,16	0,43	19,79	<b>39,58</b>
180	0,536	2	12,121	24,242	21,818	0,21	0,65	22,48	<b>44,95</b>
240	0,61	2	14,154	28,308	25,477	0,24	0,89	26,38	<b>52,76</b>
300	0,657	2	15,445	30,890	27,801	0,28	1,17	28,99	<b>57,97</b>
360	0,664	2	15,637	31,275	28,147	0,31	1,48	29,64	<b>59,28</b>

## Replikasi 2

Waktu (menit)	absorbansi	fp	kadar sampel	kadar (ppm)	jumlah (mg)	koreksi	total koreksi	Q	% disolusi
0	0	0	0	0	0	0	0	0	<b>0</b>
5	0,239	1	3,962	3,962	3,565	0,00	0,00	5,40	<b>7,13</b>
10	0,297	1	5,555	5,555	4,999	0,04	0,04	6,39	<b>10,20</b>
15	0,375	1	7,698	7,698	6,928	0,06	0,10	8,59	<b>14,22</b>
30	0,551	1	12,533	12,533	11,280	0,09	0,19	11,50	<b>23,01</b>
60	0,672	1	15,857	15,857	14,271	0,13	0,32	14,62	<b>29,24</b>
120	0,483	2	10,665	21,330	19,197	0,16	0,48	19,70	<b>39,41</b>
180	0,571	2	13,082	26,165	23,548	0,21	0,69	24,27	<b>48,54</b>
240	0,614	2	14,264	28,527	25,675	0,26	0,95	26,66	<b>53,32</b>
300	0,639	2	14,951	29,901	26,911	0,29	1,24	28,18	<b>56,36</b>
360	0,658	2	15,473	30,945	27,851	0,30	1,54	29,42	<b>58,84</b>

## Replikasi 3

Waktu (menit)	absorbansi	fp	kadar sampel	kadar (ppm)	jumlah (mg)	koreksi	total koreksi	Q	% disolusi
0	0	0	0	0	0	0	0	0	<b>0</b>
5	0,259	1	4,511	4,511	4,060	0,00	0,00	4,06	<b>8,12</b>
10	0,267	1	4,731	4,731	4,258	0,05	0,05	4,30	<b>8,61</b>
15	0,327	1	6,379	6,379	5,741	0,05	0,11	5,83	<b>11,67</b>
30	0,524	1	11,791	11,791	10,612	0,09	0,20	10,83	<b>21,67</b>
60	0,663	1	15,610	15,610	14,049	0,12	0,32	14,39	<b>28,78</b>
120	0,517	2	11,599	23,198	20,878	0,16	0,48	21,37	<b>42,75</b>
180	0,575	2	13,192	26,385	23,746	0,23	0,71	24,47	<b>48,95</b>
240	0,618	2	14,374	28,747	25,873	0,26	0,97	26,86	<b>53,73</b>
300	0,632	2	14,758	29,516	26,565	0,29	1,26	27,84	<b>55,69</b>
360	0,658	2	15,473	30,945	27,851	0,30	1,56	29,42	<b>58,85</b>

## Formula 4

## Replikasi 1

waktu (menit)	absorbansi	fp	kadar sampel	kadar (ppm)	jumlah (mg)	koreksi	total koreksi	Q	% disolusi
0	0	0	0	0	0	0	0	0	<b>0</b>
5	0,211	1	3,192	3,192	2,873	0,00	0,00	2,87	<b>5,75</b>
10	0,285	1	5,225	5,225	4,703	0,03	0,03	4,73	<b>9,47</b>
15	0,316	1	6,077	6,077	5,469	0,05	0,08	5,55	<b>11,11</b>
30	0,508	1	11,352	11,352	10,216	0,06	0,14	10,36	<b>20,72</b>
60	0,676	1	15,967	15,967	14,370	0,11	0,26	14,63	<b>29,26</b>
120	0,465	2	10,170	20,341	18,307	0,16	0,42	18,72	<b>37,45</b>
180	0,615	2	14,291	28,582	25,724	0,20	0,62	26,35	<b>52,69</b>
240	0,709	2	16,874	33,747	30,373	0,29	0,91	31,28	<b>62,56</b>
300	0,736	2	17,615	35,231	31,708	0,34	1,24	32,95	<b>65,91</b>
360	0,752	2	18,055	36,110	32,499	0,35	1,60	34,10	<b>68,19</b>

## Replikasi 2

waktu (menit)	absorbansi	fp	kadar sampel	kadar (ppm)	jumlah (mg)	koreksi	total koreksi	Q	% disolusi
0	0	0	0	0	0	0	0	0	<b>0</b>
5	0,192	1	2,670	2,670	2,403	0,00	0,00	2,40	<b>4,81</b>
10	0,263	1	4,621	4,621	4,159	0,03	0,03	4,19	<b>8,37</b>
15	0,331	1	6,489	6,489	5,840	0,05	0,07	5,91	<b>11,83</b>
30	0,504	1	11,242	11,242	10,118	0,06	0,14	10,26	<b>20,51</b>
60	0,731	1	17,478	17,478	15,730	0,11	0,25	15,98	<b>31,96</b>
120	0,475	2	10,445	20,890	18,801	0,17	0,43	19,23	<b>38,45</b>
180	0,545	2	12,368	24,736	22,263	0,21	0,63	22,90	<b>45,79</b>
240	0,618	2	14,374	28,747	25,873	0,25	0,88	26,75	<b>53,51</b>
300	0,696	2	16,516	33,033	29,730	0,29	1,17	30,90	<b>61,80</b>
360	0,773	2	18,632	37,264	33,537	0,33	1,50	35,04	<b>70,07</b>

## Replikasi 3

waktu (menit)	absorbansi	fp	kadar sampel	kadar (ppm)	jumlah (mg)	koreksi	total koreksi	Q	% disolusi
0	0	0	0	0	0	0	0	0	<b>0</b>
5	0,176	1	2,231	2,231	2,008	0,00	0,00	2,01	<b>4,02</b>
10	0,251	1	4,291	4,291	3,862	0,02	0,02	3,88	<b>7,77</b>
15	0,307	1	5,830	5,830	5,247	0,04	0,07	5,31	<b>10,62</b>
30	0,503	1	11,214	11,214	10,093	0,06	0,12	10,22	<b>20,43</b>
60	0,723	1	17,258	17,258	15,532	0,11	0,24	15,77	<b>31,54</b>
120	0,485	2	10,720	21,440	19,296	0,17	0,41	19,70	<b>39,41</b>
180	0,56	2	12,780	25,560	23,004	0,21	0,62	23,63	<b>47,25</b>
240	0,648	2	15,198	30,396	27,356	0,26	0,88	28,23	<b>56,47</b>
300	0,72	2	17,176	34,352	30,916	0,30	1,18	32,10	<b>64,20</b>
360	0,772	2	18,604	37,209	33,488	0,34	1,53	35,01	<b>70,03</b>

## Formula 5

## Replikasi 1

waktu (menit)	absorbansi	fp	kadar sampel	kadar (ppm)	jumlah (mg)	koreksi	total koreksi	Q	% disolusi
0	0	0	0	0	0	0	0	0	<b>0</b>
5	0,17	1	2,066	2,066	1,859	0,00	0,00	1,86	<b>3,71</b>
10	0,272	1	4,868	4,868	4,381	0,02	0,02	4,40	<b>8,80</b>
15	0,352	1	7,066	7,066	6,359	0,05	0,08	6,43	<b>12,86</b>
30	0,475	1	10,445	10,445	9,401	0,07	0,15	9,56	<b>19,12</b>
60	0,623	1	14,511	14,511	13,060	0,10	0,25	13,32	<b>26,64</b>
120	0,434	2	9,319	18,637	16,774	0,15	0,40	17,18	<b>34,36</b>
180	0,515	2	11,544	23,088	20,779	0,19	0,59	21,37	<b>42,75</b>
240	0,582	2	13,385	26,769	24,092	0,23	0,82	24,92	<b>49,83</b>
300	0,603	2	13,962	27,923	25,131	0,27	1,09	26,22	<b>52,45</b>
360	0,622	2	14,484	28,967	26,070	0,28	1,37	27,44	<b>54,88</b>

## Replikasi 2

waktu (menit)	absorbansi	fp	kadar sampel	kadar (ppm)	jumlah (mg)	koreksi	total koreksi	Q	% disolusi
0	0	0	0	0	0	0	0	0	<b>0</b>
5	0,174	1	2,176	2,176	1,958	0,00	0,00	1,96	<b>3,92</b>
10	0,256	1	4,429	4,429	3,986	0,02	0,02	4,01	<b>8,01</b>
15	0,337	1	6,654	6,654	5,988	0,04	0,06	6,05	<b>12,11</b>
30	0,499	1	11,104	11,104	9,994	0,08	0,14	10,17	<b>20,58</b>
60	0,625	1	14,566	14,566	13,109	0,11	0,25	13,39	<b>27,11</b>
120	0,474	2	10,418	20,835	18,752	0,15	0,40	19,18	<b>38,83</b>
180	0,528	2	11,901	23,802	21,422	0,21	0,61	22,06	<b>44,65</b>
240	0,572	2	13,110	26,220	23,598	0,24	0,85	24,47	<b>49,54</b>
300	0,593	2	13,687	27,374	24,636	0,26	1,11	25,77	<b>52,17</b>
360	0,624	2	14,538	29,077	26,169	0,27	1,38	27,58	<b>55,83</b>

## Replikasi 3

waktu (menit)	absorbansi	fp	kadar sampel	kadar (ppm)	jumlah (mg)	koreksi	total koreksi	Q	% disolusi
0	0	0	0	0	0	0	0	0	0
5	0,179	1	2,313	2,313	2,082	0,00	0,00	2,08	4,16
10	0,254	1	4,374	4,374	3,936	0,02	0,02	3,96	7,92
15	0,33	1	6,462	6,462	5,815	0,04	0,06	5,88	11,76
30	0,49	1	10,857	10,857	9,771	0,06	0,12	9,93	19,86
60	0,628	1	14,648	14,648	13,184	0,11	0,23	13,45	26,90
120	0,473	2	10,390	20,780	18,702	0,15	0,38	19,11	38,23
180	0,508	2	11,352	22,703	20,433	0,21	0,59	21,05	42,10
240	0,575	2	13,192	26,385	23,746	0,23	0,82	24,59	49,18
300	0,605	2	14,016	28,033	25,230	0,26	1,08	26,34	52,68
360	0,626	2	14,593	29,187	26,268	0,28	1,36	27,66	55,32

Perhitungan % disolusi:

- Kadar sampel:  $0,267 = 0,0948 + 0,0364 \times$

$$x = \frac{(0,267 - 0,0948)}{0,0364} = 4,731 \text{ ppm}$$

- Kadar = kadar sampel x faktor pengenceran (fp)

$$= 4,731 \times 1 = 4,731 \text{ ppm}$$

- Jumlah/ kadar dalam mg = kadar (ppm) x volume medium disolusi (lt)  
 $= 4,731 \times 0,9 = 4,258 \text{ mg}$

- Koreksi =  $\frac{\text{volume pengambilan cuplikan (ml)}}{\text{volume medium disolusi (ml)}} \times \text{kadar (mg)}$   
 $= \frac{10 \text{ ml}}{900 \text{ ml}} \times 4,258 \text{ mg}$   
 $= 0,05 \text{ mg}$

- Total koreksi = koreksi  $t_{10}$  + total koreksi  $t_5$

$$= 0,05 \text{ mg} + 0 \text{ mg} = 0,05 \text{ mg}$$

- $Q_{10}$  = kadar (mg)  $t_{10}$  + koreksi  $t_{10}$

$$= 4,258 + 0,05 = 4,308 \text{ mg}$$

- % disolusi =  $\frac{Q_{10}}{\text{kadar zat aktif dalam tablet}} \times 100 \%$   
 $= \frac{4,308 \text{ mg}}{50 \text{ mg}} \times 100 \% = 8,61 \%$

### Lampiran 10. Uji mutu fisik granul formula optimum

Waktu alir

replikasi	waktu alir (detik/100 gram)	rata - rata (detik/100 gram)	SD
1	7,2		
2	7,6	7,4	0,2
3	7,4		

Sudut diam

replikasi	diameter (cm)	jari - jari (cm)	tinggi (cm)	sudut diam (°)	rata - rata (°)	SD
1	8,5	4,25	2,21	27,47		
2	8,375	4,1875	2,175	27,45	27,47	0,02
3	8,42	4,21	2,19	27,48		

Keseragaman bobot

bobot tablet (mg)					
		301	300	300	299
		300	301	299	301
		301	300	301	300
		300	301	299	300
		299	300	301	299
rata - rata (mg)		300,1			
SD		0,79			
CV (%)		0,26			

Kekerasan tablet

kekerasan (kg)	
	14,5
	14,4
	14,2
rata - rata (kg)	14,37
SD	0,15
CV (%)	0,01



## Kerapuhan tablet

<b>bobot awal (gram)</b>	<b>bobot akhir (gram)</b>	<b>Kerapuhan (%)</b>	<b>rata - rata (%)</b>	<b>SD</b>	<b>CV (%)</b>
5,968	5,963	0,08			
5,964	5,959	0,08	0,09	0,02	0,20
5,966	5,959	0,12			

Q<sub>60</sub>

<b>replikasi</b>	<b>Q 60 (%)</b>	<b>rata - rata (%)</b>	<b>SD (%)</b>
1	30,20		
2	28,90	29,23	0,86
3	28,58		

Q<sub>360</sub>

<b>replikasi</b>	<b>Q 360 (%)</b>	<b>rata - rata (%)</b>	<b>SD (%)</b>
1	59,59		
2	58,63	59,02	0,50
3	58,85		

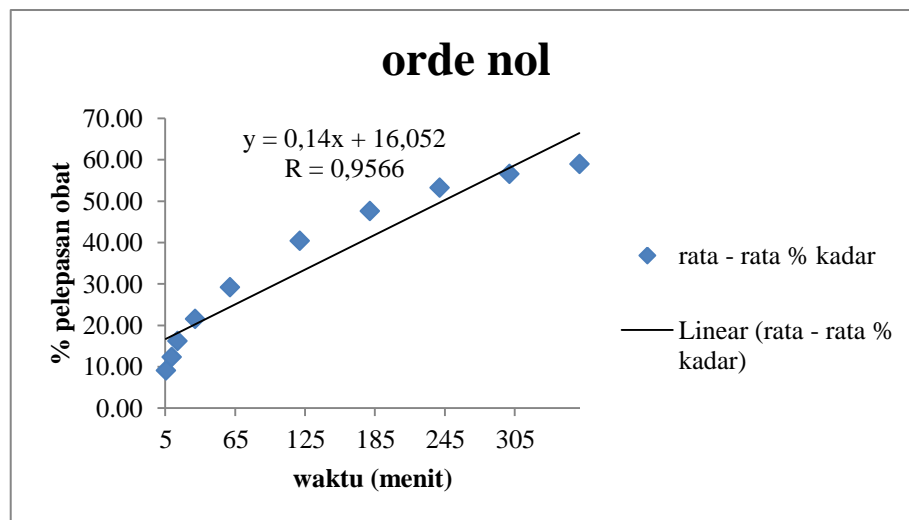
DE<sub>360</sub>

<b>replikasi</b>	<b>DE 360 (%)</b>	<b>rata - rata (%)</b>	<b>SD (%)</b>
1	43,22		
2	43,56	43,65	0,48
3	44,17		

### Lampiran 11. Hasil analisis model pelepasan formula optimum

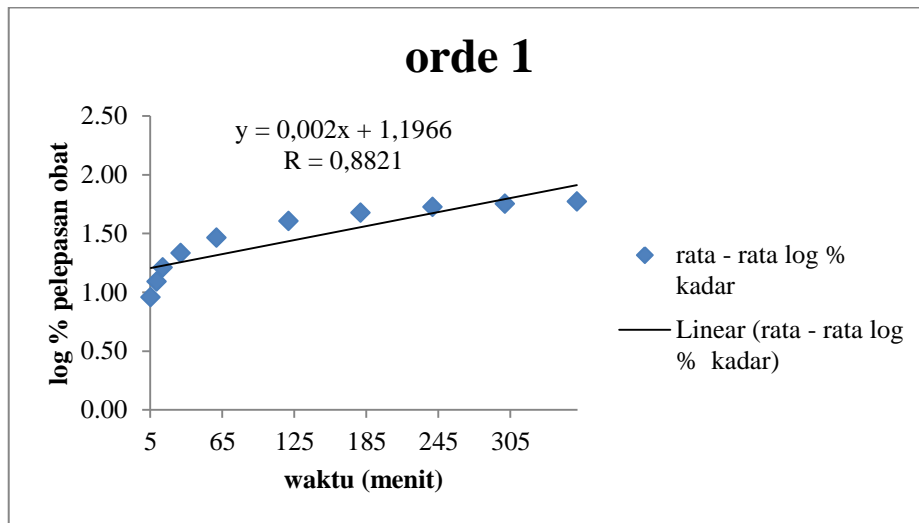
Orde nol

Waktu (menit)	rata - rata % kadar
0	0
5	9,09
10	12,34
15	16,24
30	21,57
60	29,23
120	40,42
180	47,61
240	53,27
300	56,58
360	59,02



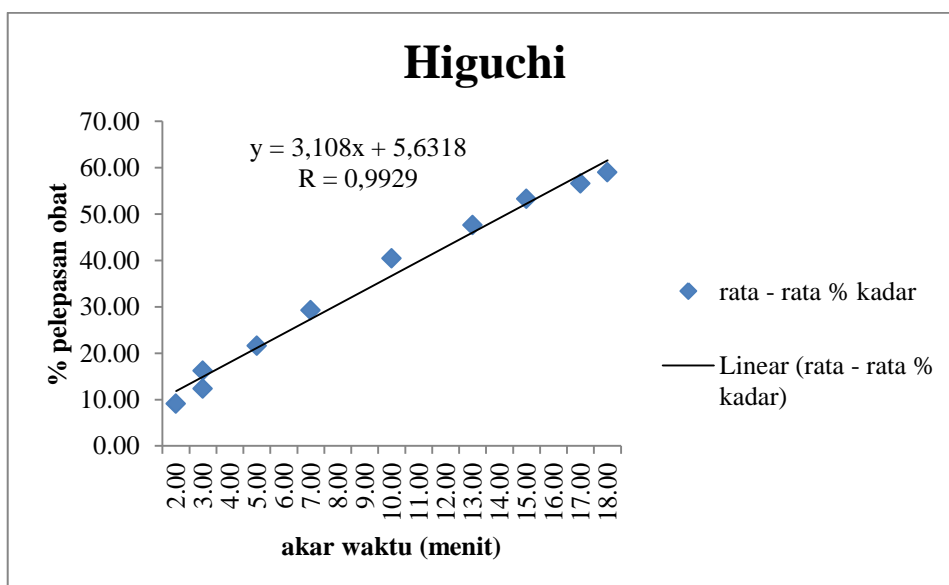
Orde satu

Waktu (menit)	rata - rata log % kadar
5	0,96
10	1,09
15	1,21
30	1,33
60	1,47
120	1,61
180	1,68
240	1,73
300	1,75
360	1,77



Model Higuchi

$\sqrt{\text{waktu (menit)}}$	rata - rata % kadar
2,24	9,09
3,16	12,34
3,87	16,24
5,48	21,57
7,75	29,23
10,95	40,42
13,42	47,61
15,49	53,27
17,32	56,58
18,97	59,02



**Lampiran 12. Hasil analisis uji T waktu alir**

**Descriptive Statistics**

	N	Mean	Std. Deviation	Minimum	Maximum
waktualir	3	7.4000	.20000	7.20	7.60

**One-Sample Kolmogorov-Smirnov Test**

		waktualir
N		3
Normal Parameters <sup>a,b</sup>	Mean	7.4000
	Std. Deviation	.20000
Most Extreme Differences	Absolute	.175
	Positive	.175
	Negative	-.175
Kolmogorov-Smirnov Z		.303
Asymp. Sig. (2-tailed)		1.000

a. Test distribution is Normal.

b. Calculated from data.

**One-Sample Statistics**

	N	Mean	Std. Deviation	Std. Error Mean
waktualir	3	7.4000	.20000	.11547

**One-Sample Test**

	Test Value = 7.24					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
waktualir	1.386	2	.300	.16000	-.3368	.6568

**Lampiran 13. Hasil analisis uji T kerapuhan**

**Descriptive Statistics**

	N	Mean	Std. Deviation	Minimum	Maximum
kerapuhan	3	.0933	.02309	.08	.12

**One-Sample Kolmogorov-Smirnov Test**

		kerapuhan
N		3
Normal Parameters <sup>a,b</sup>	Mean	.0933
	Std. Deviation	.02309
Most Extreme Differences	Absolute	.385
	Positive	.385
	Negative	-.282
Kolmogorov-Smirnov Z		.667
Asymp. Sig. (2-tailed)		.766

a. Test distribution is Normal.

b. Calculated from data.

**One-Sample Statistics**

	N	Mean	Std. Deviation	Std. Error Mean
kerapuhan	3	.0933	.02309	.01333

**One-Sample Test**

	Test Value = 0.10					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
kerapuhan	-.500	2	.667	-.00667	-.0640	.0507

**Lampiran 14. Hasil analisis uji T Q<sub>60</sub>**

**Descriptive Statistics**

	N	Mean	Std. Deviation	Minimum	Maximum
Q60	3	29.2333	.85049	28.60	30.20

**One-Sample Kolmogorov-Smirnov Test**

		Q60
N		3
Normal Parameters <sup>a,b</sup>	Mean	29.2333
	Std. Deviation	.85049
Most Extreme Differences	Absolute	.319
	Positive	.319
	Negative	-.228
Kolmogorov-Smirnov Z		.553
Asymp. Sig. (2-tailed)		.920

a. Test distribution is Normal.

b. Calculated from data.

**One-Sample Statistics**

	N	Mean	Std. Deviation	Std. Error Mean
Q60	3	29.2333	.85049	.49103

**One-Sample Test**

	Test Value = 29.38					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Q60	-.299	2	.793	-.14667	-2.2594	1.9661

Lampiran 15. Hasil analisis uji T Q<sub>360</sub>

## Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Q360	3	59.0233	.50292	58.63	59.59

## One-Sample Kolmogorov-Smirnov Test

		Q360
N		3
Normal Parameters <sup>a,b</sup>	Mean	59.0233
	Std. Deviation	.50292
Most Extreme Differences	Absolute	.301
	Positive	.301
	Negative	-.217
Kolmogorov-Smirnov Z		.522
Asymp. Sig. (2-tailed)		.948

a. Test distribution is Normal.

b. Calculated from data.

## One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Q360	3	59.0233	.50292	.29036

## One-Sample Test

	Test Value = 58.96					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Q360	.218	2	.848	.06333	-1.1860	1.3127

**Lampiran 16. Hasil analisis uji T DE<sub>360</sub>**

**Descriptive Statistics**

	N	Mean	Std. Deviation	Minimum	Maximum
DE360	3	43.6500	.48135	43.22	44.17

**One-Sample Kolmogorov-Smirnov Test**

		DE360
N		3
Normal Parameters <sup>a,b</sup>	Mean	43.6500
	Std. Deviation	.48135
Most Extreme Differences	Absolute	.241
	Positive	.241
	Negative	-.193
Kolmogorov-Smirnov Z		.417
Asymp. Sig. (2-tailed)		.995

a. Test distribution is Normal.

b. Calculated from data.

**One-Sample Statistics**

	N	Mean	Std. Deviation	Std. Error Mean
DE360	3	43.6500	.48135	.27791

**One-Sample Test**

	Test Value = 43.73					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
DE360	-.288	2	.801	-.08000	-1.2757	1.1157