

LAMPIRAN

Lampiran 1. Data rendemen ekstrak biji tua segar dan biji tua serbuk

No	Ekstrak	Berat Awal (gram)	Berat Akhir (gram)	Rendemen (% bk)
1.	Biji Tua Segar Metanol (BTSM)			
	• BTSM 1	50,00	3,80	2,14
	• BTSM 2	50,00	3,88	2,18
	• BTSM 3	50,00	3,96	2,23
Rata-rata				2,18
Standar deviasi				0,04
2.	Biji Tua Serbuk Metanol (BTBM)			
	• BTBM 1	50,00	3,97	7,14
	• BTBM 2	50,00	4,00	7,19
	• BTBM 3	50,00	3,11	5,59
Rata-rata				6,64
Standar deviasi				0,91
3.	Biji Tua Segar Etanol (BTSE)			
	• BTSE 1	50,00	2,67	1,50
	• BTSE 2	50,00	2,68	1,51
	• BTSE 3	50,00	3,11	1,75
Rata-rata				1,58
Standar deviasi				0,14
4.	Biji Tua Serbuk Etanol (BTBE)			
	• BTBE 1	50,00	3,07	5,52
	• BTBE 2	50,00	3,15	5,66
	• BTBE 3	50,00	3,15	5,66
Rata-rata				5,61
Standar deviasi				0,08

Perhitungan :

$$\text{Kadar air} = \frac{\text{berat awal} - \text{berat akhir}}{\text{berat awal}} \times 100\%$$

$$\text{Kadar air biji tua segar} = \frac{2,0714 - 0,5836}{2,0714} \times 100\% = 71,82\%$$

$$\text{Kadar air biji tua serbuk} = \frac{2,0765 - 1,8670}{2,0765} \times 100\% = 10,09\%$$

Lampiran 2. Standar deviasi rendemen biji tua segar metanol

X_i	X_i^2
2,14	4,5796
2,18	4,7524
2,23	4,9729
$\sum X_i = 6,55$	$\sum X_i^2 = 14,3049$

a. Standar Deviasi

$$\sum X_i = 6,55 \quad (\sum X_i)^2 = 42,9025$$

$$\sum X_i^2 = 14,3049$$

$$\bar{X} = \frac{\sum X_i}{n} = \frac{6,55}{3} = 2,18$$

$$\begin{aligned} V_x &= \frac{n \sum X_i^2 - (\sum X_i)^2}{n(n-1)} \\ &= \frac{3(14,3049) - 42,9025}{3(3-1)} \\ &= \frac{0,0122}{6} \\ &= 2,03 \times 10^{-3} \end{aligned}$$

$$S = \sqrt{V_x} = \sqrt{2,03 \times 10^{-3}} = 0,04$$

Lampiran 3. Standar deviasi rendemen biji tua serbuk metanol

X_i	X_i^2
7,14	50,9796
7,19	51,6961
5,59	31,2481
$\sum X_i = 19,92$	$\sum X_i^2 = 133,9238$

a. Standar Deviasi

$$\sum X_i = 19,92 \quad (\sum X_i)^2 = 396,8064$$

$$\sum X_i^2 = 133,9238$$

$$\bar{X} = \frac{\sum X_i}{n} = \frac{19,92}{3} = 6,64$$

$$\begin{aligned} V_x &= \frac{n \sum X_i^2 - (\sum X_i)^2}{n(n-1)} \\ &= \frac{3(133,9238) - 396,8064}{3(3-1)} \\ &= \frac{4,965}{6} \\ &= 0,83 \end{aligned}$$

$$S = \sqrt{V_x} = \sqrt{0,83} = 0,91$$

Lampiran 4. Standar deviasi rendemen biji tua segar etanol

X_i	X_i^2
1,50	2,25
1,51	2,2801
1,75	3,0625
$\sum X_i = 4,76$	$\sum X_i^2 = 7,5926$

a. Standar Deviasi

$$\sum X_i = 4,76 \quad (\sum X_i)^2 = 22,6576$$

$$\sum X_i^2 = 7,5926$$

$$\bar{X} = \frac{\sum X_i}{n} = \frac{4,76}{3} = 1,58$$

$$\begin{aligned} V_x &= \frac{n \sum X_i^2 - (\sum X_i)^2}{n(n-1)} \\ &= \frac{3(7,5926) - 22,6576}{3(3-1)} \end{aligned}$$

$$= \frac{0,1202}{6}$$

$$= 0,02$$

$$S = \sqrt{V_x} = \sqrt{0,02} = 0,14$$

Lampiran 5. Standar deviasi rendemen biji tua serbuk etanol

X_i	X_i^2
5,52	30,4704
5,66	32,0356
5,66	32,0356
$\sum X_i = 16,84$	$\sum X_i^2 = 94,5416$

a. Standar Deviasi

$$\sum X_i = 16,84 \quad (\sum X_i)^2 = 283,5856$$

$$\sum X_i^2 = 94,5416$$

$$\bar{X} = \frac{\sum X_i}{n} = \frac{16,84}{3} = 5,61$$

$$V_x = \frac{n \sum X_i^2 - (\sum X_i)^2}{n(n-1)}$$

$$= \frac{3(94,5416) - 283,5856}{3(3-1)}$$

$$= \frac{0,0392}{6}$$

$$= 6,53 \times 10^{-3}$$

$$S = \sqrt{V_x} = \sqrt{6,53 \times 10^{-3}} = 0,08$$

Lampiran 6. Pengukuran standar fenol total asam tanat panjang gelombang 725 nm

No	Konsentrasi ($\mu\text{g/ml}$)	Absorbansi
1.	25	0,149
2.	50	0,286
3.	100	0,588
4.	150	0,950
5.	200	1,250

Lampiran 7. Standar fenol total asam tanat

x	y	xy	x^2
25	0,149	3,725	625
50	0,286	14,3	2.500
100	0,588	58,8	10.000
150	0,950	142,5	22.500
200	1,250	250	40.000
$\sum x = 525$	$\sum y = 3,223$	$\sum xy = 469,325$	$\sum x^2 = 75.625$

Perhitungan :

$$Y = a + bx$$

$$b = \frac{\sum xy}{\sum x^2} = \frac{469,325}{75,625} = 0,0062$$

$$a = y - bx$$

$$= 3,223 - (0,0062) \times 525$$

$$= 3,223 - 3,255$$

$$= - 0,032$$

$$y = - 0,032 + 0,0062 x$$

Lampiran 8. Absorbansi sampel pada panjang gelombang 725 nm

No	Ekstrak	Absorbansi	
		I	II
1.	Biji tua segar metanol (BTSM)		
	• BTSM 1	0,870	0,820
	• BTSM 2	0,758	0,784
	• BTSM 3	0,786	0,815
2.	Biji tua serbuk metanol (BTBM)		
	• BTBM 1	1,010	1,010
	• BTBM 2	1,100	0,970
	• BTBM 3	1,030	0,975
3.	Biji tua segar etanol (BTSE)		
	• BTSE 1	1,115	1,040
	• BTSE 2	1,100	1,090
	• BTSE 3	0,985	0,960
4.	Biji tua serbuk etanol (BTBE)		
	• BTBE 1	1,180	1,128
	• BTBE 2	1,050	1,095
	• BTBE 3	1,160	1,190

Lampiran 9. Data pengukuran kadar fenol total pada panjang gelombang 725 nm

No	Ekstrak	Konsentrasi ($\mu\text{g/ml}$)	
		I	II
1.	Biji Tua Segar Metanol (BTSM)		
	• BTSM 1	145,48	137,42
	• BTSM 2	127,41	131,61
	• BTSM 3	131,93	136,61
	Rata-rata		135,07
2.	Biji Tua Serbuk Metanol (BTBM)		
	• BTBM 1	168,06	168,06
	• BTBM 2	182,58	161,61
	• BTBM 3	171,29	162,42
	Rata-rata		169,00
3.	Biji Tua Segar Etanol (BTSE)		
	• BTSE 1	185,00	172,90
	• BTSE 2	182,58	180,96
	• BTSE 3	164,03	160,00
	Rata-rata		174,24
4.	Biji Tua Serbuk Etanol (BTBE)		
	• BTBE 1	195,48	187,09
	• BTBE 2	174,51	181,77
	• BTBE 3	192,26	197,09
	Rata-rata		188,03

Perhitungan :

Lampiran 10. Standar deviasi kadar fenol total biji tua segar metanol

X_i	X_i^2
145,48	21.164,43
127,41	16.233,31
131,93	17.405,52
137,42	18.884,26
131,61	17.321,19
136,61	18.662,29
$\sum X_i = 810,46$	$\sum X_i^2 = 109.671,00$

a. Standar Deviasi

$$\sum X_i = 810,46 \quad (\sum X_i)^2 = 656.845,41$$

$$\sum X_i^2 = 109.671,00$$

$$\bar{X} = \frac{\sum X_i}{n} = \frac{810,46}{6} = 135,08$$

$$\begin{aligned} V_x &= \frac{n \sum X_i^2 - (\sum X_i)^2}{n(n-1)} \\ &= \frac{6(109.677,2716) - 656.883,6659}{6(6-1)} \\ &= \frac{1.179,9637}{30} \\ &= 39,33 \end{aligned}$$

$$S = \sqrt{V_x} = \sqrt{39,33} = 6,27$$

Lampiran 11. Standar deviasi kadar fenol total biji tua serbuk metanol

X_i	X_i^2
168,06	28.244,16
168,06	28.244,16
182,58	33.335,45
161,61	26.117,79
171,29	29.340,26
162,41	26.377,00
$\sum X_i = 1.014,01$	$\sum X_i^2 = 171.658,82$

a. Standar Deviasi

$$\sum X_i = 1.014,01 \quad (\sum X_i)^2 = 1.028.261,28$$

$$\sum X_i^2 = 171.658,82$$

$$\bar{X} = \frac{\sum X_i}{n} = \frac{1.014,01}{6} = 169,00$$

$$\begin{aligned} V_x &= \frac{n \sum X_i^2 - (\sum X_i)^2}{n(n-1)} \\ &= \frac{6(171.658,82) - 1.028.261,28}{6(6-1)} \\ &= \frac{1.691,64}{30} \\ &= 56,38 \end{aligned}$$

$$S = \sqrt{V_x} = \sqrt{56,38} = 7,51$$

Lampiran 12. Standar deviasi kadar fenol total biji tua segar etanol

X_i	X_i^2
185,00	34.225
172,90	29.894,41
182,58	33.335,45
164,03	26.905,84
180,96	32.746,52
160,00	25.600
$\sum X_i = 1.045,47$	$\sum X_i^2 = 182.707,22$

a. Standar Deviasi

$$\sum X_i = 1.045,47 \quad (\sum X_i)^2 = 1.093.007,52$$

$$\sum X_i^2 = 182.707,22$$

$$\bar{X} = \frac{\sum X_i}{n} = \frac{1.045,47}{6} = 174,24$$

$$\begin{aligned} V_x &= \frac{n \sum X_i^2 - (\sum X_i)^2}{n(n-1)} \\ &= \frac{6(182.707,22) - 1.093.007,52}{6(6-1)} \\ &= \frac{3.235,8}{30} \\ &= 107,86 \end{aligned}$$

$$S = \sqrt{V_x} = \sqrt{107,86} = 10,38$$

Lampiran 13. Standar deviasi kadar fenol total biji tua serbuk etanol

X_i	X_i^2
195,48	38.212,43
187,09	35.002,66
181,77	33.040,33
174,51	30.453,74
192,25	36.960,06
197,09	38.844,46
$\sum X_i = 1.128,19$	$\sum X_i^2 = 212.513,68$

a. Standar Deviasi

$$\sum X_i = 1.128,19 \quad (\sum X_i)^2 = 1.272.812,67$$

$$\sum X_i^2 = 212.513,68$$

$$\bar{X} = \frac{\sum X_i}{n} = \frac{1.128,19}{6} = 188,03$$

$$\begin{aligned} V_x &= \frac{n \sum X_i^2 - (\sum X_i)^2}{n(n-1)} \\ &= \frac{6(212.513,68) - 1.272.812,67}{6(6-1)} \\ &= \frac{2.269,41}{30} \\ &= 75,64 \end{aligned}$$

$$S = \sqrt{V_x} = \sqrt{75,64} = 8,69$$

Lampiran 14. Data pengukuran kemampuan mereduksi pada panjang gelombang 700 nm

No	Ekstrak	Absorban	
		I	II
1.	Biji Tua Segar Metanol (BTSM)		
	• BTSM 1	0,211	0,214
	• BTSM 2	0,199	0,196
	• BTSM 3	0,202	0,201
2.	Biji Tua Serbuk Metanol (BTBM)		
	• BTBM 1	0,190	0,195
	• BTBM 2	0,195	0,198
	• BTBM 3	0,203	0,198
3.	Biji Tua Segar Etanol (BTSE)		
	• BTSE 1	0,196	0,178
	• BTSE 2	0,196	0,182
	• BTSE 3	0,184	0,180
4.	Biji Tua Serbuk Etanol (BTBE)		
	• BTBE 1	0,191	0,193
	• BTBE 2	0,203	0,196
	• BTBE 3	0,202	0,204
	• Blanko	0,107	0,100

Lampiran 15. Data kemampuan mereduksi pada panjang gelombang 700 nm

No	Ekstrak	Absorban	
		I	II
1.	Biji Tua Segar Metanol (BTSM)		
	• BTSM 1	0,094	0,097
	• BTSM 2	0,092	0,096
	• BTSM 3	0,095	0,101
2.	Biji Tua Serbuk Metanol (BTBM)		
	• BTBM 1	0,083	0,095
	• BTBM 2	0,088	0,098
	• BTBM 3	0,096	0,098
3.	Biji Tua Segar Etanol (BTSE)		
	• BTSE 1	0,089	0,078
	• BTSE 2	0,089	0,082
	• BTSE 3	0,077	0,080
4.	Biji Tua Serbuk Etanol (BTBE)		
	• BTBE 1	0,084	0,093
	• BTBE 2	0,096	0,096
	• BTBE 3	0,095	0,104

Perhitungan :

Lampiran 16. Standar deviasi kemampuan mereduksi biji tua segar metanol

X_i	X_i^2
0,094	0,008836
0,092	0,008464
0,095	0,009025
0,097	0,009409
0,096	0,009216
0,101	0,010201
$\sum X_i = 0,575$	$\sum X_i^2 = 0,055151$

a. Standar Deviasi

$$\sum X_i = 0,575 \quad (\sum X_i)^2 = 0,330625$$

$$\sum X_i^2 = 0,055151$$

$$\bar{X} = \frac{\sum X_i}{n} = \frac{0,575}{6} = 0,095$$

$$\begin{aligned} V_x &= \frac{n \sum X_i^2 - (\sum X_i)^2}{n(n-1)} \\ &= \frac{6(0,055151) - 0,330625}{6(6-5)} \\ &= \frac{2,81 \times 10^{-4}}{30} \\ &= 9,37 \times 10^{-6} \end{aligned}$$

$$S = \sqrt{V_x} = \sqrt{9,37 \times 10^{-6}} = 3,06 \times 10^{-3}$$

Lampiran 17. Standar deviasi kemampuan mereduksi biji tua serbuk metanol

X_i	X_i^2
0,083	0,006889
0,088	0,007744
0,096	0,009216
0,095	0,009025
0,098	0,009604
0,098	0,009604
$\sum X_i = 0,558$	$\sum X_i^2 = 0,052082$

a. Standar Deviasi

$$\sum X_i = 0,558 \quad (\sum X_i)^2 = 0,311364$$

$$\sum X_i^2 = 0,052082$$

$$\bar{X} = \frac{\sum X_i}{n} = \frac{0,558}{6} = 0,093$$

$$\begin{aligned} V_x &= \frac{n \sum X_i^2 - (\sum X_i)^2}{n(n-1)} \\ &= \frac{6(0,052082) - 0,311364}{6(6-1)} \\ &= \frac{1,128 \times 10^{-3}}{30} \\ &= 3,76 \times 10^{-5} \end{aligned}$$

$$S = \sqrt{V_x} = \sqrt{3,76 \times 10^{-5}} = 6,13 \times 10^{-3}$$

Lampiran 18. Standar deviasi kemampuan mereduksi biji tua segar etanol

X_i	X_i^2
0,089	0,007921
0,089	0,007921
0,077	0,005929
0,078	0,006084
0,082	0,006724
0,080	0,006400
$\sum X_i = 0,495$	$\sum X_i^2 = 0,040979$

a. Standar Deviasi

$$\sum X_i = 0,495 \quad (\sum X_i)^2 = 0,245025$$

$$\sum X_i^2 = 0,040979$$

$$\bar{X} = \frac{\sum X_i}{n} = \frac{0,495}{6} = 0,082$$

$$\begin{aligned} V_x &= \frac{n \sum X_i^2 - (\sum X_i)^2}{n(n-1)} \\ &= \frac{6(0,040979) - 0,245025}{6(6-1)} \\ &= \frac{8,49 \times 10^{-4}}{30} \\ &= 2,83 \times 10^{-5} \end{aligned}$$

$$S = \sqrt{V_x} = \sqrt{2,83 \times 10^{-5}} = 5,32 \times 10^{-3}$$

Lampiran 19. Standar deviasi kemampuan mereduksi biji tua serbuk etanol

X_i	X_i^2
0,084	0,007056
0,096	0,009216
0,095	0,009025
0,093	0,008649
0,096	0,009216
0,104	0,010816
$\sum X_i = 0,568$	$\sum X_i^2 = 0,053978$

a. Standar Deviasi

$$\sum X_i = 0,568 \quad (\sum X_i)^2 = 0,322624$$

$$\sum X_i^2 = 0,053978$$

$$\bar{X} = \frac{\sum X_i}{n} = \frac{0,568}{6} = 0,094$$

$$\begin{aligned} V_x &= \frac{n \sum X_i^2 - (\sum X_i)^2}{n(n-1)} \\ &= \frac{6(0,053978) - 0,322624}{6(6-1)} \\ &= \frac{1,24 \times 10^{-3}}{30} \\ &= 4,13 \times 10^{-5} \end{aligned}$$

$$S = \sqrt{V_x} = \sqrt{4,13 \times 10^{-5}} = 6,43 \times 10^{-3}$$

Lampiran 20. Data pengukuran aktivitas antioksidan pada panjang gelombang 470 nm

No	Ekstrak	0		30		45	
		I	II	I	II	I	II
1.	Biji tua segar metanol (BTSM)						
	• BTSM 1	0,090	0,107	0,085	0,102	0,073	0,078
	• BTSM 2	0,106	0,100	0,080	0,083	0,078	0,078
	• BTSM 3	0,101	0,088	0,090	0,085	0,067	0,073
2.	Biji tua serbuk metanol (BTBM)						
	• BTBM 1	0,103	0,101	0,095	0,099	0,078	0,090
	• BTBM 2	0,101	0,107	0,100	0,102	0,086	0,081
	• BTBM 3	0,088	0,096	0,080	0,092	0,086	0,071
3.	Biji tua segar etanol (BTSE)						
	• BTSE 1	0,158	0,175	0,150	0,165	0,149	0,150
	• BTSE 2	0,152	0,159	0,155	0,145	0,147	0,131
	• BTSE 3	0,168	0,158	0,157	0,148	0,155	0,143
4.	Biji tua serbuk etanol (BTBE)						
	• BTBE 1	0,161	0,159	0,156	0,150	0,149	0,131
	• BTBE 2	0,171	0,165	0,168	0,150	0,151	0,148
	• BTBE 3	0,160	0,170	0,158	0,162	0,154	0,158
5.	BHT	0,128	0,080	0,120	0,059	0,117	0,056
6.	Kontrol	0,080	0,065	0,040	0,028	0,032	0,018

Perhitungan :

$$\text{Faktor protektif} = \frac{\text{rata - rata absorbansi sampel 30 menit}}{\text{rata - rata absorbansi kontrol 30 menit}}$$

Lampiran 21. Faktor protektif ekstrak biji tua terung pucuk

No.	Ekstrak	Faktor protektif (FP)
1.	Biji tua segar metanol (BTSM)	
	• BTSM 1	2,63
	• BTSM 2	2,29
	• BTSM 3	2,46
2.	Biji tua serbuk metanol (BTBM)	
	• BTBM 1	2,72
	• BTBM 2	2,84
	• BTBM 3	2,42
3.	Biji tua segar etanol (BTSE)	
	• BTSE 1	4,43
	• BTSE 2	4,22
	• BTSE 3	4,29
4.	Biji tua serbuk etanol (BTBE)	
	• BTBE 1	4,30
	• BTBE 2	4,47
	• BTBE 3	4,50
5.	BHT	2,52

Lampiran 22. Standar deviasi faktor protektif ekstrak biji tua segar metanol

X_i	X_i^2
2,63	6,9169
2,29	5,2441
2,46	6,0516
$\sum X_i = 7,38$	$\sum X_i^2 = 18,2126$

a. Standar Deviasi

$$\sum X_i = 7,38 \quad (\sum X_i)^2 = 54,4644$$

$$\sum X_i^2 = 18,2126$$

$$\bar{X} = \frac{\sum X_i}{n} = \frac{7,38}{3} = 2,46$$

$$V_x = \frac{n \sum X_i^2 - (\sum X_i)^2}{n(n-1)}$$

$$\begin{aligned}
 &= \frac{3(18,2126) - 54,4644}{3(3-1)} \\
 &= \frac{0,1734}{6} \\
 &= 0,03
 \end{aligned}$$

$$S = \sqrt{V_x} = \sqrt{0,03} = 0,17$$

Lampiran 23. Standar deviasi faktor protektif ekstrak biji tua serbuk metanol

X_i	X_i^2
2,73	7,4529
2,84	8,0656
2,42	5,8564
$\sum X_i = 7,99$	$\sum X_i^2 = 21,3749$

a. Standar Deviasi

$$\sum X_i = 7,99 \quad (\sum X_i)^2 = 63,8401$$

$$\sum X_i^2 = 21,3749$$

$$\bar{X} = \frac{\sum X_i}{n} = \frac{7,99}{3} = 2,66$$

$$\begin{aligned}
 V_x &= \frac{n \sum X_i^2 - (\sum X_i)^2}{n(n-1)} \\
 &= \frac{3(21,3749) - 63,8401}{3(3-1)} \\
 &= \frac{0,2846}{6} \\
 &= 0,05
 \end{aligned}$$

$$S = \sqrt{V_x} = \sqrt{0,05} = 0,22$$

Lampiran 24. Standar deviasi faktor protektif ekstrak biji tua segar etanol

X_i	X_i^2
4,43	19,6294
4,22	17,8084
4,29	18,4041
$\sum X_i = 12,94$	$\sum X_i^2 = 55,8374$

a. Standar Deviasi

$$\sum X_i = 12,94 \quad (\sum X_i)^2 = 167,4436$$

$$\sum X_i^2 = 55,8374$$

$$\bar{X} = \frac{\sum X_i}{n} = \frac{12,94}{3} = 4,31$$

$$\begin{aligned} V_x &= \frac{n \sum X_i^2 - (\sum X_i)^2}{n(n-1)} \\ &= \frac{3(55,8374) - 167,4436}{3(3-1)} \\ &= \frac{0,0686}{6} \\ &= 0,01 \end{aligned}$$

$$S = \sqrt{V_x} = \sqrt{0,01} = 0,10$$

Lampiran 25. Standar deviasi faktor protektif ekstrak biji tua serbuk etanol

X_i	X_i^2
4,30	18,49
4,47	19,9809
4,50	20,25
$\sum X_i = 13,27$	$\sum X_i^2 = 58,7209$

a. Standar Deviasi

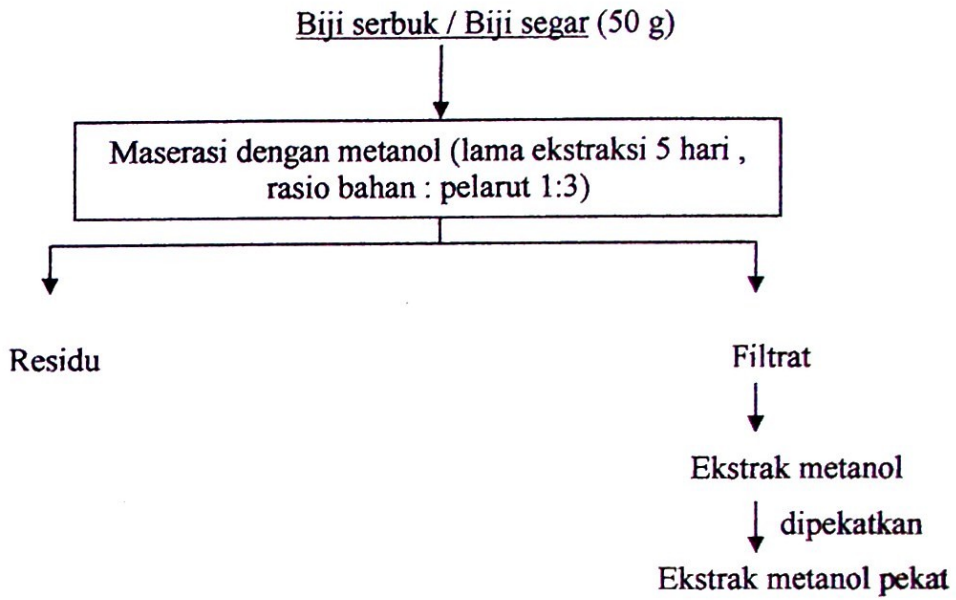
$$\sum X_i = 13,27 \quad (\sum X_i)^2 = 176,0929$$

$$\sum X_i^2 = 58,7209$$

$$\bar{X} = \frac{\sum X_i}{n} = \frac{13,27}{3} = 4,42$$

$$\begin{aligned} V_x &= \frac{n \sum X_i^2 - (\sum X_i)^2}{n(n-1)} \\ &= \frac{3(58,7209) - 176,0929}{3(3-1)} \\ &= \frac{0,0698}{6} \\ &= 0,01 \end{aligned}$$

$$S = \sqrt{V_x} = \sqrt{0,01} = 0,10$$

Lampiran 26. Diagram alir ekstraksi dengan metanol modifikasi Yasni *et al.* (1999)Lampiran 27. Diagram alir ekstraksi dengan etanol modifikasi Yasni *et al.* (1999)