

Lampiran 1. Perhitungan Kadar asam

No	Ragi (Gram)	Lama Perendaman (jam)	Lama Fermentasi (jam)	Ulangan 1	Ulangan 2	Total Kadar Asam (%)
1	1.00	15	36	6.86%	6.72%	6.79%
2	0,50	15	60	20.70%	20.29%	20.5%
3	0.75	15	48	9.12%	7.47%	8.30%
4	0.75	15	48	8.04%	10.35%	9.20%
5	0.75	15	48	6.40%	6.00%	6.20%
6	0.75	24	60	13.56%	12.54%	13.05%
7	0.50	15	36	6.72%	5.52%	6.12%
8	0.75	24	36	4.91%	5.92%	5.42%
9	1.00	24	48	6.54%	5.83%	6.19%
10	0.50	6	48	6.21%	5.58%	5.90%
11	0.50	24	48	4.81%	3.84%	4.33%
12	1.00	15	60	7.00%	7.92%	7.51%
13	0.75	6	36	6.24%	6.84%	6.54%
14	1.00	6	48	5.08%	6.00%	5.54%
15	0.75	6	60	7.00%	5.88%	6.44%

Kadar Asam :

$$\% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) = \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\%$$

Perlakuan Tempe 1 : Ulangan 1

$$\begin{aligned} \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\% \\ &= \frac{0.2 \times 2.5 \times 192.13}{14} \times 100\% \\ &= \frac{96.065}{14} \times 100\% \\ &= 6.86\% \end{aligned}$$

Perlakuan Tempe 1 : Ulangan 2

$$\begin{aligned} \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\% \\ &= \frac{0.2 \times 1.75 \times 192.13}{10} \times 100\% \\ &= \frac{67.24}{10} \times 100\% \\ &= 6.72\% \end{aligned}$$

Perlakuan Tempe 2 : Ulangan 1

$$\begin{aligned} \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times Eqwt}{V2} \times 100\% \\ &= \frac{0.2 \times 9.7 \times 192.13}{18} \times 100\% \\ &= \frac{372.73}{18} \times 100\% \\ &= 20.70\% \end{aligned}$$

Perlakuan Tempe 2 : Ulangan 2

$$\begin{aligned} \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times Eqwt}{V2} \times 100\% \\ &= \frac{0.2 \times 8.45 \times 192.13}{16} \times 100\% \\ &= \frac{324.69}{16} \times 100\% \\ &= 20.29\% \end{aligned}$$

Perlakuan Tempe 3 : Ulangan 1

$$\begin{aligned} \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times Eqwt}{V2} \times 100\% \\ &= \frac{0.2 \times 3.8 \times 192.13}{16} \times 100\% \\ &= \frac{146.01}{16} \times 100\% \\ &= 9.12\% \end{aligned}$$

Perlakuan Tempe 3 : Ulangan 2

$$\begin{aligned} \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times Eqwt}{V2} \times 100\% \\ &= \frac{0.2 \times 3.5 \times 192.13}{18} \times 100\% \\ &= \frac{134.49}{18} \times 100\% \\ &= 7.47\% \end{aligned}$$

Perlakuan Tempe 4 : Ulangan 1

$$\begin{aligned} \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times Eqwt}{V2} \times 100\% \\ &= \frac{0.2 \times 3.35 \times 192.13}{16} \times 100\% \\ &= \frac{128.72}{16} \times 100\% \\ &= 8.04\% \end{aligned}$$

Perlakuan Tempe 4 : Ulangan 2

$$\begin{aligned} \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times Eqwt}{V2} \times 100\% \\ &= \frac{0.2 \times 4.85 \times 192.13}{18} \times 100\% \\ &= \frac{186.36}{18} \times 100\% \\ &= 10.35\% \end{aligned}$$

Perlakuan Tempe 5 : Ulangan 1

$$\begin{aligned} \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\% \\ &= \frac{0.2 \times 3 \times 192.13}{16} \times 100\% \\ &= \frac{115.27}{16} \times 100\% \\ &= 6.40\% \end{aligned}$$

Perlakuan Tempe 5 : Ulangan 2

$$\begin{aligned} \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\% \\ &= \frac{0.2 \times 2.5 \times 192.13}{16} \times 100\% \\ &= \frac{96.065}{16} \times 100\% \\ &= 6.00\% \end{aligned}$$

Perlakuan Tempe 6 : Ulangan 1

$$\begin{aligned} \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\% \\ &= \frac{0.2 \times 6 \times 192.13}{17} \times 100\% \\ &= \frac{230.55}{17} \times 100\% \\ &= 13.56\% \end{aligned}$$

Perlakuan Tempe 6 : Ulangan 2

$$\begin{aligned} \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\% \\ &= \frac{0.2 \times 5.55 \times 192.13}{17} \times 100\% \\ &= \frac{213.26}{17} \times 100\% \\ &= 12.54\% \end{aligned}$$

Perlakuan Tempe 7 : Ulangan 1

$$\begin{aligned} \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\% \\ &= \frac{0.2 \times 2.8 \times 192.13}{16} \times 100\% \\ &= \frac{107.59}{16} \times 100\% \\ &= 6.72\% \end{aligned}$$

Perlakuan Tempe 7 : Ulangan 2

$$\begin{aligned} \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\% \\ &= \frac{0.2 \times 2.3 \times 192.13}{16} \times 100\% \\ &= \frac{88.37}{16} \times 100\% \\ &= 5.52\% \end{aligned}$$

Perlakuan Tempe 8 : Ulangan 1

$$\% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) = \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\%$$

$$\begin{aligned}
 &= \frac{0.2 \times 1.6 \times 192.13}{12.5} \times 100\% \\
 &= \frac{61.481}{12.5} \times 100\% \\
 &= 4.91\%
 \end{aligned}$$

Perlakuan Tempe 8 : Ulangan 2

$$\begin{aligned}
 \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\% \\
 &= \frac{0.2 \times 1.85 \times 192.13}{12} \times 100\% \\
 &= \frac{71.0881}{12} \times 100\% \\
 &= 5.92\%
 \end{aligned}$$

Perlakuan Tempe 9 : Ulangan 1

$$\begin{aligned}
 \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\% \\
 &= \frac{0.2 \times 2.3 \times 192.13}{13.5} \times 100\% \\
 &= \frac{88.37}{13.5} \times 100\% \\
 &= 6.54\%
 \end{aligned}$$

Perlakuan Tempe 9 : Ulangan 2

$$\begin{aligned}
 \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\% \\
 &= \frac{0.2 \times 2.05 \times 192.13}{13.5} \times 100\% \\
 &= \frac{78.77}{13.5} \times 100\% \\
 &= 5.83\%
 \end{aligned}$$

Perlakuan Tempe 10 : Ulangan 1

$$\begin{aligned}
 \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\% \\
 &= \frac{0.2 \times 2.75 \times 192.13}{17} \times 100\% \\
 &= \frac{105.67}{17} \times 100\% \\
 &= 6.21\%
 \end{aligned}$$

Perlakuan Tempe 10: Ulangan 2

$$\begin{aligned}
 \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\% \\
 &= \frac{0.2 \times 2.4 \times 192.13}{16.5} \times 100\% \\
 &= \frac{92.22}{16.5} \times 100\% \\
 &= 5.58\%
 \end{aligned}$$

Perlakuan Tempe 11: Ulangan 1

$$\begin{aligned}
 \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\% \\
 &= \frac{0.2 \times 2.2 \times 192.13}{17.5} \times 100\%
 \end{aligned}$$

$$= \frac{84.53}{17.5} \times 100\%$$

$$= 4.81\%$$

Perlakuan Tempe 11: Ulangan 2

$$\% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) = \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\%$$

$$= \frac{0.2 \times 1.3 \times 192.13}{13} \times 100\%$$

$$= \frac{49.95}{13} \times 100\%$$

$$= 3.84\%$$

Perlakuan Tempe 12: Ulangan 1

$$\% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) = \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\%$$

$$= \frac{0.2 \times 2.4 \times 192.13}{13} \times 100\%$$

$$= \frac{92.22}{13} \times 100\%$$

$$= 7.09\%$$

Perlakuan Tempe 12: Ulangan 2

$$\% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) = \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\%$$

$$= \frac{0.2 \times 3.3 \times 192.13}{16} \times 100\%$$

$$= \frac{126.80}{16} \times 100\%$$

$$= 7.92\%$$

Perlakuan Tempe 13: Ulangan 1

$$\% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) = \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\%$$

$$= \frac{0.2 \times 2.6 \times 192.13}{16} \times 100\%$$

$$= \frac{99.90}{16} \times 100\%$$

$$= 6.24\%$$

Perlakuan Tempe 13: Ulangan 2

$$\% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) = \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\%$$

$$= \frac{0.2 \times 2.85 \times 192.13}{16} \times 100\%$$

$$= \frac{109.51}{16} \times 100\%$$

$$= 6.84\%$$

Perlakuan Tempe 14: Ulangan 1

$$\% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) = \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\%$$

$$= \frac{0.2 \times 2.25 \times 192.13}{17} \times 100\%$$

$$= \frac{86.45}{17} \times 100\%$$

$$= 5.08\%$$

Perlakuan Tempe 14: Ulangan 2

$$\begin{aligned} \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\% \\ &= \frac{0.2 \times 2.5 \times 192.13}{16} \times 100\% \\ &= \frac{96.06}{16} \times 100\% \\ &= 6.004\% \end{aligned}$$

Perlakuan Tempe 15: Ulangan 1

$$\begin{aligned} \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\% \\ &= \frac{0.2 \times 3.1 \times 192.13}{17} \times 100\% \\ &= \frac{119.12}{17} \times 100\% \\ &= 7.00\% \end{aligned}$$

Perlakuan Tempe 15: Ulangan 2

$$\begin{aligned} \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\% \\ &= \frac{0.2 \times 2.45 \times 192.13}{16} \times 100\% \\ &= \frac{94.14}{16} \times 100\% \\ &= 5.88\% \end{aligned}$$

Lampiran 2. Pengolahan Kadar Asam di Minitab

No	Ragi (gram)	Lama Perendaman (jam)	Lama Fermentasi (jam)	Total Kadar Asam (%)
1	1.00	15	36	6.79
2	0,50	15	60	20.5
3	0.75	15	48	8.30
4	0.75	15	48	9.20
5	0.75	15	48	6.20
6	0.75	24	60	13.05
7	0.50	15	36	6.12
8	0.75	24	36	5.42
9	1.00	24	48	6.19
10	0.50	6	48	5.90
11	0.50	24	48	4.33
12	1.00	15	60	7.51
13	0.75	6	36	6.54
14	1.00	6	48	5.54
15	0.75	6	60	6.64

Response Surface Regression: Kadar Asam versus Ragi; Lama Perendaman; Lama Fermentasi

Coded Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	7,90	1,65	4,78	0,005	
Ragi	-1,35	1,01	-1,34	0,239	1,00
Lama Perendaman	0,57	1,01	0,56	0,597	1,00
Lama Fermentasi	2,83	1,01	2,80	0,038	1,00
Ragi*Ragi	-0,02	1,49	-0,01	0,989	1,01
Lama Perendaman*Lama Perendaman	-2,39	1,49	-1,60	0,169	1,01
Lama Fermentasi*Lama Fermentasi	2,35	1,49	1,58	0,175	1,01
Ragi*Lama Perendaman	0,55	1,43	0,39	0,714	1,00
Ragi*Lama Fermentasi	-3,41	1,43	-2,39	0,063	1,00
Lama Perendaman*Lama Fermentasi	1,93	1,43	1,35	0,235	1,00

Model Summary

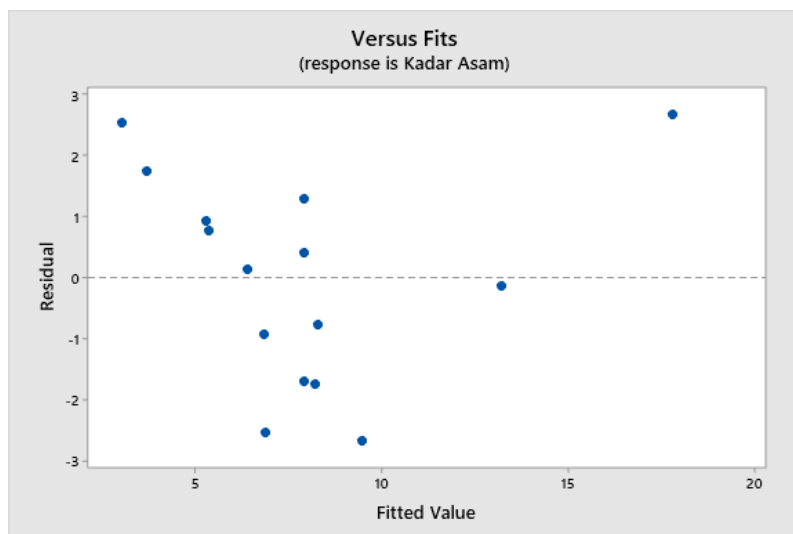
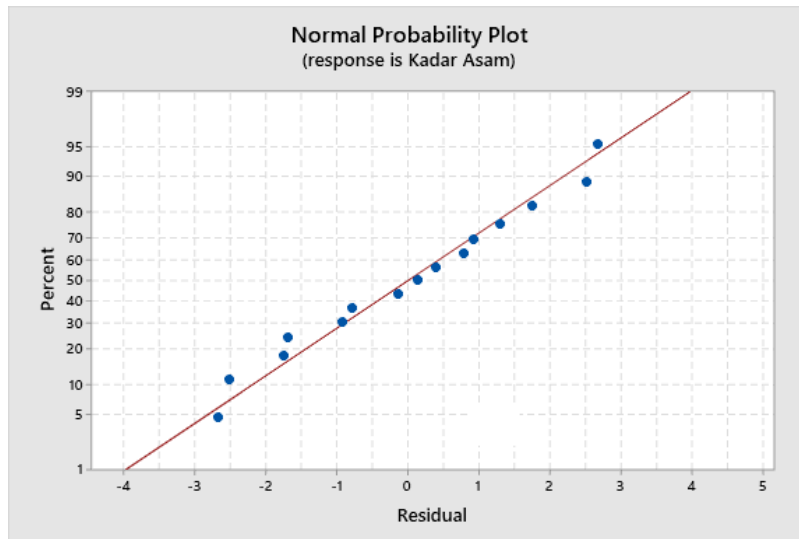
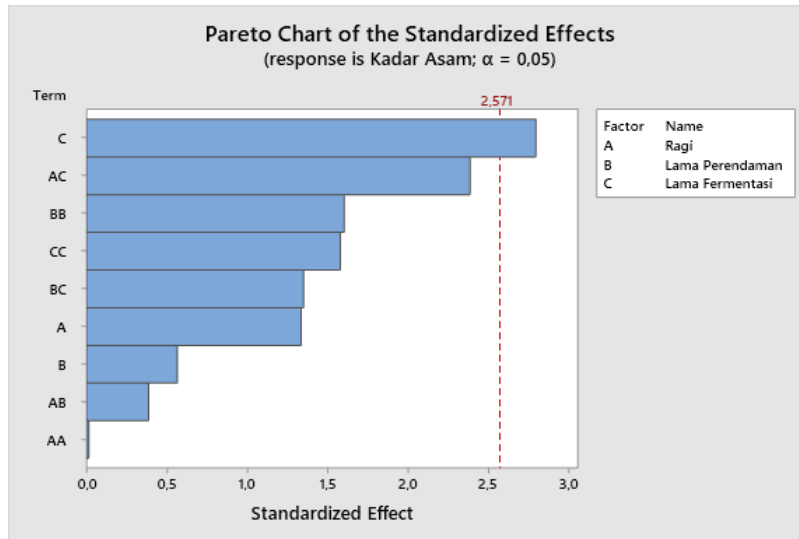
S	R-sq	R-sq(adj)	R-sq(pred)
2,86053	82,21%	50,18%	0,00%

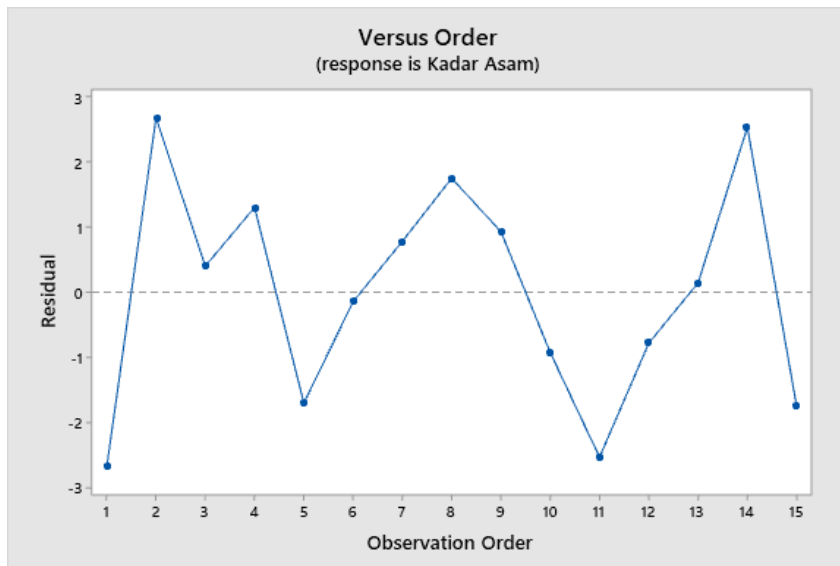
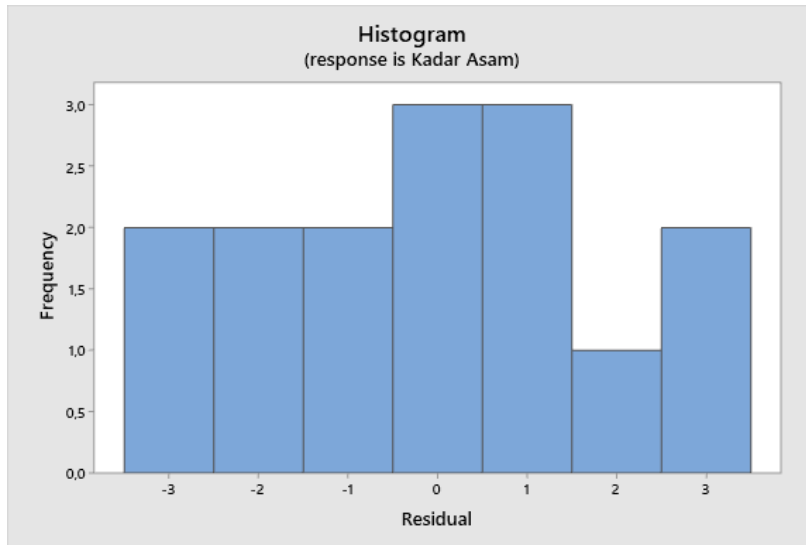
Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Model	9	189,017	21,0019	2,57	0,156
Linear	3	81,259	27,0864	3,31	0,115
Ragi	1	14,634	14,6341	1,79	0,239
Lama Perendaman	1	2,611	2,6106	0,32	0,597
Lama Fermentasi	1	64,015	64,0146	7,82	0,038
Square	3	44,939	14,9796	1,83	0,259
Ragi*Ragi	1	0,002	0,0017	0,00	0,989
Lama Perendaman*Lama Perendaman	1	21,069	21,0688	2,57	0,169
Lama Fermentasi*Lama Fermentasi	1	20,412	20,4125	2,49	0,175
2-Way Interaction	3	62,819	20,9397	2,56	0,168
Ragi*Lama Perendaman	1	1,232	1,2321	0,15	0,714
Ragi*Lama Fermentasi	1	46,649	46,6489	5,70	0,063
Lama Perendaman*Lama Fermentasi	1	14,938	14,9382	1,83	0,235
Error	5	40,913	8,1826		
Lack-of-Fit	3	36,173	12,0577	5,09	0,169
Pure Error	2	4,740	2,3700		
Total	14	229,931			

Regression Equation in Uncoded Units

Kadar = 5,2 + 46,0 Ragi - 0,096 Lama Perendaman
 Asam = 0,75 Lama Fermentasi - 0,3 Ragi*Ragi
 - 0,0295 Lama Perendaman*Lama Perendaman
 + 0,0163 Lama Fermentasi*Lama Fermentasi
 + 0,247 Ragi*Lama Perendaman
 - 1,138 Ragi*Lama Fermentasi
 + 0,0179 Lama Perendaman*Lama Fermentasi





Response Optimization: Kadar Asam

Parameters

Response	Goal	Lower Target	Upper	Weight	Importance
Kadar Asam	Minimum	4,33	20,5	1	1

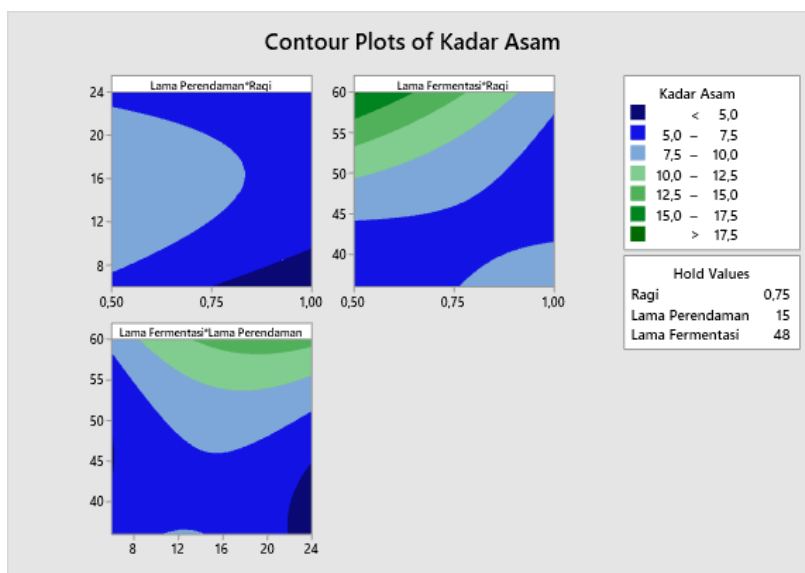
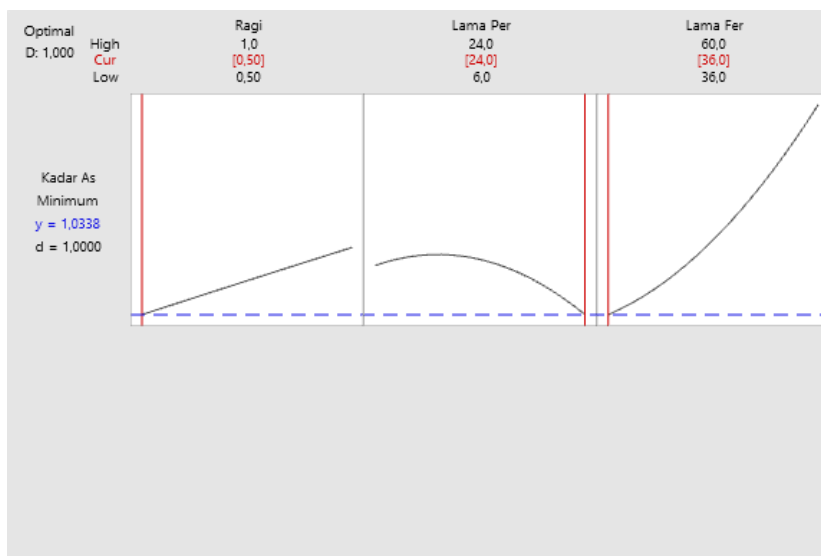
Solution

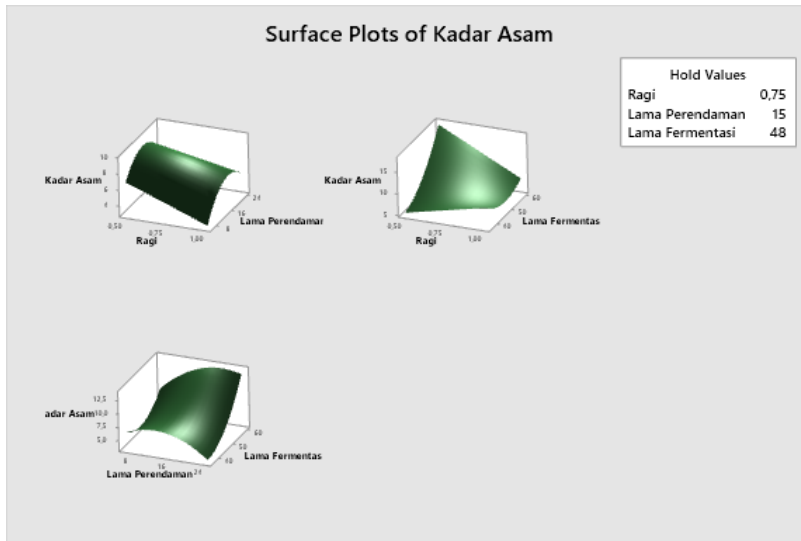
Solution	Ragi Perendaman	Lama Lama Fermentasi	Kadar Asam Composite Fit Desirability		
1	0,5	24	36	1,03375	1

Multiple Response Prediction

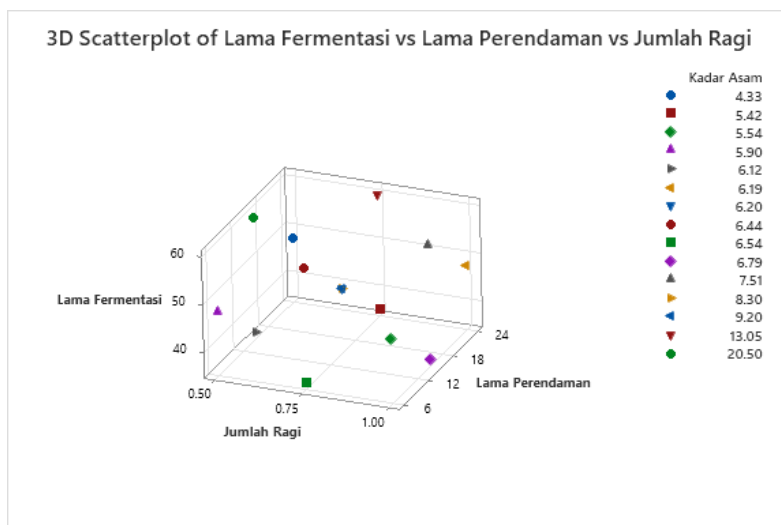
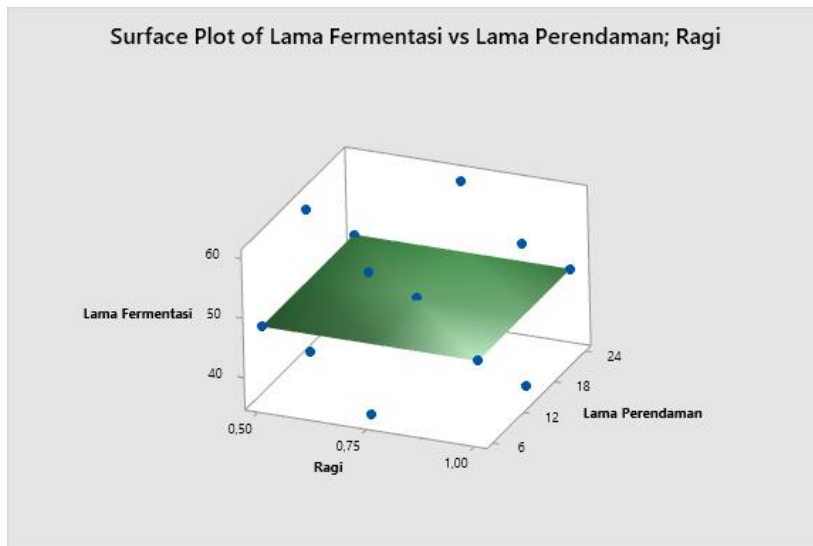
Variable	Setting
Ragi	0,5
Lama Perendaman	
Lama Fermentasi	36

Response	Fit	SE		
		Fit	95% CI	95% PI
Kadar Asam	1,03	3,38	(-7,65; 9,72)	(-10,35; 12,42)





Surface Plot of Lama Fermentasi vs Lama Perendaman vs Ragi



Lampiran 3. Perhitungan kadar alkohol dan kadar asam tempe komersil dan tempe optimal

➤ Kadar alkohol Tempe Optimal

$$\begin{aligned} \% &= \frac{a \times M \times Mr \text{ C}_2\text{H}_5\text{OH} \times \text{Pengenceran}}{\text{berat contoh}} \times 100\% \\ &= \frac{51.5 \times 0.1 \times 46 \times 0.2}{10} \times 100 \\ &= \frac{47.38}{10} \times 100\% \\ &= 4.73\% \end{aligned}$$

➤ Kadar Asam Tempe Optimal
Ulangan 1

$$\begin{aligned} \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\% \\ &= \frac{0.2 \times 1.25 \times 192.13}{10} \times 100\% \\ &= \frac{48.03}{10} \times 100\% \\ &= 4.80\% \end{aligned}$$

Ulangan 2

$$\begin{aligned} \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\% \\ &= \frac{0.2 \times 1.95 \times 192.13}{14} \times 100\% \\ &= \frac{74.93}{14} \times 100\% \\ &= 5.35\% \end{aligned}$$

➤ Kadar Asam Tempe Komersil
Ulangan 1

$$\begin{aligned} \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\% \\ &= \frac{0.2 \times 1.8 \times 192.13}{14.5} \times 100 \\ &= \frac{69.16}{14.5} \times 100\% \\ &= 4.77\% \end{aligned}$$

Ulangan 2

$$\begin{aligned} \% \text{ acid } \left(\frac{\text{wt}}{\text{vol}} \right) &= \frac{N \times V1 \times \text{Eqwt}}{V2} \times 100\% \\ &= \frac{0.2 \times 2.3 \times 192.13}{17} \times 100\% \\ &= \frac{88.37}{17} \times 100\% \\ &= 5.1\% \end{aligned}$$

Lampiran 4. Dokumentasi Proses Pembuatan Tempe Biji Lotus



