

## APPENDIX

## Appendix A Picture

## 1. Picture of Adlay angkak

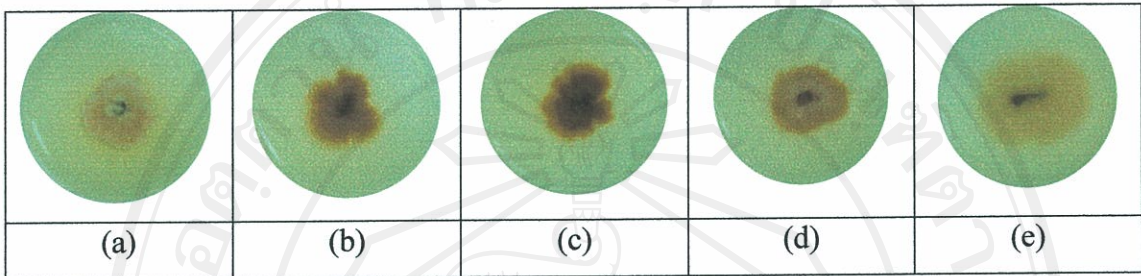


Fig A1.1 *Monascus* spp. cultivated on potato-dextrose agar for 10 days at 30°C, (a) = *M. purpureus* ATCC 16365, (b) = *M. purpureus* BCC 6131, (c) = *M. purpureus* DMKU, (d) = *M. purpureus* FTCMU, (e) = *M. ruber* TISTR 3006

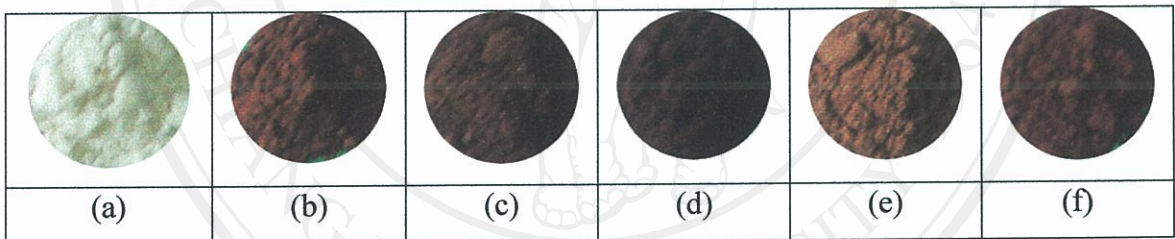


Fig A1.2 Powder adlay angkak; (a) blank, (b) *M. purpureus* ATCC16365, (c) *M. purpureus* BCC6131, (d) *M. purpureus* DMKU, (e) *M. purpureus* FTCMU, (f) *M. ruber* TISTR3006



Fig. A1.3 Adlay angkak varied on cultivation days.

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1.0%Glucose+0.3%Peptone	1.59%Glucose+0.16%Peptone	1.59%Glucose+0.44%Peptone
		
3.0%Glucose+0.1%Peptone	3.0%Glucose+0.3%Peptone	3.0%Glucose+0.5%Peptone
		
4.41%Glucose+0.16%Peptone	4.41%Glucose+0.44%Peptone	5.0%Glucose+0.3%Peptone

Fig A1.4 Adlay angkak (*M. purpureus* DMKU) varied by glucose and peptone content as substrate nutrient

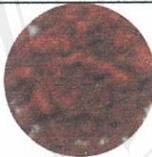

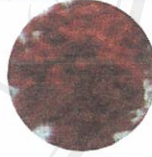
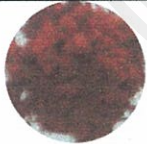





		
1.0%Glucose+0.3%Peptone	1.59%Glucose+0.16%Peptone	1.59%Glucose+0.44%Peptone
		
3.0%Glucose+0.1%Peptone	3.0%Glucose+0.3%Peptone	3.0%Glucose+0.5%Peptone
		
4.41%Glucose+0.16%Peptone	4.41%Glucose+0.44%Peptone	5.0%Glucose+0.3%Peptone

Fig A1.5 Adlay angkak (*M. ruber* TISTR3006) varied by glucose and peptone content as substrate nutrient

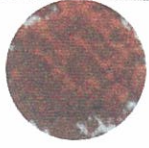



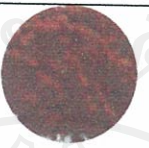
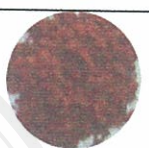



		
1.0%Lactose+0.3%Yeast Extract	1.59%Lactose+0.16%Yeast Extract	1.59%Lactose+0.44%Yeast Extract
		
3.0%Lactose+0.1%Yeast Extract	3.0%Lactose+0.3%Yeast Extract	3.0%Lactose+0.5%Yeast Extract
		
4.41%Lactose+0.16%Yeast Extract	4.41%Lactose+0.44%Yeast Extract	5.0%Lactose+0.3%Yeast Extract

Fig A1.6 Adlay angkak (*M. purpureus* DMKU) varied by lactose and yeast extract content as substrate nutrient


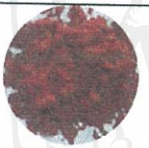


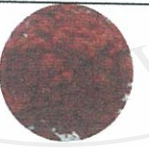




		
1.0%Lactose+0.3%Yeast Extract	1.59%Lactose+0.16%Yeast Extract	1.59%Lactose+0.44%Yeast Extract
		
3.0%Lactose+0.1%Yeast Extract	3.0%Lactose+0.3%Yeast Extract	3.0%Lactose+0.5%Yeast Extract
		
4.41%Lactose+0.16%Yeast Extract	4.41%Lactose+0.44%Yeast Extract	5.0%Lactose+0.3%Yeast Extract

Fig A1.7 Adlay angkak (*M. ruber* TISTR3006) varied by lactose and yeast extract content as substrate nutrient




		
Angkak from Thailand	Angkak from United states of America	Xeuzhikang Jiaonang (Drug)

Fig A1.8 Commercial red yeast rice

## 2. Picture of Instrument

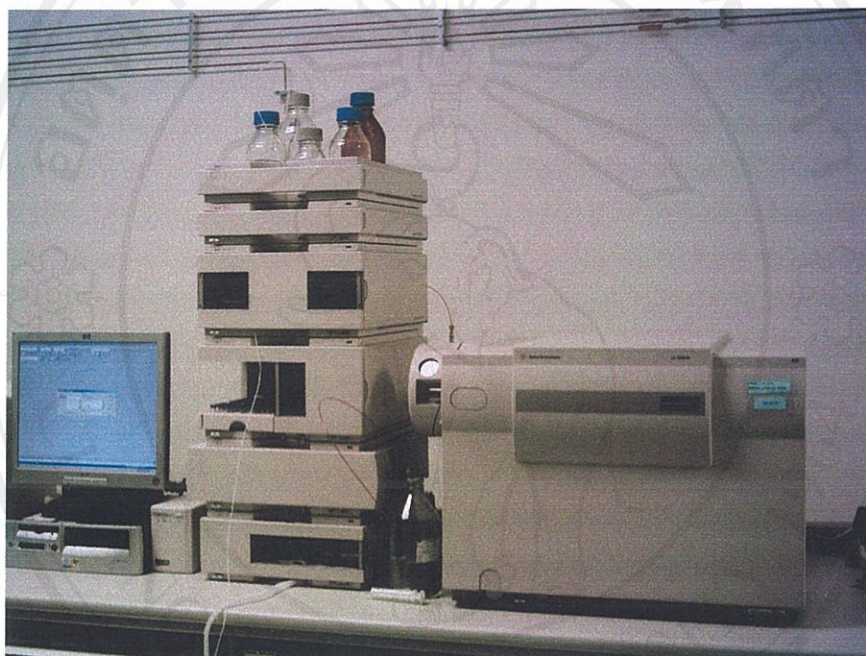


Fig A2.1 High Performance Liquid Chromatography/Diode Array Detector/Mass Spectrometer Detector (Agilent 1100, USA)

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Fig A2.2 Spectrophotometer (Agilent 8453, Germany)



Fig A2.3 Colorimeter (Minolta Camera Co., Ltd., Osaka, Japan)



Fig A2.4 pH meter (Precisa 900, Switzerland)

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## Appendix B Statistic analysis

### Code number means type of *Monascus* strains

Type 1 = *Monascus purpureus* ATCC16365

Type 2 = *Monascus purpureus* BCC6131

Type 3 = *Monascus purpureus* DMKU

Type 4 = *Monascus purpureus* FTCMU

Type 5 = *Monascus ruber* TISTR3006

### 1. Effects of *Monascus* strains on adlay angkak metabolites

Table B1.1 ANOVA table of glucosamine of adlay angkak varied on *Monascus* strains

#### Tests of Between-Subjects Effects

Dependent Variable: glucosamine

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4135.522 <sup>a</sup>	4	1033.881	227.025	.000
Intercept	8106.127	1	8106.127	1779.984	.000
type	4135.522	4	1033.881	227.025	.000
Error	45.540	10	4.554		
Total	12287.189	15			
Corrected Total	4181.062	14			

a. R Squared = .989 (Adjusted R Squared = .985)

Table B1.2 Mean comparison table of glucosamine of adlay angkak varied on *Monascus* strains

#### glucosamine

Duncan<sup>a,b</sup>

type	N	Subset			
		1	2	3	4
1.00	3	6.107167			
4.00	3		13.400800		
2.00	3			20.174333	
3.00	3			22.048600	
5.00	3				54.502533
Sig.		1.000	1.000	.307	1.000

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 4.554.

a. Uses Harmonic Mean Sample Size = 3.000.

b. Alpha = .05.



Table B1.3 ANOVA table of citrinin of adlay angkak varied on *Monascus* strains

## Tests of Between-Subjects Effects

Dependent Variable: citrinin

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	483.627 <sup>a</sup>	4	120.907	99.424	.000
Intercept	161.804	1	161.804	133.054	.000
type	483.627	4	120.907	99.424	.000
Error	12.161	10	1.216		
Total	657.592	15			
Corrected Total	495.788	14			

a. R Squared = .975 (Adjusted R Squared = .966)

Table B1.4 Mean comparison table of citrinin of adlay angkak varied on *Monascus* strains

citrinin

Duncan<sup>a,b</sup>

type	N	Subset	
		1	2
3.00	3	.261867	
2.00	3	.436867	
1.00	3	.529767	
4.00	3	.554367	
5.00	3		14.638867
Sig.		.768	1.000

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 1.216.

a. Uses Harmonic Mean Sample Size = 3.000.

b. Alpha = .05.

Table B1.5 ANOVA table of mevinolin of adlay angkak varied on *Monascus* strains

## Tests of Between-Subjects Effects

Dependent Variable: mevinolin

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	224.862 <sup>a</sup>	4	56.215	598.515	.000
Intercept	4937.730	1	4937.730	52571.004	.000
type	224.862	4	56.215	598.515	.000
Error	.939	10	.094		
Total	5163.531	15			
Corrected Total	225.801	14			

a. R Squared = .996 (Adjusted R Squared = .994)

Table B1.6 Mean comparison table of mevinolin of adlay angkak varied on *Monascus* strains

## mevinolin

Duncan<sup>a,b</sup>

type	N	Subset			
		1	2	3	4
1.00	3	14.967300			
5.00	3	15.328333	15.328333		
4.00	3		15.557367		
2.00	3			19.836633	
3.00	3				25.027233
Sig.		.180	.382	1.000	1.000

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .094.

a. Uses Harmonic Mean Sample Size = 3.000.

b. Alpha = .05.

Table B1.7 ANOVA table of yellow pigment of adlay angkak varied on *Monascus* strains

Tests of Between-Subjects Effects

Dependent Variable: yellow

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	342.246 <sup>a</sup>	4	85.561	40.353	.000
Intercept	1049.634	1	1049.634	495.032	.000
trt	342.246	4	85.561	40.353	.000
Error	21.203	10	2.120		
Total	1413.083	15			
Corrected Total	363.449	14			

a. R Squared = .942 (Adjusted R Squared = .918)

Table B1.8 Mean comparison table of yellow pigment of adlay angkak varied on *Monascus* strains

yellow

Duncan<sup>a,b</sup>

trt	N	Subset		
		1	2	3
4.00	3	2.535800		
2.00	3	2.935400		
3.00	3		9.763500	
5.00	3			13.143333
1.00	3			13.447667
Sig.		.744	1.000	.803

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 2.120.

a. Uses Harmonic Mean Sample Size = 3.000.

b. Alpha = .05.

Table B1.9 ANOVA table of orange pigment of adlay angkak varied on *Monascus* strains

Tests of Between-Subjects Effects

Dependent Variable: orange

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	202.361 <sup>a</sup>	4	50.590	52.299	.000
Intercept	274.189	1	274.189	283.448	.000
trt	202.361	4	50.590	52.299	.000
Error	9.673	10	.967		
Total	486.224	15			
Corrected Total	212.035	14			

a. R Squared = .954 (Adjusted R Squared = .936)

Table B1.10 Mean comparison table of orange pigment of adlay angkak varied on *Monascus* strains

orange

Duncan<sup>a,b</sup>

trt	N	Subset			
		1	2	3	4
2.00	3	.878133			
4.00	3	1.115933			
3.00	3		3.033000		
1.00	3			5.531900	
5.00	3				10.818167
Sig.		.773	1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .967.

a. Uses Harmonic Mean Sample Size = 3.000.

b. Alpha = .05.

Table B1.11 ANOVA table of red pigment of adlay angkak varied on *Monascus* strains

Tests of Between-Subjects Effects

Dependent Variable: red

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	150.775 <sup>a</sup>	4	37.694	35.648	.000
Intercept	272.183	1	272.183	257.414	.000
trt	150.775	4	37.694	35.648	.000
Error	10.574	10	1.057		
Total	433.532	15			
Corrected Total	161.348	14			

a. R Squared = .934 (Adjusted R Squared = .908)

Table B1.10 Mean comparison table of red pigment of adlay angkak varied on *Monascus* strains

red

Duncan<sup>a,b</sup>

trt	N	Subset			
		1	2	3	4
2.00	3	1.032633			
4.00	3	1.367833			
3.00	3		3.430000		
1.00	3			5.910833	
5.00	3				9.557500
Sig.		.698	1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 1.057.

a. Uses Harmonic Mean Sample Size = 3.000.

b. Alpha = .05.

Table B1.11 ANOVA table of L value of adlay angkak varied on *Monascus* strains

## Tests of Between-Subjects Effects

Dependent Variable: L

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	124.694 <sup>a</sup>	4	31.174	65.534	.000
Intercept	29206.558	1	29206.558	61398.732	.000
trt	124.694	4	31.174	65.534	.000
Error	4.757	10	.476		
Total	29336.009	15			
Corrected Total	129.451	14			

a. R Squared = .963 (Adjusted R Squared = .949)

Table B1.12 Mean comparison table of L value of adlay angkak varied on *Monascus* strains

L

Duncan<sup>a,b</sup>

trt	N	Subset			
		1	2	3	4
1.00	3	39.6167			
2.00	3		43.2200		
3.00	3		43.7767		
5.00	3			45.6533	
4.00	3				48.3633
Sig.		1.000	.346	1.000	1.000

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .476.

a. Uses Harmonic Mean Sample Size = 3.000.

b. Alpha = .05.

Table B1.13 ANOVA table of a value of adlay angkak varied on *Monascus* strains

## Tests of Between-Subjects Effects

Dependent Variable: a

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	72.154 <sup>a</sup>	4	18.039	9.564	.002
Intercept	2388.714	1	2388.714	1266.425	.000
trt	72.154	4	18.039	9.564	.002
Error	18.862	10	1.886		
Total	2479.730	15			
Corrected Total	91.016	14			

a. R Squared = .793 (Adjusted R Squared = .710)

Table B1.14 Mean comparison table of a value of adlay angkak varied on *Monascus* strains

a

Duncan<sup>a,b</sup>

trt	N	Subset	
		1	2
1.00	3	10.4067	
2.00	3	10.8300	
3.00	3	12.5933	
4.00	3	12.6533	
5.00	3		16.6133
Sig.		.091	1.000

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 1.886.

a. Uses Harmonic Mean Sample Size = 3.000.

b. Alpha = .05.

Table B1.15 ANOVA table of b value of adlay angkak varied on *Monascus* strains

## Tests of Between-Subjects Effects

Dependent Variable: b

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	27.938 <sup>a</sup>	4	6.985	9.248	.002
Intercept	392.602	1	392.602	519.846	.000
trt	27.938	4	6.985	9.248	.002
Error	7.552	10	.755		
Total	428.093	15			
Corrected Total	35.491	14			

a. R Squared = .787 (Adjusted R Squared = .702)

Table B1.16 Mean comparison table of a value of adlay angkak varied on *Monascus* strains

b

Duncan<sup>a,b</sup>

trt	N	Subset		
		1	2	3
1.00	3	3.2233		
2.00	3	4.4867	4.4867	
3.00	3	4.6233	4.6233	
5.00	3		6.1000	6.1000
4.00	3			7.1467
Sig.		.089	.055	.171

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .755.

a. Uses Harmonic Mean Sample Size = 3.000.

b. Alpha = .05.



Table B1.17 ANOVA table of moisture content of adlay angkak varied on *Monascus* strains

Tests of Between-Subjects Effects

Dependent Variable: water

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	80.935 <sup>a</sup>	4	20.234	244.841	.000
Intercept	102772.496	1	102772.496	1243612	.000
trt	80.935	4	20.234	244.841	.000
Error	.826	10	.083		
Total	102854.258	15			
Corrected Total	81.762	14			

a. R Squared = .990 (Adjusted R Squared = .986)

Table B1.18 Mean comparison table of moisture content of adlay angkak varied on *Monascus* strains

water

Duncan<sup>a,b</sup>

trt	N	Subset			
		1	2	3	4
5.00	3	78.166967			
3.00	3		83.513300		
4.00	3		83.714533	83.714533	
2.00	3			84.093333	84.093333
1.00	3				84.380800
Sig.		1.000	.411	.138	.249

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .083.

a. Uses Harmonic Mean Sample Size = 3.000.

b. Alpha = .05.

Table B1.19 ANOVA table of pH of adlay angkak varied on *Monascus* strains

## Tests of Between-Subjects Effects

Dependent Variable: pH

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.233 <sup>a</sup>	4	.308	8.651	.003
Intercept	556.687	1	556.687	15625.570	.000
trt	1.233	4	.308	8.651	.003
Error	.356	10	.036		
Total	558.276	15			
Corrected Total	1.589	14			

a. R Squared = .776 (Adjusted R Squared = .686)

Table B1.20 Mean comparison table of pH of adlay angkak varied on *Monascus* strains

pH

Duncan<sup>a,b</sup>

trt	N	Subset		
		1	2	3
5.00	3	5.7400		
4.00	3	5.8833		
2.00	3	6.0167	6.0167	
1.00	3		6.2767	6.2767
3.00	3			6.5433
Sig.		.117	.122	.114

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .036.

a. Uses Harmonic Mean Sample Size = 3.000.

b. Alpha = .05.

## 2. Kinetic behavior of *Monascus purpureus* DMKU fermentation on adlay

Table B2.1 Mean and standard deviation of glucosamine, citrinin and mevinolin content of adlay angkak on cultivation days.

Fermentation days	Glucosamine (ppm)	Citrinin (ppm)	Mevinolin (ppm)
0	0.5499±0.02	0±0.00	0.2385±0.02
3	1.6355±0.09	0±0.00	0.6971±0.07
6	3.4764±0.45	0±0.00	2.4611±0.21
9	4.0734±1.17	0±0.00	5.2515±1.40
12	6.8826±0.58	0±0.00	8.2633±1.27
15	7.1012±1.80	0.1816±0.10	9.1421±0.65
18	10.8704±0.86	0.7428±0.22	13.2592±2.65
21	8.3017±0.93	0.7032±0.09	27.2401±2.03
24	6.4399±1.12	1.2355±0.09	44.3037±10.42
27	5.2471±0.53	0.9538±0.36	40.2160±9.53
30	5.4242±0.11	0.9585±0.24	13.8851±0.69
33	5.5611±0.52	1.0505±0.35	18.4992±5.45
36	4.5638±0.23	0.8831±0.22	14.4622±0.95
39	4.3730±0.32	0.9259±0.06	17.8519±1.18
42	4.2912±0.20	0.8150±0.09	23.6791±10.27
45	4.4308±0.19	0.8356±0.07	21.8481±3.58
48	3.5623±0.24	0.6382±0.07	15.1169±7.87
51	3.7551±0.23	0.8719±0.06	27.4360±6.77
54	3.8179±0.03	0.8629±0.02	21.4192±5.57
57	3.7989±0.25	0.6588±0.05	28.4508±2.29

Table B2.2 Mean and standard deviation of adlay angkak pigments on cultivation days.

Fermentation days	Absorbance		
	400 nm	470 nm	500 nm
0	0.0352±0.0031	0.0195±0.0030	0.0163±0.0032
3	0.3546±0.0377	0.1770±0.0229	0.2248±0.0202
6	0.3642±0.0530	0.2095±0.0202	0.2543±0.0349
9	1.7805±0.6298	0.6099±0.2292	0.7504±0.2895
12	2.8227±0.3379	0.9509±0.0548	1.1929±0.0552
15	4.7179±0.5240	1.7107±0.1403	2.1189±0.1262
18	10.9335±1.3429	4.4488±0.6500	5.4519±0.8047
21	10.5651±3.5075	4.4004±2.0037	5.3853±2.5415
24	10.7283±1.6372	3.7526±0.4749	4.5377±0.4693
27	12.4475±2.8109	4.8705±1.3082	5.9161±1.5060
30	10.1661±0.1333	3.3910±0.1029	4.1468±0.0951
33	10.4537±2.1085	3.5332±0.8453	4.2805±0.9299
36	6.9619±1.2877	2.2746±0.4951	2.8353±0.5548
39	6.5087±0.3469	2.0765±0.1470	2.5950±0.1550
42	7.9201±3.4702	2.6715±1.0880	3.2569±1.2305
45	7.8031±1.1093	2.5297±0.4950	3.1489±0.6152
48	7.6503±1.6612	2.6150±0.6526	3.2475±0.7078
51	7.0909±1.4089	2.5550±0.4623	3.2289±0.5363
54	6.4959±1.9363	2.2734±0.7466	2.9503±0.8742
57	6.2964±1.0177	2.0085±0.2506	2.5730±0.2739

Table B2.3 Mean and standard deviation of Color on HunterLab system of adlay angkak on cultivation days.

Fermentation days	Hunter Lab		
	L value	a value	b value
0	72.04±0.60	2.76±0.37	14.64±0.26
3	65.57±1.30	10.9±0.76	10.62±0.12
6	66.71±0.32	11.43±0.34	11.21±0.03
9	61.89±1.87	15.19±0.75	10.29±0.28
12	57.98±1.62	17.55±0.92	10.22±0.16
15	55.44±0.84	18.34±0.17	9.42±0.19
18	48.87±1.89	19.35±0.30	7.80±0.38
21	48.48±1.43	18.51±0.35	8.24±0.17
24	46.52±1.30	17.80±0.44	7.51±0.30
27	48.67±2.36	18.46±0.46	8.07±0.51
30	50.41±1.59	18.69±0.59	9.15±0.17
33	48.46±1.44	17.25±0.44	9.01±0.99
36	51.76±1.51	18.26±0.15	9.86±0.87
39	48.48±1.43	17.45±0.29	8.84±0.71
42	46.24±0.42	15.64±1.15	7.44±0.03
45	47.32±0.30	16.32±1.33	8.06±0.43
48	46.45±2.22	17.10±0.55	8.88±0.31
51	44.15±0.87	14.90±1.09	6.13±0.94
54	45.39±0.50	16.49±1.32	7.11±0.58
57	47.42±0.71	16.41±0.43	7.76±0.17

Table B2.4 Mean and standard deviation of moisture content and pH of adlay angkak on cultivation days.

Fermentation days	Water content (%)	pH
0	55.536±0.51	6.28±0.05
3	54.058±0.77	6.02±0.05
6	59.4766±0.66	5.91±0.10
9	60.9406±1.48	5.73±0.04
12	63.4214±1.83	5.79±0.11
15	64.1929±0.36	5.73±0.03
18	69.4693±0.65	5.85±0.06
21	74.4703±2.58	6.01±0.24
24	75.3277±1.64	6.20±0.05
27	74.1208±0.26	6.06±0.09
30	71.5301±2.21	5.93±0.07
33	71.1591±0.88	6.07±0.01
36	70.0892±2.84	5.92±0.04
39	68.4817±0.81	6.01±0.07
42	68.9254±1.93	6.01±0.03
45	67.9859±1.10	6.08±0.12
48	67.7150±4.98	6.04±0.15
51	66.9059±4.57	6.22±0.06
54	65.4439±5.45	6.10±0.03
57	68.7194±1.00	6.02±0.03

### 3. Optimization of carbon and nitrogen source on adlay angkak

Table B3.1 ANOVA table of a value of adlay angkak (*M. ruber* TISTR3006) added glucose-peptone nutrient

ANOVA for Response Surface Quadratic Model						
Analysis of variance table [Partial sum of squares]						
Source	Sum of Squares	DF	Mean Square	F Value	Prob > F	
Model	1.8594	5	0.3719	4.0993	0.0465	significant
A	0.0039	1	0.0039	0.0425	0.8425	
B	0.4648	1	0.4648	5.1239	0.0580	
A <sup>2</sup>	0.4133	1	0.4133	4.5559	0.0702	
B <sup>2</sup>	0.3640	1	0.3640	4.0124	0.0852	
AB	0.4970	1	0.4970	5.4786	0.0518	
Residual	0.6350	7	0.0907			
Lack of Fit	0.2944	3	0.0981	1.1527	0.4303	not significant
Pure Error	0.3406	4	0.0852			
Cor Total	2.4945	12				

Table B3.2 ANOVA table of orange pigment of adlay angkak (*M. ruber* TISTR3006) added glucose-peptone nutrient

ANOVA for Response Surface Quadratic Model						
Analysis of variance table [Partial sum of squares]						
Source	Sum of Squares	DF	Mean Square	F Value	Prob > F	
Model	12.3547	5	2.4709	3.4422	0.0689	not significant
A	2.3266	1	2.3266	3.2411	0.1148	
B	0.4707	1	0.4707	0.6557	0.4447	
A <sup>2</sup>	9.3188	1	9.3188	12.9817	0.0087	
B <sup>2</sup>	0.6319	1	0.6319	0.8803	0.3793	
AB	0.0784	1	0.0784	0.1092	0.7507	
Residual	5.0249	7	0.7178			
Lack of Fit	4.1476	3	1.3825	6.3039	0.0537	not significant
Pure Error	0.8773	4	0.2193			
Cor Total	17.3795	12				

Table B3.3 ANOVA table of red pigment of adlay angkak (*M. ruber* TISTR3006) added glucose-peptone nutrient

ANOVA for Response Surface Quadratic Model						
Analysis of variance table [Partial sum of squares]						
Source	Sum of Squares	DF	Mean Square	F Value	Prob > F	
Model	11.0768	5	2.2154	3.3575	0.0728	not significant
A	2.1739	1	2.1739	3.2946	0.1124	
B	0.7747	1	0.7747	1.1742	0.3145	
A <sup>2</sup>	8.0661	1	8.0661	12.2246	0.0100	
B <sup>2</sup>	0.3391	1	0.3391	0.5140	0.4966	
AB	0.0164	1	0.0164	0.0248	0.8792	
Residual	4.6188	7	0.6598			
Lack of Fit	4.0389	3	1.3463	9.2865	0.0283	significant
Pure Error	0.5799	4	0.1450			
Cor Total	15.6956	12				

Table B3.4 ANOVA table of L value of adlay angkak (*M. ruber* TISTR3006) added lactose-yeast extract nutrient

ANOVA for Response Surface Quadratic Model						
Analysis of variance table [Partial sum of squares]						
Source	Sum of Squares	DF	Mean Square	F Value	Prob > F	
Model	4.0766	5	0.8153	7.3555	0.0104	significant
A	0.7613	1	0.7613	6.8685	0.0344	
B	0.4830	1	0.4830	4.3577	0.0752	
A <sup>2</sup>	1.4017	1	1.4017	12.6452	0.0093	
B <sup>2</sup>	0.5795	1	0.5795	5.2281	0.0561	
AB	0.5776	1	0.5776	5.2109	0.0564	
Residual	0.7759	7	0.1108			
Lack of Fit	0.5276	3	0.1759	2.8329	0.1701	not significant
Pure Error	0.2483	4	0.0621			
Cor Total	4.8525	12				



Table B3.5 ANOVA table of a value of adlay angkak (*M. ruber* TISTR3006) added lactose-yeast extract nutrient

ANOVA for Response Surface Quadratic Model						
Analysis of variance table [Partial sum of squares]						
Source	Sum of Squares	DF	Mean Square	F Value	Prob > F	
Model	10.2192	5	2.0438	5.9791	0.0182	significant
A	5.0220	1	5.0220	14.6915	0.0064	
B	0.9072	1	0.9072	2.6539	0.1473	
A <sup>2</sup>	1.0513	1	1.0513	3.0755	0.1229	
B <sup>2</sup>	1.6959	1	1.6959	4.9613	0.0612	
AB	1.8496	1	1.8496	5.4108	0.0529	
Residual	2.3928	7	0.3418			
Lack of Fit	2.0270	3	0.6757	7.3885	0.0415	significant
Pure Error	0.3658	4	0.0914			
Cor Total	12.6121	12				

#### 4. Effects of carbon and nitrogen source on adlay angkak production

##### Code number means type of angkak

Trt 1 = Adlay angkak supplemented with 1%Glucose+0.3%Peptone

Trt 2 = Adlay angkak supplemented with 3%Glucose+0.1%Peptone

Trt 3 = Adlay angkak supplemented with 3%Glucose+0.5%Peptone

Trt 4 = Adlay angkak supplemented with 5%Glucose+0.3%Peptone

Trt 10 = Adlay angkak supplemented with 1%Lactose+0.3%Yeast Extract

Trt 11 = Adlay angkak supplemented with 3%Lactose+0.1%Yeast Extract

Trt 12 = Adlay angkak supplemented with 3%Lactose+0.5%Yeast Extract

Trt 13 = Adlay angkak supplemented with 5%Lactose+0.3%Yeast Extract

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Table B4.1 ANOVA table of glucosamine of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients

Tests of Between-Subjects Effects

Dependent Variable: gluDMKUp

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2331.651 <sup>a</sup>	7	333.093	.899	.550
Intercept	2015.814	1	2015.814	5.438	.048
trt	2331.651	7	333.093	.899	.550
Error	2965.439	8	370.680		
Total	7312.904	16			
Corrected Total	5297.090	15			

a. R Squared = .440 (Adjusted R Squared = -.050)

Table B4.2 Mean comparison table of glucosamine of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients

gluDMKUp

Duncan<sup>a,b</sup>

trt	N	Subset
		1
2.00	2	3.1565
3.00	2	3.1722
4.00	2	3.3799
12.00	2	6.6989
10.00	2	7.8806
13.00	2	11.4622
11.00	2	12.1318
1.00	2	41.9135
Sig.		.101

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 370.680.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B4.3 ANOVA table of citrinin of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients

Tests of Between-Subjects Effects

Dependent Variable: citDMKUp

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2.444 <sup>a</sup>	7	.349	2.720	.092
Intercept	2.562	1	2.562	19.952	.002
trt	2.444	7	.349	2.720	.092
Error	1.027	8	.128		
Total	6.033	16			
Corrected Total	3.471	15			

a. R Squared = .704 (Adjusted R Squared = .445)

Table B4.4 Mean comparison table of citrinin of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients

citDMKUp

Duncan<sup>a,b</sup>

trt	N	Subset	
		1	2
3.00	2	.0000	
4.00	2	.0000	
13.00	2	.0000	
11.00	2	.1037	.1037
2.00	2	.6169	.6169
10.00	2	.6309	.6309
1.00	2	.8858	.8858
12.00	2		.9639
Sig.		.054	.057

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .128.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B4.5 ANOVA table of mevinolin of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients

Tests of Between-Subjects Effects

Dependent Variable: mevDMKUp

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1100.381 <sup>a</sup>	7	157.197	14.782	.001
Intercept	620.898	1	620.898	58.386	.000
trt	1100.381	7	157.197	14.782	.001
Error	85.075	8	10.634		
Total	1806.354	16			
Corrected Total	1185.456	15			

a. R Squared = .928 (Adjusted R Squared = .865)

Table B4.6 Mean comparison table of mevinolin of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients

mevDMKUp

Duncan<sup>a,b</sup>

trt	N	Subset		
		1	2	3
10.00	2	.0000		
13.00	2	.1845		
11.00	2	.2215		
4.00	2	.4045		
3.00	2	.4791		
12.00	2		10.0018	
2.00	2		16.3312	16.3312
1.00	2			22.2130
Sig.		.893	.088	.109

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 10.634.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B4.7 ANOVA table of yellow pigment of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients

Tests of Between-Subjects Effects

Dependent Variable: YellowDMKU

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	9.213 <sup>a</sup>	7	1.316	.978	.505
Intercept	591.073	1	591.073	439.076	.000
trt	9.213	7	1.316	.978	.505
Error	10.769	8	1.346		
Total	611.056	16			
Corrected Total	19.982	15			

a. R Squared = .461 (Adjusted R Squared = -.011)

Table B4.8 Mean comparison table of yellow pigment of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients

YellowDMKU

Duncan<sup>a,b</sup>

trt	N	Subset
		1
1.00	2	5.0800
10.00	2	5.1680
3.00	2	5.9040
12.00	2	5.9280
2.00	2	5.9440
11.00	2	6.3360
13.00	2	6.6720
4.00	2	7.5920
Sig.		.082

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 1.346.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B4.9 ANOVA table of orange pigment of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients

Tests of Between-Subjects Effects

Dependent Variable: OrangeDMKU

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.869 <sup>a</sup>	7	.124	.646	.711
Intercept	60.466	1	60.466	314.928	.000
trt	.869	7	.124	.646	.711
Error	1.536	8	.192		
Total	62.871	16			
Corrected Total	2.405	15			

a. R Squared = .361 (Adjusted R Squared = -.198)

Table B4.10 Mean comparison table of orange pigment of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients

OrangeDMKU

Duncan<sup>a,b</sup>

trt	N	Subset
		1
10.00	2	1.6400
1.00	2	1.7280
2.00	2	1.7760
3.00	2	1.8480
12.00	2	1.9520
11.00	2	2.0080
4.00	2	2.2880
13.00	2	2.3120
Sig.		.191

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .192.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B4.11 ANOVA table of red pigment of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients

Tests of Between-Subjects Effects

Dependent Variable: RedDMKU

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.233 <sup>a</sup>	7	.176	.634	.719
Intercept	78.712	1	78.712	283.546	.000
trt	1.233	7	.176	.634	.719
Error	2.221	8	.278		
Total	82.166	16			
Corrected Total	3.453	15			

a. R Squared = .357 (Adjusted R Squared = -.206)

Table B4.12 Mean comparison table of red pigment of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients

RedDMKU

Duncan<sup>a,b</sup>

trt	N	Subset
		1
10.00	2	1.8640
1.00	2	1.9440
2.00	2	2.0240
3.00	2	2.1040
12.00	2	2.2400
11.00	2	2.2960
4.00	2	2.5680
13.00	2	2.7040
Sig.		.177

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .278.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B4.13 ANOVA table of L value of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients

Tests of Between-Subjects Effects

Dependent Variable: LDMKU

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	26.942 <sup>a</sup>	7	3.849	1.522	.284
Intercept	37237.421	1	37237.421	14727.808	.000
trt	26.942	7	3.849	1.522	.284
Error	20.227	8	2.528		
Total	37284.590	16			
Corrected Total	47.169	15			

a. R Squared = .571 (Adjusted R Squared = .196)

Table B4.14 Mean comparison table of L value of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients

LDMKU

Duncan<sup>a,b</sup>

trt	N	Subset	
		1	2
13.00	2	45.9200	
11.00	2	46.7100	46.7100
10.00	2	47.9450	47.9450
2.00	2	48.4050	48.4050
12.00	2	48.5450	48.5450
1.00	2	48.6700	48.6700
4.00	2	49.7600	49.7600
3.00	2		49.9850
Sig.		.058	.095

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 2.528.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.



Table B4.15 ANOVA table of a value of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients

Tests of Between-Subjects Effects

Dependent Variable: aDMKU

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5.461 <sup>a</sup>	7	.780	1.149	.421
Intercept	5655.416	1	5655.416	8327.121	.000
trt	5.461	7	.780	1.149	.421
Error	5.433	8	.679		
Total	5666.311	16			
Corrected Total	10.895	15			

a. R Squared = .501 (Adjusted R Squared = .065)

Table B4.16 Mean comparison table of a value of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients

aDMKU

Duncan<sup>a,b</sup>

trt	N	Subset
		1
2.00	2	17.9350
1.00	2	18.0150
13.00	2	18.3400
3.00	2	18.9650
11.00	2	18.9650
10.00	2	19.2500
4.00	2	19.4100
12.00	2	19.5250
Sig.		.113

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .679.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B4.17 ANOVA table of b value of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients

Tests of Between-Subjects Effects

Dependent Variable: bDMKU

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	12.707 <sup>a</sup>	7	1.815	2.395	.122
Intercept	897.152	1	897.152	1183.490	.000
trt	12.707	7	1.815	2.395	.122
Error	6.064	8	.758		
Total	915.924	16			
Corrected Total	18.771	15			

a. R Squared = .677 (Adjusted R Squared = .394)

Table B4.18 Mean comparison table of b value of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients

bDMKU

Duncan<sup>a,b</sup>

trt	N	Subset	
		1	2
13.00	2	5.5950	
11.00	2	6.7300	6.7300
2.00	2	7.5000	7.5000
10.00	2	7.6750	7.6750
12.00	2	7.7050	7.7050
1.00	2	7.7650	7.7650
4.00	2		8.2250
3.00	2		8.7100
Sig.		.051	.070

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .758.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B4.19 ANOVA table of moisture content of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients

Tests of Between-Subjects Effects

Dependent Variable: WCDMKU

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	486.323 <sup>a</sup>	7	69.475	3.463	.051
Intercept	73954.083	1	73954.083	3686.690	.000
trt	486.323	7	69.475	3.463	.051
Error	160.478	8	20.060		
Total	74600.884	16			
Corrected Total	646.801	15			

a. R Squared = .752 (Adjusted R Squared = .535)

Table B4.20 Mean comparison table of moisture content of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients

WCDMKU

Duncan<sup>a,b</sup>

trt	N	Subset		
		1	2	3
3.00	2	59.0600		
13.00	2	61.8250	61.8250	
11.00	2	65.8150	65.8150	65.8150
1.00	2	67.0150	67.0150	67.0150
12.00	2	68.0500	68.0500	68.0500
10.00	2		71.8850	71.8850
2.00	2			73.9200
4.00	2			76.3200
Sig.		.099	.071	.063

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 20.060.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B4.21 ANOVA table of pH of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients

Tests of Between-Subjects Effects

Dependent Variable: pHDMKU

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.283 <sup>a</sup>	7	.040	1.197	.399
Intercept	523.037	1	523.037	15503.132	.000
trt	.283	7	.040	1.197	.399
Error	.270	8	.034		
Total	523.590	16			
Corrected Total	.553	15			

a. R Squared = .512 (Adjusted R Squared = .084)

Table B4.22 Mean comparison table of pH of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients

pHDMKU

Duncan<sup>a,b</sup>

trt	N	Subset	
		1	2
3.00	2	5.4300	
1.00	2	5.6250	5.6250
13.00	2	5.6950	5.6950
11.00	2	5.7200	5.7200
2.00	2	5.7700	5.7700
4.00	2	5.8000	5.8000
10.00	2	5.8000	5.8000
12.00	2		5.9000
Sig.		.101	.202

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .034.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B4.23 ANOVA table of glucosamine of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients

Tests of Between-Subjects Effects

Dependent Variable: gluRUBERp

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	30358.903 <sup>a</sup>	7	4336.986	2.639	.099
Intercept	61512.965	1	61512.965	37.431	.000
trt	30358.903	7	4336.986	2.639	.099
Error	13147.085	8	1643.386		
Total	105018.953	16			
Corrected Total	43505.988	15			

a. R Squared = .698 (Adjusted R Squared = .433)

Table B4.24 Mean comparison table of glucosamine of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients

gluRUBERp

Duncan<sup>a,b</sup>

trt	N	Subset	
		1	2
11.00	2	6.9988	
4.00	2	11.6473	
13.00	2	35.6071	
2.00	2	58.8356	58.8356
1.00	2	64.5234	64.5234
12.00	2	72.7927	72.7927
3.00	2	96.4298	96.4298
10.00	2		149.2013
Sig.		.077	.073

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 1643.386.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B4.25 ANOVA table of citrinin of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients

Tests of Between-Subjects Effects

Dependent Variable: citRUBERp

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	316.253 <sup>a</sup>	7	45.179	6.597	.008
Intercept	178.372	1	178.372	26.046	.001
trt	316.253	7	45.179	6.597	.008
Error	54.786	8	6.848		
Total	549.410	16			
Corrected Total	371.039	15			

a. R Squared = .852 (Adjusted R Squared = .723)

Table B4.26 Mean comparison table of citrinin of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients

citRUBERp

Duncan<sup>a,b</sup>

trt	N	Subset	
		1	2
3.00	2	.0000	
4.00	2	.0000	
11.00	2	.0000	
13.00	2	.0000	
2.00	2	2.0321	
12.00	2	3.1390	
10.00	2		9.9511
1.00	2		11.5890
Sig.		.295	.549

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 6.848.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B4.27 ANOVA table of mevinolin of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients

Tests of Between-Subjects Effects

Dependent Variable: mevRUBERp

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1838.595 <sup>a</sup>	7	262.656	1.663	.245
Intercept	1627.026	1	1627.026	10.300	.012
trt	1838.595	7	262.656	1.663	.245
Error	1263.690	8	157.961		
Total	4729.311	16			
Corrected Total	3102.285	15			

a. R Squared = .593 (Adjusted R Squared = .236)

Table B4.28 Mean comparison table of mevinolin of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients and commercial red yeast rice

mevRUBERp

Duncan<sup>a,b</sup>

trt	N	Subset
		1
3.00	2	.0000
11.00	2	.1057
13.00	2	.1507
4.00	2	.2047
10.00	2	13.2020
2.00	2	18.1122
12.00	2	20.2711
1.00	2	28.6264
Sig.		.070

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 157.961.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B4.29 ANOVA table of yellow pigment of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients

Tests of Between-Subjects Effects

Dependent Variable: YellowRUBER

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	115.181 <sup>a</sup>	7	16.454	.596	.745
Intercept	18347.244	1	18347.244	664.387	.000
trt	115.181	7	16.454	.596	.745
Error	220.922	8	27.615		
Total	18683.348	16			
Corrected Total	336.104	15			

a. R Squared = .343 (Adjusted R Squared = -.232)

Table B4.30 Mean comparison table of yellow pigment of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients

YellowRUBER

Duncan<sup>a,b</sup>

trt	N	Subset
		1
3.00	2	29.6960
1.00	2	31.3120
4.00	2	32.7040
12.00	2	33.5120
10.00	2	34.0480
11.00	2	34.3200
2.00	2	36.3840
13.00	2	38.9280
Sig.		.143

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 27.615.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.



Table B4.31 ANOVA table of orange pigment of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients

Tests of Between-Subjects Effects

Dependent Variable: OrangeRUBER

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	94.926 <sup>a</sup>	7	13.561	4.289	.029
Intercept	1009.714	1	1009.714	319.378	.000
trt	94.926	7	13.561	4.289	.029
Error	25.292	8	3.162		
Total	1129.932	16			
Corrected Total	120.218	15			

a. R Squared = .790 (Adjusted R Squared = .606)

Table B4.32 Mean comparison table of orange pigment of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients

OrangeRUBER

Duncan<sup>a,b</sup>

trt	N	Subset		
		1	2	3
3.00	2	5.1840		
1.00	2	5.6240		
4.00	2	6.5200	6.5200	
2.00	2	7.0160	7.0160	
12.00	2	7.7360	7.7360	
10.00	2	8.2400	8.2400	
11.00	2		10.1200	10.1200
13.00	2			13.1120
Sig.		.150	.097	.131

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 3.162.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B4.33 ANOVA table of red pigment of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients

Tests of Between-Subjects Effects

Dependent Variable: RedRUBER

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	63.723 <sup>a</sup>	7	9.103	3.545	.048
Intercept	773.952	1	773.952	301.370	.000
trt	63.723	7	9.103	3.545	.048
Error	20.545	8	2.568		
Total	858.220	16			
Corrected Total	84.268	15			

a. R Squared = .756 (Adjusted R Squared = .543)

Table B4.34 Mean comparison table of red pigment of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients

RedRUBER

Duncan<sup>a,b</sup>

trt	N	Subset	
		1	2
3.00	2	4.7360	
1.00	2	5.0080	
4.00	2	6.0000	
2.00	2	6.2240	
12.00	2	6.8560	
10.00	2	7.0960	
11.00	2	8.3120	8.3120
13.00	2		11.4080
Sig.		.075	.089

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 2.568.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B4.35 ANOVA table of L value of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients

Tests of Between-Subjects Effects

Dependent Variable: LRUBER

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	58.437 <sup>a</sup>	7	8.348	5.617	.013
Intercept	36585.169	1	36585.169	24614.412	.000
trt	58.437	7	8.348	5.617	.013
Error	11.891	8	1.486		
Total	36655.497	16			
Corrected Total	70.328	15			

a. R Squared = .831 (Adjusted R Squared = .683)

Table B4.36 Mean comparison table of L value of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients

LRUBER

Duncan<sup>a,b</sup>

trt	N	Subset		
		1	2	3
13.00	2	45.6950		
10.00	2	46.2050		
12.00	2	46.2850		
11.00	2	46.7200		
2.00	2	47.1050	47.1050	
4.00	2		49.6750	49.6750
1.00	2		49.7400	49.7400
3.00	2			51.1200
Sig.		.311	.072	.288

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 1.486.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B4.37 ANOVA table of a value of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients

Tests of Between-Subjects Effects

Dependent Variable: aRUBER

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4.339 <sup>a</sup>	7	.620	2.313	.131
Intercept	6504.019	1	6504.019	24273.823	.000
trt	4.339	7	.620	2.313	.131
Error	2.144	8	.268		
Total	6510.502	16			
Corrected Total	6.483	15			

a. R Squared = .669 (Adjusted R Squared = .380)

Table B4.38 Mean comparison table of a value of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients

aRUBER

Duncan<sup>a,b</sup>

trt	N	Subset	
		1	2
11.00	2	19.0700	
13.00	2	19.6450	19.6450
12.00	2	19.9900	19.9900
1.00	2		20.4400
4.00	2		20.4550
3.00	2		20.4800
10.00	2		20.5100
2.00	2		20.7050
Sig.		.127	.096

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .268.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B4.39 ANOVA table of b value of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients

Tests of Between-Subjects Effects

Dependent Variable: bRUBER

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	14.010 <sup>a</sup>	7	2.001	12.941	.001
Intercept	732.514	1	732.514	4736.594	.000
trt	14.010	7	2.001	12.941	.001
Error	1.237	8	.155		
Total	747.761	16			
Corrected Total	15.247	15			

a. R Squared = .919 (Adjusted R Squared = .848)

Table B4.40 Mean comparison table of b value of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients

bRUBER

Duncan<sup>a,b</sup>

trt	N	Subset		
		1	2	3
12.00	2	5.5900		
13.00	2	5.7350		
10.00	2	5.9900	5.9900	
11.00	2	6.3900	6.3900	
2.00	2		6.7650	
1.00	2			7.7100
4.00	2			7.9550
3.00	2			7.9950
Sig.		.092	.095	.506

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .155.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B4.41 ANOVA table of moisture content of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients

Tests of Between-Subjects Effects

Dependent Variable: WCRUBER

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	91.830 <sup>a</sup>	7	13.119	1.734	.229
Intercept	62761.523	1	62761.523	8295.061	.000
trt	91.830	7	13.119	1.734	.229
Error	60.529	8	7.566		
Total	62913.882	16			
Corrected Total	152.359	15			

a. R Squared = .603 (Adjusted R Squared = .255)

Table B4.42 Mean comparison table of moisture content of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients

WCRUBER

Duncan<sup>a,b</sup>

trt	N	Subset	
		1	2
13.00	2	58.9250	
11.00	2	59.3200	59.3200
10.00	2	62.1950	62.1950
12.00	2	62.5650	62.5650
4.00	2	63.0850	63.0850
3.00	2	63.3150	63.3150
1.00	2	65.7500	65.7500
2.00	2		65.8900
Sig.		.053	.060

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 7.566.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B4.43 ANOVA table of pH of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients

Tests of Between-Subjects Effects

Dependent Variable: pH RUBER

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.890 <sup>a</sup>	7	.127	10.405	.002
Intercept	498.406	1	498.406	40769.376	.000
trt	.890	7	.127	10.405	.002
Error	.098	8	.012		
Total	499.394	16			
Corrected Total	.988	15			

a. R Squared = .901 (Adjusted R Squared = .814)

Table B4.44 Mean comparison table of pH of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients

pH RUBER

Duncan<sup>a,b</sup>

trt	N	Subset				
		1	2	3	4	5
11.00	2	5.1950				
13.00	2	5.3750	5.3750			
10.00	2	5.4600	5.4600	5.4600		
12.00	2		5.5550	5.5550	5.5550	
2.00	2		5.5600	5.5600	5.5600	
4.00	2			5.7000	5.7000	
1.00	2				5.8100	5.8100
3.00	2					5.9950
Sig.		.050	.154	.076	.062	.133

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .012.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

### 5. Comparison of properties of adlay angkak added carbon-nitrogen source with commercial red rice

#### Code number means type of angkak

Trt 5 = Adlay angkak sample blank (no carbon-nitrogen source)

Trt 7 = Red yeast rice (Thai)

Trt 8 = Red yeast rice (U.S.A.)

Trt 9 = Xuezhikang Jiaonang (drug)

Table B5.1 ANOVA table of glucosamine of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients, without supplement and commercial red rice

#### Tests of Between-Subjects Effects

Dependent Variable: gluDMKUp

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3750.472 <sup>a</sup>	5	750.094	1.726	.262
Intercept	7037.121	1	7037.121	16.195	.007
trt	3750.472	5	750.094	1.726	.262
Error	2607.148	6	434.525		
Total	13394.742	12			
Corrected Total	6357.621	11			

a. R Squared = .590 (Adjusted R Squared = .248)



Table B5.2 Mean comparison table of glucosamine of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients, without supplement and commercial red rice

gluDMKU<sub>p</sub>

Duncan<sup>a,b</sup>

trt	N	Subset	
		1	
9.00	2	.0000	
12.00	2	6.6989	
5.00	2	15.0251	
8.00	2	36.8146	
1.00	2	41.9135	
7.00	2	44.8455	
Sig.		.089	

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 434.525.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B5.3 ANOVA table of citrinin of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients, without supplement and commercial red rice

Tests of Between-Subjects Effects

Dependent Variable: citDMKU<sub>p</sub>

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2.601 <sup>a</sup>	5	.520	7.828	.013
Intercept	3.915	1	3.915	58.906	.000
trt	2.601	5	.520	7.828	.013
Error	.399	6	.066		
Total	6.915	12			
Corrected Total	3.000	11			

a. R Squared = .867 (Adjusted R Squared = .756)

Table B5.4 Mean comparison table of citrinin of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients, without supplement and commercial red rice

citDMKUp

Duncan<sup>a,b</sup>

trt	N	Subset		
		1	2	3
9.00	2	.0000		
5.00	2	.0100		
8.00	2	.3862	.3862	
1.00	2		.8858	.8858
12.00	2		.9639	.9639
7.00	2			1.1812
Sig.		.198	.074	.310

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .066.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B5.5 ANOVA table of mevinolin of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients, without supplement and commercial red rice

Tests of Between-Subjects Effects

Dependent Variable: mevDMKUp

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	97328.499 <sup>a</sup>	5	19465.700	219.209	.000
Intercept	42595.688	1	42595.688	479.683	.000
trt	97328.499	5	19465.700	219.209	.000
Error	532.798	6	88.800		
Total	140456.984	12			
Corrected Total	97861.296	11			

a. R Squared = .995 (Adjusted R Squared = .990)

Table B5.6 Mean comparison table of mevinolin of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients, without supplement and commercial red rice

**mevDMKU**

Duncan<sup>a,b</sup>

trt	N	Subset		
		1	2	3
12.00	2	10.0018		
5.00	2	12.7683		
7.00	2	14.1255		
1.00	2	22.2130	22.2130	
8.00	2		38.5129	
9.00	2			259.8516
Sig.		.261	.134	1.000

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 88.800.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B5.7 ANOVA table of yellow pigment of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients, without supplement and commercial red rice

**Tests of Between-Subjects Effects**

Dependent Variable: YellowDMKU

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	673.108 <sup>a</sup>	5	134.622	166.045	.000
Intercept	1965.261	1	1965.261	2423.998	.000
trt	673.108	5	134.622	166.045	.000
Error	4.865	6	.811		
Total	2643.233	12			
Corrected Total	677.972	11			

a. R Squared = .993 (Adjusted R Squared = .987)

Table B5.8 Mean comparison table of yellow pigment of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients, without supplement and commercial red rice

**YellowDMKU**

Duncan<sup>a,b</sup>

trt	N	Subset				
		1	2	3	4	5
1.00	2	5.0800				
12.00	2	5.9280				
5.00	2		8.9280			
9.00	2			13.2560		
7.00	2				16.6640	
8.00	2					26.9280
Sig.		.383	1.000	1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .811.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B5.9 ANOVA table of orange pigment of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients, without supplement and commercial red rice

**Tests of Between-Subjects Effects**

Dependent Variable: OrangeDMKU

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	530.748 <sup>a</sup>	5	106.150	436.164	.000
Intercept	760.849	1	760.849	3126.296	.000
trt	530.748	5	106.150	436.164	.000
Error	1.460	6	.243		
Total	1293.057	12			
Corrected Total	532.208	11			

a. R Squared = .997 (Adjusted R Squared = .995)

Table B5.10 Mean comparison table of orange pigment of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients, without supplement and commercial red rice

**OrangeDMKU**

Duncan<sup>a,b</sup>

trt	N	Subset				
		1	2	3	4	5
1.00	2	1.7280				
12.00	2	1.9520				
5.00	2		3.2400			
9.00	2			8.4400		
7.00	2				12.2160	
8.00	2					20.2000
Sig.		.666	1.000	1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .243.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B5.11 ANOVA table of red pigment of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients, without supplement and commercial red rice

**Tests of Between-Subjects Effects**

Dependent Variable: RedDMKU

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1132.972 <sup>a</sup>	5	226.594	552.489	.000
Intercept	1443.213	1	1443.213	3518.888	.000
trt	1132.972	5	226.594	552.489	.000
Error	2.461	6	.410		
Total	2578.646	12			
Corrected Total	1135.432	11			

a. R Squared = .998 (Adjusted R Squared = .996)

Table B5.12 Mean comparison table of red pigment of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients, without supplement and commercial red rice

RedDMKU						
Duncan <sup>a,b</sup>						
trt	N	Subset				
		1	2	3	4	5
1.00	2	1.9440				
12.00	2	2.2400	2.2400			
5.00	2		3.7600			
9.00	2			11.2320		
7.00	2				18.2080	
8.00	2					28.4160
Sig.		.660	.055	1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .410.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B5.13 ANOVA table of L value of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients, without supplement and commercial red rice

#### Tests of Between-Subjects Effects

Dependent Variable: LDMKU

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	66.833 <sup>a</sup>	5	13.367	5.206	.034
Intercept	26307.222	1	26307.222	10245.775	.000
trt	66.833	5	13.367	5.206	.034
Error	15.406	6	2.568		
Total	26389.461	12			
Corrected Total	82.239	11			

a. R Squared = .813 (Adjusted R Squared = .657)

Table B5.14 Mean comparison table of L value of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients, without supplement and commercial red rice

**LDMKU**

Duncan<sup>a,b</sup>

trt	N	Subset	
		1	2
9.00	2	41.9200	
8.00	2		46.2800
7.00	2		47.0650
5.00	2		48.4500
12.00	2		48.5450
1.00	2		48.6700
Sig.		1.000	.205

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 2.568.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B5.15 ANOVA table of a value of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients, without supplement and commercial red rice

**Tests of Between-Subjects Effects**

Dependent Variable: aDMKU

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	126.594 <sup>a</sup>	5	25.319	39.437	.000
Intercept	3868.225	1	3868.225	6025.195	.000
trt	126.594	5	25.319	39.437	.000
Error	3.852	6	.642		
Total	3998.672	12			
Corrected Total	130.446	11			

a. R Squared = .970 (Adjusted R Squared = .946)

Table B5.16 Mean comparison table of a value of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients, without supplement and commercial red rice

**aDMKU**

Duncan<sup>a,b</sup>

trt	N	Subset		
		1	2	3
9.00	2	11.0800		
5.00	2		18.0050	
1.00	2		18.0150	
12.00	2		19.5250	19.5250
8.00	2			20.3350
7.00	2			20.7650
Sig.		1.000	.117	.185

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .642.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B5.17 ANOVA table of b value of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients, without supplement and commercial red rice

**Tests of Between-Subjects Effects**

Dependent Variable: bDMKU

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	76.945 <sup>a</sup>	5	15.389	18.864	.001
Intercept	322.092	1	322.092	394.822	.000
trt	76.945	5	15.389	18.864	.001
Error	4.895	6	.816		
Total	403.932	12			
Corrected Total	81.839	11			

a. R Squared = .940 (Adjusted R Squared = .890)

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Table B5.18 Mean comparison table of b value of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients, without supplement and commercial red rice

**bDMKU**

Duncan<sup>a,b</sup>

trt	N	Subset		
		1	2	3
9.00	2	.6000		
7.00	2		4.0800	
8.00	2		4.2300	
5.00	2			6.7050
12.00	2			7.7050
1.00	2			7.7650
Sig.		1.000	.874	.299

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .816.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B5.19 ANOVA table of moisture content of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients, without supplement and commercial red rice

**Tests of Between-Subjects Effects**

Dependent Variable: WCDMKU

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5.027 <sup>a</sup>	2	2.514	.160	.859
Intercept	27831.108	1	27831.108	1771.806	.000
trt	5.027	2	2.514	.160	.859
Error	47.123	3	15.708		
Total	27883.259	6			
Corrected Total	52.151	5			

a. R Squared = .096 (Adjusted R Squared = -.506)

Table 5.20 Mean comparison table of moisture content of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients, without supplement and commercial red rice

**WCDMKU**

Duncan<sup>a,b</sup>

trt	N	Subset
		1
1.00	2	67.0150
12.00	2	68.0500
5.00	2	69.2550
Sig.		.609

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 15.708.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B5.21 ANOVA table of pH of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients, without supplement and commercial red rice

**Tests of Between-Subjects Effects**

Dependent Variable: pHDMKU

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3.640 <sup>a</sup>	5	.728	83.925	.000
Intercept	334.435	1	334.435	38551.609	.000
trt	3.640	5	.728	83.925	.000
Error	.052	6	.009		
Total	338.128	12			
Corrected Total	3.692	11			

a. R Squared = .986 (Adjusted R Squared = .974)

Table B5.22 Mean comparison table of pH of adlay angkak (*M. purpureus* DMKU) added carbon-nitrogen nutrients, without supplement and commercial red rice

pHDMKU

Duncan<sup>a,b</sup>

trt	N	Subset		
		1	2	3
9.00	2	4.6550		
8.00	2	4.6850		
7.00	2	4.8850		
1.00	2		5.6250	
12.00	2			5.9000
5.00	2			5.9250
Sig.		.055	1.000	.797

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .009.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B5.23 ANOVA table of glucosamine of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients, without supplement and commercial red rice

Tests of Between-Subjects Effects

Dependent Variable: gluRUBERp

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	6757.134 <sup>a</sup>	5	1351.427	.916	.528
Intercept	20800.153	1	20800.153	14.097	.009
trt	6757.134	5	1351.427	.916	.528
Error	8852.996	6	1475.499		
Total	36410.283	12			
Corrected Total	15610.130	11			

a. R Squared = .433 (Adjusted R Squared = -.040)

Table B5.24 Mean comparison table of glucosamine of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients, without supplement and commercial red rice

**gluRUBERp**

Duncan<sup>a,b</sup>

trt	N	Subset
		1
9.00	2	.0000
5.00	2	30.8246
8.00	2	36.8146
7.00	2	44.8455
1.00	2	64.5234
12.00	2	72.7927
Sig.		.123

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 1475.499.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B5.25 ANOVA table of citrinin of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients, without supplement and commercial red rice

**Tests of Between-Subjects Effects**

Dependent Variable: citRUBERp

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	196.384 <sup>a</sup>	5	39.277	5.247	.034
Intercept	95.914	1	95.914	12.812	.012
trt	196.384	5	39.277	5.247	.034
Error	44.917	6	7.486		
Total	337.215	12			
Corrected Total	241.301	11			

a. R Squared = .814 (Adjusted R Squared = .659)

Table B5.26 Mean comparison table of citrinin of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients, without supplement and commercial red rice

citRUBERp

Duncan<sup>a,b</sup>

trt	N	Subset	
		1	2
9.00	2	.0000	
8.00	2	.3862	
5.00	2	.6675	
7.00	2	1.1812	
12.00	2	3.1390	
1.00	2		11.5890
Sig.		.314	1.000

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 7.486.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B5.27 ANOVA table of mevinolin of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients, without supplement and commercial red rice

**Tests of Between-Subjects Effects**

Dependent Variable: mevRUBERp

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	95944.282 <sup>a</sup>	5	19188.856	86.989	.000
Intercept	45000.642	1	45000.642	204.001	.000
trt	95944.282	5	19188.856	86.989	.000
Error	1323.541	6	220.590		
Total	142268.465	12			
Corrected Total	97267.823	11			

a. R Squared = .986 (Adjusted R Squared = .975)

Table B5.28 Mean comparison table of mevinolin of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients and commercial red yeast rice, without supplement and commercial red rice

mevRUBERp

Duncan<sup>a,b</sup>

trt	N	Subset	
		1	2
5.00	2	6.0386	
7.00	2	14.1255	
12.00	2	20.2711	
1.00	2	28.6264	
8.00	2	38.5129	
9.00	2		259.8516
Sig.		.085	1.000

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 220.590.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B5.29 ANOVA table of yellow pigment of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients, without supplement and commercial red rice

Tests of Between-Subjects Effects

Dependent Variable: YellowRUBER

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	800.711 <sup>a</sup>	5	160.142	28.939	.000
Intercept	8086.229	1	8086.229	1461.254	.000
trt	800.711	5	160.142	28.939	.000
Error	33.203	6	5.534		
Total	8920.142	12			
Corrected Total	833.913	11			

a. R Squared = .960 (Adjusted R Squared = .927)

Table B5.30 Mean comparison table of yellow pigment of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients, without supplement and commercial red rice

**YellowRUBER**

Duncan<sup>a,b</sup>

trt	N	Subset		
		1	2	3
9.00	2	13.2560		
7.00	2	16.6640		
8.00	2		26.9280	
1.00	2		31.3120	31.3120
12.00	2			33.5120
5.00	2			34.0800
Sig.		.198	.112	.298

Means for groups in homogeneous subsets are displayed.  
Based on Type III Sum of Squares  
The error term is Mean Square(Error) = 5.534.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B5.31 ANOVA table of orange pigment of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients, without supplement and commercial red rice

**Tests of Between-Subjects Effects**

Dependent Variable: OrangeRUBER

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	274.420 <sup>a</sup>	5	54.884	98.854	.000
Intercept	1305.586	1	1305.586	2351.559	.000
trt	274.420	5	54.884	98.854	.000
Error	3.331	6	.555		
Total	1583.337	12			
Corrected Total	277.751	11			

a. R Squared = .988 (Adjusted R Squared = .978)

Table B5.32 Mean comparison table of orange pigment of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients, without supplement and commercial red rice

**OrangeRUBER**

Duncan<sup>a,b</sup>

trt	N	Subset			
		1	2	3	4
1.00	2	5.6240			
12.00	2		7.7360		
5.00	2		8.3680		
9.00	2		8.4400		
7.00	2			12.2160	
8.00	2				20.2000
Sig.		1.000	.395	1.000	1.000

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .555.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B5.33 ANOVA table of red pigment of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients, without supplement and commercial red rice

**Tests of Between-Subjects Effects**

Dependent Variable: RedRUBER

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	800.985 <sup>a</sup>	5	160.197	247.723	.000
Intercept	1983.732	1	1983.732	3067.577	.000
trt	800.985	5	160.197	247.723	.000
Error	3.880	6	.647		
Total	2788.598	12			
Corrected Total	804.865	11			

a. R Squared = .995 (Adjusted R Squared = .991)



Table B5.34 Mean comparison table of red pigment of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients, without supplement and commercial red rice

**RedRUBER**

Duncan<sup>a,b</sup>

trt	N	Subset				
		1	2	3	4	5
1.00	2	5.0080				
12.00	2	6.8560	6.8560			
5.00	2		7.4240			
9.00	2			11.2320		
7.00	2				18.2080	
8.00	2					28.4160
Sig.		.061	.506	1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .647.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B5.35 ANOVA table of L value of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients, without supplement and commercial red rice

**Tests of Between-Subjects Effects**

Dependent Variable: LRUBER

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	64.638 <sup>a</sup>	5	12.928	32.189	.000
Intercept	25850.370	1	25850.370	64365.780	.000
trt	64.638	5	12.928	32.189	.000
Error	2.410	6	.402		
Total	25917.418	12			
Corrected Total	67.047	11			

a. R Squared = .964 (Adjusted R Squared = .934)

Table B5.36 Mean comparison table of L value of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients, without supplement and commercial red rice

**LRUBER**

Duncan<sup>a,b</sup>

trt	N	Subset		
		1	2	3
9.00	2	41.9200		
8.00	2		46.2800	
12.00	2		46.2850	
7.00	2		47.0650	
5.00	2		47.1900	
1.00	2			49.7400
Sig.		1.000	.219	1.000

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .402.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B5.37 ANOVA table of a value of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients, without supplement and commercial red rice

**Tests of Between-Subjects Effects**

Dependent Variable: aRUBER

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	142.860 <sup>a</sup>	5	28.572	103.993	.000
Intercept	4229.257	1	4229.257	15393.108	.000
trt	142.860	5	28.572	103.993	.000
Error	1.649	6	.275		
Total	4373.765	12			
Corrected Total	144.509	11			

a. R Squared = .989 (Adjusted R Squared = .979)

Table B5.38 Mean comparison table of a value of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients, without supplement and commercial red rice

**aRUBER**

Duncan<sup>a,b</sup>

trt	N	Subset	
		1	2
9.00	2	11.0800	
12.00	2		19.9900
5.00	2		20.0300
8.00	2		20.3350
1.00	2		20.4400
7.00	2		20.7650
Sig.		1.000	.209

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .275.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B5.39 ANOVA table of b value of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients, without supplement and commercial red rice

**Tests of Between-Subjects Effects**

Dependent Variable: bRUBER

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	58.152 <sup>a</sup>	5	11.630	191.263	.000
Intercept	266.115	1	266.115	4376.292	.000
trt	58.152	5	11.630	191.263	.000
Error	.365	6	.061		
Total	324.632	12			
Corrected Total	58.517	11			

a. R Squared = .994 (Adjusted R Squared = .989)

Table B5.40 Mean comparison table of b value of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients, without supplement and commercial red rice

**bRUBER**

Duncan<sup>a,b</sup>

trt	N	Subset			
		1	2	3	4
9.00	2	.6000			
7.00	2		4.0800		
8.00	2		4.2300		
12.00	2			5.5900	
5.00	2			6.0450	
1.00	2				7.7100
Sig.		1.000	.565	.115	1.000

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .061.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B5.41 ANOVA table of moisture content of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients, without supplement and commercial red rice

**Tests of Between-Subjects Effects**

Dependent Variable: WCRUBER

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	14.404 <sup>a</sup>	2	7.202	.722	.555
Intercept	24240.513	1	24240.513	2431.081	.000
trt	14.404	2	7.202	.722	.555
Error	29.913	3	9.971		
Total	24284.831	6			
Corrected Total	44.318	5			

a. R Squared = .325 (Adjusted R Squared = -.125)

Table B5.42 Mean comparison table of moisture content of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients, without supplement and commercial red rice

**WCRUBER**

Duncan<sup>a,b</sup>

trt	N	Subset
		1
5.00	2	62.3700
12.00	2	62.5650
1.00	2	65.7500
Sig.		.360

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 9.971.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

Table B5.43 ANOVA table of pH of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients, without supplement and commercial red rice

**Tests of Between-Subjects Effects**

Dependent Variable: pHRUBER

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2.476 <sup>a</sup>	5	.495	81.743	.000
Intercept	323.752	1	323.752	53439.187	.000
trt	2.476	5	.495	81.743	.000
Error	.036	6	.006		
Total	326.265	12			
Corrected Total	2.512	11			

a. R Squared = .986 (Adjusted R Squared = .973)

Table B5.44 Mean comparison table of pH of adlay angkak (*M. ruber* TISTR3006) added carbon-nitrogen nutrients, without supplement and commercial red rice

**pHRUBER**

Duncan<sup>a,b</sup>

trt	N	Subset			
		1	2	3	4
8.00	2	4.6850			
9.00	2	4.6900			
7.00	2		4.8850		
5.00	2			5.5400	
12.00	2			5.5550	
1.00	2				5.8100
Sig.		.951	1.000	.854	1.000

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .006.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = .05.

## Appendix C Chromatogram

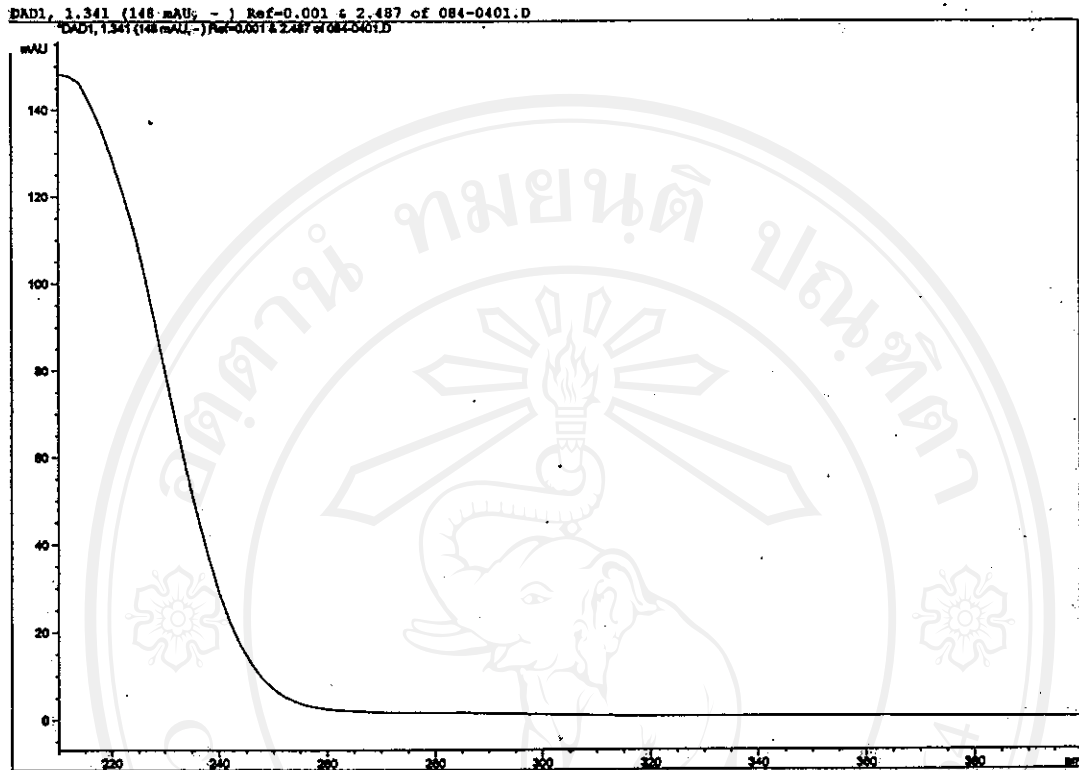


Fig C1. Glucosamine spectrum

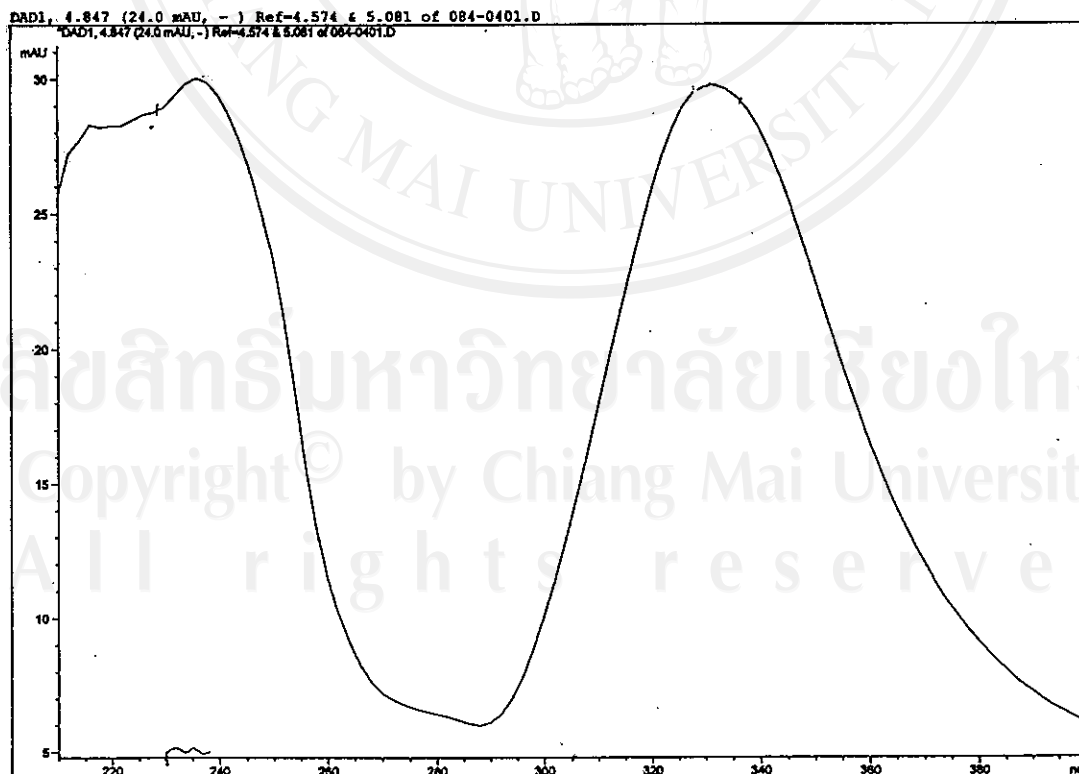


Fig C2. Citrinin spectrum

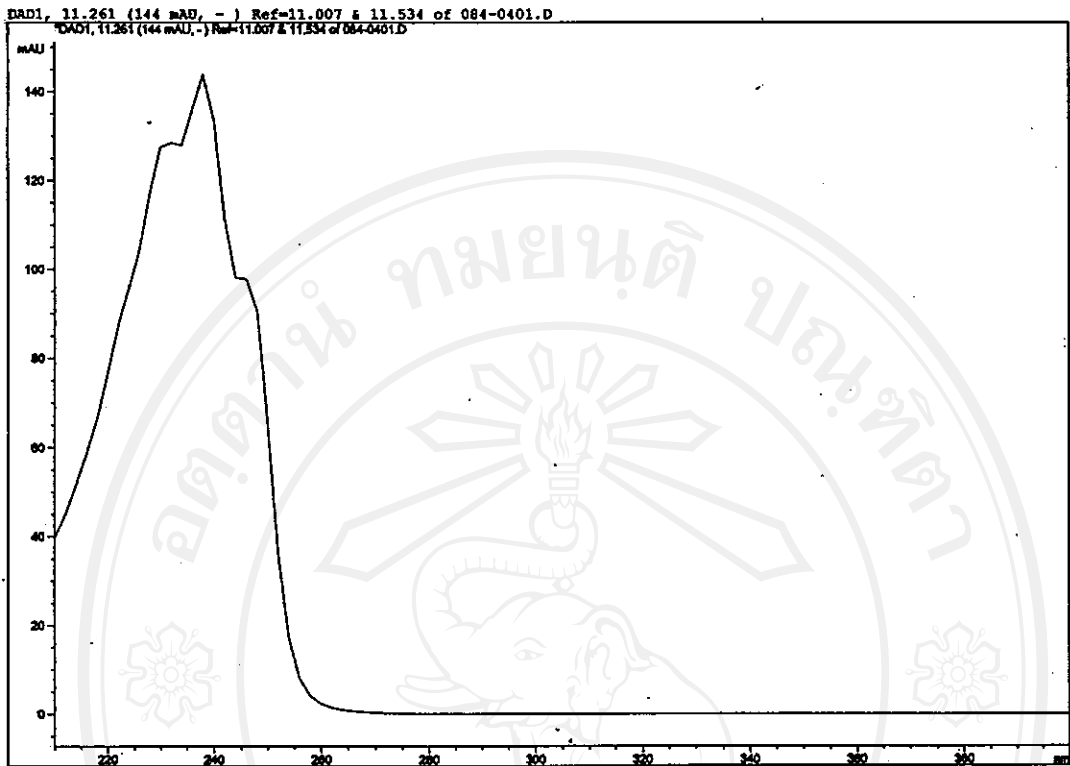


Fig C3. Mevinolin spectrum

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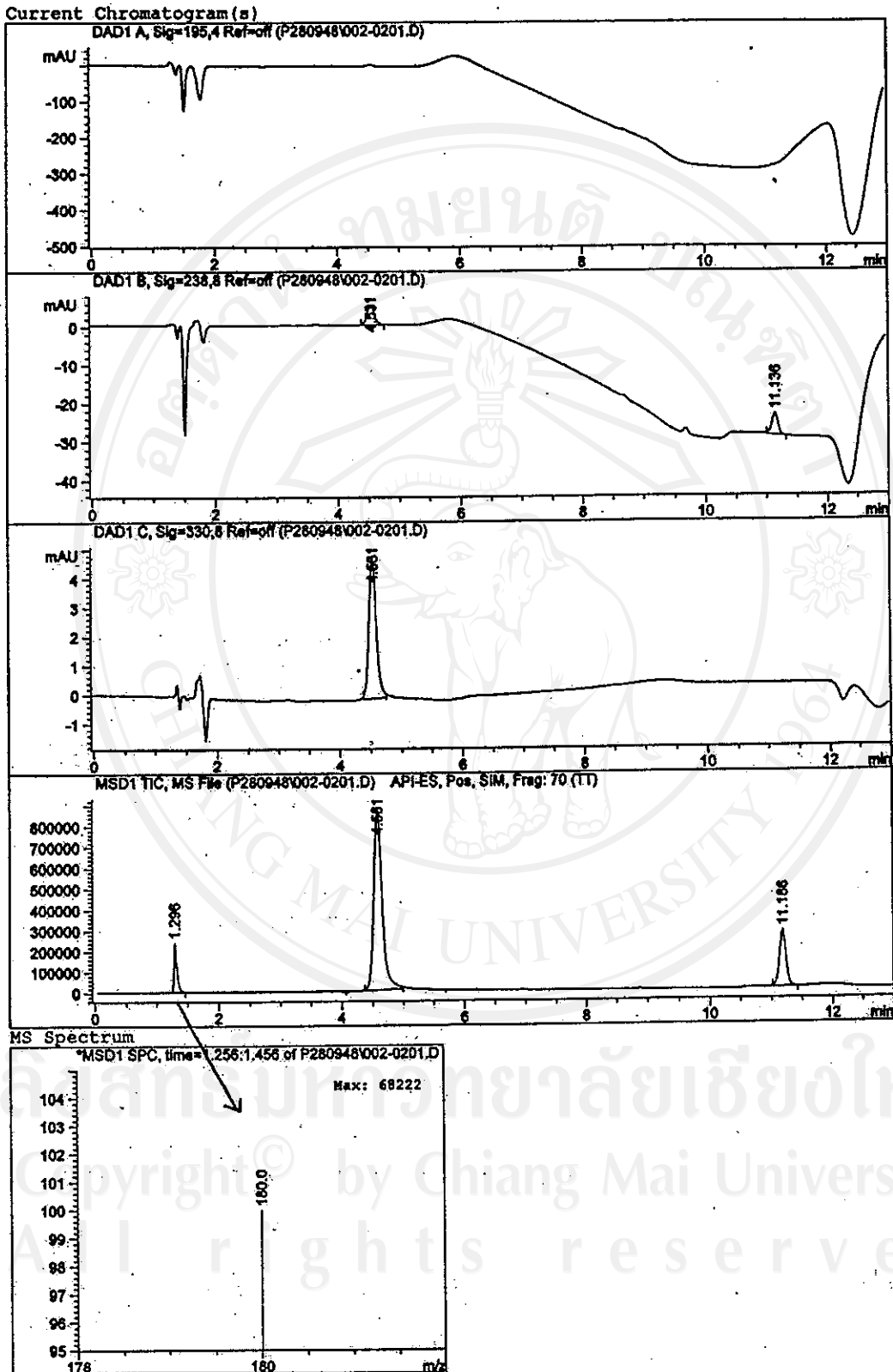


Fig C4. Chromatogram of glucosamine standard

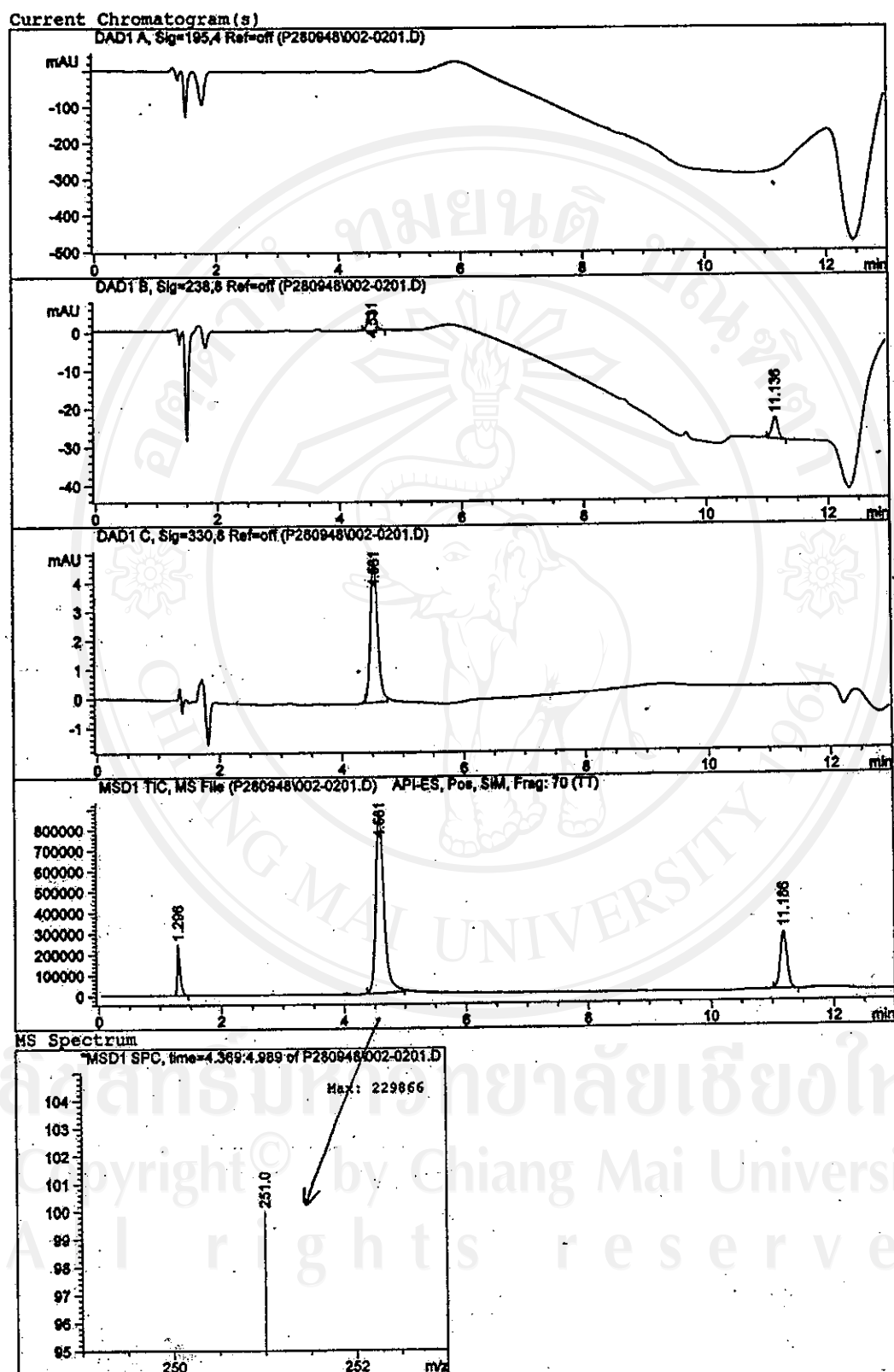


Fig C5. Chromatogram of citrinin standard

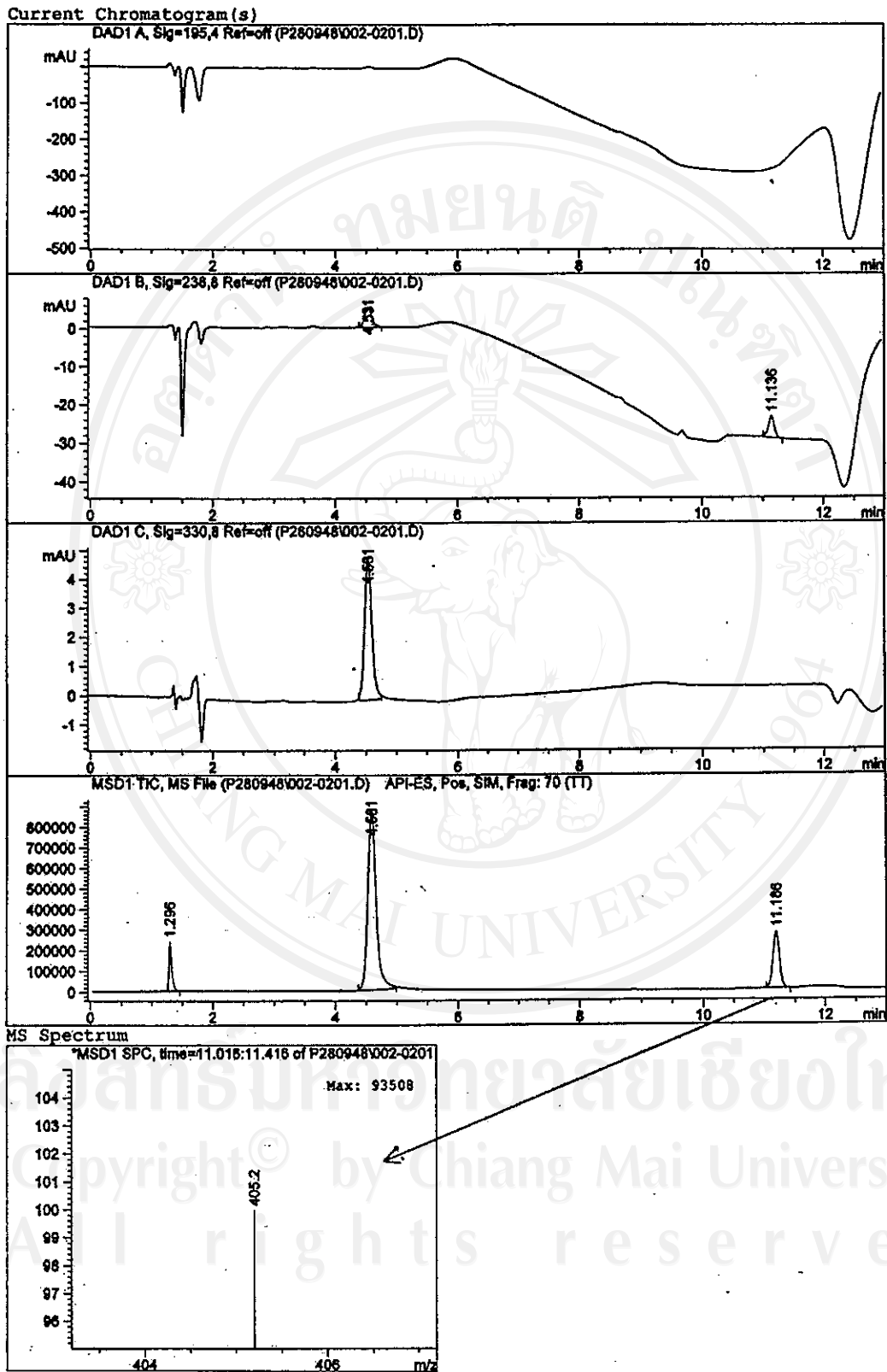
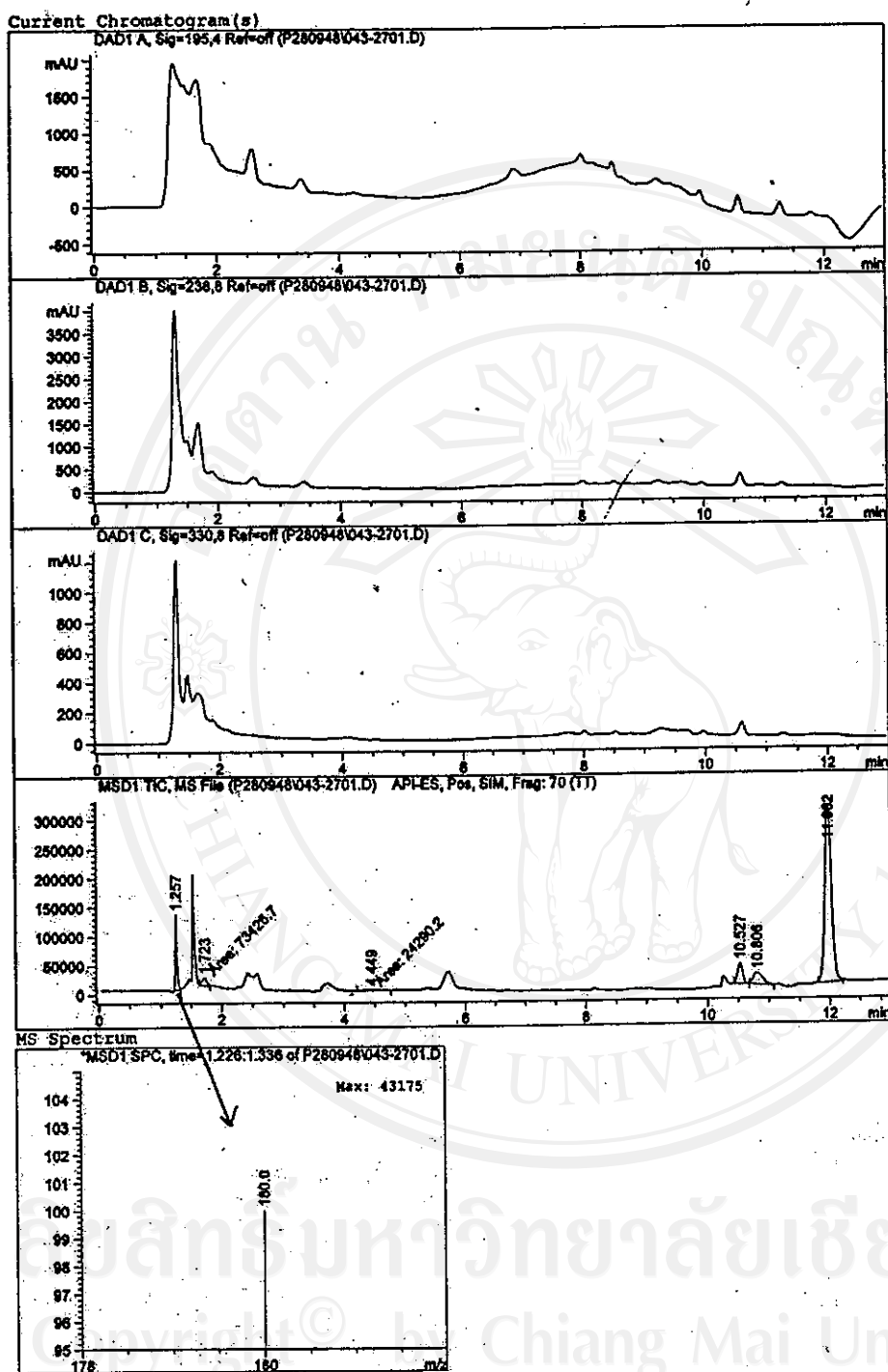


Fig C6. Chromatogram of mevinolin standard



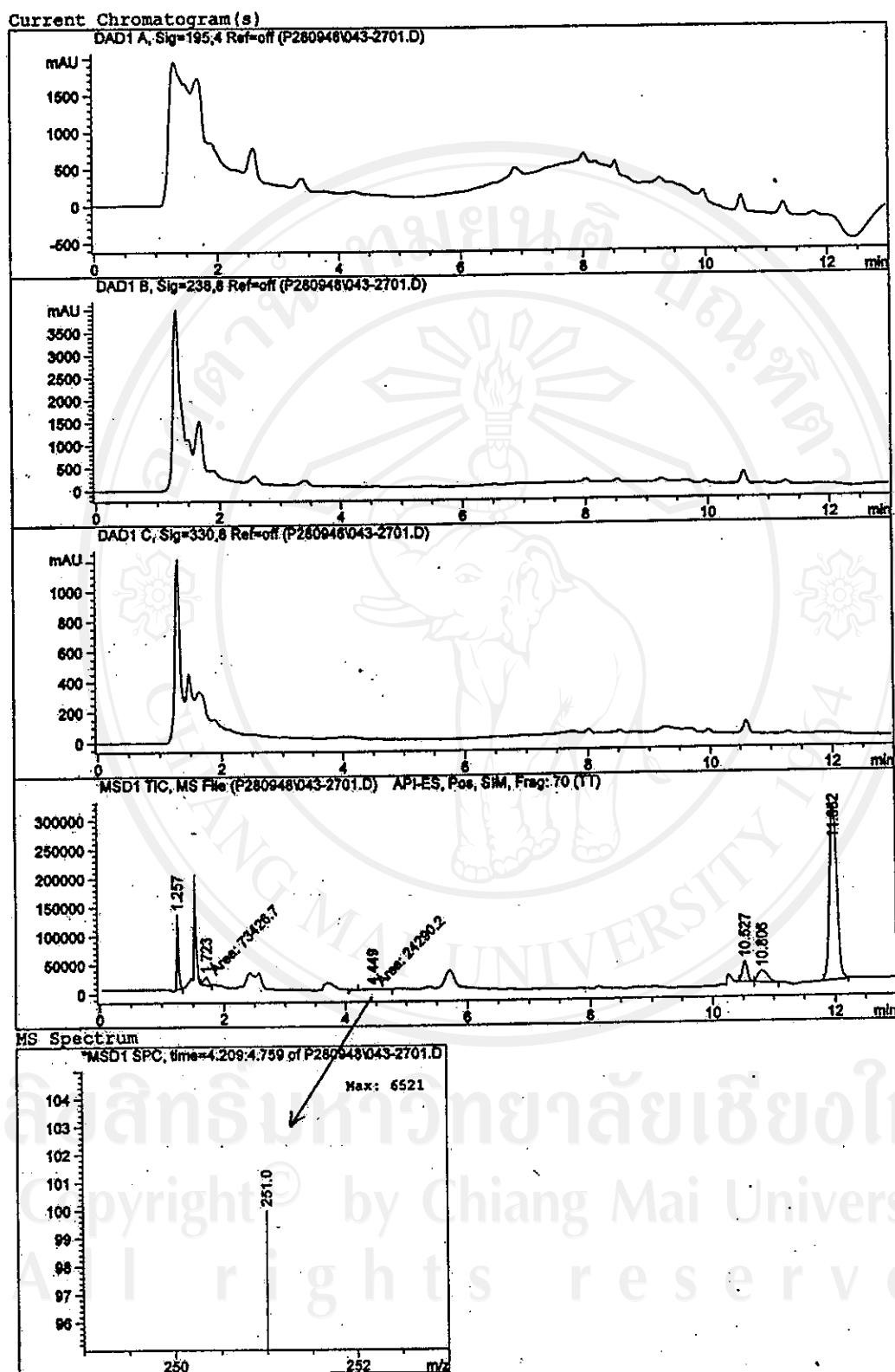


Fig C8. Chromatogram of citrinin in adlay angkak sample (*M. purpureus* DMKU)

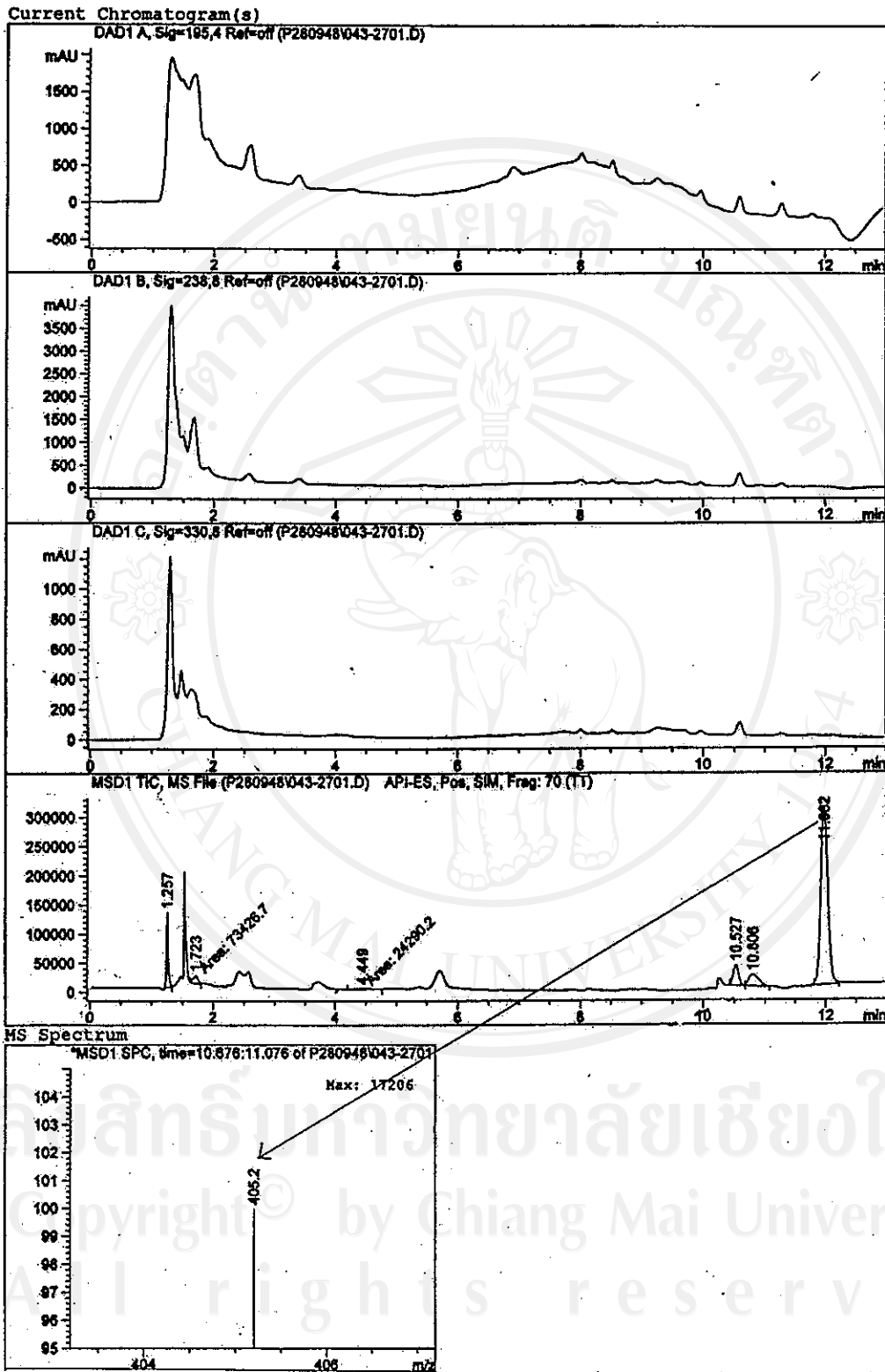


Fig C9. Chromatogram of mevinolin in adlay angkak sample (*M. purpureus* DMKU)

**Appendix D Calculation of the validation method of mevinolin, citrinin and glucosamine (Sarai, 2003)**

**1. Limit of Detection (LOD)**

$$\text{LOD} = 3\text{SD}$$

- i) Find out SD from concentration of sample blank spiked with 5 ppm mevinolin standard

Sample	Concentration (ppm)
1	0.1484
2	0.1790
3	0.1684
4	0.1542
5	0.2515
6	0.1802
7	0.1688
8	0.1624
9	0.1240
10	0.1417
<b>Mean</b>	<b>0.1679</b>
<b>SD</b>	<b>0.0341</b>

- ii) SD was multiplied with 3

$$3\text{SD} = 0.0341 * 3 = 0.1023 \text{ ppm}$$

$$\therefore \text{LOD} = 0.1023 \text{ ppm}$$

**2. Limit of Quantitation (LOQ)**

$$\text{LOQ} = 10\text{SD}$$

- i) Find out SD from concentration of sample blank spiked with 0.5 ppm glucosamine standard

Sample	Concentration (ppm)
1	0.1445
2	0.1449
3	0.1407
4	0.1424
5	0.1449
6	0.1475
7	0.1448
8	0.1596
9	0.1464
10	0.1464
<b>Mean</b>	<b>0.1462</b>
<b>SD</b>	<b>0.0051</b>

- ii) SD was multiplied with 10

$$10\text{SD (Area)} = 0.0051 \times 10 = 0.0510 \quad \text{ppm}$$

$$\therefore \text{LOQ} = 0.0510 \quad \text{ppm}$$



### 3. Percent of Relative Standard Deviation (RSD)

$$\%RSD = SD * 100 / \bar{X}$$

- i) Find out mean and SD of standard concentration in sample blank spiked with 0.5 ppm citrinin standard

Sample	Concentration (ppm)
1	0.0125
2	0.0123
3	0.0124
<b>Mean</b>	<b>0.0124</b>
<b>SD</b>	<b>0.0001</b>

- ii) %RSD is SD multiplied with 100 and divided with mean

$$\%RSD = 0.0001 * 100 / 0.0124 = 0.8486 \%$$

$$\therefore \%RSD = 0.8486 \%$$

- iii) Horrat is a value presented repeatability acceptance of analysis method. AOAC allows horrat value must less than or equal 2.

$$\text{Horrat} = \frac{\%RSD}{\text{Predicated Harwitz RSD}}$$

Predicated Harwitz RSD

$$\text{Predicated Harwitz RSD} = 0.66 \times 2^{(1-0.5\log C)}$$

C = Concentration ratio = 0.01 (1% of analysed amount), 0.1 (10% of analysed amount)

$$\therefore \text{Predicated Harwitz RSD} = 0.66 \times 2^{(1-0.5\log 0.01)}$$

$$= 0.66 \times 2^{(1+1)}$$

$$= 2.64$$

$$\therefore \text{Horrat} = \frac{0.8486}{2.64}$$

$$= 0.3214$$

$$= 0.3214$$

#### 4. Percent of Recovery

$$\% \text{Recovery} = \frac{(\text{Analysed amount} - \text{Original amount}) \times 100}{\text{Added amount}}$$

- i) Find out the concentration of sample blank spiked with 0.15 ppm mevinolin

Sample	Concentration (ppm)
1	0.1484
2	0.1790
3	0.1684
<b>Mean</b>	<b>0.1481</b>
<b>SD</b>	<b>0.0063</b>

- ii) %Recovery is the analysed amount of spiked standard from chromatogram minused with original amount of sample blank and multiplied with 100. Then, this amount is divided with added spiked standard amount

$$\begin{aligned} \% \text{Recovery} &= \frac{(0.1481 - 0.00) \times 100}{0.15} \\ &= 98.74\% \end{aligned}$$

**Appendix E The range of adlay angkak properties on carbon and nitrogen source supplement**

**1. Combination of 1-5%glucose and 0.1-0.5%peptone affect *M. purpureus* DKMU**

Property	Range	R <sup>2</sup>
1. Glucosamine	5.4480-51.2494 ppm	0.5375
2. Citrinin	0.0000-1.1755 ppm	0.1852
3. Mevinolin	0.1602-55.2031 ppm	0.0000
4. Yellow pigment	4.3680-8.0800	0.4901
5. Orange pigment	1.2160-2.4800	0.5060
6. Red pigment	1.3600-2.8160	0.5106
7. L value	47.30-51.31	0.4078
8. a value	16.72-19.96	0.4526
9. b value	7.07-9.18	0.5082
10. Moisture content	53.81-77.19 %	0.6067
11. pH	5.43-5.90	0.4653

**2. Combination of 1-5%glucose and 0.1-0.5%peptone affect *M. ruber* TISTR3006**

Property	Range	R <sup>2</sup>
1. Glucosamine	4.2473-126.0982 ppm	0.0000
2. Citrinin	0.0000-1.5115 ppm	0.0000
3. Mevinolin	0.0000-34.1587 ppm	0.0000
4. Yellow pigment	24.8960-39.4880	0.4214
5. L value	47.80-54.49	0.6567
6. b value	6.81-9.28	0.6429
7. Moisture content	56.91-66.69 %	0.0000
8. pH	5.19-5.99	0.3971

**3. Combination of 1-5%lactose and 0.1-0.5%yeast extract affect *M. purpureus*  
DKMU**

Property	Range	R <sup>2</sup>
1. Glucosamine	2.7065-7.3402 ppm	0.4472
2. Citrinin	0.0000-8.8100 ppm	0.0000
3. Mevinolin	0.0000-30.8168 ppm	0.0000
4. Yellow pigment	2.9280-8.3200	0.6470
5. Orange pigment	0.8640-2.9440	0.5336
6. Red pigment	0.9760-3.4720	0.5181
7. L value	45.50-50.95	0.5589
8. a value	17.63-19.92	0.4392
9. b value	5.35-9.09	0.3122
10. Moisture content	63.28-73.59 %	0.2547
11. pH	5.80-6.11	0.5613

**4. Combination of 1-5%lactose and 0.1-0.5%yeast extract affect *M. ruber*  
TISTR3006**

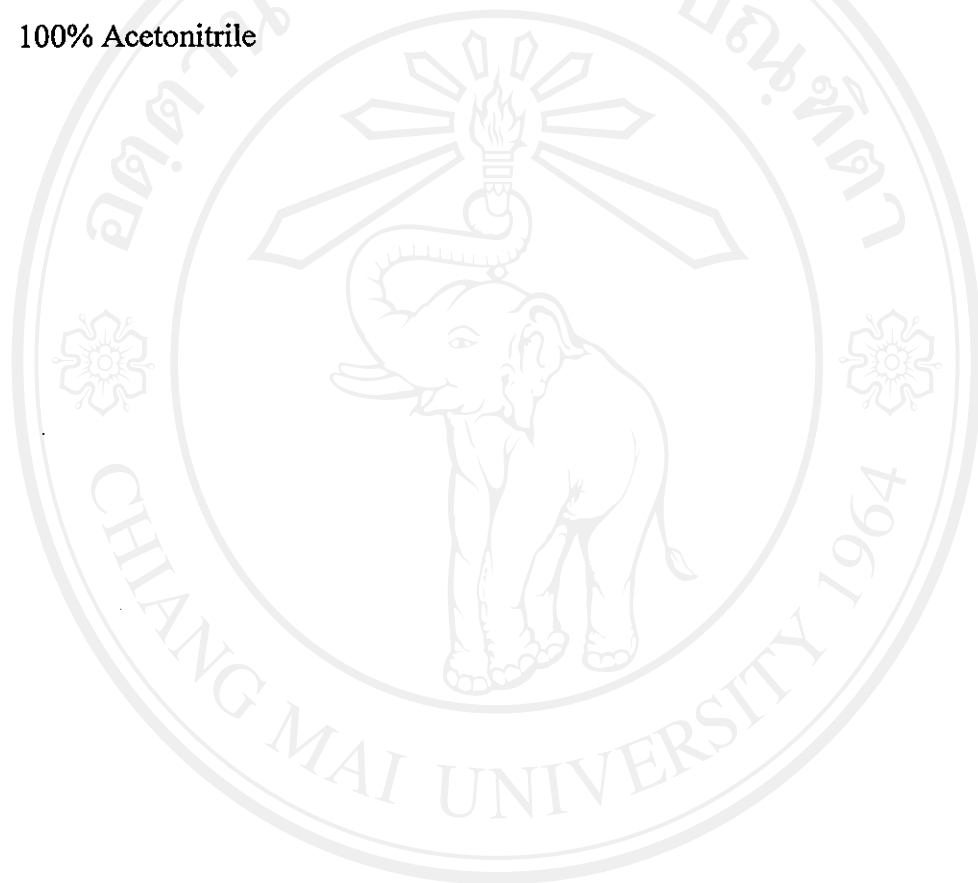
Property	Range	R <sup>2</sup>
1. Glucosamine	6.2465-93.4607 ppm	0.6083
2. Citrinin	0.0000-1.0940 ppm	0.5332
3. Yellow pigment	29.1840-42.3200	0.6670
4. Orange pigment	7.7920-14.2240	0.5643
5. Red pigment	6.8160-12.2240	0.4425
6. b value	5.59-6.68	0.3644
7. Moisture content	55.29-65.19 %	0.0000
8. pH	5.56-6.25	0.1208

**Appendix F Preparation of mobile phase solution****1. Solution A**

Preparation of 1 litre solution A: 350 ml acetonitrile and 100 ml isopropanol were mixed in 550 ml deionized water. Adjust pH equal to 2.5 by formic acid (glucosamine and citrinin analysis) or phosphoric acid (mevinolin analysis)

**2. Solution B**

100% Acetonitrile



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