



ภาคผนวก

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ภาคผนวก ก

ตารางการออกแบบการทดลองกับผลตอบที่ได้

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ตาราง 1ก ผลการออกแบบการทดลองของเชื้อ *Escherichia coli* แบบแฟกทอเรียลเชิงเศษส่วน
กับจำนวนเชื้อแบคทีเรีย ($\log(\text{CFU/mL})$)

Std Order	Run Order	Center Pt	Blks	A	B	C	D	E	Log (CFU/mL)
31	1	1	1	1	-1	-1	1	1	0
15	2	1	1	1	-1	-1	1	1	0
8	3	1	1	1	1	1	1	1	0
6	4	1	1	1	-1	1	-1	1	1.875061263
30	5	1	1	-1	-1	-1	1	-1	0
22	6	1	1	1	-1	1	-1	1	3.176091259
5	7	1	1	-1	-1	1	1	-1	
32	8	1	1	-1	-1	-1	-1	-1	3.781755375
23	9	1	1	-1	1	1	-1	-1	1
27	10	1	1	1	-1	1	1	-1	3.832510337
19	11	1	1	-1	1	-1	-1	1	0
14	12	1	1	-1	1	-1	1	-1	0
34	13	0	1	0	0	0	1	0	3.550228353
28	14	1	1	-1	-1	1	-1	1	2.066053125
11	15	1	1	1	-1	1	1	-1	3.560058289
20	16	1	1	1	1	-1	1	-1	3.242550774
1	17	1	1	-1	-1	-1	1	1	3.161789504
29	18	1	1	1	1	-1	-1	1	0
12	19	1	1	-1	-1	1	-1	1	2.425847242
13	20	1	1	1	1	-1	-1	1	0
24	21	1	1	1	1	1	1	1	0
3	22	1	1	-1	1	-1	-1	1	0
26	23	1	1	-1	1	1	1	1	0
10	24	1	1	-1	1	1	1	1	0

ตาราง 1ก (ต่อ)ผลการออกแบบการทดลองของเชื้อ *Escherichia coli* แบบแฟกทอเรียลเชิง
 เศษส่วนกับจำนวนเชื้อแบคทีเรีย (log(CFU/mL))

Std Order	Run Order	Center Pt	Blks	A	B	C	D	E	log(CFU/mL)
33	25	0	1	0	0	0	-1	0	0
16	26	1	1	-1	-1	-1	-1	-1	3.079367536
17	27	1	1	-1	-1	-1	1	1	4.41830127
18	28	1	1	1	-1	-1	-1	-1	0
9	29	1	1	1	1	1	-1	-1	2.130333776
7	30	1	1	-1	1	1	-1	-1	0.612529392
21	31	1	1	-1	-1	1	1	-1	2.834677424
35	32	0	1	0	0	0	-1	0	0
25	33	1	1	1	1	1	-1	-1	1.244686716
36	34	0	1	0	0	0	1	0	2.981968113
4	35	1	1	1	1	-1	1	-1	2.639970021
2	36	1	1	1	-1	-1	-1	-1	0
Average									1.474679422
StD									1.560406784

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ตาราง 2ก ผลการออกแบบการทดลองของเชื้อ *Staphylococcus Aureus* แบบแฟคทอเรียลเชิง
เศษส่วนกับเชื้อแบคทีเรีย (log(CFU/mL))

Std Order	Run Order	Center Pt	Blocks	A	B	C	D	E	log(CFU/mL)
31	1	1	1	1	-1	-1	1	1	0
15	2	1	1	1	-1	-1	1	1	0
8	3	1	1	1	1	1	1	1	0
6	4	1	1	1	-1	1	-1	1	1.698970004
30	5	1	1	-1	1	-1	1	-1	0
22	6	1	1	1	-1	1	-1	1	1.557194642
5	7	1	1	-1	-1	1	1	-1	0
32	8	1	1	-1	-1	-1	-1	-1	2.308994891
23	9	1	1	-1	1	1	-1	-1	1.166859485
27	10	1	1	1	-1	1	1	-1	3.000154391
19	11	1	1	-1	1	-1	-1	1	0
14	12	1	1	-1	1	-1	1	-1	0
34	13	0	1	0	0	0	1	0	2.414054499
28	14	1	1	-1	-1	1	-1	1	2.963333584
11	15	1	1	1	-1	1	1	-1	3.32254875
20	16	1	1	1	1	-1	1	-1	1.176091259
1	17	1	1	-1	-1	-1	1	1	2.69019608
29	18	1	1	1	1	-1	-1	1	3.333034231
12	19	1	1	-1	-1	1	-1	1	2.671534213
13	20	1	1	1	1	-1	-1	1	3.88610059
24	21	1	1	1	1	1	1	1	0
3	22	1	1	-1	1	-1	-1	1	0
26	23	1	1	-1	1	1	1	1	0

ตาราง 2ก(ต่อ) ผลการออกแบบการทดลองของเชื้อ *Staphylococcus Aureus* แบบ
แฟกทอเรียลเชิงเศษส่วนกับเชื้อแบคทีเรีย (log(CFU/mL))

Std Order	Run Order	Center Pt	Blocks	A	B	C	D	E	log(CFU/mL)
10	24	1	1	-1	1	1	1	1	0
33	25	0	1	0	0	0	-1	0	0
16	26	1	1	-1	-1	-1	-1	-1	2.242774833
17	27	1	1	-1	-1	-1	1	1	2.522943568
18	28	1	1	1	-1	-1	-1	-1	1.561066597
9	29	1	1	1	1	1	-1	-1	1.054825247
7	30	1	1	-1	1	1	-1	-1	0.645024943
21	31	1	1	-1	-1	1	1	-1	0
35	32	0	1	0	0	0	-1	0	0
25	33	1	1	1	1	1	-1	-1	1.75866857
36	34	0	1	0	0	0	1	0	2.414054499
4	35	1	1	1	1	-1	1	-1	1.176091259
2	36	1	1	1	-1	-1	-1	-1	1.41096404
Average									1.304874449
StD									1.253342687

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ภาคผนวก ข

ผลการวิเคราะห์จากโปรแกรม Minitab

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1.1. ผลการวิเคราะห์จากโปรแกรม Minitab16.0 สำหรับเชื้อ *Escherichia coli* โดยรวม

Center point ในสมการ

Alias Information for Terms in the Model.

Totally confounded terms were removed from the analysis.

I + B*C*D*E
A + A*B*C*D*E
B + C*D*E
C + B*D*E
D + B*C*E
E + B*C*D
A*B + A*C*D*E
A*C + A*B*D*E
A*D + A*B*C*E
A*E + A*B*C*D
B*C + D*E
B*D + C*E
B*E + C*D
A*B*C + A*D*E
A*B*D + A*C*E
A*B*E + A*C*D

* NOTE * Some of the terms requested in MEANS were removed from the analysis.

Factorial Fit: %Inhibition of E.coli versus A, B, C, D, E

Estimated Effects and Coefficients for %Inhibition of E.coli (coded units)

Term	Effect	Coef	SE Coef	T	P
Constant		27.01	2.298	11.76	0.000
A	-6.01	-3.00	2.298	-1.31	0.207
B	-29.48	-14.74	2.298	-6.41	0.000
C	8.13	4.06	2.298	1.77	0.093
D	12.52	6.26	2.166	2.89	0.009
E	-16.35	-8.17	2.298	-3.56	0.002
A*B	23.27	11.64	2.298	5.06	0.000
A*C	13.32	6.66	2.298	2.90	0.009
A*D	5.23	2.62	2.298	1.14	0.269
A*E	-10.84	-5.42	2.298	-2.36	0.029
B*C	-10.15	-5.07	2.298	-2.21	0.040
B*D	-4.69	-2.34	2.298	-1.02	0.321
B*E	-8.20	-4.10	2.298	-1.78	0.090
A*B*C	-22.62	-11.31	2.298	-4.92	0.000
A*B*D	4.07	2.04	2.298	0.89	0.387
A*B*E	-6.43	-3.21	2.298	-1.40	0.178
Ct Pt		2.49	6.893	0.36	0.722

S = 12.9984 PRESS = 294358

R-Sq = 88.35% R-Sq(pred) = 0.00% R-Sq(adj) = 78.54%

Analysis of Variance for %Inhibition of E.coli (coded units)

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Main Effects	5	11317.2	11317.2	2263.44	13.40	0.000
A	1	288.9	288.9	288.95	1.71	0.207
B	1	6950.9	6950.9	6950.93	41.14	0.000
C	1	528.5	528.5	528.51	3.13	0.093
D	1	1410.7	1410.7	1410.66	8.35	0.009

E	1	2138.1	2138.1	2138.15	12.65	0.002
2-Way Interactions	7	8448.7	8448.7	1206.96	7.14	0.000
A*B	1	4333.5	4333.5	4333.48	25.65	0.000
A*C	1	1418.9	1418.9	1418.88	8.40	0.009
A*D	1	219.1	219.1	219.15	1.30	0.269
A*E	1	939.6	939.6	939.62	5.56	0.029
B*C	1	824.0	824.0	824.01	4.88	0.040
B*D	1	175.8	175.8	175.81	1.04	0.321
B*E	1	537.8	537.8	537.77	3.18	0.090
3-Way Interactions	3	4556.9	4556.9	1518.95	8.99	0.001
A*B*C	1	4093.9	4093.9	4093.92	24.23	0.000
A*B*D	1	132.5	132.5	132.53	0.78	0.387
A*B*E	1	330.4	330.4	330.42	1.96	0.178
Curvature	1	22.1	22.1	22.06	0.13	0.722
Residual Error	19	3210.2	3210.2	168.96		
Lack of Fit	1	2431.0	2431.0	2431.00	56.16	0.000
Pure Error	18	779.2	779.2	43.29		
Total	35	27555.0				

Obs	StdOrder	%Inhibition of E.coli	Fit	SE Fit	Residual	St Resid
1	31	0.0000	2.9053	9.1593	-2.9053	-0.32
2	15	0.0000	2.9053	9.1593	-2.9053	-0.32
3	8	0.0000	2.9053	9.1593	-2.9053	-0.32
4	6	33.8746	38.7505	9.1593	-4.8758	-0.53
5	30	0.0000	2.9053	9.1593	-2.9053	-0.32
6	22	49.4370	38.7505	9.1593	10.6865	1.16
7	5	57.8825	57.4521	9.1593	0.4305	0.05
8	32	68.3208	59.0708	9.1593	9.2500	1.00
9	23	18.0659	11.6606	9.1593	6.4053	0.69
10	27	69.2377	69.6820	9.1593	-0.4443	-0.05
11	19	0.0000	-2.9053	9.1593	2.9053	0.32
12	14	0.0000	2.9053	9.1593	-2.9053	-0.32
13	34	64.1380	35.7623	6.8507	28.3758	2.57R
14	28	37.3251	37.6697	9.1593	-0.3447	-0.04
15	11	64.3156	69.6820	9.1593	-5.3664	-0.58
16	20	58.5796	56.0418	9.1593	2.5377	0.28
17	1	57.1205	71.3759	9.1593	-14.2553	-1.55
18	29	0.0000	-2.9053	9.1593	2.9053	0.32
19	12	43.8251	37.6697	9.1593	6.1553	0.67
20	13	0.0000	-2.9053	9.1593	2.9053	0.32
21	24	0.0000	2.9053	9.1593	-2.9053	-0.32
22	3	0.0000	-2.9053	9.1593	2.9053	0.32
23	26	0.0000	2.9053	9.1593	-2.9053	-0.32
24	10	0.0000	2.9053	9.1593	-2.9053	-0.32
25	33	0.0000	23.2427	6.8507	-23.2427	-2.10R
26	16	55.6315	59.0708	9.1593	-3.4393	-0.37
27	17	79.8205	71.3759	9.1593	8.4447	0.92
28	18	0.0000	-2.9053	9.1593	2.9053	0.32
29	9	38.4864	27.5810	9.1593	10.9053	1.18
30	7	11.0659	11.6606	9.1593	-0.5947	-0.06
31	21	51.2110	57.4521	9.1593	-6.2411	-0.68
32	35	0.0000	23.2427	6.8507	-23.2427	-2.10R
33	25	22.4864	27.5810	9.1593	-5.0947	-0.55
34	36	53.8719	35.7623	6.8507	18.1096	1.64
35	4	47.6934	56.0418	9.1593	-8.3484	-0.91
36	2	0.0000	-2.9053	9.1593	2.9053	0.32

R denotes an observation with a large standardized residual.

Estimated Coefficients for %Inhibition of E.coli using data in uncoded units

Term	Coef
Constant	27.0119

A	-3.00494
B	-14.7383
C	4.06396
D	6.25978
E	-8.17418
A*B	11.6371
A*C	6.65883
A*D	2.61692
A*E	-5.41878
B*C	-5.07449
B*D	-2.34392
B*E	-4.09941
A*B*C	-11.3108
A*B*D	2.03508
A*B*E	-3.21334
Ct Pt	2.49062

Least Squares Means for %Inhibition of E.coli

	Mean	SE Mean
A		
-1	30.0168	3.250
1	24.0069	3.250
B		
-1	41.7501	3.250
1	12.2736	3.250
C		
-1	22.9479	3.250
1	31.0758	3.250
D		
-1	20.7521	3.158
1	33.2716	3.158
E		
-1	35.1860	3.250
1	18.8377	3.250
A*B		
-1 -1	56.3921	4.596
1 -1	27.1081	4.596
-1 1	3.6415	4.596
1 1	20.9057	4.596
A*C		
-1 -1	32.6117	4.596
1 -1	13.2841	4.596
-1 1	27.4219	4.596
1 1	34.7297	4.596
A*D		
-1 -1	26.3739	4.531
1 -1	15.1302	4.531
-1 1	33.6597	4.531
1 1	32.8836	4.531
A*E		
-1 -1	32.7722	4.596
1 -1	37.5999	4.596
-1 1	27.2614	4.596
1 1	10.4140	4.596
B*C		
-1 -1	32.6117	4.596
1 -1	13.2841	4.596
-1 1	50.8886	4.596
1 1	11.2631	4.596
B*D		
-1 -1	33.1464	4.531
1 -1	8.3577	4.531
-1 1	50.3538	4.531
1 1	16.1895	4.531
B*E		

-1	-1	45.8249	4.596
1	-1	24.5472	4.596
-1	1	37.6754	4.596
1	1	-0.0000	4.596

A*B*C

-1	-1	-1	65.2233	6.499
1	-1	-1	0.0000	6.499
-1	1	-1	-0.0000	6.499
1	1	-1	26.5682	6.499
-1	-1	1	47.5609	6.499
1	-1	1	54.2162	6.499
-1	1	1	7.2829	6.499
1	1	1	15.2432	6.499

A*B*D

-1	-1	-1	48.3703	6.454
1	-1	-1	17.9226	6.454
-1	1	-1	4.3776	6.454
1	1	-1	12.3378	6.454
-1	-1	1	64.4140	6.454
1	-1	1	36.2937	6.454
-1	1	1	2.9053	6.454
1	1	1	29.4736	6.454

A*B*E

-1	-1	-1	58.2614	6.499
1	-1	-1	33.3883	6.499
-1	1	-1	7.2829	6.499
1	1	-1	41.8114	6.499
-1	-1	1	54.5228	6.499
1	-1	1	20.8279	6.499
-1	1	1	-0.0000	6.499
1	1	1	0.0000	6.499

Means for Pseudo Center Points

D

-1	0.0000
1	59.0050

1.2. ผลการวิเคราะห์การทดลองของเชื้อ *Escherichia coli* โดยไม่รวม Center point ในสมการ

Factorial Fit: % inhibition of E.coli versus A, B, C, D, E

Estimated Effects and Coefficients for % inhibition of E.coli (coded units)

Term	Effect	Coef	SE Coef	T	P
Constant		72.71	2.545	28.57	0.000
A	6.01	3.00	2.699	1.11	0.276
B	29.48	14.74	2.699	5.46	0.000
C	-8.13	-4.06	2.699	-1.51	0.145
D	-12.52	-6.26	2.545	-2.46	0.021
E	16.35	8.17	2.699	3.03	0.006
A*B	-23.27	-11.64	2.699	-4.31	0.000
A*D	-5.23	-2.62	2.699	-0.97	0.342
A*E	10.84	5.42	2.699	2.01	0.056
B*C	10.15	5.07	2.699	1.88	0.072
A*B*C	22.62	11.31	2.699	4.19	0.000

S = 15.2678

PRESS = 10676.1

R-Sq = 78.85%

R-Sq(pred) = 61.26%

R-Sq(adj) = 70.39%

Analysis of Variance for % inhibition of E.coli (coded units)

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Main Effects	5	11317.2	11317.2	2263.44	9.71	0.000
A	1	288.9	288.9	288.95	1.24	0.276
B	1	6950.9	6950.9	6950.93	29.82	0.000
C	1	528.5	528.5	528.51	2.27	0.145
D	1	1410.7	1410.7	1410.66	6.05	0.021
E	1	2138.1	2138.1	2138.15	9.17	0.006
2-Way Interactions	4	6316.3	6316.3	1579.07	6.77	0.001
A*B	1	4333.5	4333.5	4333.48	18.59	0.000
A*D	1	219.1	219.1	219.15	0.94	0.342
A*E	1	939.6	939.6	939.62	4.03	0.056
B*C	1	824.0	824.0	824.01	3.53	0.072
3-Way Interactions	1	4093.9	4093.9	4093.92	17.56	0.000
A*B*C	1	4093.9	4093.9	4093.92	17.56	0.000
Residual Error	25	5827.7	5827.7	233.11		
Curvature	1	22.1	22.1	22.06	0.09	0.765
Lack of Fit	6	5026.4	5026.4	837.73	19.35	0.000
Pure Error	18	779.2	779.2	43.29		
Total	35	27555.0				

Unusual Observations for % inhibition of E.coli

Obs	StdOrder	% inhibition of E.coli	Fit	SE Fit	Residual	St Resid
13	34	35.862	66.452	3.599	-30.590	-2.06R
29	9	61.514	86.423	8.861	-24.909	-2.00R

R denotes an observation with a large standardized residual.

* NOTE * Estimated regression coefficients in uncoded units are not available because the model is non-hierarchical.

Least Squares Means for % inhibition of E.coli

	Mean	SE Mean
A		
-1	69.71	3.709
1	75.72	3.709
B		
-1	57.97	3.709
1	87.45	3.709
C		
-1	76.78	3.709
1	68.65	3.709
D		
-1	78.97	3.599
1	66.45	3.599
E		
-1	64.54	3.709
1	80.89	3.709
A*B		
-1 -1	43.33	5.322
1 -1	72.62	5.322
-1 1	96.08	5.322
1 1	78.82	5.322
A*D		
-1 -1	73.35	5.246
1 -1	84.59	5.246
-1 1	66.06	5.246
1 1	66.84	5.246
A*E		
-1 -1	66.95	5.322
1 -1	62.12	5.322

-1	1		72.46	5.322
1	1		89.31	5.322
B*C				
-1	-1		67.11	5.322
1	-1		86.44	5.322
-1	1		48.83	5.322
1	1		88.46	5.322
A*B*C				
-1	-1	-1	41.16	7.084
1	-1	-1	93.06	7.084
-1	1	-1	106.38	7.084
1	1	-1	66.50	7.084
-1	-1	1	45.50	7.084
1	-1	1	52.17	7.084
-1	1	1	85.78	7.084
1	1	1	91.14	7.084

Means for Pseudo Center Points

D	
-1	100.00
1	41.00

Alias Structure

I + B*C*D*E
 A + A*B*C*D*E
 B + C*D*E
 C + B*D*E
 D + B*C*E
 E + B*C*D
 A*B + A*C*D*E
 A*D + A*B*C*E
 A*E + A*B*C*D
 B*C + D*E
 A*B*C + A*D*E

2.1. ผลการวิเคราะห์จากโปรแกรม Minitab16.0 สำหรับเชื้อ *Staphylococcus Aureus* โดยรวม

Center point ในสมการ

S.Aureus

Factorial Fit: A1 versus A, B, C, D, E
Fractional Factorial Design

Factors:	5	Base Design:	5, 8	Resolution:	IV
Runs:	36	Replicates:	2	Fraction:	1/2
Blocks:	1	Center pts (total):	4		

Design Generators (before folding): D = AB, E = AC

Folded on Factors: A, B, C, D, E

Alias Structure

I + BCDE
 A + ABCDE
 B + CDE

C + BDE
 D + BCE
 E + BCD
 AB + ACDE
 AC + ABDE
 AD + ABCE
 AE + ABCD
 BC + DE
 BD + CE
 BE + CD
 ABC + ADE
 ABD + ACE
 ABE + ACD

Alias Information for Terms in the Model.
 Totally confounded terms were removed from the analysis.

I + B*C*D*E
 A + A*B*C*D*E
 B + C*D*E
 C + B*D*E
 D + B*C*E
 E + B*C*D
 A*B + A*C*D*E
 A*C + A*B*D*E
 A*D + A*B*C*E
 A*E + A*B*C*D
 B*C + D*E
 B*D + C*E
 B*E + C*D
 A*B*C + A*D*E
 A*B*D + A*C*E
 A*B*E + A*C*D

* NOTE * Some of the terms requested in MEANS were removed from the analysis.

Estimated Effects and Coefficients for A1 (coded units)

Term	Effect	Coef	SE Coef	T	P
Constant		27.08	2.692	10.06	0.000
A	9.93	4.96	2.692	1.84	0.081
B	-17.68	-8.84	2.692	-3.28	0.004
C	-3.17	-1.59	2.692	-0.59	0.563
D	-10.90	-5.45	2.538	-2.15	0.045
E	0.64	0.32	2.692	0.12	0.906
A*B	17.25	8.62	2.692	3.20	0.005
A*C	2.79	1.39	2.692	0.52	0.611
A*D	-1.03	-0.51	2.692	-0.19	0.850
A*E	-10.88	-5.44	2.692	-2.02	0.058
B*C	-9.54	-4.77	2.692	-1.77	0.092
B*D	-5.93	-2.96	2.692	-1.10	0.285
B*E	-0.02	-0.01	2.692	-0.00	0.997
A*B*C	-24.81	-12.41	2.692	-4.61	0.000
A*B*D	-14.05	-7.03	2.692	-2.61	0.017
A*B*E	20.82	10.41	2.692	3.87	0.001
Ct Pt		-2.26	8.076	-0.28	0.782

S = 15.2280 PRESS = 507539
 R-Sq = 81.05% R-Sq(pred) = 0.00% R-Sq(adj) = 65.08%

Analysis of Variance for A1 (coded units)

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Main Effects	5	4441.1	4441.14	888.23	3.83	0.014
A	1	788.3	788.27	788.27	3.40	0.081
B	1	2499.4	2499.43	2499.43	10.78	0.004
C	1	80.6	80.55	80.55	0.35	0.563
D	1	1069.6	1069.60	1069.60	4.61	0.045
E	1	3.3	3.29	3.29	0.01	0.906
2-Way Interactions	7	4407.6	4407.60	629.66	2.72	0.039
A*B	1	2380.2	2380.16	2380.16	10.26	0.005
A*C	1	62.1	62.05	62.05	0.27	0.611
A*D	1	8.5	8.47	8.47	0.04	0.850
A*E	1	947.8	947.75	947.75	4.09	0.058
B*C	1	728.0	727.97	727.97	3.14	0.092
B*D	1	281.2	281.20	281.20	1.21	0.285
B*E	1	0.0	0.00	0.00	0.00	0.997
3-Way Interactions	3	9972.7	9972.74	3324.25	14.34	0.000
A*B*C	1	4924.9	4924.87	4924.87	21.24	0.000
A*B*D	1	1580.3	1580.32	1580.32	6.81	0.017
A*B*E	1	3467.5	3467.54	3467.54	14.95	0.001
Curvature	1	18.2	18.22	18.22	0.08	0.782
Residual Error	19	4405.9	4405.95	231.89		
Lack of Fit	1	4123.2	4123.16	4123.16	262.45	0.000
Pure Error	18	282.8	282.78	15.71		
Total	35	23245.6				

Unusual Observations for A1

Obs	StdOrder	A1	Fit	SE Fit	Residual	St Resid
13	34	49.6380	19.3682	8.0259	30.2698	2.34R
25	33	0.0000	30.2698	8.0259	-30.2698	-2.34R
32	35	0.0000	30.2698	8.0259	-30.2698	-2.34R
34	36	49.6380	19.3682	8.0259	30.2698	2.34R

R denotes an observation with a large standardized residual.

Estimated Coefficients for A1 using data in uncoded units

Term	Coef
Constant	27.0824
A	4.96320
B	-8.83782
C	-1.58658
D	-5.45078
E	0.32080
A*B	8.62438
A*C	1.39255
A*D	-0.51441
A*E	-5.44218
B*C	-4.76959
B*D	-2.96437
B*E	-0.01034
A*B*C	-12.4057
A*B*D	-7.02745
A*B*E	10.4096
Ct Pt	-2.26343

Least Squares Means for A1

	Mean	SE Mean
A		
-1	22.1192	3.807
1	32.0456	3.807
B		
-1	35.9202	3.807

1	18.2446	3.807
C		
-1	28.6690	3.807
1	25.4958	3.807
D		
-1	32.5332	3.700
1	21.6316	3.700
E		
-1	26.7616	3.807
1	27.4032	3.807
A*B		
-1 -1	39.5814	5.384
1 -1	32.2591	5.384
-1 1	4.6570	5.384
1 1	31.8322	5.384
A*C		
-1 -1	25.0983	5.384
1 -1	32.2397	5.384
-1 1	19.1401	5.384
1 1	31.8516	5.384
A*D		
-1 -1	27.0556	5.309
1 -1	38.0108	5.309
-1 1	17.1828	5.309
1 1	26.0804	5.309
A*E		
-1 -1	16.3562	5.384
1 -1	37.1670	5.384
-1 1	27.8822	5.384
1 1	26.9242	5.384
B*C		
-1 -1	32.7372	5.384
1 -1	24.6008	5.384
-1 1	39.1032	5.384
1 1	11.8884	5.384
B*D		
-1 -1	38.4067	5.309
1 -1	26.6597	5.309
-1 1	33.4338	5.309
1 1	9.8294	5.309
B*E		
-1 -1	35.5891	5.384
1 -1	17.9341	5.384
-1 1	36.2514	5.384
1 1	18.5550	5.384
A*B*C		
-1 -1 -1	50.1967	7.614
1 -1 -1	15.2778	7.614
-1 1 -1	-0.0000	7.614
1 1 -1	49.2015	7.614
-1 -1 1	28.9661	7.614
1 -1 1	49.2403	7.614
-1 1 1	9.3140	7.614
1 1 1	14.4628	7.614
A*B*D		
-1 -1 -1	48.5809	7.561
1 -1 -1	28.2324	7.561
-1 1 -1	5.5303	7.561
1 1 -1	47.7892	7.561
-1 -1 1	30.5820	7.561
1 -1 1	36.2857	7.561
-1 1 1	3.7837	7.561
1 1 1	15.8752	7.561
A*B*E		
-1 -1 -1	23.3985	7.614
1 -1 -1	47.7797	7.614
-1 1 -1	9.3140	7.614

1	1	-1	26.5543	7.614
-1	-1	1	55.7644	7.614
1	-1	1	16.7384	7.614
-1	1	1	-0.0000	7.614
1	1	1	37.1101	7.614

Means for Pseudo Center Points

D	
-1	0.0000
1	49.6380

2.2. ผลการวิเคราะห์จากโปรแกรม Minitab16.0 สำหรับเชื้อ *Staphylococcus Aureus* โดยไม่รวม Center point ในสมการ

Factorial Fit: %Inhibition of S.aureus versus A, B, C, D, E

Estimated Effects and Coefficients for %Inhibition of S.aureus (coded units)

Term	Effect	Coef	SE Coef	T	P
Constant		73.17	2.625	27.87	0.000
A	-9.93	-4.96	2.785	-1.78	0.086
B	17.68	8.84	2.785	3.17	0.004
C	3.17	1.59	2.785	0.57	0.574
D	10.90	5.45	2.625	2.08	0.048
E	-0.64	-0.32	2.785	-0.12	0.909
A*B	-17.25	-8.62	2.785	-3.10	0.005
A*B*C	24.81	12.41	2.785	4.46	0.000
A*B*D	14.05	7.03	2.785	2.52	0.018
A*B*E	-20.82	-10.41	2.785	-3.74	0.001

S = 15.7524 PRESS = 9871.65
R-Sq = 72.25% R-Sq(pred) = 57.53% R-Sq(adj) = 62.64%

Analysis of Variance for %Inhibition of S.aureus (coded units)

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Main Effects	5	4441.1	4441.09	888.22	3.58	0.014
A	1	788.3	788.25	788.25	3.18	0.086
B	1	2499.4	2499.40	2499.40	10.07	0.004
C	1	80.6	80.56	80.56	0.32	0.574
D	1	1069.6	1069.58	1069.58	4.31	0.048
E	1	3.3	3.29	3.29	0.01	0.909
2-Way Interactions	1	2380.2	2380.17	2380.17	9.59	0.005
A*B	1	2380.2	2380.17	2380.17	9.59	0.005
3-Way Interactions	3	9972.7	9972.67	3324.22	13.40	0.000
A*B*C	1	4924.9	4924.86	4924.86	19.85	0.000
A*B*D	1	1580.3	1580.30	1580.30	6.37	0.018
A*B*E	1	3467.5	3467.51	3467.51	13.97	0.001
Residual Error	26	6451.6	6451.58	248.14		
Curvature	1	18.2	18.21	18.21	0.07	0.792
Lack of Fit	7	6150.6	6150.57	878.65	55.93	0.000
Pure Error	18	282.8	282.79	15.71		
Total	35	23245.5				

Unusual Observations for %Inhibition of S.aureus

Obs	StdOrder	%Inhibition of S.aureus	Fit	SE Fit	Residual	St Resid
25	33	100.000	67.718	3.713	32.282	2.11R
32	35	100.000	67.718	3.713	32.282	2.11R

R denotes an observation with a large standardized residual.

* NOTE * Estimated regression coefficients in uncoded units are not available because the model is non-hierarchical.

Least Squares Means for %Inhibition of S.aureus

	Mean	SE Mean
A		
-1	78.13	3.827
1	68.21	3.827
B		
-1	64.33	3.827
1	82.01	3.827
C		
-1	71.58	3.827
1	74.76	3.827
D		
-1	67.72	3.713
1	78.62	3.713
E		
-1	73.49	3.827
1	72.85	3.827
A*B		
-1 -1	60.67	5.491
1 -1	67.99	5.491
-1 1	95.59	5.491
1 1	68.42	5.491
A*B*C		
-1 -1 -1	46.68	6.758
1 -1 -1	78.81	6.758
-1 1 -1	106.41	6.758
1 1 -1	54.43	6.758
-1 -1 1	74.66	6.758
1 -1 1	57.17	6.758
-1 1 1	84.78	6.758
1 1 1	82.41	6.758
A*B*D		
-1 -1 -1	48.19	6.693
1 -1 -1	69.57	6.693
-1 1 -1	97.17	6.693
1 1 -1	55.94	6.693
-1 -1 1	73.15	6.693
1 -1 1	66.42	6.693
-1 1 1	94.02	6.693
1 1 1	80.90	6.693
A*B*E		
-1 -1 -1	71.40	6.758
1 -1 -1	57.90	6.758
-1 1 -1	85.51	6.758
1 1 -1	79.15	6.758
-1 -1 1	49.94	6.758
1 -1 1	78.08	6.758
-1 1 1	105.68	6.758
1 1 1	57.69	6.758

Means for Pseudo Center Points

D
-1 100.00

1 50.36

Alias Structure

I + B*C*D*E
A + A*B*C*D*E
B + C*D*E
C + B*D*E
D + B*C*E
E + B*C*D
A*B + A*C*D*E
A*B*C + A*D*E
A*B*D + A*C*E
A*B*E + A*C*D

3.1. ผลการวิเคราะห์ด้วยฟังก์ชัน Response Optimizer สำหรับเชื้อ *Escherichia coli*

Response Optimization

Parameters

	Goal	Lower	Target	Upper	Weight	Import
% inhibition	Target	99.9	100	100.1	1	1

Starting Point

A = 1
B = 1
C = -1
D = -1 (-1)
E = 1

Local Solution

A = 0.896030
B = 0.417054
C = -0.951565
D = -1 (-1)
E = 1

Predicted Responses

% inhibition = 100 , desirability = 1.000000

Composite Desirability = 1.000000

Local Solution

A = 1
B = -0.468806
C = -1
D = 1 (1)
E = 1

Predicted Responses

% inhibition = 100 , desirability = 1.000000

Composite Desirability = 1.000000

Global Solution

A = 0.896030
B = 0.417054
C = -0.951565
D = -1 (-1)
E = 1

Predicted Responses

% inhibition = 100 , desirability = 1.000000

Composite Desirability = 1.000000

3.2. ผลการวิเคราะห์ด้วยฟังก์ชัน Response Optimizer สำหรับเชื้อ *Staphylococcus Aureus*

Response Optimization

Parameters

	Goal	Lower	Target	Upper	Weight	Import
%Inhibition	Target	99.9	100	100.1	1	1

Starting Point

A = -1
B = 1
C = 1
D = 1 (1)
E = -1

Local Solution

A = -0.969972
B = 1
C = -0.204122
D = -1 (-1)
E = 0.134564

Predicted Responses

%Inhibition = 100 , desirability = 1.000000

Composite Desirability = 1.000000

Local Solution

A = 0.817772

B = 1
 C = 1
 D = 1 (1)
 E = -0.699086

Predicted Responses

%Inhibition = 100 , desirability = 1.000000

Composite Desirability = 1.000000

Global Solution

A = 0.817772
 B = 1
 C = 1
 D = 1 (1)
 E = -0.699086

Predicted Responses

%Inhibition = 100 , desirability = 1.000000

Composite Desirability = 1.000000

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ประวัติผู้เขียน

ชื่อ – สกุล

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วัน เดือน ปี เกิด

30 มิถุนายน 2533

ประวัติการศึกษา

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เชียงใหม่ ปีการศึกษา 2551

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