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สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Appendix I

The Preparation of Buffers

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Buffer Preparations

IPB pH 3.0 (0.15 M):

85%H_3PO_4	0.56 ml
NaH_2PO_4	9.19 gm
NaCl	0.78 gm
H_2O qs.to	500 ml

IPB pH 4.0 (0.15M):

NaH_2PO_4	10.22 gm
85%H_3PO_4	40 µl
NaCl	0.42 gm
H_2O qs.to	500 ml

IPB pH 5.0 (0.15 M):

NaH_2PO_4	0.125 gm
Na_2HPO_4	10.28 gm
NaCl	0.59 gm
H_2O qs.to	500 ml

IPBpH 6.0 (0.15 M):

NaH_2PO_4	3.6 gm
Na_2HPO_4	0.47 gm
NaCl	2.6 gm
H_2O qs.to	500 ml

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

IPB pH 7.4 (0.15 M):

NaH_2PO_4	0.80 gm
Na_2HPO_4	3.79 gm
NaCl	2.24 gm
H_2O qs.to	500 ml

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Appendix II

Individual Plasma Calcium Data (% of initial value) for baseline, control and $sCT_{treated}$ groups at various pH

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Appendix II_a

Individual Plasma Calcium Data (% of initial value) for the baseline groups at pH 3.0 - 7.4

0.15 M Phosphate Buffer pH 3.0

Subject No.	Time (mins)										$AUC_{(0\text{-}240)min}$
	0	10	20	30	40	60	90	120	180	240	[% . min]
1	100.00	100.52	101.23	100.91	97.71	93.32	90.34	92.63	96.45	97.33	22,910.79
2	100.00	104.33	105.11	101.26	100.61	96.29	93.85	95.63	93.23	94.83	23,080.41
3	100.00	98.45	101.00	98.75	96.58	92.61	91.77	93.49	92.21	94.40	22,568.96
4	100.00	103.66	100.58	102.66	100.63	97.44	93.44	90.22	94.22	95.34	22,891.07
5	100.00	102.01	98.15	97.33	94.77	93.54	93.00	94.59	92.80	91.89	22,606.00
Mean	**100.00**	**101.79**	**101.21**	**100.18**	**98.06**	**94.64**	**92.48**	**93.31**	**93.78**	**94.76**	**22,811.45**
± SD.	**0.00**	**2.13**	**2.24**	**1.90**	**2.29**	**1.88**	**1.28**	**1.85**	**1.49**	**1.75**	**194.71**

0.15 M Phosphate Buffer pH 4.0

Subject No.	Time (mins)										$AUC_{(0\text{-}240)min}$
	0	10	20	30	40	60	90	120	180	240	[% . min]
1	100.00	104.81	103.91	104.21	102.31	101.99	99.02	100.52	98.93	97.86	24,079.62
2	100.00	105.22	101.23	102.34	101.17	100.52	100.11	97.05	96.83	98.15	23,743.52
3	100.00	101.82	99.02	100.12	98.62	100.06	98.74	96.96	98.44	97.72	23,653.80
4	100.00	100.47	102.76	103.22	101.50	101.56	100.26	98.45	100.64	101.90	24,158.96
5	100.00	98.60	100.60	98.01	100.22	98.64	97.56	96.72	97.65	95.23	23,436.00
Mean	**100.00**	**102.18**	**101.50**	**101.58**	**100.76**	**100.55**	**99.14**	**97.94**	**98.50**	**98.17**	**23,814.38**
± SD.	**0.00**	**2.53**	**1.70**	**2.24**	**1.26**	**1.18**	**0.99**	**1.43**	**1.29**	**2.14**	**269.47**

0.15 M Phosphate Buffer pH 5.0

Subject No.	Time (mins)										$AUC_{(0-240)min}$
	0	10	20	30	40	60	90	120	180	240	[% . min]
1	100.00	103.91	105.41	102.83	104.42	103.62	100.51	98.74	95.52	97.29	23,886.18
2	100.00	106.11	103.60	104.45	102.34	100.12	102.93	100.56	96.15	98.84	24,026.44
3	100.00	101.11	102.15	100.34	105.70	101.62	97.33	96.55	100.52	100.23	23,964.66
4	100.00	100.81	101.89	100.09	102.07	100.40	101.16	102.82	100.89	98.73	24,245.13
5	100.00	98.68	100.59	101.15	100.93	103.00	100.65	101.44	98.70	100.83	24,124.36
Mean	**100.00**	**102.12**	**102.73**	**101.77**	**103.09**	**101.75**	**100.52**	**100.02**	**98.36**	**99.18**	**24,049.35**
± SD.	**0.00**	**2.60**	**1.65**	**1.65**	**1.72**	**1.38**	**1.81**	**2.18**	**2.20**	**1.24**	**125.12**

0.15 M Phosphate Buffer pH 6.0

Subject No.	Time (mins)										$AUC_{(0-240)min}$
	0	10	20	30	40	60	90	120	180	240	% . min
1	100.00	103.46	103.45	102.46	103.26	100.86	101.67	102.20	100.34	100.07	24,335.55
2	100.00	104.12	102.25	103.52	104.23	101.93	102.87	100.31	98.11	101.77	24,250.30
3	100.00	103.13	102.41	103.45	100.56	101.45	101.11	101.58	100.25	100.54	24,270.34
4	100.00	101.51	100.58	98.78	100.32	98.46	100.56	98.19	98.31	100.26	23,816.72
5	100.00	102.25	101.43	100.20	98.74	97.55	96.55	97.26	97.10	98.53	23,513.42
Mean	**100.00**	**102.89**	**102.02**	**101.68**	**101.42**	**100.05**	**100.55**	**99.91**	**98.82**	**100.23**	**24,037.27**
± SD.	**0.00**	**0.92**	**0.97**	**1.88**	**2.02**	**1.73**	**2.14**	**1.91**	**1.27**	**1.04**	**319.92**

0.15 M Phosphate Buffer pH 7.4

Subject No.	Time (mins)										$AUC_{(0-240)min}$
	0	10	20	30	40	60	90	120	180	240	[% . min]
1	100.00	107.16	102.66	100.13	102.52	97.45	101.93	100.15	101.96	103.49	24,359.93
2	100.00	102.59	103.49	105.95	98.56	100.58	103.77	98.18	99.15	98.29	24,041.74
3	100.00	100.58	97.46	101.92	100.73	99.75	98.96	100.45	97.82	102.40	23,934.37
4	100.00	98.47	100.79	101.23	97.17	99.16	100.01	97.16	100.12	101.64	23,870.00
5	100.00	101.16	102.74	98.15	102.46	103.56	100.16	102.42	104.15	100.92	24,536.11
Mean	**100.00**	**101.99**	**101.43**	**101.47**	**100.29**	**100.10**	**100.97**	**99.67**	**100.64**	**101.34**	**24,148.43**
± SD.	**0.00**	**2.90**	**2.17**	**2.58**	**2.13**	**2.01**	**1.70**	**1.84**	**2.21**	**1.75**	**256.81**

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Appendix II_b

Individual Plasma Calcium Data (% of initial value) for the control groups (sCT_{alone} at pH 3.0 - 7.4)

sCT(in) pH = 3.0

Subject No.	Time (mins)										$AUC_{(0\text{-}240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00				83.47	87.84	88.55	89.64	90.12	90.65	21,517.77	83.47	40.00	5.67
2	100.00	96.16	95.16	88.34	82.52	84.23	87.44	90.02	89.36	88.12	21,319.20	82.52	40.00	6.54
3	100.00	102.19	96.89	92.35	85.82	91.92	93.56	90.71	88.73	91.26	21,949.96	85.82	40.00	3.78
4	100.00	100.66	94.85	87.81	83.93	86.96	85.93	88.16	91.82	88.96	21,489.32	83.93	40.00	5.80
5	100.00	96.92	90.76	84.46	88.49	89.14	90.49	89.03	89.29	90.31	21,544.55	84.46	30.00	5.47
Mean	**100.00**	**98.98**	**94.41**	**88.24**	**84.85**	**88.02**	**89.19**	**89.51**	**89.86**	**89.86**	**21,564.16**	**84.04**	**38.00**	**5.45**
± SD.	**0.00**	**2.52**	**2.25**	**2.80**	**2.11**	**2.53**	**2.64**	**0.87**	**1.08**	**1.15**	**208.32**	**1.09**	**4.00**	**0.91**

sCT(in) pH = 4.0

Subject No.	Time (mins)										$AUC_{(0\text{-}240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	101.22	99.67	100.62	96.80	89.38	92.50	94.68	94.26	93.91	22,709.97	89.38	60.00	4.64
2	100.00	100.79	98.57	98.53	92.83	87.58	94.81	91.42	93.83	92.72	22,430.29	87.58	60.00	5.81
3	100.00	98.43	95.95	97.73	93.49	85.93	90.74	93.71	89.41	94.12	22,099.16	85.93	60.00	7.20
4	100.00	103.82	100.47	102.82	97.49	90.92	86.73	88.43	94.85	90.69	22,299.32	86.73	90.00	6.36
5	100.00	102.13	101.34	98.49	95.83	91.20	91.27	95.66	95.93	93.82	22,850.14	91.20	60.00	4.05
Mean	**100.00**	**101.28**	**99.20**	**99.64**	**95.28**	**89.00**	**91.21**	**92.78**	**93.66**	**93.05**	**22,477.78**	**88.16**	**66.00**	**5.61**
± SD.	**0.00**	**1.76**	**1.86**	**1.86**	**1.83**	**2.01**	**2.64**	**2.59**	**2.24**	**1.28**	**272.04**	**1.90**	**12.00**	**1.14**

sCT(in) pH = 5.0

Subject No.	Time (mins)										$AUC_{(0\text{-}240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	100.56	101.62	98.01	97.24	94.34	96.81	95.70	94.36	97.00	23,101.65	94.34	60.00	3.94
2	100.00	105.93	102.32	103.11	98.83	95.11	94.43	92.91	92.31	94.82	22,870.96	92.31	180.00	4.90
3	100.00	98.26	100.11	96.45	93.40	89.29	92.67	89.52	95.73	91.45	22,376.75	82.29	60.00	6.95
4	100.00	101.34	100.01	98.49	94.72	90.32	93.53	92.52	91.82	90.22	22,362.51	90.22	240.00	7.01
5	100.00	102.81	103.93	100.52	96.26	92.12	94.09	93.23	95.92	95.40	22,954.27	92.12	60.00	4.55
Mean	**100.00**	**101.78**	**101.60**	**99.32**	**96.09**	**92.24**	**94.30**	**92.78**	**94.03**	**93.78**	**22,733.23**	**90.26**	**120.00**	**5.47**
± SD.		**2.54**	**1.46**	**2.30**	**1.90**	**2.24**	**1.39**	**1.97**	**1.70**	**2.54**	**305.96**	**4.19**	**75.89**	**1.27**

sCT(in) pH = 6.0

Subject No.	Time (mins)										$AUC_{(0\text{-}240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	101.20	100.56	98.70	95.79	93.16	93.91	96.23	95.87	95.97	23,049.33	93.16	60.00	4.11
2	100.00	105.56	102.97	97.51	94.58	92.81	95.80	94.25	91.11	92.53	22,657.13	91.11	180.00	5.74
3	100.00	97.16	101.15	99.02	96.88	93.53	97.75	95.63	90.37	93.71	22,733.56	90.37	180.00	5.42
4	100.00	100.23	98.81	96.34	94.66	90.92	93.17	90.42	95.63	92.06	22,510.05	90.42	120.00	6.35
5	100.00	102.82	99.22	100.62	97.35	95.64	93.27	96.83	94.33	94.81	23,036.91	93.27	90.00	4.16
Mean	**100.00**	**101.39**	**100.54**	**98.44**	**95.85**	**93.21**	**94.78**	**94.67**	**93.46**	**93.82**	**22,797.40**	**91.67**	**126.00**	**5.16**
± SD.	**0.00**	**2.78**	**1.48**	**1.44**	**1.12**	**1.51**	**1.76**	**2.29**	**2.30**	**1.44**	**213.15**	**1.29**	**48.00**	**0.89**

sCT(in) pH = 7.4

Subject No.	Time (mins)										$AUC_{(0\text{-}240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	100.33	101.36	97.13	94.83	92.92	93.82	93.52	94.34	96.42	22,809.48	92.92	60.00	5.54
2	100.00	105.28	100.79	100.33	97.81	96.86	92.83	96.11	93.83	95.21	23,048.07	92.83	90.00	4.56
3	100.00	98.43	96.36	98.65	95.43	91.63	93.55	92.51	91.93	93.23	22,438.67	91.63	60.00	7.08
4	100.00	101.83	102.83	96.63	96.29	92.70	95.62	93.61	95.94	92.69	22,893.05	92.69	240.00	5.20
5	100.00	100.26	98.42	96.29	93.72	94.92	94.26	96.45	96.83	95.83	23,080.83	93.72	40.00	4.42
Mean	**100.00**	**101.22**	**99.95**	**97.80**	**95.62**	**93.80**	**94.02**	**94.44**	**94.57**	**94.68**	**22,854.02**	**92.76**	**98.00**	**5.36**
± SD.	**0.00**	**2.30**	**2.29**	**1.50**	**1.38**	**1.86**	**0.93**	**1.55**	**1.70**	**1.46**	**230.27**	**0.67**	**72.77**	**0.95**

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Appendix II_c

Individual Plasma Calcium Data (% of initial value) for the $sCT_{treated}$ groups (1.0 % CS J at pH 3.0 - 6.0)

1.0% CS J pH = 3.0

Subject No.	Time (mins)										$AUC_{(0-240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	min)	
1	100.00	92.22	85.47	74.34	76.76	84.40	86.99	88.22	85.53	87.83	20,627.96	74.34	30.00	9.57
2	100.00	93.69	81.23	68.45	75.98	81.03	84.72	87.21	86.83	85.66	20,344.82	68.45	30.00	10.81
3	100.00	92.23	84.98	72.24	79.829	83.78	81.81	84.89	90.82	85.73	20,581.39	72.24	30.00	9.78
4	100.00	100.14	92.98	81.01	76.932	82.06	86.00	83.63	89.92	86.12	20,768.46	76.93	40.00	8.96
5	100.00	91.75	82.95	71.33	73.69	77.45	80.72	82.12	83.61	84.90	19,682.29	71.33	30.00	13.72
Mean	**100.00**	**94.01**	**85.52**	**73.47**	**76.64**	**81.74**	**84.05**	**85.21**	**87.34**	**86.05**	**20,400.98**	**72.66**	**32.00**	**10.57**
± SD.	**0.00**	**3.14**	**4.02**	**4.22**	**1.97**	**2.46**	**2.41**	**2.25**	**2.69**	**0.97**	**384.39**	**2.86**	**4.00**	**1.69**

1.0% CS J pH = 4.0

Subject No.	Time (mins)										$AUC_{(0-240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	102.33	92.15	83.84	74.44	86.72	93.82	93.14	92.36	91.72	21,866.95	74.44	40.00	8.18
2	100.00	98.22	87.30	80.65	71.16	82.96	86.79	92.69	90.83	92.71	21,309.22	71.16	40.00	10.52
3	100.00	104.91	94.42	84.84	78.72	73.81	82.53	93.52	91.13	90.81	21,244.08	73.81	60.00	10.79
4	100.00	100.34	89.47	78.26	72.56	80.76	89.75	95.73	93.46	95.15	21,750.21	72.56	40.00	8.67
5	100.00	101.66	90.15	87.58	75.36	81.73	83.63	90.62	88.76	93.15	21,174.57	75.36	40.00	11.08
Mean	**100.00**	**101.49**	**90.70**	**83.03**	**74.45**	**81.19**	**87.30**	**93.14**	**91.31**	**92.71**	**21,469.01**	**73.47**	**44.00**	**9.85**
± SD.	**0.00**	**2.21**	**2.42**	**3.26**	**2.59**	**4.21**	**4.12**	**1.64**	**1.58**	**1.47**	**282.93**	**1.47**	**8.00**	**1.19**

1.0% CS J pH = 5.0

Subject No.	Time (mins)										$AUC_{(0-240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	102.72	95.83	88.32	84.36	90.47	95.13	93.14	93.66	93.45	22,364.15	84.36	40.00	7.01
2	100.00	100.36	98.30	90.51	79.28	87.12	92.44	94.48	92.01	93.52	22,109.90	79.28	40.00	8.06
3	100.00	103.89	95.15	91.30	87.18	83.56	90.42	93.75	94.45	94.59	22,236.15	83.56	60.00	7.52
4	100.00	99.05	92.95	87.46	83.45	89.18	87.13	91.84	92.26	90.96	21,786.71	83.45	40.00	9.41
5	100.00	99.16	99.64	93.52	86.20	92.15	93.87	93.26	94.16	94.45	22,510.19	86.20	40.00	6.40
Mean	**100.00**	**101.04**	**96.37**	**90.22**	**84.09**	**88.49**	**91.80**	**93.29**	**93.31**	**93.39**	**22,201.42**	**83.37**	**44.00**	**7.68**
± SD.	**0.00**	**1.94**	**2.36**	**2.16**	**2.74**	**2.97**	**2.81**	**0.87**	**0.99**	**1.30**	**246.33**	**2.27**	**8.00**	**1.02**

1.0% CS J pH = 6.0

Subject No.	Time (mins)										$AUC_{(0-240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	100.34	97.42	94.86	90.46	86.11	91.56	92.81	93.51	92.82	22,254.30	86.11	60.00	7.42
2	100.00	104.26	100.26	97.26	94.36	87.78	94.79	90.45	91.46	90.48	22,187.85	87.78	60.00	7.69
3	100.00	99.76	97.45	95.58	88.78	84.16	92.26	95.18	93.02	93.46	22,299.50	84.16	60.00	7.23
4	100.00	98.57	95.13	92.41	87.29	84.59	92.58	94.96	95.79	94.16	22,402.00	84.59	60.00	6.80
5	100.00	101.75	99.15	96.45	94.83	89.35	88.73	91.67	94.16	94.42	22,395.75	88.73	40.00	6.83
Mean	**100.00**	**100.94**	**97.88**	**95.31**	**91.14**	**86.40**	**91.98**	**93.01**	**93.59**	**93.07**	**22,307.88**	**86.27**	**56.00**	**7.19**
± SD.	**0.00**	**1.95**	**1.75**	**1.66**	**2.99**	**1.95**	**1.95**	**1.84**	**1.42**	**1.41**	**82.37**	**1.77**	**8.00**	**0.34**

Appendix II_d

Individual Plasma Calcium Data (% of initial value) for the $sCT_{treated}$ groups (1.0 % CS G at pH 3.0 - 6.0)

1.0% CS G pH = 3.0

Subject No.	Time (mins)										$AUC_{(0-240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	92.42	85.47	82.36	86.12	85.89	88.23	89.79	89.07	88.11	21,225.20	82.36	30.00	6.95
2	100.00	97.56	94.11	85.19	79.46	82.35	84.18	88.59	90.28	89.11	21,121.30	79.46	40.00	7.41
3	100.00	96.92	89.71	84.40	91.02	84.04	85.42	87.45	88.46	89.33	21,161.95	84.04	60.00	7.23
4	100.00	94.39	83.74	81.05	84.96	87.17	87.76	87.38	89.85	87.92	21,148.50	81.05	30.00	7.29
5	100.00	94.12	85.70	83.29	87.12	90.56	86.68	85.49	88.26	89.59	21,125.65	83.29	30.00	7.39
Mean	**100.00**	**95.08**	**87.75**	**83.26**	**85.74**	**86.00**	**86.45**	**87.74**	**89.18**	**88.81**	**21,156.52**	**82.04**	**38.00**	**7.25**
± SD.	**0.00**	**1.90**	**3.74**	**1.46**	**3.74**	**2.80**	**1.49**	**1.43**	**0.78**	**0.67**	**37.43**	**1.63**	**11.66**	**0.17**

1.0% CS G pH = 4.0

Subject No.	Time (mins)										$AUC_{(0-240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	102.22	96.58	92.44	89.23	85.83	93.66	90.89	92.20	94.52	22,163.75	85.83	60.00	6.93
2	100.00	100.94	94.79	88.80	85.45	93.72	93.23	94.96	93.52	89.46	22,337.15	85.45	40.00	6.20
3	100.00	98.15	95.01	89.54	86.34	88.31	90.10	93.75	92.59	91.26	22,045.00	86.34	40.00	7.43
4	100.00	100.61	97.22	94.49	82.66	86.86	89.36	90.43	92.72	94.85	21,993.45	82.66	40.00	7.65
5	100.00	97.82	91.48	85.16	83.68	85.34	92.79	89.82	95.95	92.88	21,997.30	83.68	40.00	7.63
Mean	**100.00**	**99.95**	**95.02**	**90.08**	**85.47**	**88.01**	**91.83**	**91.97**	**93.40**	**92.59**	**22,107.33**	**84.79**	**44.00**	**7.17**
± SD.	**0.00**	**1.69**	**1.99**	**3.20**	**2.28**	**3.03**	**1.75**	**2.01**	**1.35**	**2.02**	**130.35**	**1.39**	**8.00**	**0.55**

1.0% CS G pH = 5.0

Subject No.	Time (mins)										$AUC_{(0-240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	101.56	100.24	96.65	85.86	80.75	86.42	92.62	95.23	96.85	22,171.29	80.75	60.00	7.81
2	100.00	98.24	95.95	84.65	80.55	86.92	92.57	95.81	93.64	95.97	22,255.16	80.55	40.00	7.46
3	100.00	97.81	94.75	87.91	82.01	89.23	95.50	95.92	94.86	93.10	22,431.55	82.01	40.00	6.73
4	100.00	100.37	98.19	93.39	81.31	85.46	92.42	94.52	95.49	94.14	22,354.56	81.31	40.00	7.05
5	100.00	101.00	96.85	90.09	83.12	88.44	93.12	95.15	93.57	92.47	22,312.85	83.12	40.00	7.22
Mean	**100.00**	**99.79**	**97.20**	**90.54**	**82.57**	**86.16**	**92.01**	**94.81**	**94.56**	**94.51**	**22,305.08**	**81.55**	**44.00**	**7.25**
± SD.		**1.50**	**1.89**	**4.18**	**1.85**	**3.00**	**3.00**	**1.20**	**0.80**	**1.67**	**88.20**	**0.94**	**8.00**	**0.37**

1.0% CS G pH = 6.0

Subject No.	Time (mins)										$AUC_{(0-240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	104.98	101.53	95.46	84.46	81.45	85.55	89.26	92.49	94.16	21,779.86	81.45	60.00	9.39
2	100.00	102.64	98.15	92.79	80.51	84.57	92.21	93.82	94.98	92.07	22,206.94	80.51	40.00	7.61
3	100.00	98.19	89.49	84.92	78.08	83.96	87.47	91.62	95.32	96.48	22,102.10	78.08	40.00	8.05
4	100.00	100.63	96.26	87.96	80.35	87.65	94.45	92.41	93.45	91.93	21,856.99	80.35	40.00	9.07
5	100.00	95.84	92.45	83.15	76.48	82.56	89.90	94.85	97.56	95.15	22,099.04	76.48	40.00	8.06
Mean	**100.00**	**100.46**	**95.58**	**88.86**	**79.98**	**84.04**	**89.92**	**92.39**	**94.76**	**93.96**	**22,008.99**	**79.38**	**44.00**	**8.44**
± SD.	**0.00**	**3.22**	**4.23**	**4.65**	**2.70**	**2.11**	**3.19**	**1.93**	**1.74**	**1.76**	**162.21**	**1.82**	**8.00**	**0.68**

Appendix III

Individual Plasma Calcium Data (% of initial value) for sCT with chitosans at various concentrations

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Appendix III_a

Individual Plasma Calcium Data (% of initial value) for sCT with CS J (pH 4.0) at various concentrations

0.25% CS J pH = 4.0

Subject No.	Time (mins)										$AUC_{(0-240)min.}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	101.55	97.26	96.40	88.12	82.54	89.19	91.67	93.21	90.55	21,947.11	82.54	60.00	7.84
2	100.00	98.13	100.82	96.22	88.46	84.36	86.53	89.01	91.63	90.41	21,698.65	84.36	40.00	8.88
3	100.00	100.83	96.35	94.82	85.65	80.62	88.96	95.11	93.96	90.56	22,023.20	80.62	60.00	7.52
4	100.00	102.34	99.45	93.85	84.15	80.36	92.68	96.39	95.95	93.16	22,396.81	80.36	60.00	5.95
5	100.00	101.25	98.35	95.86	83.65	79.58	85.46	90.78	93.85	94.27	21,806.71	79.58	60.00	8.43
Mean	**100.00**	**100.82**	**98.45**	**95.43**	**86.01**	**81.49**	**88.56**	**92.59**	**93.72**	**91.79**	**21,974.50**	**81.49**	**56.00**	**7.72**
± SD.	**0.00**	**1.43**	**1.58**	**0.96**	**1.98**	**1.73**	**2.50**	**2.75**	**1.39**	**1.61**	**239.05**	**1.73**	**8.00**	**1.00**

0.50% CS J pH = 4.0

Subject No.	Time (mins)										$AUC_{(0-240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	98.34	95.12	86.52	79.20	84.06	88.21	92.63	94.66	94.72	21,924.71	84.06	60.00	7.93
2	100.00	102.96	100.73	96.47	87.16	80.71	85.62	91.88	95.15	93.62	22,047.71	80.71	40.00	7.42
3	100.00	100.50	97.13	88.16	77.51	82.62	86.26	94.95	92.75	90.12	21.715.28	82.62	60.00	8.81
4	100.00	104.96	101.46	94.19	81.16	86.62	82.18	90.55	90.45	91.89	21,613.08	82.18	90.00	9.24
5	100.00	100.15	98.16	84.49	80.12	83.65	83.17	95.15	91.46	93.45	21,688.73	83.17	90.00	8.93
Mean	**100.00**	**101.38**	**98.52**	**89.97**	**81.03**	**83.53**	**85.09**	**93.03**	**92.89**	**92.76**	**21,818.56**	**82.55**	**68.00**	**8.47**
± SD.	**0.00**	**2.32**	**2.33**	**4.59**	**3.29**	**1.93**	**2.17**	**1.78**	**1.80**	**1.60**	**175.25**	**1.11**	**19.39**	**0.68**

0.75% CS J pH = 4.0

Subject No.	Time (mins)										$AUC_{(0\text{-}240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	105.44	99.26	97.29	85.08	79.49	82.41	88.16	93.50	94.25	21,631.66	79.49	60.00	9.17
2	100.00	102.00	102.26	99.56	82.12	87.62	84.72	86.65	91.19	93.15	21,647.72	80.82	40.00	9.10
3	100.00	98.45	94.70	85.78	77.06	82.45	87.62	91.34	95.86	92.69	21,777.16	77.06	40.00	8.55
4	100.00	104.86	100.05	95.85	84.12	72.11	84.76	91.49	95.78	95.68	22,060.04	72.11	60.00	7.37
5	100.00	98.46	95.86	90.63	74.14	83.16	83.71	91.67	93.45	91.45	21,542.06	74.14	40.00	9.54
Mean	**100.00**	**101.84**	**98.42**	**93.82**	**80.50**	**80.97**	**84.64**	**89.86**	**93.96**	**93.44**	**21,731.73**	**76.73**	**48.00**	**8.75**
± SD.	**0.00**	**3.00**	**2.78**	**4.98**	**4.22**	**5.14**	**1.72**	**2.06**	**1.74**	**1.43**	**180.50**	**3.24**	**9.80**	**0.76**

1.00% CS J pH = 4.0

Subject No.	Time (mins)										$AUC_{(0\text{-}240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	102.33	92.15	83.84	74.44	86.72	93.82	93.14	92.36	91.72	21,866.95	74.44	40.00	8.18
2	100.00	98.22	87.30	80.65	71.16	82.96	86.79	92.69	90.83	92.71	21,309.22	71.16	40.00	10.52
3	100.00	104.91	94.42	84.84	78.72	73.81	82.53	93.52	91.13	90.81	21,244.08	73.81	60.00	10.79
4	100.00	100.34	89.47	78.26	72.56	80.76	89.75	95.73	93.46	95.15	21,750.21	72.56	40.00	8.67
5	100.00	101.66	90.15	87.58	75.36	81.73	83.63	90.62	88.76	93.15	21,174.57	75.36	40.00	11.08
Mean	**100.00**	**101.49**	**90.70**	**83.03**	**74.45**	**81.19**	**87.30**	**93.14**	**91.31**	**92.71**	**21,469.01**	**73.47**	**44.00**	**9.85**
± SD.	**0.00**	**2.21**	**2.42**	**3.26**	**2.59**	**4.21**	**4.12**	**1.64**	**1.58**	**1.47**	**282.93**	**1.47**	**8.00**	**1.19**

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1.25% CS J pH = 4.0

Subject No.	Time (mins)										$AUC_{(0\text{-}240)min}$	C_{max}	T_{max}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	96.22	92.54	85.40	76.91	83.41	87.21	94.04	91.13	93.88	21,712.58	76.91	60.00	8.83
2	100.00	96.87	98.49	87.20	75.16	83.16	79.68	82.50	90.42	90.09	20,862.77	75.16	40.00	12.39
3	100.00	102.79	98.45	92.85	74.26	82.02	80.64	90.79	93.46	92.10	21,580.21	74.26	40.00	9.38
4	100.00	100.03	97.46	94.90	76.10	85.75	82.16	95.45	91.02	94.46	21,863.89	76.10	60.00	8.19
5	100.00	100.76	97.76	89.22	75.78	81.06	85.02	83.69	89.19	89.16	20,983.32	75.78	40.00	11.89
Mean	**100.00**	**99.33**	**96.94**	**89.91**	**75.64**	**83.08**	**82.94**	**89.29**	**91.04**	**91.94**	**21,400.55**	**75.64**	**48.00**	**10.14**
± SD.	**0.00**	**2.46**	**2.24**	**3.51**	**0.89**	**1.58**	**2.80**	**5.30**	**1.39**	**2.06**	**401.90**	**0.89**	**9.80**	**1.69**

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Appendix III_b

Individual Plasma Calcium Data (% of initial value) for sCT with CS G (pH 6.0) at various concentrations

0.25% CS G pH = 6.0

Subject No.	Time (mins)										$AUC_{(0\text{-}240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	100.23	98.41	96.82	89.76	85.22	92.74	98.62	94.94	95.76	22,730.97	85.22	60.00	5.43
2	100.00	96.79	94.79	90.60	84.46	88.79	93.76	94.89	95.76	95.82	22,510.78	83.46	40.00	6.35
3	100.00	103.69	100.14	97.47	91.86	89.16	87.86	89.75	95.75	93.63	22,348.38	87.86	90.00	7.03
4	100.00	98.45	97.68	95.47	89.05	83.94	91.49	95.49	95.15	96.49	22,495.18	82.24	60.00	6.42
5	100.00	101.86	102.49	98.75	92.85	85.42	89.83	94.46	94.76	95.62	22,559.04	85.42	60.00	6.15
Mean	**100.00**	**100.20**	**98.70**	**95.82**	**89.59**	**86.51**	**91.14**	**94.64**	**95.27**	**95.46**	**22,528.87**	**84.84**	**62.00**	**6.28**
± SD.	**0.00**	**2.43**	**2.56**	**2.82**	**2.91**	**2.08**	**2.10**	**2.85**	**0.41**	**0.96**	**123.12**	**1.91**	**16.00**	**0.52**

0.50% CS G pH = 6.0

Subject No.	Time (mins)										$AUC_{(0\text{-}240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	97.88	95.69	91.72	82.57	89.51	93.45	96.85	94.33	95.66	22,520.82	82.57	40.00	6.31
2	100.00	100.46	96.17	89.35	84.32	88.59	95.49	92.19	90.85	94.19	22,129.43	84.32	40.00	7.94
3	100.00	102.49	97.46	91.20	83.41	91.60	95.05	94.19	94.83	92.15	22,496.35	83.41	40.00	6.41
4	100.00	98.19	100.79	95.15	81.25	89.49	93.23	95.69	92.73	93.45	22,366.72	81.25	40.00	6.95
5	100.00	104.48	97.15	92.48	86.45	84.16	91.92	95.75	95.23	93.58	22,428.64	84.16	60.00	6.69
Mean	**100.00**	**100.70**	**97.45**	**91.98**	**83.60**	**88.67**	**93.83**	**94.93**	**93.59**	**93.81**	**22,388.39**	**83.14**	**44.00**	**6.86**
± SD.	**0.00**	**2.52**	**1.79**	**1.89**	**1.75**	**2.46**	**1.30**	**1.61**	**1.61**	**1.14**	**140.24**	**1.13**	**8.00**	**0.58**

0.75% CS G pH = 6.0

Subject No.	Time (mins)										$AUC_{(0-240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	96.58	95.66	92.14	82.56	84.75	93.72	91.67	93.23	94.71	22,197.69	82.56	40.00	7.65
2	100.00	100.90	97.49	95.75	80.81	83.75	90.15	92.97	95.49	94.96	22,212.97	80.81	40.00	7.59
3	100.00	103.46	101.49	96.90	84.79	82.48	89.45	95.49	94.81	90.19	22,226.78	82.48	60.00	7.53
4	100.00	99.76	96.66	88.85	79.93	89.48	92.78	93.65	96.46	96.73	22,476.64	79.93	40.00	6.49
5	100.00	101.23	95.88	90.81	83.65	90.49	88.46	93.33	92.50	95.45	22,163.15	83.65	40.00	7.80
Mean	**100.00**	**100.38**	**97.44**	**92.89**	**82.35**	**86.19**	**90.91**	**93.42**	**94.50**	**94.41**	**22,255.45**	**81.89**	**44.00**	**7.41**
± SD.	**0.00**	**2.25**	**2.13**	**3.01**	**1.78**	**3.20**	**2.01**	**1.23**	**1.45**	**2.22**	**112.61**	**1.33**	**8.00**	**0.47**

1.00% CS G pH = 6.0

Subject No.	Time (mins)										$AUC_{(0-240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	104.98	101.53	95.46	84.46	81.45	85.55	89.26	92.49	94.16	21,779.86	81.45	60.00	9.39
2	100.00	102.64	98.15	92.79	80.51	84.57	92.21	93.82	94.98	92.07	22,206.94	80.51	40.00	7.61
3	100.00	98.19	89.49	84.92	78.08	83.96	87.47	91.62	95.32	96.48	22,102.10	78.08	40.00	8.05
4	100.00	100.63	96.26	87.96	80.35	87.65	94.45	92.41	93.45	91.93	21,856.99	80.35	40.00	9.07
5	100.00	95.84	92.45	83.15	76.48	82.56	89.90	94.85	97.56	95.15	22,099.04	76.48	40.00	8.06
Mean	**100.00**	**100.46**	**95.58**	**88.86**	**79.98**	**84.04**	**89.92**	**92.39**	**94.76**	**93.96**	**22,008.99**	**79.38**	**44.00**	**8.44**
± SD.	**0.00**	**3.22**	**4.23**	**4.65**	**2.70**	**2.11**	**3.19**	**1.93**	**1.74**	**1.76**	**162.21**	**1.82**	**8.00**	**0.68**

1.25% CS G pH = 6.0

Subject No.	Time (mins)										$AUC_{(0\text{-}240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	102.46	97.86	88.90	79.03	86.78	89.98	91.76	94.55	92.88	22,014.68	79.03	40.00	8.41
2	100.00	97.00	92.23	87.92	80.24	85.57	91.47	94.89	94.76	92.61	22,092.36	80.24	40.00	8.09
3	100.00	102.57	98.32	95.83	84.51	81.66	88.34	91.66	93.45	93.01	21,948.48	81.66	60.00	8.69
4	100.00	98.04	94.23	86.63	80.31	88.95	93.47	90.12	94.36	93.50	22,043.22	80.31	40.00	8.30
5	100.00	101.42	99.75	93.95	82.45	89.30	92.43	92.76	93.01	92.33	22,218.20	82.45	40.00	7.57
Mean	**100.00**	**100.30**	**96.48**	**90.65**	**81.31**	**86.45**	**91.14**	**92.24**	**94.03**	**92.87**	**22,063.39**	**80.74**	**44.00**	**8.21**
± SD.	**0.00**	**2.33**	**2.80**	**3.59**	**1.94**	**2.76**	**1.81**	**1.57**	**0.68**	**0.39**	**90.32**	**1.19**	**8.00**	**0.38**

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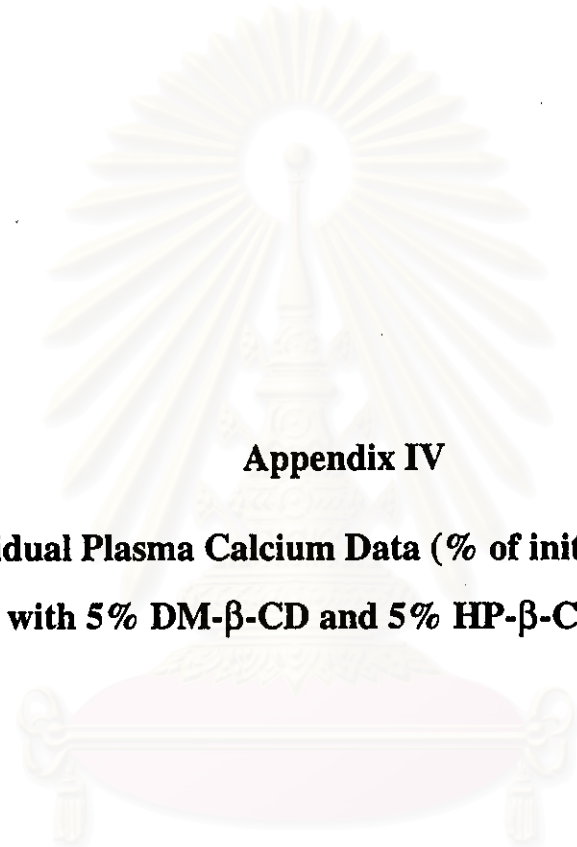

Appendix IV

Individual Plasma Calcium Data (% of initial value) for sCT with 5% DM-β-CD and 5% HP-β-CD at pH 7.4

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Appendix IV

Individual Plasma Calcium Data (% of initial value) for sCT with 5% DM-*B*-CD and 5% HP-*B*-CD at pH 7.4

5% DM-*B*-CD pH = 7.4

Subject No.	Time (mins)										$AUC_{(0\text{-}240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	100.14	94.85	85.75	76.29	83.02	87.87	90.90	93.92	94.28	21,717.15	76.29	40.00	10.07
2	100.00	106.17	101.56	96.83	81.15	79.43	83.78	88.78	94.55	93.90	21,747.22	79.43	60.00	9.94
3	100.00	98.16	96.76	86.77	79.22	85.75	90.20	95.81	91.82	91.62	21,923.97	79.22	40.00	9.21
4	100.00	101.22	95.25	86.16	77.12	81.52	89.49	91.45	94.49	94.23	21,855.81	77.12	40.00	9.49
5	100.00	100.81	98.19	89.59	75.49	87.56	94.20	92.48	90.15	90.15	21,807.91	75.49	40.00	9.69
Mean	**100.00**	**101.30**	**97.32**	**89.02**	**77.85**	**83.46**	**89.11**	**91.88**	**92.99**	**92.83**	**21,810.41**	**77.51**	**44.00**	**9.68**
± SD.	**0.00**	**2.65**	**2.43**	**4.13**	**2.06**	**2.91**	**3.38**	**2.30**	**1.73**	**1.66**	**74.37**	**1.57**	**8.00**	**0.31**

5% HP-*B*-CD pH = 7.4

Subject No.	Time (mins)										$AUC_{(0\text{-}240)min}$	C_{min}	T_{min}	%D
	0	10	20	30	40	60	90	120	180	240	[% . min]	[%]	(min)	
1	100.00	98.22	94.04	89.26	83.40	85.18	89.24	92.82	94.30	93.19	22,324.14	83.40	40.00	7.55
2	100.00	103.50	100.91	96.16	85.69	83.78	89.86	90.96	96.87	94.60	22,003.53	83.78	60.00	8.88
3	100.00	102.59	97.43	93.49	81.49	87.62	90.26	93.15	94.29	92.62	22,183.18	81.49	40.00	8.14
4	100.00	101.89	98.18	95.36	84.26	89.16	93.16	90.43	93.53	93.45	22,226.35	84.26	40.00	7.96
5	100.00	100.34	96.45	90.30	81.22	86.79	91.95	92.83	95.97	94.26	22,281.29	81.22	40.00	7.73
Mean	**100.00**	**101.31**	**97.40**	**92.91**	**83.21**	**86.51**	**90.89**	**92.04**	**94.99**	**93.62**	**22,203.70**	**82.83**	**44.00**	**8.05**
± SD.	**0.00**	**1.86**	**2.24**	**2.72**	**1.68**	**1.87**	**1.45**	**1.11**	**1.23**	**0.72**	**110.93**	**1.24**	**8.00**	**0.46**

Appendix V

Individual Plasma sCT Concentration Data after Nasal Administration of sCT with or without Enhancers Compared with Intravenous Administration

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Appendix V

Individual plasma sCT concentration (pg/ml) of sCT with or without enhancers after intranasal and intravenous administration

sCT(in) + 1% CS J. pH = 4.0

Subject No.	Time (min)									$AUC_{(0-180)min}$	C_{max}	T_{max}
	0	5	10	15	30	40	60	120	180	[pg/ml].min	(pg/ml)	(min)
1	0.00	16.72	22.18	39.52	85.41	73.09	45.05	24.33	15.23	6,472.56	85.41	30.00
2	0.00	24.66	38.13	53.78	96.81	87.96	60.31	35.79	29.17	8,816.18	96.81	30.00
3	0.00	19.32	25.59	44.06	89.56	80.11	40.25	23.14	23.97	6,703.80	89.56	30.00
Mean	**0.00**	**20.23**	**28.63**	**45.79**	**90.59**	**80.39**	**48.54**	**27.75**	**22.79**	**7,330.85**	**90.59**	**30.00**
± SD.		**3.31**	**6.86**	**5.95**	**4.71**	**6.07**	**8.55**	**5.70**	**5.75**	**1,054.52**	**4.71**	**0.00**

sCT(in) + 5% DM-*B*-CD pH = 7.4

Subject No.	Time (min)									$AUC_{(0-180)min}$	C_{max}	T_{max}
	0	5	10	15	30	40	60	120	180	[pg/ml].min	(pg/ml)	(min)
1	0.00	19.65	26.40	30.13	74.68	51.90	30.60	16.06	18.26	4,978.95	74.68	30.00
2	0.00	15.12	22.34	28.76	69.94	48.03	34.18	21.24	15.32	5,170.80	69.94	30.00
3	0.00	31.08	38.98	45.16	80.85	60.23	45.34	30.40	20.10	6,956.58	80.85	30.00
Mean	**0.00**	**21.95**	**29.24**	**34.68**	**75.16**	**53.39**	**36.71**	**22.57**	**17.89**	**5,702.11**	**75.16**	**30.00**
± SD.		**6.72**	**7.08**	**7.43**	**4.47**	**5.09**	**6.28**	**5.93**	**1.97**	**890.49**	**4.47**	**0.00**

sCT(in) pH = 4.0

Subject No.	Time (min)									$AUC_{(0-180)min}$	C_{max}	T_{max}
	0	5	10	15	30	40	60	120	180	[pg/ml].min	(pg/ml)	(min)
1	0.00	0.00	12.42	15.61	21.51	36.68	21.92	14.82	18.46	3,357.08	36.68	40.00
2	0.00	0.00	18.96	24.67	35.16	43.42	27.08	21.05	15.45	4,242.00	43.42	40.00
3	0.00	0.00	14.35	17.48	23.29	32.50	19.63	15.20	20.34	3,332.58	32.50	40.00
Mean	**0.00**	**0.00**	**15.24**	**19.25**	**26.65**	**37.53**	**22.88**	**17.02**	**18.08**	**3643.88**	**37.53**	**40.00**
± SD.		**0.00**	**2.74**	**3.91**	**6.06**	**4.50**	**3.12**	**2.85**	**2.01**	**423.05**	**4.50**	**0.00**

sCT(iv) pH = 4.0

Subject No.	Time (min)									$AUC_{(0-180)min}$	C_{max}
	0	5	10	15	30	40	60	120	180	[pg/ml].min	(pg/ml)
1	65.93	46.16	35.21	27.09	24.43	20.36	23.65	18.23	25.22	4,249.85	65.93
2	84.75	59.44	47.52	36.73	32.20	27.18	25.12	20.75	17.08	4,686.25	84.75
3	78.73	56.31	43.74	28.34	25.56	22.54	19.47	24.91	20.59	4,528.89	78.73
Mean	**0.00**	**53.97**	**42.16**	**30.72**	**27.40**	**23.36**	**22.75**	**21.30**	**20.96**	**4,488.33**	**76.47**
± SD.		**5.67**	**5.15**	**4.28**	**3.43**	**2.84**	**2.40**	**2.75**	**3.33**	**180.45**	**7.85**

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Appendix VI

Statistical Analysis of the Percent Total Decrease in Plasma Calium for Control and $sCT_{treated}$ Groups at Various pH

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จุฬาลงกรณ์มหาวิทยาลัย

Appendix VI_a

Total percent decrease in plasma calcium (%D) of sCT with or without chitosan

ONEWAY ANOVA

Means		Condition
Mean # 1	5.452	sCT (pH 3.0)
Mean # 2	7.250	sCT + CS G
Mean # 3	10.568	sCT + CS J

Source	df	SS	MS	F
Between	2	67.35901	33.67951	21.87085
Within	12	18.47913	1.54E+00	
Total	14	85.83814		

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DUNCAN's multiple range test

MS Error = 1.540 df Error = 12

Significance level = .05

Least Significant Ranges	
LSR where p = 2.....	1.709
LSR where p = 3.....	2.092

Means			
Mean # 1	=	5.452	sCT (pH 3.0)
Mean # 2	=	7.250	sCT + CS G
Mean # 3	=	10.568	sCT + CS J

Result :

1 2 3

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Appendix VI_c

Total percent decrease in plasma calcium (%D) of sCT with or without chitosan

ONEWAY ANOVA

Means		Condition
Mean # 1	5.612	sCT (pH 4.0)
Mean # 2	9.848	sCT + CS J
Mean # 3	7.170	sCT + CS G

Source	df	SS	MS	F
Between	2	45.904	22.952	18.301
Within	12	15.050	1.254	
Total	14	60.954		

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จุฬาลงกรณ์มหาวิทยาลัย

DUNCAN's multiple range test

MS Error = 1.254 df Error = 12

Significance level = .05

Least Significant Ranges

LSR where p = 2.....	1.543
LSR where p = 3.....	1.888

Means

Mean # 1	=	5.612	sCT (pH 4.0)
Mean # 2	=	7.170	sCT + CS G
Mean # 3	=	9.848	sCT + CS J

Result :

1 2 3

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Appendix VI_d

Total percent decrease in plasma calcium (%D) of sCT with or without chitosan

ONEWAY ANOVA

Means		Condition
Mean # 1	5.470	sCT (pH 5.0)
Mean # 2	7.682	sCT + CS J
Mean # 3	7.254	sCT + CS G

Source	df	SS	MS	F
Between	2	13.765	6.882	5.899
Within	12	14.001	1.167	
Total	14	27.766		

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

DUNCAN's multiple range test

MS Error = 1.167 df Error = 12

Significance level = .05

Least Significant Ranges	
LSR where p = 2.....	1.488
LSR where p = 3.....	1.821

Means			
Mean # 1	=	5.470	sCT (pH 5.0)
Mean # 2	=	7.254	sCT + CS G
Mean # 3	=	7.682	sCT + CS J

Result :

1 2 3

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Appendix VI_e

Total percent decrease in plasma calcium (%D) of sCT with or without chitosan

ONEWAY ANOVA

Means		Condition
Mean # 1	5.156	sCT (pH 6.0)
Mean # 2	7.194	sCT + CS J
Mean # 3	8.436	sCT + CS G

Source	df	SS	MS	F
Between	2	27.424	13.712	24.092
Within	12	6.830	0.569	
Total	14	34.254		

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

DUNCAN's multiple range test

MS Error = 0.569 df Error = 12

Significance level = .05

Least Significant Ranges

LSR where p = 2.....	1.039
LSR where p = 3.....	1.272

Means

Mean # 1	=	5.470	sCT (pH6.0)
Mean # 2	=	7.194	sCT + CS J
Mean # 3	=	8.436	sCT + CS G

Result :

1 2 3

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จุฬาลงกรณ์มหาวิทยาลัย

Appendix VII

Statistical Analysis of the Total Percent Decrease in Plasma Calcium for sCT with 1 % Chitosans at pH 4.0, 5.0 and 6.0

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Appendix VII$_a$

Total percent decrease in plasma calcium (%D) of sCT with 1% CS J at various pH

ONEWAY ANOVA

Means		Condition
Mean # 1	9.848	1% CS J (pH 4.0)
Mean # 2	7.680	1% CS J (pH 5.0)
Mean # 3	7.194	1% CS J (pH 6.0)

Source	df	SS	MS	F	Prob.
Between	2	19.966	9.983	9.31E+00	0.004
Within	12	12.863	1.072		
Total	14	32.830			

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DUNCAN's multiple range test

MS Error = 1.072 df Error = 12

Significance level = .05

Least Significant Ranges	
LSR where p = 2.....	1.426
LSR where p = 3.....	1.746

Means		
Mean # 1	7.194	1% CS J (pH 6.
Mean # 2	7.680	1% CS J (pH 5.
Mean # 3	9.848	1% CS J (pH 4.

Result :

1 2 3

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จุฬาลงกรณ์มหาวิทยาลัย

Appendix VII_b

Total percent decrease in plasma calcium (%D) of sCT with 1% CS G at various pH

ONEWAY ANOVA

Means		Condition
Mean # 1	7.168	1% CS G (pH 4.0)
Mean # 2	7.254	1% CS G (pH 5.0)
Mean # 3	8.436	1% CS G (pH 6.0)

Source	df	SS	MS	F	Prob.
Between	2	5.021	2.510	6.75E+00	0.0109
Within	12	4.461	0.372		
Total	14	9.482			

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

DUNCAN's multiple range test

MS Error = 0.372 df Error = 12

Significance level = .05

Least Significant Ranges	
LSR where p = 2.....	0.834
LSR where p = 3.....	1.028

Means		
Mean # 1	7.168	1% CS G (pH 4.
Mean # 2	7.254	1% CS G (pH 5.
Mean # 3	8.436	1% CS G (pH 6.

Result :

1 2 3

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Appendix VIII

Statistical Analysis of the % D, C_{min} and T_{min} for Control Groups and $AUC_{0\text{-}240\ min}$ for Baseline Groups at Various pH

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Appendix VII$_a$

Total percent decrease in plasma calcium of sCT without enhancers at various pH

ONEWAY ANOVA

Means		Condition
Mean # 1	5.450	control group (pH 3.0)
Mean # 2	5.613	control group (pH 4.0)
Mean # 3	5.471	control group (pH 5.0)
Mean # 4	5.158	control group (pH 6.0)
Mean # 5	5.360	control group (pH 7.4)

Source	df	SS	MS	F	Prob.
Between	4	0.561	0.14	0.103	0.9773
Within	20	27.264	1.363		
Total	24	27.825			

DUNCAN's multiple range test

MS Error = 1.363 df Error = 20

Significance level = .05

Least Significant Ranges	
LSR where p = 2.....	1.540
LSR where p = 3.....	1.619
LSR where p = 4.....	1.660
LSR where p = 5.....	1.697

Means

Mean # 1	=	5.158	control group (pH 6.0)
Mean # 2	=	5.360	control group (pH 7.4)
Mean # 3	=	5.450	control group (pH 3.0)
Mean # 4	=	5.471	control group (pH 5.0)
Mean # 5	=	5.613	control group (pH 4.0)

Result :

1 2 3 4 5

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Appendix VIII$_b$

C_{min} of the control groups (sCT $_{alone}$) at various pH (3.0-7.4)

ONEWAY ANOVA

Means		Condition
Mean # 1	84.040	control group (pH 3.0)
Mean # 2	88.164	control group (pH 4.0)
Mean # 3	90.256	control group (pH 5.0)
Mean # 4	91.666	control group (pH 6.0)
Mean # 5	92.758	conrtrol group (pH 7.4)

Source	df	SS	MS	F	Prob.
Between	4	237	59.25	9.673	0.0004
Within	20	122.5	6.125		
Total	24	359.5			

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DUNCAN's multiple range test

MS Error = 6.125 df Error = 20

Significance level = .05

Least Significant Ranges	
LSR where p = 2.....	3.265
LSR where p = 3.....	3.962
LSR where p = 4.....	4.383
LSR where p = 5.....	4.693

Means		
Mean # 1	84.040	control group (pH 3.0)
Mean # 2	88.164	control group (pH 4.0)
Mean # 3	90.256	control group (pH 5.0)
Mean # 4	91.666	control group (pH 6.0)
Mean # 5	92.758	conrtrol group (pH 7.4)

Result :

1 2 3 4 5

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Appendix VIII$_c$

T_{min} of the control groups (sCT_{alone}) at various pH (3.0-7.4)

ONEWAY ANOVA

Means		Condition
Mean # 1	38.00	control group (pH 3.0)
Mean # 2	66.00	control group (pH 4.0)
Mean # 3	120.00	control group (pH 7.4)
Mean # 4	126.00	control group (pH 5.0)
Mean # 5	98.00	control group (pH 6.0)

Source	df	SS	MS	F	Prob.
Between	4	27696	6924	2.049	0.1255
Within	20	67600	3380		
Total	24	95296			

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DUNCAN's multiple range test

MS Error = 3380 df Error = 20

Significance level = .05

Least Significant Ranges

LSR where p = 2.....	76.700
LSR where p = 3.....	93.080
LSR where p = 4.....	102.960
LSR where p = 5.....	110.240

Means

Mean # 1	38.000	control group (pH 3.0)
Mean # 2	66.000	control group (pH 4.0)
Mean # 3	98.000	control group (pH 7.4)
Mean # 4	120.000	control group (pH 5.0)
Mean # 5	126.000	control group (pH 6.0)

Result :

1	2	3	4	5

Appendix $VIII_d$

Area under the plasma calcium curve of baseline groups at various pH

ONEWAY ANOVA

Means		Condition
Mean # 1	22811.450	baseline group (pH 3.0)
Mean # 2	23814.380	baseline group (pH 4.0)
Mean # 3	24049.360	baseline group (pH 5.0)
Mean # 4	24037.270	baseline group (pH 6.0)
Mean # 5	24148.430	baseline group (pH 7.4)

Source	df	SS	MS	F	Prob.
Between	4	6067200	1516800	20.602	0.0001
Within	20	1472512	73625.6		
Total	24	7539712			

DUNCAN's multiple range test

MS Error = 73625.6 df Error = 20

Significance level = .05

Least Significant Ranges	
LSR where p = 2.....	357.974
LSR where p = 3.....	376.176
LSR where p = 4.....	385.884
LSR where p = 5.....	394.378

Means

Mean # 1	=	22811.450	baseline group (pH 3.0)
Mean # 2	=	23814.380	baseline group (pH 4.0)
Mean # 3	=	24037.270	baseline group (pH 6.0)
Mean # 4	=	24049.360	baseline group (pH 5.0)
Mean # 5	=	24148.430	baseline group (pH 7.4)

Result :

1 2 3 4 5

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Appendix IX

Statistical Analysis of the Total Percent Decrease in Plasma Calcium for sCT with 1% Chitosans at Various Concentrations

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DUNCAN's multiple range test

MS Error = 1.585 df Error = 24

Significance level = .05

Least Significant Ranges

LSR where p = 2.....	1.644
LSR where p = 3.....	1.729
LSR where p = 4.....	1.774
LSR where p = 5.....	1.813
LSR where p = 6.....	1.847

Means

Mean # 1	=	5.613	sCT (pH 4.0)
Mean # 2	=	7.725	0.25% CS J
Mean # 3	=	8.468	0.50% CS J
Mean # 4	=	8.746	0.75% CS J
Mean # 5	=	9.849	1.00%CS J
Mean # 6	=	10.136	1.25%CS J

Result :

1 2 3 4 5 6

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Appendix IX_a

Total decrease in plasma calcium of sCT with CS J at various concentrations

ONEWAY ANOVA

Means		Condition
Mean # 1	5.613	sCT (pH 4.0)
Mean # 2	7.726	0.25% CS J
Mean # 3	8.468	0.50% CS J
Mean # 4	8.746	0.75% CS J
Mean #5	9.849	1.00%CS J
Mean # 6	10.136	1.25%CS J

Source	df	SS	MS	F	Prob.
Between	5	67.286	13.457	8.490	0.0003
Within	24	38.04	1.585		
Total	29	105.326			

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Appendix IX$_b$

Total percent decrease in plasma calcium of sCT with CS G at various concentrations

ONEWAY ANOVA

Means		Condition
Mean # 1	5.158	sCT (pH 6.0)
Mean # 2	6.275	0.25% CS G
Mean # 3	6.860	0.50% CS G
Mean # 4	7.413	0.75% CS G
Mean # 5	8.438	1.00% CS G
Mean # 6	8.212	1.25%CS G

Source	df	SS	MS	F	Prob.
Between	5	38.103	7.621	16.595	0.0001
Within	24	11.026	0.459		
Total	29	49.13			

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DUNCAN's multiple range test

MS Error = 0.459 df Error = 24

Significance level = .05

Least Significant Ranges

LSR where p = 2.....	0.885
LSR where p = 3.....	0.931
LSR where p = 4.....	0.955
LSR where p = 5.....	0.976
LSR where p = 6.....	0.994

Means

Mean # 1	=	5.158	sCT (pH 6.0)
Mean # 2	=	6.275	0.25% CS G
Mean # 3	=	6.860	0.50% CS G
Mean # 4	=	7.413	0.75% CS G
Mean # 5	=	8.212	1.00% CS G
Mean # 6	=	8.438	1.25%CS G

Result :

1 2 3 4 5 6

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Appendix X

Statistical Analysis of the %D, C_{min} and T_{min} for sCT with Different Enhancers (CS J, CS G, DM-β-CD and HP-β-CD)

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Appendix X_a

Total percent decrease in plasma calcium of sCT with different enhancers

ONEWAY ANOVA

Means		Condition
Mean # 1	9.848	1% CS J (pH 4.0)
Mean # 2	8.438	1% CS G (pH 6.0)
Mean # 3	9.682	5% DM-B-CD (pH 7.4)
Mean # 4	8.053	5% HP-B-CD (pH 7.4)

Source	df	SS	MS	F	Prob.
Between	3	11.989	3.996	5.888	0.0068
Within	16	10.86	0.679		
Total	19	22.848			

DUNCAN's multiple range test

MS Error = 0.679 df Error = 16

Significance level = .05

Least Significant Ranges	
LSR where p = 2.....	1.105
LSR where p = 3.....	1.161
LSR where p = 4.....	1.190

Means			
Mean # 1	=	8.053	5% HP-B-CD (pH 7.4)
Mean # 2	=	8.438	1% CS G (pH 6.0)
Mean # 3	=	9.682	5% DM-B-CD (pH 7.4)
Mean # 4	=	9.849	1% CS J (pH 4.0)

Result :

1 2 3 4

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Appendix X_b

C_{min} of various enhancers (1%CS J, 1%CS G, 5%DM-*B*-CD and 5%HP-*B*-CD)

ONEWAY ANOVA

Means		Condition
Mean # 1	73.466	1% CS J (pH 4.0)
Mean # 2	79.374	1% CS G (pH 6.0)
Mean # 3	77.510	5% DM-*B*-CD (pH 7.4)
Mean # 4	82.830	5% HP-*B*-CD (pH 7.4)

Source	df	SS	MS	F	Prob.
Between	3	228.344	76.115	25.698	0.0001
Within	16	47.391	2.962		
Total	19	275.7344			

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DUNCAN's multiple range test

MS Error = 2.962 df Error = 16

Significance level = .05

Least Significant Ranges	
LSR where p = 2.....	2.309
LSR where p = 3.....	2.809
LSR where p = 4.....	3.117

Means		
Mean # 1	73.466	1% CS J (pH 4.0)
Mean # 2	77.510	5% DM-B-CD (pH 7.4)
Mean # 3	79.374	1% CS G (pH 6.0)
Mean # 4	82.830	5% HP-B-CD (pH 7.4)

Result :

1 2 3 4

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Appendix X_c

T_{min} of various enhancers (1%CS J, 1%CS G, 5%DM-*B*-CD and 5%HP-*B*-CD)

ONEWAY ANOVA

Means		Condition
Mean # 1	44.000	1% CS J (pH 4.0)
Mean # 2	44.000	1% CS G (pH 6.0)
Mean # 3	44.000	5% DM-*B*-CD (pH 7.4)
Mean # 4	44.000	5% HP-*B*-CD (pH 7.4)

Source	df	SS	MS	F	Prob.
Between	3	0	0	0.000	0.9999
Within	16	1280	80		
Total	19	1280			

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DUNCAN's multiple range test

MS Error = 2.962 df Error = 16

Significance level = .05

Least Significant Ranges

LSR where p = 2.....	0.000
LSR where p = 3.....	0.000
LSR where p = 4.....	0.000

Means

Mean # 1	44.000	1% CS J (pH 4.0)
Mean # 2	44.000	5% DM-B-CD (pH 7.4)
Mean # 3	44.000	1% CS G (pH 6.0)
Mean # 4	44.000	5% HP-B-CD (pH 7.4)

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Result :

1 2 3 4

Appendix XI

Statistical Analysis of the Total Percent Decrease in Plasma Calcium for sCT with 5% DM-β-CD and HP-β-CD) at pH 7.4 Compared with the Control Group

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Appendix XI

Total percent decrease in plasma calcium (%D) of sCT with or without cyclodextrins

ONEWAY ANOVA

Means		Condition
Mean # 1	8.052	5% HP-B-CD (pH 7.4)
Mean # 2	9.680	5% DM-B-CD (pH 7.4)
Mean # 3	5.360	Control group

Source	df	SS	MS	F	Prob.
Between	2	47.599	23.800	4.70E+01	0.001
Within	12	6.074	0.506		
Total	14	53.674			

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DUNCAN's multiple range test

MS Error = 0.506 df Error = 12

Significance level = .05

Least Significant Ranges	
LSR where p = 2.....	0.980
LSR where p = 3.....	1.200

Means		
Mean # 1	5.360	Control group
Mean # 2	8.052	5% HP-B-CD (pH 7.4)
Mean # 3	9.680	5% DM-B-CD (pH 7.4)

Result :

1 2 3

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Appendix XII

Statistical Analysis of the Area Under the Plasma Curves for sCT with 1% CS J at pH 4.0 and 5% DM-β-CD at pH 7.4 Compared with the Control Group

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Appendix XII

Area under the plasma sCT concentration during 0-180 min of sCT with or without enhancer

ONEWAY ANOVA

Means		Condition
Mean # 1	7330.846	1% CS J (pH 4.0)
Mean # 2	5702.110	5% DM-B-CD (pH 7.4)
Mean # 3	3643.887	sCT(in)

Source	df	SS	MS	F	Prob.
Between	2	2.05E+07	1.02E+07	9.83E+00	0.0134
Within	6	6251904	1.04E+06		
Total	8	2.67E+07			

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DUNCAN's multiple range test

MS Error = 1041984 df Error = 6

Significance level = .05

Least Significant Ranges

LSR where p = 2.....	2039.135
LSR where p = 3.....	2109.857

Means

Mean # 1	=	3643.887	sCT (in)
Mean # 2	=	5702.110	5% DM-B-CD (pH 7.4)
Mean # 3	=	7330.846	1% CS J (pH 4.0)

Result :

1 2 3

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Appendix XIII

Individual Data of Concentration of p-Nitroaniline following BAPA Incubation with Trypsin at Various pH (4.0-9.0) and Substrate Concentrations (0.0 - 1.50 mM) : Preliminary Study

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Appendix XIII$_a$

Individual data of concentration of p-nitroaniline following BAPA incubation with trypsin at various pH (4.0-9.0)

Trypsin activity pH = 4.0

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.455	0.439	0.470	0.455	0.455	0.439	2.030	2.530	3.060	467.965	0 000
2	0.409	0.424	0.424	0.439	0.455	0.394	1.909	2.409	3.106	455.895	0.001
3	0.424	0.424	0.455	0.409	0.414	0.424	1.879	2.470	2.833	443.610	0.000
Mean	0.429	0.429	0.450	0.434	0.441	0.419	1.939	2.470	3.000	455.823	0.000
± S.D.	0.02	0.01	0.02	0.02	0.02	0.02	0.07	0.05	0.12	9.943	0.001

Trypsin activity pH = 5.0

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.455	2.773	3.758	4.700	7.591	9.333	11.576	13.818	20.364	3,067.245	0.162
2	0.424	2.454	4.288	5.348	6.955	8.212	10.424	13.576	17.636	2,821.725	0.160
3	0.424	2.500	5.318	5.045	5.682	7.955	11.727	13.061	20.364	2,968.080	0.131
Mean	0.434	2.576	4.455	5.031	6.743	8.500	11.242	13.485	19.455	2,952.350	0.151
± S.D.	0.01	0.14	0.65	0.26	0.79	0.60	0.58	0.32	1.29	100.848	0.014

Trypsin activity pH = 6.0

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.455	11.333	16.939	18.879	21.848	23.439	26.591	27.606	26.788	5,862.940	0.503
2	0.409	10.288	14.561	15.606	17.394	24.182	21.152	22.532	21.470	4,884.715	0.393
3	0.424	10.879	13.318	19.152	21.030	18.970	23.621	23.455	25.697	5,234.885	0.495
Mean	0.429	10.833	14.939	17.879	20.091	22.197	23.788	24.531	24.651	5,327.513	0.464
± S.D.	0.02	0.43	1.50	1.61	1.94	2.30	2.22	2.21	2.29	404.694	0.050

Trypsin activity pH = 7.0

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.455	23.333	27.394	29.591	30.046	32.470	32.576	26.424	32.091	6,952.435	0.654
2	0.470	24.939	26.773	25.197	26.091	28.197	28.015	29.742	30.182	6,749.750	0.515
3	0.409	26.182	29.106	30.121	30.591	26.742	27.409	32.061	26.318	6,789.475	0.643
Mean	0.444	24.818	27.758	28.303	28.909	29.136	29.333	29.409	29.530	6,830.553	0.604
± S.D.	0.03	1.17	0.99	2.21	2.01	2.43	2.31	2.31	2.40	87.696	0.063

Trypsin activity pH = 8.0

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.455	26.909	29.545	36.970	38.106	31.333	34.546	33.470	33.712	7,860.781	0.854
2	0.455	28.939	35.424	28.879	30.424	34.955	33.182	33.121	33.227	7,738.085	0.599
3	0.424	32.470	33.303	34.788	33.924	37.076	36.636	37.227	36.424	8,520.035	0.693
Mean	0.445	29.439	32.757	33.546	34.151	34.455	34.788	34.606	34.454	8,039.634	0.715
± S.D.	0.01	2.30	2.43	3.42	3.14	2.37	1.42	1.86	1.41	343.368	0.105

Trypsin activity pH = 9.0

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.409	28.333	32.333	28.621	32.015	33.470	35.803	33.682	33.606	7,828.490	0.635
2	0.470	22.970	26.318	30.076	27.606	31.894	28.015	29.242	33.212	7,033.750	0.614
3	0.409	30.515	28.712	31.121	31.652	29.318	32.364	33.848	30.318	7,441.855	0.631
Mean	0.429	27.273	29.121	29.939	30.424	31.561	32.061	32.257	32.379	7,434.698	0.627
± S.D.	0.03	3.17	2.47	1.03	2.00	1.71	3.19	2.13	1.47	324.491	0.009

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Control pH = 6.0

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.415	9.536	16.470	18.677	18.915	19.450	25.813	26.814	24.830	5,494.120	0.461
2	0.442	11.637	15.638	19.501	21.725	24.152	25.112	22.802	27.051	5,486.215	0.504
3	0.460	11.569	13.042	15.855	20.077	23.478	20.964	24.421	22.616	5,112.520	0.435
Mean	0.439	10.914	15.050	18.011	20.239	22.360	23.963	24.679	24.832	5,364.285	0.467
± S.D.	0.02	0.97	1.46	1.56	1.15	2.08	2.14	1.65	1.81	178.054	0.028

Aprotinin (0.88 TIU/ml)

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.454	0.394	0.368	0.386	0.425	0.433	0.521	0.449	0.418	105.335	-0.001
2	0.412	0.432	0.450	0.442	0.413	0.463	0.318	0.401	0.411	97.345	0.000
3	0.424	0.472	0.472	0.411	0.452	0.439	0.451	0.485	0.461	110.990	0.000
Mean	0.430	0.433	0.430	0.413	0.430	0.445	0.430	0.445	0.430	104.557	0.000
± S.D.	0.02	0.03	0.04	0.02	0.02	0.01	0.08	0.03	0.02	5.598	0.000

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Appendix XIII$_b$

Trypsin activity for substrate concentration of 0.00 mM (pH = 6.0)

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mean	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
± S.D.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000

Trypsin activity for substrate concentration of 0.25 mM (pH = 6.0)

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.021	0.089	0.156	0.364	0.402	0.617	0.816	0.995	1.462	217.225	0.010
2	0.015	0.076	0.128	0.224	0.547	0.578	0.681	0.788	1.005	166.840	0.012
3	0.036	0.156	0.277	0.336	0.489	0.547	0.655	0.814	0.839	182.310	0.011
Mean	0.024	0.107	0.187	0.308	0.479	0.581	0.717	0.866	1.102	188.792	0.011
± S.D.	0.01	0.04	0.06	0.06	0.06	0.03	0.07	0.09	0.26	21.074	0.001

Trypsin activity for substrate concentration of 0.50 mM (pH = 6.0)

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.048	0.357	0.700	1.568	2.947	3.012	3.940	4.235	6.547	974.640	0.070
2	0.078	0.260	0.560	1.006	1.036	2.113	2.350	3.998	5.152	766.485	0.027
3	0.061	0.237	0.649	0.847	1.258	2.014	3.150	4.912	5.938	906.035	0.030
Mean	0.062	0.285	0.636	1.140	1.747	2.380	3.147	4.382	5.879	882.387	0.042
± S.D.	0.01	0.05	0.06	0.31	0.85	0.45	0.65	0.39	0.57	86.609	0.020

Trypsin activity for substrate concentration of 0.75 mM (pH = 6.0)

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.147	2.480	4.894	7.140	8.150	10.890	12.147	15.860	17.924	3,169.725	0.207
2	0.236	1.580	3.567	5.891	7.235	10.410	12.369	14.023	15.922	2,858.450	0.183
3	0.270	2.690	5.169	8.156	9.047	11.787	12.986	14.116	15.840	3,060.580	0.230
Mean	0.218	2.250	4.543	7.062	8.144	11.029	12.501	14.666	16.562	3,029.585	0.207
± S.D.	0.05	0.48	0.70	0.93	0.74	0.57	0.35	0.84	0.96	128.954	0.019

Trypsin activity for substrate concentration of 1.00 mM (pH = 6.0)

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.455	11.333	16.939	18.879	21.848	23.439	26.591	27.606	26.788	5,862.040	0.503
2	0.409	10.288	14.561	15.606	17.394	24.182	21.152	22.532	21.470	4,884.715	0.393
3	0.424	10.879	13.318	19.152	21.030	18.970	23.621	23.455	25.697	5,234.885	0.495
Mean	0.429	10.833	14.939	17.879	20.091	22.197	23.788	24.531	24.651	5,327.513	0.464
± S.D.	0.02	0.43	1.50	1.61	1.94	2.30	2.22	2.21	2.29	404.694	0.050

Trypsin activity for substrate concentration of 1.25 mM (pH = 6.0)

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.254	13.120	16.187	19.156	20.473	21.456	23.779	25.041	27.556	5,574.200	0.465
2	0.124	12.510	14.885	17.125	12.157	16.147	20.146	21.560	23.415	4,823.130	0.287
3	0.189	13.960	15.478	18.960	20.335	24.107	26.000	27.489	28.199	5,926.240	0.453
Mean	0.189	13.197	15.517	18.414	17.655	20.570	23.308	24.697	26.390	5,441.190	0.401
± S.D.	0.05	0.59	0.53	0.91	3.89	3.31	2.41	2.43	2.12	460.059	0.081

Trypsin activity for substrate concentration of 1.50 mM (pH = 6.0)

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.740	13.488	16.146	20.297	23.459	23.974	24.158	25.870	29.481	5,888.095	0.522
2	0.540	11.168	13.189	14.127	16.854	18.555	20.144	22.784	22.824	4,786.785	0.356
3	0.460	11.964	17.419	20.559	23.450	25.030	26.150	28.480	29.841	6,190.180	0.546
Mean	0.580	12.207	15.585	18.328	21.254	22.520	23.484	25.711	27.382	5,621.687	0.475
± S.D.	0.12	0.96	1.77	2.97	3.11	2.84	2.50	2.33	3.23	603.108	0.085

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Appendix XIV

Individual Data of Concentration of p-Nitroaniline following BAPA Incubation with Trypsin and Chitosans at Various Concentrations

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Appendix XIV$_a$

Individual data of concentration of p-nitroaniline following BAPA incubation with trypsin and CSJ at various concentrations

0.25 % CS J

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.425	14.377	16.853	19.367	21.060	25.282	26.102	24.077	27.260	5,650.470	0.463
2	0.401	10.637	14.778	21.063	20.526	21.725	24.152	27.012	28.706	5,742.920	0.507
3	0.486	13.458	15.575	21.733	24.456	21.177	24.479	26.233	24.104	5,149.440	0.562
Mean	0.437	12.824	15.735	20.721	22.014	22.728	24.911	25.774	26.690	5,514.277	0.511
± S.D.	0.04	1.59	0.85	1.00	1.74	1.82	0.85	1.24	1.92	260.725	0.041

0.5 % CS J

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.482	10.394	15.258	16.580	18.516	22.036	26.128	25.233	26.874	5,542.125	0.423
2	0.389	12.472	13.254	19.663	22.505	23.141	21.116	22.162	22.465	5,015.465	0.514
3	0.447	8.490	15.951	19.059	21.445	20.625	24.228	27.647	26.762	5,680.820	0.526
Mean	0.439	10.452	14.821	18.434	20.822	21.934	23.824	25.014	25.367	5,412.803	0.487
± S.D.	0.04	1.63	1.14	1.33	1.69	1.03	2.07	2.24	2.05	286.609	0.046

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0.75 % CS J

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.475	9.836	12.504	18.238	14.570	19.242	23.813	25.245	26.832	5,325.440	0.366
2	0.382	10.367	15.638	16.079	21.725	22.152	24.312	22.802	24.865	5,233.835	0.484
3	0.486	12.332	13.042	15.855	20.177	23.874	20.050	24.298	22.166	5,056.430	0.429
Mean	0.448	10.845	13.728	16.724	18.824	21.756	22.725	24.115	24.621	5,205.235	0.426
± S.D.	0.05	1.07	1.37	1.07	3.07	1.91	1.90	1.01	1.91	111.669	0.048

1.0 % CS J

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.521	12.364	13.554	17.422	19.478	20.514	22.141	26.134	28.282	5,562.205	0.430
2	0.324	11.599	13.036	16.041	21.023	25.329	25.677	23.872	24.758	5,403.140	0.458
3	0.415	9.532	15.536	20.573	24.395	25.023	26.486	25.048	22.680	5,483.965	0.590
Mean	0.420	11.165	14.042	18.012	21.632	23.622	24.768	25.018	25.240	5,483.103	0.493
± S.D.	0.08	1.20	1.08	1.90	2.05	2.20	1.89	0.92	2.31	64.941	0.070

1.25 % CS J

No.	Time (min)									$AUC_{0-240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.472	12.364	13.554	12.422	15.478	20.514	25.141	23.752	26.500	5,256.410	0.301
2	0.339	13.599	12.036	16.041	16.023	16.329	19.836	23.872	24.758	4,937.985	0.338
3	0.421	8.609	11.952	14.956	17.135	19.224	20.486	25.048	25.680	5,128.880	0.398
Mean	0.411	11.524	12.514	14.473	16.212	18.689	21.821	24.224	25.646	5,107.758	0.346
± S.D.	0.05	2.12	0.74	1.52	0.69	1.75	2.36	0.58	0.71	130.852	0.040

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Appendix XIV_b

Individual data of concentration of p-nitroaniline following BAPA incubation with trypsin and CS G at various concentrations

0.25 % CS G

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.442	11.303	14.982	18.891	20.990	21.763	23.979	26.616	25.914	5,586.305	0.487
2	0.436	12.765	15.939	19.756	22.696	24.156	25.798	25.512	26.710	5,721.060	0.515
3	0.454	10.517	13.865	17.724	18.972	20.013	21.790	24.714	23.916	5,147.715	0.442
Mean	0.444	11.528	14.929	18.790	20.886	21.977	23.856	25.614	25.513	5,485.027	0.481
± S.D.	0.01	0.93	0.85	0.83	1.52	1.70	1.64	0.78	1.18	244.778	0.030

0.5 % CS G

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.453	11.469	13.897	18.994	21.680	22.773	23.026	23.332	23.212	5,173.790	0.500
2	0.426	12.685	12.795	19.642	23.614	24.532	23.621	24.128	24.528	5,410.770	0.533
3	0.424	10.724	14.463	17.868	20.115	20.947	26.116	27.145	27.145	5,705.993	0.465
Mean	0.434	11.626	13.718	18.835	21.803	22.751	24.254	24.868	24.962	5,430.184	0.499
± S.D.	0.01	0.81	0.69	0.73	1.43	1.46	1.34	1.64	1.63	217.704	0.028

0.75 % CS G

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.429	11.679	13.825	16.147	18.017	23.932	22.323	25.206	25.548	5,380.230	0.396
2	0.496	8.924	15.959	18.798	20.879	22.908	25.981	26.725	26.330	5,688.780	0.506
3	0.525	11.385	14.961	18.250	21.165	21.427	23.456	22.224	21.156	4,941.575	0.481
Mean	0.483	10.663	14.915	17.732	20.020	22.756	23.920	24.718	24.345	5,336.862	0.461
± S.D.	0.04	1.24	0.87	1.14	1.42	1.03	1.53	1.87	2.28	306.583	0.047

1.0 % CS G

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.426	11.018	16.324	19.312	22.686	19.678	26.556	24.894	22.382	5,307.560	0.528
2	0.435	12.010	16.897	21.215	22.473	23.997	22.395	25.751	26.112	5,610.310	0.533
3	0.424	10.101	12.826	17.216	19.875	24.764	25.316	22.910	27.018	5,419.585	0.460
Mean	0.428	11.043	15.349	19.248	21.678	22.813	24.756	24.518	25.171	5,445.818	0.507
± S.D.	0.00	0.78	1.80	1.63	1.28	2.24	1.74	1.19	2.01	124.981	0.033

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1.25 % CS G

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^3	mg/ml/min x 10^3
1	0.445	13.147	11.807	12.625	15.305	17.554	20.884	24.916	26.511	5,132.320	0.292
2	0.472	12.132	13.879	15.715	15.151	18.912	18.857	22.829	24.478	4,866.250	0.329
3	0.468	10.815	12.755	15.581	18.479	19.785	22.904	21.007	28.603	5,144.485	0.408
Mean	0.462	12.031	12.814	14.640	16.312	18.750	20.882	22.917	26.531	5,047.685	0.343
± S.D.	0.01	0.95	0.85	1.43	1.53	0.92	1.65	1.60	1.68	128.390	0.048

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Appendix XV

Statistical Analysis of Area Under the Metabolite Curves of trypsin Activity with Chitosans at Different Concentrations

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Appendix XV_a

AUC of trypsin activity with CS J at different concentration compared with aprotinin

ONEWAY ANOVA

Means		Condition
Mean # 1	5364.285	Control (pH 6.0)
Mean # 2	5514.277	0.25% CS J
Mean # 3	5412.803	0.50% CS J
Mean # 4	5205.235	0.75% CS J
Mean # 5	5483.104	1.00% CS J
Mean # 6	5107.759	1.25% CS J

Source	df	SS	MS	F	Prob.
Between	5	3.85E+05	7.71E+04	1.430	0.2821
Within	12	646912	53909.33		
Total	17	1.03E+06			

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DUNCAN's multiple range test

MS Error = 53909.33 df Error = 12

Significance level = .05

Least Significant Ranges	
LSR where p = 2.....	412.878
LSR where p = 3.....	432.986
LSR where p = 4.....	446.391
LSR where p = 5.....	450.4127
LSR where p = 6.....	455.775

Means		
Mean # 1	5107.759	1.25% CS J
Mean # 2	5205.235	0.75% CS J
Mean # 3	5364.285	Control (pH 6.0)
Mean # 4	5412.803	0.50% CS J
Mean # 5	5483.104	1.00% CS J
Mean # 6	5514.277	0.25% CS J

Result :

1 2 3 4 5 6

Appendix XV_b

AUC of trypsin activity with CS G at different concentration compared with aprotinin

ONEWAY ANOVA

Means		Condition
Mean # 1	5364.285	Control (pH 6.0)
Mean # 2	5485.027	0.25% CS G
Mean # 3	5430.185	0.50% CS G
Mean # 4	5336.862	0.75% CS G
Mean # 5	5445.819	1.00% CS G
Mean # 6	5047.685	1.25% CS G

Source	df	SS	MS	F	Prob.
Between	5	3.77E+05	7.54E+04	1.137	0.3933
Within	12	795328	66277.34		
Total	17	1.17E+06			

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DUNCAN's multiple range test

MS Error = 66277.34 df Error = 12

Significance level = .05

Least Significant Ranges

LSR where p = 2.....	457.797
LSR where p = 3.....	560.355
LSR where p = 4.....	624.268
LSR where p = 5.....	670.3451
LSR where p = 6.....	706.018

Means

Mean # 1	5047.685	1.25% CS G
Mean # 2	5336.862	0.75% CS G
Mean # 3	5364.285	Control (pH 6.0)
Mean # 4	5430.185	0.50% CS G
Mean # 5	5445.819	1.00% CS G
Mean # 6	5485.027	0.25% CS G

Result :

1 2 3 4 5 6

Appendix XV_c

AUC of trypsin activity for control group and aprotinin

Student's t-test (with pooled variance)

Mean of control group	5364.285
Standard deviation of control group	218.073
Standard error of control group	125.905
Mean of aprotinin	104.557
Standard deviation of aprotinin	6.856
Standard error of aprotinin	3.958
Pooled SE	125.997
Pooled t	-41.755
Probability	p = 0.000001
Degree of freedom	4.000

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Appendix XVI

Individual Data of Concentration of β-Napthylamine following L-Leu-β-NA Incubation with Leucine Aminopeptidase at pH (4.0-9.0)

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Appendix XVI

LAP actvity at pH = 4.0

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.036	0.239	0.523	1.029	1.360	2.450	2.874	3.457	4.560	718.835	0.034
2	0.029	0.354	0.419	1.542	2.102	3.623	4.561	4.214	5.905	952.580	0.053
3	0.033	0.124	0.633	0.752	0.654	1.344	1.251	2.680	3.207	489.615	0.019
Mean	0.033	0.239	0.525	1.108	1.372	2.472	2.895	3.450	4.557	720.343	0.035
± S.D.	0.00	0.09	0.09	0.33	0.59	0.93	1.35	0.63	1.10	189.008	0.014

LAP actvity at pH = 5.0

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.029	1.528	2.212	7.692	10.421	10.136	12.336	13.542	18.149	2,998.850	0.269
2	0.039	0.689	2.814	6.457	8.415	12.303	15.466	16.789	15.547	3,189.570	0.225
3	0.134	2.408	3.415	5.234	6.432	8.145	9.187	10.320	12.547	2,213.775	0.154
Mean	0.067	1.542	2.814	6.461	8.423	10.195	12.330	13.550	15.414	2,800.732	0.216
± S.D.	0.05	0.70	0.49	1.00	1.63	1.70	2.56	2.64	2.29	422.281	0.047

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LAP actvity at pH = 6.0

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.260	4.012	7.745	10.460	13.460	16.000	19.612	22.250	23.130	4,470.280	0.328
2	0.178	2.758	4.120	6.547	8.241	10.450	12.961	16.522	18.045	3,230.685	0.199
3	0.112	3.455	5.926	8.573	10.848	13.203	16.296	19.397	20.585	3,851.650	0.266
Mean	0.183	3.408	5.930	8.527	10.850	13.218	16.290	19.390	20.587	3,850.872	0.265
± S.D.	0.06	0.51	1.48	1.60	2.13	2.27	2.72	2.34	2.08	506.063	0.053

LAP actvity at pH = 7.0

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.263	6.512	7.884	9.304	15.035	16.170	21.430	23.755	20.208	4,505.095	0.323
2	0.137	4.824	7.269	10.744	12.043	17.317	18.782	20.855	23.146	4,358.970	0.297
3	0.202	3.209	6.651	12.187	16.070	16.579	19.396	21.913	26.127	4,669.981	0.407
Mean	0.201	4.848	7.268	10.745	14.383	16.689	19.869	22.174	23.160	4,511.349	0.343
± S.D.	0.05	1.35	0.50	1.18	1.71	0.47	1.13	1.20	2.42	127.047	0.047

LAP actvity at pH = 8.0

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.256	6.479	13.155	16.973	19.815	22.019	26.120	29.178	29.254	5,942.240	0.496
2	0.214	8.457	10.518	14.847	17.825	20.058	21.334	21.015	22.155	4,653.560	0.416
3	0.166	4.380	7.910	12.695	15.848	18.145	23.716	25.012	25.624	5,066.845	0.397
Mean	0.212	6.439	10.528	14.838	17.829	20.074	23.723	25.068	25.678	5,220.882	0.436
± S.D.	0.04	1.66	2.14	1.75	1.62	1.58	1.95	3.33	2.90	537.258	0.043

LAP actvity at pH = 9.0

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.125	5.185	12.482	14.515	16.418	19.180	20.814	22.524	25.422	4,887.255	0.419
2	0.264	7.240	14.560	15.478	18.226	21.160	23.490	25.460	28.230	5,484.490	0.442
3	0.136	3.121	10.360	13.650	14.803	17.100	18.145	19.615	22.651	4,296.070	0.399
Mean	0.175	5.182	12.467	14.548	16.482	19.147	20.816	22.533	25.434	4,889.272	0.420
± S.D.	0.06	1.68	1.71	0.75	1.40	1.66	2.18	2.39	2.28	485.173	0.018

LAP actvity at pH = 6.0

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.260	4.012	7.745	10.460	13.460	16.000	19.612	22.250	23.130	4,470.280	0.328
2	0.178	2.758	4.120	6.547	8.241	10.450	12.961	16.522	18.045	3,230.685	0.199
3	0.112	3.455	5.926	8.573	10.848	13.203	16.296	19.397	20.585	3,851.650	0.266
Mean	0.183	3.408	5.930	8.527	10.850	13.218	16.290	19.390	20.587	3,850.872	0.265
± S.D.	0.06	0.51	1.48	1.60	2.13	2.27	2.72	2.34	2.08	506.063	0.053

LAP actvity at pH = 7.0

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.263	6.512	7.884	9.304	15.035	16.170	21.430	23.755	20.208	4,505.095	0.323
2	0.137	4.824	7.269	10.744	12.043	17.317	18.782	20.855	23.146	4,358.970	0.297
3	0.202	3.209	6.651	12.187	16.070	16.579	19.396	21.913	26.127	4,669.981	0.407
Mean	0.201	4.848	7.268	10.745	14.383	16.689	19.869	22.174	23.160	4,511.349	0.343
± S.D.	0.05	1.35	0.50	1.18	1.71	0.47	1.13	1.20	2.42	127.047	0.047

LAP actvity at pH = 8.0

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.256	6.479	13.155	16.973	19.815	22.019	26.120	29.178	29.254	5,942.240	0.496
2	0.214	8.457	10.518	14.847	17.825	20.058	21.334	21.015	22.155	4,653.560	0.416
3	0.166	4.380	7.910	12.695	15.848	18.145	23.716	25.012	25.624	5,066.845	0.397
Mean	0.212	6.439	10.528	14.838	17.829	20.074	23.723	25.068	25.678	5,220.882	0.436
± S.D.	0.04	1.66	2.14	1.75	1.62	1.58	1.95	3.33	2.90	537.258	0.043

LAP actvity at pH = 9.0

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.125	5.185	12.482	14.515	16.418	19.180	20.814	22.524	25.422	4,887.255	0.419
2	0.264	7.240	14.560	15.478	18.226	21.160	23.490	25.460	28.230	5,484.490	0.442
3	0.136	3.121	10.360	13.650	14.803	17.100	18.145	19.615	22.651	4,296.070	0.399
Mean	0.175	5.182	12.467	14.548	16.482	19.147	20.816	22.533	25.434	4,889.272	0.420
± S.D.	0.06	1.68	1.71	0.75	1.40	1.66	2.18	2.39	2.28	485.173	0.018

Appendix XVII

Individual Data of Concentration of β-Napthylamine following L-Leu-β-NA Incubation with Leucine Aminopeptidase at Various Substrate Concentration

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Appendix XVII

LAP actvity for substrate concentration of 0.00 mM (at pH = 6.0)

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mean	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
± S.D.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000

LAP actvity for substrate concentration of 0.20 mM (at pH = 6.0)

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.260	0.312	0.452	0.815	1.456	2.014	3.147	4.485	5.474	848.505	0.029
2	0.147	0.364	0.671	1.240	1.978	2.645	4.113	5.673	5.453	995.325	0.045
3	0.176	0.289	0.455	0.945	1.036	2.840	3.050	3.147	4.423	697.250	0.024
Mean	0.194	0.322	0.526	1.000	1.490	2.500	3.437	4.435	5.117	847.027	0.033
± S.D.	0.05	0.03	0.10	0.18	0.39	0.35	0.48	1.03	0.49	121.693	0.009

LAP actvity for substrate concentration of 0.39 mM (at pH = 6.0)

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.078	1.870	4.020	6.150	6.890	9.450	11.230	12.457	10.700	2,373.565	0.179
2	0.122	0.896	2.850	4.230	5.244	7.110	8.250	10.063	13.659	2,158.545	0.136
3	0.140	1.315	3.450	5.170	6.023	8.116	9.780	11.040	12.181	2,245.555	0.156
Mean	0.113	1.360	3.440	5.183	6.052	8.225	9.753	11.187	12.180	2,259.222	0.157
± S.D.	0.03	0.40	0.48	0.78	0.67	0.96	1.22	0.98	1.21	88.312	0.018

LAP actvity for substrate concentration of 0.59 mM (at pH = 6.0)

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.247	2.115	4.160	6.489	8.566	10.120	13.420	15.847	16.378	3,084.020	0.210
2	0.390	1.630	3.187	5.961	7.006	9.057	12.448	14.815	13.545	2,738.510	0.176
3	0.148	2.450	4.125	7.012	9.678	11.833	14.158	16.475	18.910	3,372.570	0.236
Mean	0.262	2.065	3.824	6.487	8.417	10.337	13.342	15.712	16.278	3,065.033	0.207
± S.D.	0.10	0.34	0.45	0.43	1.10	1.14	0.70	0.68	2.19	259.202	0.025

LAP actvity for substrate concentration of 0.78 mM (at pH = 6.0)

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.260	4.012	7.745	10.460	13.460	16.000	19.612	22.250	23.130	4,470.280	0.328
2	0.178	2.758	4.120	6.547	8.241	10.450	12.961	16.522	18.045	3,230.685	0.199
3	0.112	3.455	5.926	8.573	10.848	13.203	16.296	19.397	20.585	3,851.650	0.266
Mean	0.183	3.408	5.930	8.527	10.850	13.218	16.290	19.390	20.587	3,850.872	0.265
± S.D.	0.06	0.51	1.48	1.60	2.13	2.27	2.72	2.34	2.08	506.063	0.053

LAP actvity for substrate concentration of 1.17 mM (at pH = 6.0)

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.231	4.125	6.987	9.145	12.147	13.141	16.123	20.816	23.045	4,142.045	0.289
2	0.364	3.660	6.011	8.178	10.690	12.910	15.167	18.455	21.195	3,774.245	0.252
3	0.170	2.910	5.603	8.014	9.370	14.556	16.270	17.130	19.150	3,592.420	0.235
Mean	0.255	3.565	6.200	8.446	10.736	13.536	15.853	18.800	21.130	3,836.237	0.258
± S.D.	0.08	0.50	0.58	0.50	1.13	0.73	0.49	1.52	1.59	228.625	0.022

Appendix XVIII

Individual Data of Concentration of β-Napthylamine following L-Leu-β-NA Incubation with Leucine Aminopeptidase and Chitosans at Different Concentrations

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LAP actvity for substrate concentration of 1.56 mM (at pH = 6.0)

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.310	4.250	6.480	9.178	11.364	13.486	16.148	18.588	22.737	3,951.000	0.270
2	0.195	3.004	6.340	8.700	11.360	15.750	18.147	22.947	24.560	4,484.600	0.280
3	0.220	2.770	5.121	8.016	10.124	13.230	16.170	19.682	20.876	3,856.590	0.251
Mean	0.242	3.341	5.980	8.631	10.949	14.155	16.822	20.406	22.724	4,097.397	0.267
± S.D.	0.05	0.65	0.61	0.48	0.58	1.13	0.94	1.85	1.50	276.494	0.012

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Appendix XVIII$_a$

Individual data of *B*-naphthylamine conc. following substrate incubation with LAP enzyme and CS J at various concentrations

Control (LAP)

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.125	3.158	5.117	7.711	9.433	13.838	17.329	20.854	20.757	3,977.270	0.232
2	0.141	2.974	5.712	7.012	10.914	16.625	18.524	21.497	22.450	4,252.015	0.256
3	0.103	3.064	4.653	5.828	11.325	13.722	16.237	17.685	19.367	3,624.395	0.252
Mean	0.123	3.065	5.161	6.850	10.557	14.728	17.363	20.012	20.858	3,951.227	0.247
± S.D.	0.02	0.08	0.43	0.78	0.81	1.34	0.93	1.67	1.26	256.886	0.011

LAP + 0.25 % CS J

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.065	3.012	3.498	7.542	10.074	14.125	17.667	17.032	23.000	3,832.490	0.245
2	0.080	3.528	4.852	6.693	10.129	13.382	16.870	18.484	19.157	3,679.435	0.233
3	0.051	2.631	5.396	5.799	11.150	15.016	18.452	19.905	21.078	3,992.280	0.254
Mean	0.065	3.057	4.582	6.678	10.451	14.174	17.663	18.474	21.078	3,834.735	0.244
± S.D.	0.01	0.37	0.80	0.71	0.49	0.67	0.65	1.17	1.57	127.728	0.009

LAP + 0.50 % CS J

No.	Time (min)									$AUC_{0-240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.123	2.464	5.771	6.873	10.638	14.547	17.300	19.855	22.624	4,040.505	0.254
2	0.147	2.875	4.955	6.785	10.434	13.269	15.902	18.936	20.040	3,734.780	0.245
3	0.101	2.070	3.964	5.793	9.041	12.025	14.509	16.820	20.710	3,494.385	0.216
Mean	0.124	2.470	4.897	6.484	10.038	13.280	15.904	18.537	21.125	3,756.557	0.238
± S.D.	0.02	0.33	0.74	0.49	0.71	1.03	1.14	1.27	1.09	223.484	0.016

LAP + 0.75 % CS J

No.	Time (min)									$AUC_{0-240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.122	3.318	4.395	7.826	11.365	14.097	19.401	20.631	20.206	4,020.615	0.270
2	0.091	3.012	4.685	7.134	9.123	15.498	17.770	19.313	22.884	4,027.675	0.222
3	0.067	2.739	5.787	6.450	10.095	13.250	16.150	18.029	21.554	3,762.685	0.238
Mean	0.093	3.023	4.956	7.137	10.194	14.282	17.774	19.324	21.548	3,936.992	0.243
± S.D.	0.02	0.24	0.60	0.56	0.92	0.93	1.33	1.06	1.09	123.287	0.020

LAP + 1.00 % CS J

No.	Time (min)									$AUC_{0-240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.078	3.300	5.384	6.758	10.389	16.192	19.877	22.327	23.640	4,404.680	0.241
2	0.061	2.312	4.193	5.956	12.315	14.481	19.754	19.480	21.845	4,035.985	0.282
3	0.098	2.753	3.570	7.277	11.185	16.951	17.292	22.890	19.820	4,152.750	0.267
Mean	0.079	2.788	4.382	6.664	11.296	15.875	18.974	21.566	21.768	4,197.805	0.263
± S.D.	0.02	0.40	0.75	0.54	0.79	1.03	1.19	1.49	1.56	153.854	0.017

LAP + 1.25 % CS J

No.	Time (min)									$AUC_{0-240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.116	3.512	5.943	7.055	13.323	14.624	20.154	21.104	21.247	4,193.365	0.300
2	0.101	3.728	6.188	8.012	11.868	15.375	19.288	22.300	23.154	4,382.856	0.278
3	0.133	4.031	4.833	9.122	10.369	17.198	18.456	20.128	22.009	4,149.830	0.256
Mean	0.117	3.757	5.655	8.063	11.853	15.732	19.299	21.177	22.137	4,242.017	0.278
± S.D.	0.01	0.21	0.59	0.84	1.21	1.08	0.69	0.89	0.78	101.162	0.018

Appendix XVIII$_b$

Individual data of *B*-naphthylamine conc. following substrate incubation with LAP enzyme and CS G at various concentrations

LAP + 0.25 % CS G

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.098	2.980	4.592	7.128	12.363	18.274	20.569	22.614	19.985	4,302.005	0.287
2	0.117	2.737	4.080	6.589	10.056	16.418	19.145	19.335	21.241	3,994.870	0.237
3	0.142	2.492	5.112	6.040	11.207	17.342	17.410	18.598	23.114	4,042.795	0.257
Mean	0.119	2.736	4.595	6.586	11.209	17.345	19.041	20.182	21.447	4,113.223	0.260
± S.D.	0.02	0.20	0.42	0.44	0.94	0.76	1.29	1.75	1.29	134.915	0.020

LAP + 0.50+A83% CS G

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.110	2.464	4.765	8.015	8.385	17.230	19.800	21.131	19.185	4,039.440	0.221
2	0.125	3.760	3.413	7.224	10.226	13.213	22.605	23.058	25.960	4,593.410	0.237
3	0.076	2.689	4.512	6.266	11.047	16.836	18.306	18.382	21.047	3,912.305	0.255
Mean	0.104	2.971	4.230	7.168	9.886	15.760	20.237	20.857	22.064	4,181.718	0.238
± S.D.	0.02	0.57	0.59	0.72	1.11	1.81	1.78	1.92	2.86	295.701	0.014

LAP + 0.75 % CS G

No.	Time (min)									$AUC_{0-240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.104	3.810	5.409	8.156	12.605	19.414	21.622	21.615	24.412	4,583.200	0.293
2	0.090	4.110	4.903	7.280	9.940	17.913	18.002	18.554	20.169	3,902.055	0.229
3	0.121	3.090	4.413	6.390	11.228	16.405	19.807	20.040	22.284	4,152.330	0.255
Mean	0.105	3.670	4.908	7.275	11.258	17.911	19.810	20.070	22.288	4,212.528	0.259
± S.D.	0.01	0.43	0.41	0.72	1.09	1.23	1.48	1.25	1.73	281.315	0.027

LAP + 1.00 % CS G

No.	Time (min)									$AUC_{0-240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.107	3.279	4.939	9.122	12.657	17.015	19.781	23.585	20.512	4,382.190	0.309
2	0.157	3.914	4.086	7.226	10.383	14.172	21.394	21.523	22.219	4,252.275	0.238
3	0.085	4.172	3.184	8.007	11.596	15.591	18.165	19.804	23.951	4,185.080	0.269
Mean	0.116	3.788	4.070	8.118	11.545	15.593	19.780	21.637	22.227	4,273.182	0.272
± S.D.	0.03	0.38	0.72	0.78	0.93	1.16	1.32	1.55	1.40	81.816	0.029

Appendix XIX

Statistical Analysis of Area Under the Metabolite Curves of Leucine Aminopeptidase Activity with Chitosans at Different Concentrations

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LAP + 1.25 % CS G

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.123	5.122	6.023	8.596	10.538	19.015	19.256	21.428	22.985	4,395.350	0.243
2	0.145	4.914	5.088	7.970	11.693	21.032	21.814	23.217	24.963	4,775.115	0.262
3	0.101	3.817	4.451	6.970	9.440	18.763	19.023	19.624	20.894	4,075.060	0.218
Mean	0.123	4.618	5.187	7.845	10.557	19.603	20.031	21.423	22.947	4,415.175	0.241
± S.D.	0.02	0.57	0.65	0.67	0.92	1.02	1.26	1.47	1.66	286.140	0.018

Bestatin (0.145 mM)

No.	Time (min)									$AUC_{0\text{-}240min}$	k
	0	10	20	30	40	60	90	120	240	[mg/ml].min x 10^4	mg/ml/min x 10^4
1	0.780	2.617	4.623	6.102	4.326	6.949	6.842	6.807	4.551	1,364.780	0.106
2	0.881	2.335	4.112	5.202	5.447	4.565	4.482	4.955	7.093	1,248.390	0.120
3	0.680	2.052	3.600	4.302	6.804	5.987	5.668	5.870	5.822	1,314.285	0.145
Mean	0.780	2.335	4.112	5.202	5.526	5.834	5.664	5.877	5.822	1,309.152	0.124
± S.D.	0.08	0.23	0.42	0.73	1.01	0.98	0.96	0.76	1.04	47.654	0.016

Appendix XIX$_a$

AUC of LAP activity with CS J at different concentration compared with bestatin

ONEWAY ANOVA

Means		**Condition**
Mean # 1	3951.227	Control (pH 6.0)
Mean # 2	3834.735	0.25% CS J
Mean # 3	3756.557	0.50% CS J
Mean # 4	3936.992	0.75% CS J
Mean # 5	4197.805	1.00% CS J
Mean # 6	4242.017	1.25% CS J

Source	df	SS	MS	F	Prob.
Between	5	5.69E+05	1.14E+05	2.508	0.089
Within	12	544064	45338.67		
Total	17	1.11E+06			

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DUNCAN's multiple range test

MS Error = 45338.67 df Error = 12

Significance level = .05

Least Significant Ranges	
LSR where p = 2.....	378.638
LSR where p = 3.....	463.463
LSR where p = 4.....	516.325
LSR where p = 5.....	554.435
LSR where p = 6.....	583.939

Means		
Mean # 1	3756.557	0.50% CS J
Mean # 2	3834.735	0.25% CS J
Mean # 3	3936.992	0.75% CS J
Mean # 4	3951.227	Control (pH 6.0)
Mean # 5	4197.805	1.00% CS J
Mean # 6	4242.017	1.25% CS J

Result :

1 2 3 4 5 6

Appendix XIX_b

AUC of LAP activity with CS G at different concentration compared with bestatin

ONEWAY ANOVA

Means		Condition
Mean # 1	3951.893	Control (pH 6.0)
Mean # 2	4113.223	0.25% CS G
Mean # 3	4181.718	0.50% CS G
Mean # 4	4212.529	0.75% CS G
Mean # 5	4273.182	1.00% CS G
Mean # 6	4415.176	1.25% CS G

Source	df	SS	MS	F	Prob.
Between	5	3.63E+05	7.27E+04	0.857	0.5375
Within	12	1018048	84837.34		
Total	17	1.38E+06			

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DUNCAN's multiple range test

MS Error = 84837.34 df Error = 12

Significance level = .05

Least Significant Ranges

LSR where p = 2.....	517.945
LSR where p = 3.....	633.978
LSR where p = 4.....	706.289
LSR where p = 5.....	758.4195
LSR where p = 6.....	798.779

Means

Mean # 2	3951.893	Control (pH 6.0)
Mean # 3	4113.223	0.25% CS G
Mean # 4	4181.718	0.50% CS G
Mean # 5	4212.529	0.75% CS G
Mean # 6	4273.182	1.00% CS G
Mean # 7	4415.176	1.25% CS G

Result :

1 2 3 4 5 6

Appendix XIX_c

AUC of LAP activity for control group and bestatin

Student's t-test (with pooled variance)

Mean of control group	3951.227
Standard deviation of control group	314.620
Standard error of control group	181.646
Mean of bestatin	1309.152
Standard deviation of bestatin	58.363
Standard error of bestatin	33.696
Pooled SE	184.745
Pooled t	-14.301
Probability	p = 0.000069
Degree of freedom	4.000

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VITA

Miss Prapasri Sinswat was borned on 31th March 1972 in Bangkok, Thailand. She graduated with the Bachelor's degree of Science in Pharmacy in 1995 from the Faculty of Pharmaceutical Sciences, Chulalongkorn University. She was awarded a University Developing Commissions (UDC) scholarship with an obligation to serve, after the completion of her M.S. study, as a faculty member at the Department of Pharmaceutics, Faculty of Pharmaceutical Sciences, Chulalongkorn University.

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