

APPENDICES

APPENDIX A

Amount of Charge Molecules Calculation

From pH values of 5% and 10% tranexamic acid (TA) solution, the amount of charge molecules of H_3O^+ and OH^- can be calculated. This will indicate the charge properties of 5 and 10% TA solution by the following equations :

$$\text{pH} = -\log [\text{H}_3\text{O}^+] \quad (1)$$

$$[\text{H}_3\text{O}^+] \times [\text{OH}^-] = 10^{-14} \quad (2)$$

since one mole per liter of $[\text{H}_3\text{O}^+]$ or $[\text{OH}^-]$ has 6.023×10^{23} charge molecules, the charge molecules of 5% TA solution which has the measured pH of 7.51 can be determined as follows :

$$\text{From : pH} = -\log [\text{H}_3\text{O}^+]$$

$$7.51 = -\log [\text{H}_3\text{O}^+]$$

$$[\text{H}_3\text{O}^+] = 3.09 \times 10^{-8}$$

$$\text{From : } [\text{H}_3\text{O}^+] \times [\text{OH}^-] = 10^{-14}$$

$$[\text{OH}^-] = 10^{-14} / 3.09 \times 10^{-8} = 3.23 \times 10^{-7} \text{ mole / liter}$$

Then, 3.09×10^{-8} mole / liter of $[\text{H}_3\text{O}^+]$ has $(6.023 \times 10^{23}) \times 3.09 \times 10^{-8} = 1.86 \times 10^{16}$ charge molecules.

Thus, 3.23×10^{-7} mole / liter of $[\text{OH}^-]$ has $(6.023 \times 10^{23}) \times 3.23 \times 10^{-7} = 1.94 \times 10^{17}$ charge molecules.

For 10% TA solution which has the measured pH of 7.57, the charge molecules can be calculated as the following :

From $\text{pH} = -\log [\text{H}_3\text{O}^+]$

$$7.57 = -\log [\text{H}_3\text{O}^+]$$

$$[\text{H}_3\text{O}^+] = 2.69 \times 10^{-8}$$

From $[\text{H}_3\text{O}^+] \times [\text{OH}^-] = 10^{-14}$

$$[\text{OH}^-] = 10^{-14} / 2.69 \times 10^{-8} = 3.71 \times 10^{-7} \text{ mole / liter}$$

Then, 2.69×10^{-8} mole / liter of $[\text{H}_3\text{O}^+]$ has $(6.023 \times 10^{23}) \times 2.69 \times 10^{-8} = 1.62 \times 10^{16}$ charge molecules

Thus, 3.71×10^{-7} mole / liter of $[\text{OH}^-]$ has $(6.023 \times 10^{23}) \times 3.71 \times 10^{-7} = 2.23 \times 10^{17}$ charge molecules

The following table summarizes the charge molecules of H_3O^+ and OH^- .

Table A1 : Charge molecules of H_3O^+ and OH^-

Formulation	Amount of H_3O^+	Amount of OH^-	Expected charges of TA
5%TA solution	1.86×10^{16}	1.94×10^{17}	weak positive
10%TA solution	1.62×10^{16}	2.23×10^{17}	weak positive

APPENDIX B

Calculation of the Percentages of Entrapment and Loading of Tranexamic acid (TA) in Liposomes

For the 7:2:1 (5%TA,+) liposome lot 1 (1), the absorbance of TA in the supernatant and the pellets were 0.185 and 0.226 respectively.

The concentrations of TA in the supernatant and the pellets were calculated by substituting the absorbance and multiplying with the dilution factor (as mentioned in the method) were 39.87 and 7.18 mg / g respectively. The percentages of entrapment of TA in liposomes can be calculated as the following :

$$\%TA \text{ encapsulated} = TA_{Pel} \times 100 / (TA_{Pel} + TA_{Sup})$$

where TA_{Pel} = total amount of TA in pellets = 7.18 mg

TA_{Sup} = total amount of TA in supernatant = 39.87 mg

$$\begin{aligned} \%TA \text{ encapsulated} &= 7.18 \text{ mg} \times 100 / (7.18 \text{ mg} + 39.87 \text{ mg}) \\ &= 15.25 \end{aligned}$$

Thus, the percentages of entrapment of TA in 7:2:1 (5%TA,+) liposome lot 1 (1) was 15.25%.

$$\begin{aligned} \% \text{ loading of TA} &= (\text{amount of TA in pellets} / \text{total lipid}) \times 100 \\ &= (7.18 \text{ mg} / 25 \text{ mg}) \times 100 \\ &= 28.72 \end{aligned}$$

Thus, the percentages loading of TA in 7:2:1 (5%TA,+) liposome lot 1 (1) was 28.72 %.

APPENDIX C

Calculation of Leakage Rate and Shelf Life of Liposome Formulation

The equations used to calculate the leakage rate and shelf life of various liposome formulations are the following :

- Zero order kinetics : $C = C_0 + kt$
- First order kinetics : $\log C = \log C_0 + kt / 2.303$
- Higuchi model kinetics : $C = C_0 + kt^{1/2}$

When C_0 = initial concentration (percentages)

C = concentration at given t (percentages)

t = time (day)

k = rate constant of the reaction (percentages per day)

For the 7:2:1 (5%TA,+) liposome formulation, Tables 3.25 to 3.27 showed the percentages of TA remaining in liposomes at 4, 30 and 45 °C.

Table C1 : The percentages of TA remaining in liposomes at 4, 30 and 45 °C

Days	Temperature (°C)		
	4	30	45
0	100.00	100.00	100.00
14	92.19	96.50	91.61
30	91.62	93.41	87.66
60	83.20	78.58	68.56
90	75.90	72.02	61.72

The percentages of TA remaining in liposomes at the given time of 0, 14, 30, 60, 90 days were used to calculate the linear regression of the zero order, first order and the Higuchi model. The values of C_0 (intercept), k (slope) and r^2 were shown in Table C2.

Table C2 : The values of C_0 (intercept), k (slope) and r^2 of 7:2:1(5%TA,+)

7:2:1 (5%TA,+)	Zero order			First order			Higuchi model		
	Slope (-)	Inter- cept	r^2	Slope (-)	Inter- cept	r^2	Slope (-)	Inter- cept	r^2
4 °C	0.2510	98.3291	0.9697	0.0013	1.9941	0.9755	2.4378	101.4892	0.9392
30 °C	0.3749	99.9001	0.9940	0.0020	2.0030	0.9919	3.5561	104.1730	0.9131
45 °C	0.4383	98.9196	0.9734	0.0024	2.0002	0.9787	4.1999	104.1362	0.9176

Note : (-) the negative slope indicated the reciprocal relationship.

The r^2 values from the first order model were higher than those from the zero and the Higuchi model kinetic. This indicated the best relation when fitted to the first order model. Thus, the leakage rates (k) from the first order model at the temperatures of 4, 30 and 45 °C were used for calculation of shelf life of 7:2:1(5%TA,+) liposome formulation. This equation was as the following : $\log C = \log C_0 + kt / 2.303$

For example, prediction at 4 °C

$$\begin{aligned}
 k = \text{leakage rate} &= \text{slope} \times 2.303 \\
 &= 0.0013 \times 2.303 \\
 &= 0.0029 \% / \text{day} \\
 \text{shelf life } (t_{90}) &= \{(\log C / C_0) \times 2.303\} / k \\
 &= \{(\log 90 / 100) \times 2.303\} / k \\
 &= 0.105 / k \\
 &= 0.105 / 0.0029 \\
 &= 35.07 \text{ days}
 \end{aligned}$$

Thus, at 4 °C the 7:2:1 (5%TA,+) liposome gave the predicted leakage rate and shelf life of 0.0029 % / day and 35.07 days respectively.

APPENDIX D

Size and Size Distribution Raw Data

The raw data of size and size distribution (μm) of various liposome formulations determined by light scattering particle analyzer are presented in the following tables :

Table D1 : Size and size distribution of positively charged liposomes without the entrapped TA [7:2:1 (+)] Lot.1

Table D2 : Size and size distribution of positively charged liposomes without the entrapped TA [7:2:1 (+)] Lot.2

Table D3 : Size and size distribution of positively charged liposomes with the entrapped 5%TA [7:2:1 (5%,TA+)] Lot.1

Table D4 : Size and size distribution of positively charged liposomes with the entrapped 5%TA [7:2:1 (5%,TA+)] Lot.2

Table D5 : Size and size distribution of positively charged liposomes with the entrapped 10%TA [7:2:1 (10%,TA+)] Lot.1

Table D6 : Size and size distribution of positively charged liposomes with the entrapped 10%TA [7:2:1 (10%,TA+)] Lot.2

Table D7 : Size and size distribution of negatively charged liposomes without the entrapped TA [7:2:1 (-)] Lot.1

Table D8 : Size and size distribution of negatively charged liposomes without the entrapped TA [7:2:1 (-)] Lot.2

Table D9 : Size and size distribution of negatively charged liposomes with the entrapped 5%TA [7:2:1 (5%,TA-)] Lot.1

Table D10 : Size and size distribution of negatively charged liposomes with the entrapped 5%TA [7:2:1 (5%,TA-)] Lot.2

Table D11 : Size and size distribution of negatively charged liposomes with the entrapped 10%TA [7:2:1 (10%,TA-)] Lot.1

Table D12 : Size and size distribution of negatively charged liposomes with the entrapped
10%TA [7:2:1 (10%,TA-)] Lot.2

Size Low (μm), In %, Size High (μm) and Under %

In % is the percentage amount of particle size between size low and size high.

Under % is the percentage amount of particle size below size high.

For example, from Table D1

Size Low (μm) = 0.06

Size High (μm) = 0.07

In % = 0.51

Under % = 0.77

This means that the 7:2:1 (+) liposome Lot.1 has the percentage amount of the particle sizes between 0.06 to 0.07 μm of 0.51 % and the percentage amount of the particle size below 0.07 μm is 0.77 %.

Table D1 : Size and size distribution of positively charged liposomes without the entrapped

TA [7:2:1 (+)] Lot.1

Size Low (µm)	In %	Size High (µm)	Under %	Size Low (µm)	In %	Size High (µm)	Under %
0.05	0.26	0.06	0.26	6.63	0.84	7.72	25.71
0.06	0.51	0.07	0.77	7.72	1.50	9.00	27.20
0.07	0.75	0.08	1.52	9.00	2.49	10.48	29.69
0.08	0.97	0.09	2.50	10.48	3.83	12.21	33.52
0.09	1.20	0.11	3.69	12.21	5.44	14.22	38.97
0.13	1.67	0.15	6.79	16.57	8.44	19.31	54.49
0.15	1.92	0.17	8.71	19.31	89.18	22.49	63.68
0.17	2.18	0.20	10.89	22.49	8.41	26.40	72.82
0.20	2.41	0.23	13.30	26.20	7.26	30.53	81.24
0.23	2.49	0.27	15.80	30.53	5.28	35056	88.49
0.27	2.32	0.31	18.12	35.56	3.50	41.43	93.77
0.31	1.91	0.36	20.03	41.43	1.97	48.27	97.27
0.36	1.43	0.42	21.49	48.27	0.75	56.23	99.24
0.42	1.02	0.49	22.49	56.23	0.01	65.51	99.99
0.49	0.68	0.58	23.17	65.51	0.00	76.32	100.00
0.58	0.39	0.67	23.55	76.32	0.00	88.91	100.00
0.67	0.20	0.78	23.75	88.91	0.00	103.58	100.00
0.78	0.12	0.91	23.87	103.58	0.00	120.67	100.00
0.91	0.06	1.06	23.93	120.67	0.00	140.58	100.00
1.06	0.00	0.24	23.93	140.58	0.00	163.77	100.00
1.24	0.00	0.44	23.93	163.77	0.00	190.80	100.00
1.44	0.00	1.68	23.93	190.80	0.00	222.28	100.00
1.68	0.00	1.95	23.93	222.28	0.00	258.95	100.00
1.95	0.00	2.28	23.93	258.95	0.00	301.68	100.00
2.28	0.00	2.65	23.93	301.68	0.00	351.46	100.00
2.65	0.00	3.09	23.93	351.46	0.00	409.45	100.00
3.09	0.00	3.60	23.93	409.45	0.00	477.01	100.00
3.60	0.10	4.19	24.03	477.01	0.00	555.71	100.00
4.19	0.14	4.88	24.17	555.71	0.00	647.41	100.00
4.88	0.24	5.69	24.41	647.41	0.00	754.23	100.00
5.69	0.45	6.63	24.86	754.23	0.00	878.67	100.00

Table D2 : Size and size distribution of positively charged liposomes without the entrapped

TA [7:2:1 (+)] Lot.2

Size Low (μm)	In %	Size High (μm)	Under %	Size Low (μm)	In %	Size High (μm)	Under %
0.05	0.25	0.06	0.25	6.63	0.91	7.72	26.34
0.06	0.50	0.07	0.75	7.72	1.61	9.00	27.95
0.07	0.73	0.08	1.48	9.00	2.66	10.48	30.61
0.08	0.96	0.09	2.44	10.48	4.08	12.21	34.69
0.09	1.18	0.11	3.62	12.21	5.75	14.22	40.44
0.13	1.65	0.15	6.68	16.57	8.71	19.31	56.56
0.15	1.91	0.17	8.59	19.31	9.34	22.49	65.90
0.17	2.19	0.20	10.78	22.49	9.14	26.20	75.05
0.20	2.43	0.23	13.21	26.20	8.22	30.53	83.27
0.23	2.54	0.27	15.75	30.53	6.90	35.56	90.17
0.27	2.38	0.31	18.13	35.56	4.84	41.43	95.01
0.31	1.99	0.36	20.12	41.43	3.05	48.27	98.06
0.36	1.51	0.42	21.63	48.27	1.54	56.23	99.60
0.42	1.10	0.49	22.73	56.23	0.40	65.51	100.00
0.49	0.74	0.58	23.48	65.51	0.00	76.32	100.00
0.58	0.44	0.67	23.92	76.32	0.00	88.91	100.00
0.67	0.24	0.78	24.15	88.91	0.00	103.58	100.00
0.78	0.15	0.91	24.30	103.58	0.00	120.67	100.00
0.91	0.09	1.06	24.39	120.67	0.00	140.58	100.00
1.06	0.05	1.24	24.44	140.58	0.00	163.77	100.00
1.24	0.00	1.44	24.44	163.77	0.00	190.80	100.00
1.44	0.00	1.68	24.44	190.80	0.00	222.28	100.00
1.68	0.00	1.95	24.44	222.28	0.00	258.95	100.00
1.95	0.00	2.28	24.44	258.95	0.00	301.68	100.00
2.28	0.00	2.65	24.44	301.68	0.00	351.46	100.00
2.65	0.00	3.09	24.44	351.46	0.00	409.45	100.00
3.09	0.00	3.60	24.44	409.45	0.00	477.01	100.00
3.60	0.10	4.19	24.54	477.01	0.00	555.71	100.00
4.19	0.15	4.88	24.69	555.71	0.00	647.41	100.00
4.88	0.26	5.69	24.95	647.41	0.00	754.23	100.00
5.69	0.49	6.63	25.43	754.23	0.00	878.67	100.00

Table D3 : Size and size distribution of positively charged liposomes with the entrapped
5%TA [7:2:1 (5%,TA+)] Lot.1

Size Low (μm)	In %	Size High (μm)	Under %	Size Low (μm)	In %	Size High (μm)	Under %
0.05	0.02	0.06	0.02	6.63	2.51	7.72	32.61
0.06	0.05	0.07	0.07	7.72	3.40	9.00	36.02
0.07	0.08	0.08	0.15	9.00	4.39	10.48	40.41
0.08	0.13	0.09	0.28	10.48	5.37	12.21	45.77
0.09	0.19	0.11	0.46	12.21	6.17	14.22	51.94
0.13	0.42	0.15	1.16	16.57	6.93	19.31	65.57
0.15	0.67	0.17	1.83	19.31	6.98	22.49	72.55
0.17	1.09	0.20	2.92	22.49	6.28	26.20	78.83
0.20	1.74	0.23	4.66	26.20	5.38	30.53	84.21
0.23	2.54	0.27	7.20	30.53	4.39	35.56	88.60
0.27	3.07	0.31	10.27	35.56	3.44	41.43	92.04
0.31	2.95	0.36	13.22	41.43	2.57	48.27	94.61
0.36	2.50	0.42	15.73	48.27	1.84	56.23	96.45
0.42	2.16	0.49	17.88	56.23	1.27	65.51	97.72
0.49	1.83	0.58	19.71	65.51	0.84	76.32	98.56
0.58	1.36	0.67	21.07	76.32	0.55	88.91	99.11
0.67	0.99	0.78	22.07	88.91	0.36	103.58	99.46
0.78	0.74	0.91	22.81	103.58	0.24	120.67	99.71
0.91	0.55	1.06	23.35	120.67	0.16	140.58	99.87
1.06	0.42	1.24	23.77	140.58	0.10	163.77	99.97
1.24	0.34	1.44	24.11	163.77	0.03	190.80	100.00
1.44	0.29	1.68	24.40	190.80	0.00	222.28	100.00
1.68	0.26	1.95	24.66	222.28	0.00	258.95	100.00
1.95	0.25	2.28	24.91	258.95	0.00	301.68	100.00
2.28	0.25	2.65	25.16	301.68	0.00	351.46	100.00
2.65	0.28	3.09	25.44	351.46	0.00	409.45	100.00
3.09	0.36	3.60	25.81	409.45	0.00	477.01	100.00
3.60	0.52	4.19	26.33	477.01	0.00	555.71	100.00
4.19	0.79	4.88	27.12	555.71	0.00	647.41	100.00
4.88	1.20	5.69	28.33	647.41	0.00	754.23	100.00
5.69	1.77	6.63	30.10	754.23	0.00	878.67	100.00

Table D4 : Size and size distribution of positively charged liposomes with the entrapped

5%TA [7:2:1 (5%,TA+)] Lot.

Size Low (μm)	In %	Size High (μm)	Under %	Size Low (μm)	In %	Size High (μm)	Under %
0.05	0.01	0.06	0.01	6.63	2.46	7.72	31.52
0.06	0.03	0.07	0.04	7.72	3.34	9.00	34.86
0.07	0.04	0.08	0.08	9.00	4.33	10.48	39.19
0.08	0.07	0.09	0.15	10.48	5.31	12.21	44.50
0.09	0.11	0.11	0.25	12.21	6.13	14.22	50.63
0.13	0.27	0.15	0.69	16.57	6.957	19.31	64.26
0.15	0.48	0.17	1.17	19.31	7.01	22.49	71.28
0.17	0.86	0.20	2.03	22.49	6.35	26.20	77.63
0.20	1.53	0.23	3.56	26.20	5.49	30.53	83.12
0.23	2.44	0.27	6.00	30.53	4.55	35.56	87.67
0.27	3.10	0.31	9.10	35.56	3.62	41.43	91.29
0.31	3.01	0.36	12.11	41.43	2.77	48.27	94.06
0.36	2.52	0.42	14.64	48.27	2.04	56.23	96.10
0.42	2.17	0.49	16.81	56.23	1.43	65.51	97.53
0.49	1.87	0.58	18.69	65.51	0.96	76.32	98.48
0.58	1.37	0.67	20.05	76.32	0.62	88.91	99.10
0.67	1.00	0.78	21.05	88.91	0.38	103.58	99.48
0.78	0.74	0.91	21.79	103.58	0.23	120.67	99.71
0.91	0.54	1.06	22.34	120.67	0.13	140.58	99.84
1.06	0.41	1.24	22.75	140.58	0.17	163.77	99.90
1.24	0.33	1.44	23.08	163.77	0.03	190.80	99.94
1.44	0.29	1.68	23.37	190.80	0.00	222.28	99.94
1.68	0.26	1.95	23.63	222.28	0.01	258.95	99.95
1.95	0.25	2.28	23.88	258.95	0.05	301.68	100.00
2.28	0.25	2.65	24.13	301.68	0.00	351.46	100.00
2.65	0.29	3.09	24.42	351.46	0.00	409.45	100.00
3.09	0.37	3.60	24.79	409.45	0.00	477.01	100.00
3.60	0.53	4.19	25.32	477.01	0.00	555.71	100.00
4.19	0.79	4.88	26.12	555.71	0.00	647.41	100.00
4.88	1.19	5.69	27.31	647.41	0.00	754.23	100.00
5.69	1.75	6.63	29.05	754.23	0.00	878.67	100.00

Table D5 : Size and size distribution of positively charged liposomes with the entrapped
10%TA [7:2:1 (10%,TA+) Lot.1

Size Low (μm)	In %	Size High (μm)	Under %	Size Low (μm)	In %	Size High (μm)	Under %
0.05	0.01	0.06	0.01	6.63	3.11	7.72	27.18
0.06	0.01	0.07	0.02	7.72	4.10	9.00	31.29
0.07	0.02	0.08	0.04	9.00	5.17	10.48	36.46
0.08	0.04	0.09	0.08	10.48	6.16	12.21	42.62
0.09	0.06	0.11	0.14	12.21	6.94	14.22	49.56
0.13	0.17	0.15	0.41	16.57	7.75	19.31	64.75
0.15	0.31	0.17	0.72	19.31	7.14	22.49	71.89
0.17	0.59	0.20	1.31	22.49	6.21	26.20	78.10
0.20	1.12	0.23	2.44	26.20	5.10	30.53	83.20
0.23	1.89	0.27	4.32	30.53	3.96	35.56	87.16
0.27	2.44	0.31	6.76	35.56	2.90	41.43	90.07
0.31	2.33	0.36	9.10	41.43	2.01	48.27	92.07
0.36	1.88	0.42	10.98	48.27	1.30	56.23	93.38
0.42	1.56	0.49	12.54	56.23	0.80	65.51	94.18
0.49	1.27	0.58	13.81	65.51	.48	76.32	94.66
0.58	0.86	0.67	14.67	76.32	0.31	88.91	94.98
0.67	0.56	0.78	15.23	88.91	0.24	103.58	95.22
0.78	0.36	0.91	15.62	103.58	0.22	120.67	95.43
0.91	0.28	1.06	15.91	120.67	0.20	140.58	95.64
1.06	0.23	1.24	16.13	140.58	0.19	163.77	95.83
1.24	0.22	1.44	16.35	163.77	0.18	190.80	96.01
1.44	0.23	1.68	16.59	190.80	0.19	222.28	96.20
1.68	0.26	1.95	16.85	222.28	0.022	258.95	96.43
1.95	0.30	2.28	17.15	258.95	0.29	301.68	96.71
2.28	0.34	2.65	17.49	301.68	0.37	351.46	97.09
2.65	0.41	3.09	17.89	351.46	0.47	409.45	97.55
3.09	0.53	3.60	18.42	409.45	0.55	477.01	98.10
3.60	0.74	4.19	19.16	477.01	0.60	555.71	98.69
4.19	1.08	4.88	20.25	555.71	0.59	647.41	99.28
4.88	1.58	5.69	21.82	647.41	0.47	754.23	99.75
5.69	2.25	6.63	24.08	754.23	0.25	878.67	100.00

Table D6 : Size and size distribution of positively charged liposomes with the entrapped
10%TA [7:2:1 (10%,TA+) Lot.1

Size Low (μm)	In %	Size High (μm)	Under %	Size Low (μm)	In %	Size High (μm)	Under %
0.05	0.01	0.06	0.01	6.63	3.01	7.72	26.19
0.06	0.02	0.07	0.03	7.72	3.89	9.00	30.08
0.07	0.03	0.08	0.06	9.00	4.82	10.48	34.90
0.08	0.05	0.09	0.12	10.48	5.69	12.21	40.56
0.09	0.08	0.11	0.20	12.21	6.37	14.22	46.96
0.13	0.20	0.15	0.53	16.57	6.92	19.31	60.66
0.15	0.34	0.17	0.87	19.31	6.89	22.49	67.55
0.17	0.59	0.20	1.46	22.49	6.19	26.20	73.74
0.20	1.01	0.23	2.46	26.20	5.33	30.53	79.08
0.23	1.55	0.27	4.02	30.53	4.41	35.56	83.49
0.27	1.93	0.31	5.95	35.56	3.51	41.43	87.00
0.31	1.85	0.36	7.79	41.43	2.71	48.27	89.7
0.36	1.54	0.42	9.33	48.27	2.02	56.23	91.73
0.42	1.31	0.49	10.64	56.23	1.46	65.51	93.19
0.49	1.11	0.58	11.75	65.51	1.03	76.32	94.22
0.58	0.81	0.67	12.57	76.32	0.72	88.91	94.94
0.67	0.60	0.78	13.17	88.91	0.51	103.58	95.45
0.78	0.48	0.91	13.66	103.58	0.37	120.67	95.82
0.91	0.40	1.06	14.06	120.67	0.27	140.58	96.10
1.06	0.36	1.24	14.42	140.58	0.20	163.77	96.30
1.24	0.35	1.44	14.77	163.77	0.16	190.80	96.46
1.44	0.35	1.68	15.13	190.80	0.15	222.28	96.62
1.68	0.36	1.95	15.49	222.28	0.17	258.95	96.79
1.95	0.37	2.28	15.86	258.95	0.23	301.68	97.02
2.28	0.40	2.65	16.27	301.68	0.30	351.46	97.32
2.65	0.47	3.09	16.74	351.46	0.39	409.45	97.70
3.09	0.60	3.60	17.33	409.45	0.48	477.01	98.18
3.60	0.82	4.19	18.15	477.01	0.54	555.71	98.72
4.19	1.15	4.88	19.30	555.71	0.55	647.41	99.27
4.88	1.62	5.69	20.92	647.41	0.47	754.23	99.74
5.69	2.25	6.63	23.17	754.23	0.26	878.67	100.00

Table D7 : Size and size distribution of negatively charged liposomes without the entrapped

TA [7:2:1 (-)] Lot.1

Size Low (μm)	In %	Size High (μm)	Under %	Size Low (μm)	In %	Size High (μm)	Under %
0.05	0.00	0.06	0.00	6.63	1.73	7.72	21.18
0.06	0.00	0.07	0.00	7.72	2.43	9.00	23.61
0.07	0.00	0.08	0.00	9.00	3.32	10.48	26.92
0.08	0.00	0.09	0.00	10.48	4.37	12.21	31.30
0.09	0.00	0.11	0.00	12.21	5.50	14.22	36.79
0.13	0.01	0.15	0.02	16.57	7.29	19.31	50.62
0.15	0.04	0.17	0.07	19.31	7.61	22.49	58.23
0.17	0.16	0.20	0.23	22.49	7.44	26.20	65.67
0.20	0.57	0.23	0.80	26.20	6.89	30.53	72.55
0.23	1.66	0.27	2.46	30.53	6.04	35.56	78.59
0.27	2.89	0.31	5.35	35.56	5.07	41.43	83.66
0.31	2.78	0.36	8.13	41.43	4.10	48.27	87.76
0.36	1.94	0.42	10.06	48.27	3.22	56.23	90.98
0.42	1.48	0.49	11.54	56.23	2.49	65.51	93.47
0.49	1.14	0.58	12.68	65.51	1.91	76.32	95.37
0.58	0.62	0.67	13.30	76.32	1.48	88.91	96.95
0.67	0.34	0.78	13.64	88.91	1.18	103.58	98.03
0.78	0.22	0.91	13.87	103.58	1.00	120.67	99.03
0.91	0.18	1.06	14.05	120.67	0.97	140.58	100.00
1.06	0.19	1.24	14.23	140.58	0.00	163.77	100.00
1.24	0.24	1.44	14.47	163.77	0.00	190.80	100.00
1.44	0.29	1.68	14.76	190.80	0.00	222.28	100.00
1.68	0.32	1.95	15.08	222.28	0.00	258.95	100.00
1.95	0.34	2.28	15.42	258.95	0.00	301.68	100.00
2.28	0.33	2.65	15.76	301.68	0.00	351.46	100.00
2.65	0.33	3.09	16.08	351.46	0.00	409.45	100.00
3.09	0.35	3.60	16.43	409.45	0.00	477.01	100.00
3.60	0.42	4.19	16.86	477.01	0.00	555.71	100.00
4.19	0.57	4.88	17.43	555.71	0.00	647.41	100.00
4.88	0.82	5.69	18.25	647.41	0.00	754.23	100.00
5.69	1.20	6.63	19.45	754.23	0.00	878.67	100.00

Table D8 : Size and size distribution of negatively charged liposomes without the entrapped

TA [7:2:1 (-)] Lot.2

Size Low (μm)	In %	Size High (μm)	Under %	Size Low (μm)	In %	Size High (μm)	Under %
0.05	0.00	0.06	0.00	6.63	1.70	7.72	21.63
0.06	0.01	0.07	0.01	7.72	2.41	9.00	24.03
0.07	0.01	0.08	0.02	9.00	3.29	10.48	27.32
0.08	0.02	0.09	0.04	10.48	4.33	12.21	31.65
0.09	0.03	0.11	0.07	12.21	5.41	14.22	37.05
0.13	0.11	0.15	0.24	16.57	7.13	19.31	50.59
0.15	0.23	0.17	0.47	19.31	7.44	22.49	58.04
0.17	0.49	0.20	0.95	22.49	7.32	26.20	65.36
0.20	1.05	0.23	2.00	26.20	6.68	30.53	72.19
0.23	1.94	0.27	3.94	30.53	6.06	35.56	78.25
0.27	2.64	0.31	6.57	35.56	5.15	41.43	83.40
0.31	2.44	0.36	9.01	41.43	4.21	48.27	87.61
0.36	1.85	0.42	10.86	48.27	3.34	56.23	90.95
0.42	1.43	0.49	12.29	56.23	2.58	65.51	93.53
0.49	1.08	0.58	13.37	65.51	1.96	76.32	95.49
0.58	0.63	0.67	14.00	76.32	1.50	88.91	96.98
0.67	0.35	0.78	14.35	88.91	1.17	103.58	98.15
0.78	0.25	0.91	14.60	103.58	0.96	120.67	99.12
0.91	0.20	1.06	14.79	120.67	0.88	140.58	100.00
1.06	0.19	1.24	14.99	140.58	0.00	163.77	100.00
1.24	0.23	1.44	15.21	163.77	0.00	190.80	100.00
1.44	0.27	1.68	15.48	190.80	0.00	222.28	100.00
1.68	0.30	1.95	15.77	222.28	0.00	258.95	100.00
1.95	0.31	2.28	16.08	258.95	0.00	301.68	100.00
2.28	0.31	2.65	16.39	301.68	0.00	351.46	100.00
2.65	0.31	3.09	16.70	351.46	0.00	409.45	100.00
3.09	0.33	3.60	17.02	409.45	0.00	477.01	100.00
3.60	0.40	4.19	17.42	477.01	0.00	555.71	100.00
4.19	0.54	4.88	17.97	555.71	0.00	647.41	100.00
4.88	0.79	5.69	18.76	647.41	0.00	754.23	100.00
5.69	1.17	6.63	19.93	754.23	0.00	878.67	100.00

Table D9 : Size and size distribution of negatively charged liposomes with the entrapped
5%TA [7:2:1 (5%,TA-)] Lot.1

Size Low (μm)	In %	Size High (μm)	Under %	Size Low (μm)	In %	Size High (μm)	Under %
0.05	0.03	0.06	0.03	6.63	0.44	7.72	90.96
0.06	0.08	0.07	0.11	7.72	0.49	9.00	91.44
0.07	0.13	0.08	0.24	9.00	0.55	10.48	92.00
0.08	0.21	0.09	0.45	10.48	0.64	12.21	92.64
0.09	0.33	0.11	0.78	12.21	0.75	14.22	93.39
0.13	0.89	0.15	2.20	16.57	0.96	19.31	94.26
0.15	1.59	0.17	3.79	19.31	0.99	22.49	96.20
0.17	2.97	0.20	6.76	22.49	0.95	26.20	97.16
0.20	5.48	0.23	12.23	26.20	0.85	30.53	98.00
0.23	9.03	0.27	21.26	30.53	0.69	35.56	98.69
0.27	11.63	0.31	32.94	35.56	0.53	41.43	99.22
0.31	11.39	0.36	44.33	41.43	0.40	48.27	99.62
0.36	9.52	0.42	53.85	48.27	0.34	56.23	99.96
0.42	8.24	0.49	62.09	56.23	0.00	65.51	99.96
0.49	7.15	0.58	62.94	65.51	0.00	76.32	99.96
0.58	5.30	0.67	74.54	76.32	0.00	88.91	99.96
0.67	3.95	0.78	78.49	88.91	0.00	103.58	99.96
0.78	2.67	0.91	81.16	103.58	0.00	120.67	99.96
0.91	1.85	1.06	83.01	120.67	0.00	140.58	99.96
1.06	1.33	1.24	84.34	140.58	0.00	163.77	99.96
1.24	1.05	1.44	85.39	163.77	0.00	190.80	99.96
1.44	0.87	1.68	86.26	190.80	0.00	222.28	99.96
1.68	0.74	1.95	87.00	222.28	0.00	258.95	99.96
1.95	0.62	2.28	87.63	258.95	0.00	301.68	99.96
2.28	0.51	2.65	88.13	301.68	0.00	351.46	99.96
2.65	0.43	3.09	88.57	351.46	0.04	409.45	100.00
3.09	0.39	3.60	88.95	409.45	0.00	477.01	100.00
3.60	0.37	4.19	89.33	477.01	0.00	555.71	100.00
4.19	0.38	4.88	89.70	555.71	0.00	647.41	100.00
4.88	0.39	5.69	90.09	647.41	0.00	754.23	100.00
5.69	0.42	6.63	90.51	754.23	0.00	878.67	100.00

Table D10 : Size and size distribution of negatively charged liposomes with the entrapped
5%TA [7:2:1 (5%,TA-)] Lot.2

Size Low (μm)	In %	Size High (μm)	Under %	Size Low (μm)	In %	Size High (μm)	Under %
0.05	0.08	0.06	0.06	6.63	0.43	7.72	91.60
0.06	0.17	0.07	0.07	7.72	0.48	9.00	92.08
0.07	0.29	0.08	0.08	9.00	0.55	10.48	92.63
0.08	0.44	0.09	0.09	10.48	0.64	12.21	93.27
0.09	0.65	0.11	0.11	12.21	0.73	14.22	94.00
0.13	1.49	0.15	0.15	16.57	0.87	19.31	94.82
0.15	2.36	0.17	0.17	19.31	0.86	22.49	95.69
0.17	3.85	0.20	0.20	22.49	0.80	26.20	96.55
0.20	6.18	0.23	0.23	26.20	0.69	30.53	97.35
0.23	9.05	0.27	0.27	30.53	0.56	35.56	98.05
0.27	10.95	0.31	0.31	35.56	0.42	41.43	98.60
0.31	10.59	0.36	0.36	41.43	0.29	48.27	99.02
0.36	9.04	0.42	0.42	48.27	0.20	56.23	99.31
0.42	7.85	0.49	0.49	56.23	0.13	65.51	99.51
0.49	6.77	0.58	0.58	65.51	0.09	76.32	99.64
0.58	5.12	0.67	0.67	76.32	0.07	88.91	99.73
0.67	3.83	0.78	0.78	88.91	0.06	103.58	99.81
0.78	2.63	0.91	0.91	103.58	0.05	120.67	99.87
0.91	1.82	1.06	1.06	120.67	0.03	140.58	99.92
1.06	1.30	1.24	1.24	140.58	0.00	163.77	99.95
1.24	1.00	1.44	1.44	163.77	0.00	190.80	99.95
1.44	0.81	1.68	1.68	190.80	0.00	222.28	99.95
1.68	0.68	1.95	1.95	222.28	0.00	258.95	99.95
1.95	0.57	2.28	2.28	258.95	0.00	301.68	99.95
2.28	0.47	2.65	2.65	301.68	0.00	351.46	99.95
2.65	0.40	3.09	3.09	351.46	0.05	409.45	100.00
3.09	0.35	3.60	3.60	409.45	0.00	477.01	100.00
3.60	0.34	4.19	4.19	477.01	0.00	555.71	100.00
4.19	0.35	4.88	4.88	555.71	0.00	647.41	100.00
4.88	0.37	5.69	5.69	647.41	0.00	754.23	100.00
5.69	0.40	6.63	6.63	754.23	0.00	878.67	100.00

Table D11 : Size and size distribution of negatively charged liposomes with the entrapped
10%TA [7:2:1 (10%,TA-)] Lot.1

Size Low (μm)	In %	Size High (μm)	Under %	Size Low (μm)	In %	Size High (μm)	Under %
0.05	0.02	0.06	0.02	6.63	1.19	7.72	89.51
0.06	0.06	0.07	0.09	7.72	1.43	9.00	90.95
0.07	0.13	0.08	0.22	9.00	1.61	10.48	92.55
0.08	0.23	0.09	0.45	10.48	1.67	12.21	94.22
0.09	0.40	0.11	0.85	12.21	1.59	14.22	95.81
0.13	1.20	0.15	2.47	16.57	1.38	19.31	97.19
0.15	2.20	0.17	4.94	19.31	1.09	22.49	98.28
0.17	4.14	0.20	9.08	22.49	0.77	26.20	99.06
0.20	7.58	0.23	16.66	26.20	0.49	30.53	99.54
0.23	12.14	0.27	28.80	30.53	0.27	35.56	99.81
0.27	14.85	0.31	43.65	35.56	0.13	41.43	99.93
0.31	13.23	0.36	56.87	41.43	0.05	48.27	99.98
0.36	9.69	0.42	66.57	48.27	0.01	56.23	100.00
0.42	6.99	0.49	73.56	56.23	0.00	65.51	100.00
0.49	4.69	0.58	78.25	65.51	0.00	76.32	100.00
0.58	2.41	0.67	80.66	76.32	0.00	88.91	100.00
0.67	1.05	0.78	81.71	88.91	0.00	103.58	100.00
0.78	0.55	0.91	82.25	103.58	0.00	120.67	100.00
0.91	0.27	1.06	82.52	120.67	0.00	140.58	100.00
1.06	0.13	1.24	82.65	140.58	0.00	163.77	100.00
1.24	0.14	1.44	82.79	163.77	0.00	190.80	100.00
1.44	0.66	1.68	83.45	190.80	0.00	222.28	100.00
1.68	0.77	1.95	84.22	222.28	0.00	258.95	100.00
1.95	0.67	2.28	85.88	258.95	0.00	301.68	100.00
2.28	0.47	2.65	85.35	301.68	0.00	351.46	100.00
2.65	0.27	3.09	85.63	351.46	0.00	409.45	100.00
3.09	0.12	3.60	85.75	409.45	0.00	477.01	100.00
3.60	0.43	4.19	86.18	477.01	0.00	555.71	100.00
4.19	0.52	4.88	86.70	555.71	0.00	647.41	100.00
4.88	0.69	5.69	87.39	647.41	0.00	754.23	100.00
5.69	0.93	6.63	88.32	754.23	0.00	878.67	100.00

Table D12 : Size and size distribution of negatively charged liposomes with the entrapped
10%TA [7:2:1 (10%,TA-)] Lot2

Size Low (μm)	In %	Size High (μm)	Under %	Size Low (μm)	In %	Size High (μm)	Under %
0.05	0.09	0.06	0.09	6.63	1.20	7.72	88.90
0.06	0.22	0.07	0.32	7.72	1.43	9.00	91.32
0.07	0.40	0.08	0.71	9.00	1.57	10.48	92.90
0.08	0.63	0.09	1.34	10.48	1.61	12.21	94.50
0.09	0.95	0.11	2.29	12.21	1.52	14.22	96.02
0.13	2.13	0.15	5.83	16.57	1.03	19.31	98.36
0.15	3.28	0.17	9.12	19.31	0.73	22.49	99.09
0.17	5.13	0.20	14.24	22.49	0.46	26.20	99.55
0.20	7.82	0.23	22.06	26.20	0.26	30.53	99.81
0.23	10.79	0.27	32.85	30.53	0.12	35.56	99.94
0.27	12.28	0.31	45.14	35.56	0.05	41.43	99.98
0.31	11.13	0.36	56.27	41.43	0.01	48.27	100.00
0.36	8.74	0.42	65.01	48.27	0.00	56.23	100.00
0.42	6.72	0.49	72.72	56.23	0.00	65.51	100.00
0.49	4.85	0.58	76.58	65.51	0.00	76.32	100.00
0.58	2.87	0.67	79.58	76.32	0.00	88.91	100.00
0.67	1.49	0.78	80.94	88.91	0.00	103.58	100.00
0.78	0.90	0.91	81.85	103.58	0.00	120.67	100.00
0.91	0.50	1.06	82.35	120.67	0.00	140.58	100.00
1.06	0.21	1.24	82.56	140.58	0.00	163.77	100.00
1.24	0.20	1.44	82.76	163.77	0.00	190.80	100.00
1.44	0.50	1.68	83.26	190.80	0.00	222.28	100.00
1.68	0.62	1.95	83.88	222.28	0.00	258.95	100.00
1.95	0.65	2.28	84.53	258.95	0.00	301.68	100.00
2.28	0.58	2.65	85.11	301.68	0.00	351.46	100.00
2.65	0.50	3.09	85.61	351.46	0.00	409.45	100.00
3.09	0.44	3.60	86.05	409.45	0.00	477.01	100.00
3.60	0.44	4.19	86.49	477.01	0.00	555.71	100.00
4.19	0.54	4.88	87.03	555.71	0.00	647.41	100.00
4.88	0.71	5.69	87.74	647.41	0.00	754.23	100.00
5.69	0.95	6.63	88.69	754.23	0.00	878.67	100.00

CURRICULUM VITAE

Name Miss Koonsup Podjanasoonthon

Date of birth 1st December 1970

Birth Place Nongkhai, Thailand

Education High school degree from Thabo School, Nongkhai, Thailand
B. Pharm. Degree from Rangsit University, Pathumthanee, Thailand

Address 24/3, Moo 2, Jaradonsawan street, Amphur Thabo, Nongkhai,
Thailand

Scientific Presentation Koonsup Podjanasoonthon, Jiradej Manosroi and Aranya Manosroi,
"Development of Multiple Emulsion Containing 2.5% Lidocaine
Hydrochloride," First National Symposium on Grade Research,
Chiang Mai University, Thailand, 10-10 June 2000.