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## APPENDICES

### Appendix A Nitrogen Content of Different Chitosan/Sericin Blend Ratio in Bacterial Cellulose

The amount of chitosan and sericin incorporated into bacterial cellulose pellicle was determined by using Kjeldahl method for determining the nitrogen contents of chitosan and sericin.

**Table A1** Nitrogen content of chitosan/sericin solution different chitosan/sericin blend ratio

| Chitosan/Sericin Blend Ratio | Nitrogen Content in Solution (mg) |       |       |         |      |
|------------------------------|-----------------------------------|-------|-------|---------|------|
|                              | 1                                 | 2     | 3     | Average | S.D. |
| 100/0                        | 12.71                             | 10.15 | 16.40 | 13.09   | 3.14 |
| 75/25                        | 15.98                             | 16.69 | 10.86 | 14.51   | 3.17 |
| 50/50                        | 16.61                             | 18.53 | 23.71 | 19.62   | 3.67 |
| 25/75                        | 21.37                             | 27.26 | 18.60 | 22.41   | 4.42 |
| 0/100                        | 24.64                             | 27.69 | 21.16 | 24.50   | 3.26 |

**Table A2** Nitrogen content of chitosan/sericin different chitosan/sericin blend ratio in bacterial cellulose

| Chitosan/Sericin Blend Ratio | Nitrogen Content in Solution (mg) |       |       |         |      |
|------------------------------|-----------------------------------|-------|-------|---------|------|
|                              | 1                                 | 2     | 3     | Average | S.D. |
| 100/0                        | 10.72                             | 13.56 | 7.32  | 10.53   | 3.12 |
| 75/25                        | 14.41                             | 15.69 | 8.882 | 12.99   | 3.62 |
| 50/50                        | 15.69                             | 17.68 | 20.38 | 17.92   | 2.35 |
| 25/75                        | 19.10                             | 20.94 | 22.79 | 20.94   | 1.84 |
| 0/100                        | 21.23                             | 22.36 | 19.67 | 21.09   | 1.35 |

The chitosan and sericin-incorporated bacterial cellulose was immersed in 1% NaOH to remove sericin out from bacterial cellulose matrix. The bacterial cellulose pellicles are containing chitosan and sericin dissolved in NaOH solution. The amount of chitosan and sericin was determined by using Kjeldahl method for determining the nitrogen contents of chitosan and sericin.

**Table A3** Chitosan content in different chitosan/sericin blend ratio in bacterial cellulose

| Chitosan/Sericin<br>Blend Ratio | Nitrogen Content in Solution (mg) |      |      |         |      |
|---------------------------------|-----------------------------------|------|------|---------|------|
|                                 | 1                                 | 2    | 3    | Average | S.D. |
| 100/0                           | 11.32                             | 9.98 | 9.53 | 10.28   | 0.92 |
| 75/25                           | 10.09                             | 8.51 | 9.78 | 9.46    | 0.83 |
| 50/50                           | 8.80                              | 9.23 | 8.57 | 8.86    | 0.33 |
| 25/75                           | 5.32                              | 4.97 | 5.54 | 5.27    | 0.28 |
| 0/100                           | 0                                 | 0    | 0    | 0       | 0    |

**Table A4** Sericin content in NaOH solution in different chitosan/sericin blend ratio

| Chitosan/Sericin<br>Blend Ratio | Nitrogen Content in Solution (mg) |       |       |         |      |
|---------------------------------|-----------------------------------|-------|-------|---------|------|
|                                 | 1                                 | 2     | 3     | Average | S.D. |
| 100/0                           | 0                                 | 0     | 0     | 0       | 0    |
| 75/25                           | 2.98                              | 3.21  | 3.07  | 3.08    | 0.11 |
| 50/50                           | 8.32                              | 8.99  | 9.51  | 8.94    | 0.59 |
| 25/75                           | 15.79                             | 14.09 | 16.21 | 15.36   | 1.12 |
| 0/100                           | 21.97                             | 21.03 | 19.87 | 20.95   | 1.05 |

## Appendix B Antioxidant Activity of Chitosan and Sericin-incorporated Bacterial Cellulose

The antioxidant activity of chitosan and sericin-incorporated bacterial cellulose was determined based on the 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging activity method.

**Table B1** Antioxidant activity of chitosan and sericin-incorporated bacterial cellulose

| Chitosan/Sericin Blend<br>Ratio |       | Scavenging activity (%) |       |       |         |      |
|---------------------------------|-------|-------------------------|-------|-------|---------|------|
|                                 |       | 1                       | 2     | 3     | Average | S.D. |
| Chitosan A<br>in BC             | 100/0 | 7.38                    | 9.04  | 8.76  | 8.39    | 0.89 |
|                                 | 75/25 | 11.03                   | 12.65 | 10.72 | 11.47   | 1.03 |
|                                 | 50/50 | 13.46                   | 13.50 | 13.67 | 13.54   | 0.11 |
|                                 | 25/75 | 15.02                   | 15.50 | 15.70 | 15.41   | 0.35 |
| Chitosan B<br>in BC             | 100/0 | 6.92                    | 5.30  | 6.01  | 6.08    | 0.80 |
|                                 | 75/25 | 9.65                    | 10.08 | 9.54  | 9.76    | 0.28 |
|                                 | 50/50 | 11.78                   | 12.09 | 11.98 | 11.95   | 0.15 |
|                                 | 25/75 | 13.27                   | 12.49 | 12.48 | 12.75   | 0.44 |
| Sericin in BC                   | 0/100 | 17.81                   | 18.60 | 18.03 | 18.15   | 0.40 |

### Appendix C Antibacterial Activity of Chitosan and Sericin-incorporated Bacterial Cellulose

The antibacterial activity of chitosan and sericin-incorporated bacterial cellulose was determined based on colony forming count method.

**Table C1** Antibacterial Activity of chitosan and sericin-incorporated bacterial cellulose against *S. aureus* at  $1.8 \times 10^{-8}$  cfu/mL.

| Chitosan/Sericin Blend<br>Ratio |       | Bacterial Reduction Rate (%) |       |        |         |      |
|---------------------------------|-------|------------------------------|-------|--------|---------|------|
|                                 |       | 1                            | 2     | 3      | Average | S.D. |
| Chitosan A<br>in BC             | 100/0 | 77.14                        | 66.28 | 70.85  | 71.42   | 5.45 |
|                                 | 75/25 | 60.00                        | 61.14 | 52.00  | 57.71   | 4.61 |
|                                 | 50/50 | 42.28                        | 44.00 | 49.14  | 45.14   | 3.56 |
|                                 | 25/75 | 28.57                        | 26.28 | 36.57  | 30.47   | 5.40 |
| Chitosan B<br>in BC             | 100/0 | 54.28                        | 45.71 | 49.142 | 49.71   | 4.31 |
|                                 | 75/25 | 42.28                        | 30.85 | 27.42  | 33.52   | 7.77 |
|                                 | 50/50 | 23.42                        | 26.28 | 14.85  | 21.52   | 5.94 |
|                                 | 25/75 | 8.00                         | 10.28 | 17.14  | 11.80   | 4.75 |
| Sericin in BC                   | 0/100 | 9.14                         | 7.42  | 15.42  | 10.66   | 4.21 |



**Table C2** Antibacterial Activity of chitosan and sericin-incorporated bacterial cellulose against *E. coli* at  $1.8 \times 10^{-8}$  cfu/mL.

| Chitosan/Sericin Blend |       | Bacterial Reduction Rate (%) |       |       |         |       |
|------------------------|-------|------------------------------|-------|-------|---------|-------|
| Ratio                  |       | 1                            | 2     | 3     | Average | S.D.  |
| Chitosan A<br>in BC    | 100/0 | 71.64                        | 54.63 | 65.40 | 63.89   | 8.60  |
|                        | 75/25 | 46.12                        | 44.42 | 55.19 | 48.58   | 5.43  |
|                        | 50/50 | 41.02                        | 38.18 | 36.48 | 38.56   | 2.29  |
|                        | 25/75 | 34.21                        | 28.54 | 34.78 | 32.51   | 3.44  |
| Chitosan B<br>in BC    | 100/0 | 37.61                        | 46.12 | 29.11 | 37.61   | 8.50  |
|                        | 75/25 | 29.11                        | 22.87 | 21.17 | 24.38   | 4.180 |
|                        | 50/50 | 23.44                        | 15.50 | 10.96 | 16.63   | 6.31  |
|                        | 25/75 | 6.42                         | 14.93 | 12.09 | 11.15   | 4.33  |
| Sericin in BC          | 0/100 | 7.561                        | 12.66 | 1.89  | 7.37    | 5.39  |

## Appendix D Water Vapor Transmission Rate

**Table D1** Water vapor transmission rate of chitosan and sericin-incorporated bacterial cellulose

| Chitosan/Sericin Blend Ratio |       | Water vapor transmission rate (g/m <sup>2</sup> /hour) |         |         |           |        |
|------------------------------|-------|--------------------------------------------------------|---------|---------|-----------|--------|
|                              |       | 1                                                      | 2       | 3       | Average   | S.D.   |
| Pure BC                      |       | 1834.61                                                | 1861.61 | 2331.05 | 2009.09   | 279.15 |
| Chitosan A in BC             | 100/0 | 1554.11                                                | 1793.99 | 1508.87 | 1618.99   | 153.23 |
|                              | 75/25 | 1440.26                                                | 1608.30 | 1506.39 | 1518.32   | 84.65  |
|                              | 50/50 | 1590.90                                                | 1395.64 | 1364.82 | 1450.46   | 122.60 |
|                              | 25/75 | 1391.92                                                | 1363.08 | 1372.15 | 1365.72   | 14.74  |
| Chitosan B in BC             | 100/0 | 1165.54                                                | 1201.23 | 1535.67 | 1300.81   | 204.17 |
|                              | 75/25 | 1034.45                                                | 1294.56 | 1357.9  | 1228.97   | 171.41 |
|                              | 50/50 | 1096.65                                                | 1236.08 | 1145.83 | 1159.52   | 70.71  |
|                              | 25/75 | 1022.42                                                | 1129.53 | 1134.09 | 1095.34   | 63.19  |
| SS in BC                     | 0/100 | 1466.12                                                | 1253.83 | 1337.10 | 1352.3555 | 106.96 |

## Appendix E Sericin Releasing Behavior

**Table E1** Sericin releasing profile of 100/0 chitosan/sericin blend ratio in acetic/acetate buffer at pH 5.5

| Time (hr) | Absorbance at 562 nm | Protein Concentration (mg) | Average | SD     |
|-----------|----------------------|----------------------------|---------|--------|
| 0.166     | -0.0275              | -0.0534                    | -0.0369 | 0.0159 |
|           | -0.0104              | -0.0216                    |         |        |
|           | -0.0179              | -0.0356                    |         |        |
| 0.333     | -0.0111              | -0.0247                    | -0.0165 | 0.0074 |
|           | -0.0040              | -0.0105                    |         |        |
|           | -0.0059              | -0.0143                    |         |        |
| 0.5       | -0.0108              | -0.0241                    | -0.0086 | 0.0149 |
|           | 0.0041               | 0.0056                     |         |        |
|           | -0.0024              | -0.0073                    |         |        |
| 0.75      | -0.0043              | -0.0111                    | -0.0086 | 0.0144 |
|           | -0.0095              | -0.0215                    |         |        |
|           | 0.0047               | 0.0068                     |         |        |
| 1         | -0.0084              | -0.0193                    | -0.0028 | 0.0149 |
|           | 0.0019               | 0.0012                     |         |        |
|           | 0.0061               | 0.0096                     |         |        |
| 1.30      | -0.0030              | -0.0085                    | -0.0031 | 0.0080 |
|           | -0.0021              | -0.0067                    |         |        |
|           | 0.0043               | 0.0060                     |         |        |
| 2         | 0.0028               | 0.0030                     | 0.0123  | 0.0082 |
|           | 0.0088               | 0.0150                     |         |        |
|           | 0.0107               | 0.0188                     |         |        |
| 3         | 0.0085               | 0.0144                     | 0.0091  | 0.0053 |
|           | 0.0032               | 0.0038                     |         |        |
|           | 0.0057               | 0.0088                     |         |        |

| Time (hr) | Absorbance at 562 nm | Protein Concentration (mg) | Average | SD     |
|-----------|----------------------|----------------------------|---------|--------|
| 5         | -0.0063              | -0.0151                    | 0.0042  | 0.0168 |
|           | 0.0090               | 0.0154                     |         |        |
|           | 0.0074               | 0.0122                     |         |        |
| 8         | -0.0053              | -0.0131                    | 0.0028  | 0.0139 |
|           | 0.0073               | 0.0120                     |         |        |
|           | 0.0060               | 0.0094                     |         |        |
| 12        | -0.0045              | -0.0115                    | -0.0002 | 0.0108 |
|           | 0.0018               | 0.0010                     |         |        |
|           | 0.0062               | 0.0098                     |         |        |
| 24        | 0.0022               | 0.0018                     | 0.0060  | 0.0099 |
|           | 0.0099               | 0.0172                     |         |        |
|           | 0.0007               | -0.0011                    |         |        |
| 36        | 0.0017               | 0.0008                     | 0.0103  | 0.0084 |
|           | 0.0078               | 0.0130                     |         |        |
|           | 0.0098               | 0.0170                     |         |        |
| 48        | 0.0058               | 0.0090                     | 0.0165  | 0.0099 |
|           | 0.0151               | 0.0276                     |         |        |
|           | 0.0076               | 0.0126                     |         |        |
| 60        | 0.0080               | 0.0130                     | 0.0225  | 0.0088 |
|           | 0.0133               | 0.0240                     |         |        |
|           | 0.0165               | 0.0304                     |         |        |
| 72        | 0.0110               | 0.0188                     | 0.0271  | 0.0080 |
|           | 0.0150               | 0.0274                     |         |        |
|           | 0.0187               | 0.0348                     |         |        |

**Table E2** Sericin releasing profile of 75/25 chitosan/sericin blend ratio in acetic/acetate buffer at pH 5.5

| Time (hr) | Absorbance at 562 nm | Protein Concentration (mg) | Average | SD     |
|-----------|----------------------|----------------------------|---------|--------|
| 0.166     | -0.0040              | -0.0098                    | 0.0137  | 0.0206 |
|           | 0.0165               | 0.0283                     |         |        |
|           | 0.0135               | 0.0227                     |         |        |
| 0.333     | 0.0079               | 0.0132                     | 0.0259  | 0.0110 |
|           | 0.0169               | 0.0312                     |         |        |
|           | 0.0179               | 0.0332                     |         |        |
| 0.5       | 0.0111               | 0.0196                     | 0.0283  | 0.0115 |
|           | 0.0132               | 0.0238                     |         |        |
|           | 0.0219               | 0.0412                     |         |        |
| 0.75      | 0.0122               | 0.0218                     | 0.0288  | 0.0134 |
|           | 0.0114               | 0.0202                     |         |        |
|           | 0.0234               | 0.0442                     |         |        |
| 1         | 0.0155               | 0.0284                     | 0.0467  | 0.0159 |
|           | 0.0287               | 0.0548                     |         |        |
|           | 0.0297               | 0.0568                     |         |        |
| 1.30      | 0.0170               | 0.0314                     | 0.0384  | 0.0171 |
|           | 0.0142               | 0.0258                     |         |        |
|           | 0.0302               | 0.0578                     |         |        |
| 2         | 0.0126               | 0.0226                     | 0.0405  | 0.0166 |
|           | 0.0230               | 0.0434                     |         |        |
|           | 0.0290               | 0.0554                     |         |        |
| 3         | 0.0487               | 0.0948                     | 0.0761  | 0.0163 |
|           | 0.0341               | 0.0656                     |         |        |
|           | 0.0352               | 0.0678                     |         |        |

| Time (hr) | Absorbance at 562 nm | Protein Concentration (mg) | Average | SD     |
|-----------|----------------------|----------------------------|---------|--------|
| 5         | 0.0834               | 0.1642                     | 0.1038  | 0.0524 |
|           | 0.0375               | 0.0724                     |         |        |
|           | 0.0386               | 0.0746                     |         |        |
| 8         | 0.0772               | 0.1518                     | 0.1183  | 0.0293 |
|           | 0.0505               | 0.098                      |         |        |
|           | 0.0535               | 0.1044                     |         |        |
| 12        | 0.1306               | 0.2586                     | 0.1961  | 0.0545 |
|           | 0.0805               | 0.1584                     |         |        |
|           | 0.0869               | 0.1712                     |         |        |
| 24        | 0.1206               | 0.2786                     | 0.2708  | 0.0288 |
|           | 0.1407               | 0.2388                     |         |        |
|           | 0.1487               | 0.2948                     |         |        |
| 36        | 0.1569               | 0.3112                     | 0.3271  | 0.0141 |
|           | 0.1673               | 0.3320                     |         |        |
|           | 0.1703               | 0.3380                     |         |        |
| 48        | 0.1670               | 0.3314                     | 0.3367  | 0.0045 |
|           | 0.1710               | 0.3394                     |         |        |
|           | 0.1708               | 0.3390                     |         |        |
| 60        | 0.1750               | 0.3474                     | 0.3489  | 0.0080 |
|           | 0.1721               | 0.3416                     |         |        |
|           | 0.1800               | 0.3574                     |         |        |
| 72        | 0.1760               | 0.3494                     | 0.3513  | 0.0094 |
|           | 0.1727               | 0.3428                     |         |        |
|           | 0.182                | 0.3614                     |         |        |

**Table E3** Sericin releasing profile of 50/50 chitosan/sericin blend ratio in acetic/acetate buffer at pH 5.5

| Time (hr) | Absorbance at 562 nm | Protein Concentration (mg) | Average | SD     |
|-----------|----------------------|----------------------------|---------|--------|
| 0.166     | 0.0060               | 0.0088                     | 0.0233  | 0.0153 |
|           | 0.0223               | 0.0392                     |         |        |
|           | 0.0130               | 0.0218                     |         |        |
| 0.333     | 0.0101               | 0.0177                     | 0.0339  | 0.0171 |
|           | 0.0271               | 0.0517                     |         |        |
|           | 0.0174               | 0.0323                     |         |        |
| 0.5       | 0.0193               | 0.0361                     | 0.0546  | 0.0192 |
|           | 0.0385               | 0.0745                     |         |        |
|           | 0.0279               | 0.0533                     |         |        |
| 0.75      | 0.0309               | 0.0593                     | 0.0740  | 0.0257 |
|           | 0.0531               | 0.1037                     |         |        |
|           | 0.0308               | 0.0591                     |         |        |
| 1         | 0.0284               | 0.0543                     | 0.0745  | 0.0228 |
|           | 0.05090              | 0.0993                     |         |        |
|           | 0.0362               | 0.0699                     |         |        |
| 1.30      | 0.03930              | 0.0761                     | 0.0848  | 0.0077 |
|           | 0.0451               | 0.0877                     |         |        |
|           | 0.0466               | 0.0907                     |         |        |
| 2         | 0.0422               | 0.0819                     | 0.1054  | 0.0204 |
|           | 0.0604               | 0.1183                     |         |        |
|           | 0.0593               | 0.1161                     |         |        |
| 3         | 0.0854               | 0.1683                     | 0.1421  | 0.0227 |
|           | 0.0654               | 0.1283                     |         |        |
|           | 0.0661               | 0.1297                     |         |        |

| Time (hr) | Absorbance at 562 nm | Protein Concentration (mg) | Average | SD     |
|-----------|----------------------|----------------------------|---------|--------|
| 5         | 0.1672               | 0.3319                     | 0.2552  | 0.0665 |
|           | 0.1118               | 0.2211                     |         |        |
|           | 0.1076               | 0.2127                     |         |        |
| 8         | 0.1920               | 0.3815                     | 0.3121  | 0.0646 |
|           | 0.15189              | 0.3013                     |         |        |
|           | 0.1281               | 0.2537                     |         |        |
| 12        | 0.2555               | 0.5087                     | 0.4250  | 0.0791 |
|           | 0.2087               | 0.4149                     |         |        |
|           | 0.1770               | 0.3515                     |         |        |
| 24        | 0.2741               | 0.5457                     | 0.5135  | 0.0381 |
|           | 0.2630               | 0.5235                     |         |        |
|           | 0.2370               | 0.4715                     |         |        |
| 36        | 0.2753               | 0.5483                     | 0.5675  | 0.0457 |
|           | 0.3111               | 0.6197                     |         |        |
|           | 0.2685               | 0.5345                     |         |        |
| 48        | 0.2863               | 0.5701                     | 0.5948  | 0.0492 |
|           | 0.3270               | 0.6515                     |         |        |
|           | 0.2827               | 0.5629                     |         |        |
| 60        | 0.2860               | 0.5695                     | 0.6149  | 0.0411 |
|           | 0.3260               | 0.6495                     |         |        |
|           | 0.3142               | 0.6259                     |         |        |
| 72        | 0.2840               | 0.5655                     | 0.6401  | 0.0658 |
|           | 0.3340               | 0.6655                     |         |        |
|           | 0.3460               | 0.6895                     |         |        |



**Table E4** Sericin releasing profile of 25/75 chitosan/sericin blend ratio in acetic/acetate buffer at pH 5.5

| Time (hr) | Absorbance at 562 nm | Protein Concentration (mg) | Average | SD     |
|-----------|----------------------|----------------------------|---------|--------|
| 0.166     | 0.0168               | 0.0288                     | 0.0296  | 0.0061 |
|           | 0.0142               | 0.0240                     |         |        |
|           | 0.0207               | 0.0361                     |         |        |
| 0.333     | 0.0618               | 0.1211                     | 0.1167  | 0.0079 |
|           | 0.0551               | 0.1077                     |         |        |
|           | 0.0620               | 0.1215                     |         |        |
| 0.5       | 0.0872               | 0.1719                     | 0.1710  | 0.0067 |
|           | 0.0899               | 0.1773                     |         |        |
|           | 0.0832               | 0.1639                     |         |        |
| 0.75      | 0.1183               | 0.2341                     | 0.2595  | 0.0223 |
|           | 0.1393               | 0.2761                     |         |        |
|           | 0.1354               | 0.2683                     |         |        |
| 1         | 0.1250               | 0.2475                     | 0.2451  | 0.0176 |
|           | 0.1145               | 0.2265                     |         |        |
|           | 0.1320               | 0.2615                     |         |        |
| 1.30      | 0.1190               | 0.2355                     | 0.2531  | 0.0268 |
|           | 0.1212               | 0.2399                     |         |        |
|           | 0.1432               | 0.2839                     |         |        |
| 2         | 0.1332               | 0.2639                     | 0.2799  | 0.0246 |
|           | 0.1351               | 0.2677                     |         |        |
|           | 0.1554               | 0.3083                     |         |        |
| 3         | 0.1878               | 0.3731                     | 0.3397  | 0.0376 |
|           | 0.1507               | 0.2989                     |         |        |
|           | 0.1748               | 0.3471                     |         |        |

| Time (hr) | Absorbance at 562 nm | Protein Concentration (mg) | Average | SD     |
|-----------|----------------------|----------------------------|---------|--------|
| 5         | 0.1893               | 0.3761                     | 0.3382  | 0.0378 |
|           | 0.1515               | 0.3005                     |         |        |
|           | 0.1703               | 0.3381                     |         |        |
| 8         | 0.2839               | 0.5653                     | 0.4950  | 0.0637 |
|           | 0.2406               | 0.4787                     |         |        |
|           | 0.2218               | 0.4411                     |         |        |
| 12        | 0.3534               | 0.7043                     | 0.6491  | 0.0571 |
|           | 0.3276               | 0.6527                     |         |        |
|           | 0.2964               | 0.5903                     |         |        |
| 24        | 0.3758               | 0.7491                     | 0.7761  | 0.0246 |
|           | 0.3999               | 0.7973                     |         |        |
|           | 0.3922               | 0.7819                     |         |        |
| 36        | 0.3869               | 0.7713                     | 0.8060  | 0.0306 |
|           | 0.4102               | 0.8179                     |         |        |
|           | 0.4157               | 0.8289                     |         |        |
| 48        | 0.3844               | 0.7663                     | 0.8113  | 0.0409 |
|           | 0.4121               | 0.8217                     |         |        |
|           | 0.4243               | 0.8461                     |         |        |
| 60        | 0.3860               | 0.7695                     | 0.8229  | 0.0504 |
|           | 0.4161               | 0.8297                     |         |        |
|           | 0.4361               | 0.8697                     |         |        |
| 72        | 0.3971               | 0.7917                     | 0.8337  | 0.0415 |
|           | 0.4187               | 0.8349                     |         |        |
|           | 0.4386               | 0.8747                     |         |        |

**Table E5** Sericin releasing profile of 0/100 chitosan/sericin blend ratio in acetic/acetate buffer at pH 5.5

| Time (hr) | Absorbance at 562 nm | Protein Concentration (mg) | Average | SD     |
|-----------|----------------------|----------------------------|---------|--------|
| 0.166     | 0.0154               | 0.0262                     | 0.0328  | 0.0056 |
|           | 0.0207               | 0.0361                     |         |        |
|           | 0.0207               | 0.0361                     |         |        |
| 0.333     | 0.0393               | 0.0761                     | 0.0729  | 0.0103 |
|           | 0.0320               | 0.0615                     |         |        |
|           | 0.0420               | 0.0815                     |         |        |
| 0.5       | 0.0799               | 0.1573                     | 0.1549  | 0.0101 |
|           | 0.0732               | 0.1439                     |         |        |
|           | 0.0832               | 0.1639                     |         |        |
| 0.75      | 0.1108               | 0.2191                     | 0.2518  | 0.0284 |
|           | 0.1354               | 0.2683                     |         |        |
|           | 0.1354               | 0.2683                     |         |        |
| 1         | 0.1534               | 0.3043                     | 0.3327  | 0.0247 |
|           | 0.1748               | 0.3471                     |         |        |
|           | 0.1748               | 0.3471                     |         |        |
| 1.30      | 0.1677               | 0.3329                     | 0.3363  | 0.0030 |
|           | 0.1703               | 0.3381                     |         |        |
|           | 0.1703               | 0.3381                     |         |        |
| 2         | 0.1720               | 0.3415                     | 0.3545  | 0.0113 |
|           | 0.1818               | 0.3611                     |         |        |
|           | 0.1818               | 0.3611                     |         |        |
| 3         | 0.2587               | 0.5149                     | 0.5651  | 0.0435 |
|           | 0.2964               | 0.5903                     |         |        |
|           | 0.2964               | 0.5903                     |         |        |

| Time (hr) | Absorbance at 562 nm | Protein Concentration (mg) | Average | SD     |
|-----------|----------------------|----------------------------|---------|--------|
| 5         | 0.3774               | 0.7523                     | 0.7853  | 0.0286 |
|           | 0.4022               | 0.8019                     |         |        |
|           | 0.4022               | 0.8019                     |         |        |
| 8         | 0.3961               | 0.7897                     | 0.8825  | 0.0804 |
|           | 0.4657               | 0.9289                     |         |        |
|           | 0.4657               | 0.9289                     |         |        |
| 12        | 0.4465               | 0.8905                     | 0.9542  | 0.0552 |
|           | 0.4943               | 0.9861                     |         |        |
|           | 0.4943               | 0.9861                     |         |        |
| 24        | 0.4854               | 0.9683                     | 0.9892  | 0.0207 |
|           | 0.5061               | 1.0097                     |         |        |
|           | 0.4961               | 0.9897                     |         |        |
| 36        | 0.4991               | 0.9957                     | 1.0069  | 0.0100 |
|           | 0.5086               | 1.0147                     |         |        |
|           | 0.5065               | 1.0105                     |         |        |
| 48        | 0.5093               | 1.0161                     | 1.0249  | 0.0076 |
|           | 0.5157               | 1.0289                     |         |        |
|           | 0.5161               | 1.0297                     |         |        |
| 60        | 0.5152               | 1.0279                     | 1.0323  | 0.0076 |
|           | 0.5152               | 1.0279                     |         |        |
|           | 0.5218               | 1.0411                     |         |        |
| 72        | 0.5191               | 1.0357                     | 1.0406  | 0.0122 |
|           | 0.5171               | 1.0317                     |         |        |
|           | 0.5285               | 1.0545                     |         |        |

## Appendix F Chitosan Releasing Behavior

**Table F1** Chitosan releasing profile of 100/0 chitosan/sericin blend ratio in acetic/acetate buffer at pH 5.5

| Time (hr) | Absorbance at 570 nm | Chitosan Concentration (mg) | Average | SD     |
|-----------|----------------------|-----------------------------|---------|--------|
| 0.166     | 0.0275               | 3.5694                      | 3.8380  | 0.2665 |
|           | 0.0316               | 4.1024                      |         |        |
|           | 0.0296               | 3.8424                      |         |        |
| 0.333     | 0.0357               | 4.9919                      | 5.6733  | 0.9155 |
|           | 0.0380               | 5.3139                      |         |        |
|           | 0.0480               | 6.7139                      |         |        |
| 0.5       | 0.0372               | 5.2019                      | 5.5473  | 1.0514 |
|           | 0.0337               | 4.7119                      |         |        |
|           | 0.0481               | 6.7279                      |         |        |
| 0.75      | 0.0385               | 5.3839                      | 5.1833  | 1.1403 |
|           | 0.0444               | 6.2099                      |         |        |
|           | 0.0283               | 3.9559                      |         |        |
| 1         | 0.0433               | 6.0559                      | 7.6939  | 1.4199 |
|           | 0.0604               | 8.4499                      |         |        |
|           | 0.0613               | 8.5759                      |         |        |
| 1.30      | 0.0527               | 7.3719                      | 7.3953  | 0.6793 |
|           | 0.0578               | 8.0859                      |         |        |
|           | 0.0481               | 6.7279                      |         |        |
| 2         | 0.0778               | 10.8859                     | 12.3933 | 1.6450 |
|           | 0.0868               | 12.1459                     |         |        |
|           | 0.1011               | 14.1479                     |         |        |
| 3         | 0.0929               | 12.9999                     | 12.8879 | 0.6098 |
|           | 0.0960               | 13.4339                     |         |        |
|           | 0.0874               | 12.2299                     |         |        |

| Time (hr) | Absorbance at 570 nm | Chitosan Concentration (mg) | Average | SD     |
|-----------|----------------------|-----------------------------|---------|--------|
| 5         | 0.1096               | 15.3379                     | 15.6506 | 0.4593 |
|           | 0.1103               | 15.4359                     |         |        |
|           | 0.1156               | 16.1779                     |         |        |
| 8         | 0.1304               | 18.2499                     | 17.5079 | 1.7400 |
|           | 0.1109               | 15.5199                     |         |        |
|           | 0.1340               | 18.7539                     |         |        |
| 12        | 0.1379               | 19.2999                     | 21.2973 | 1.7480 |
|           | 0.1611               | 22.5479                     |         |        |
|           | 0.1575               | 22.0439                     |         |        |
| 24        | 0.1793               | 25.0959                     | 25.2826 | 0.5160 |
|           | 0.1778               | 24.8859                     |         |        |
|           | 0.1848               | 25.8659                     |         |        |
| 36        | 0.2033               | 28.4559                     | 28.9133 | 0.4483 |
|           | 0.2067               | 28.9319                     |         |        |
|           | 0.2097               | 29.3519                     |         |        |
| 48        | 0.2167               | 30.3319                     | 30.9806 | 0.8493 |
|           | 0.2191               | 30.6679                     |         |        |
|           | 0.2282               | 31.9419                     |         |        |
| 60        | 0.2168               | 30.3459                     | 31.0413 | 0.8465 |
|           | 0.2200               | 30.7939                     |         |        |
|           | 0.2285               | 31.9839                     |         |        |
| 72        | 0.2191               | 30.6679                     | 30.8546 | 1.3537 |
|           | 0.2307               | 32.2919                     |         |        |
|           | 0.2115               | 29.6039                     |         |        |

**Table F2** Chitosan releasing profile of 75/25 chitosan/sericin blend ratio in acetic/acetate buffer at pH 5.5

| Time (hr) | Absorbance at 570 nm | Chitosan Concentration (mg) | Average | SD     |
|-----------|----------------------|-----------------------------|---------|--------|
| 0.166     | 0.0170               | 2.2044                      | 3.3094  | 0.9596 |
|           | 0.0303               | 3.9334                      |         |        |
|           | 0.0292               | 3.7904                      |         |        |
| 0.333     | 0.0281               | 3.9279                      | 4.5906  | 0.6796 |
|           | 0.0326               | 4.5579                      |         |        |
|           | 0.0378               | 5.2859                      |         |        |
| 0.5       | 0.0343               | 4.7959                      | 4.8286  | 0.1773 |
|           | 0.0334               | 4.6699                      |         |        |
|           | 0.0359               | 5.0199                      |         |        |
| 0.75      | 0.0381               | 5.3279                      | 5.0199  | 0.3229 |
|           | 0.0361               | 5.0479                      |         |        |
|           | 0.0335               | 4.6839                      |         |        |
| 1         | 0.0357               | 4.9919                      | 5.7666  | 0.7118 |
|           | 0.0423               | 5.9159                      |         |        |
|           | 0.0457               | 6.3919                      |         |        |
| 1.30      | 0.0455               | 6.3639                      | 7.0686  | 0.6170 |
|           | 0.0524               | 7.3299                      |         |        |
|           | 0.0537               | 7.5119                      |         |        |
| 2         | 0.0639               | 8.9399                      | 9.2386  | 1.2589 |
|           | 0.0759               | 10.6199                     |         |        |
|           | 0.0583               | 8.1559                      |         |        |
| 3         | 0.0670               | 9.3739                      | 10.3259 | 0.8508 |
|           | 0.0757               | 10.5919                     |         |        |
|           | 0.0787               | 11.0119                     |         |        |

| Time (hr) | Absorbance at 570 nm | Chitosan Concentration (mg) | Average | SD     |
|-----------|----------------------|-----------------------------|---------|--------|
| 5         | 0.0908               | 12.7059                     | 13.0046 | 0.3515 |
|           | 0.0957               | 13.3919                     |         |        |
|           | 0.0923               | 12.9159                     |         |        |
| 8         | 0.1054               | 14.7499                     | 16.1406 | 1.2850 |
|           | 0.1171               | 16.3879                     |         |        |
|           | 0.1235               | 17.2839                     |         |        |
| 12        | 0.1216               | 17.0179                     | 18.8566 | 1.6660 |
|           | 0.1378               | 19.2859                     |         |        |
|           | 0.1448               | 20.2659                     |         |        |
| 24        | 0.1470               | 20.5739                     | 22.3473 | 1.6208 |
|           | 0.1697               | 23.7519                     |         |        |
|           | 0.1623               | 22.7159                     |         |        |
| 36        | 0.1758               | 24.6059                     | 25.0773 | 0.4990 |
|           | 0.1788               | 25.0259                     |         |        |
|           | 0.1829               | 25.5999                     |         |        |
| 48        | 0.1869               | 26.1599                     | 26.5659 | 0.4628 |
|           | 0.1934               | 27.0699                     |         |        |
|           | 0.1891               | 26.4679                     |         |        |
| 60        | 0.1907               | 26.6919                     | 26.7899 | 0.4354 |
|           | 0.1887               | 26.4119                     |         |        |
|           | 0.1948               | 27.2659                     |         |        |
| 72        | 0.2017               | 28.2319                     | 27.2146 | 0.8811 |
|           | 0.1907               | 26.6919                     |         |        |
|           | 0.1909               | 26.7199                     |         |        |



**Table F3** Chitosan releasing profile of 50/50 chitosan/sericin blend ratio in acetic/acetate buffer at pH 5.5

| Time (hr) | Absorbance at 570 nm | Chitosan Concentration (mg) | Average | SD     |
|-----------|----------------------|-----------------------------|---------|--------|
| 0.166     | 0.0068               | 0.8784                      | 2.0917  | 1.0765 |
|           | 0.0226               | 2.9324                      |         |        |
|           | 0.0190               | 2.4644                      |         |        |
| 0.333     | 0.0168               | 2.3459                      | 3.1813  | 0.8698 |
|           | 0.0223               | 3.1159                      |         |        |
|           | 0.0292               | 4.0819                      |         |        |
| 0.5       | 0.0237               | 3.3119                      | 4.4599  | 1.0083 |
|           | 0.0372               | 5.2019                      |         |        |
|           | 0.0348               | 4.8659                      |         |        |
| 0.75      | 0.0304               | 4.2499                      | 4.4179  | 0.3790 |
|           | 0.0347               | 4.8519                      |         |        |
|           | 0.0297               | 4.1519                      |         |        |
| 1         | 0.0315               | 4.4039                      | 4.7773  | 0.3260 |
|           | 0.0352               | 4.9219                      |         |        |
|           | 0.0358               | 5.0059                      |         |        |
| 1.30      | 0.0318               | 4.4459                      | 4.4179  | 0.3508 |
|           | 0.0290               | 4.0539                      |         |        |
|           | 0.0340               | 4.7539                      |         |        |
| 2         | 0.0347               | 4.8519                      | 5.5753  | 0.6404 |
|           | 0.0415               | 5.8039                      |         |        |
|           | 0.0434               | 6.0699                      |         |        |
| 3         | 0.0465               | 6.5039                      | 7.0266  | 0.6175 |
|           | 0.0551               | 7.7079                      |         |        |
|           | 0.0491               | 6.8679                      |         |        |

| Time (hr) | Absorbance at 570 nm | Chitosan Concentration (mg) | Average | SD     |
|-----------|----------------------|-----------------------------|---------|--------|
| 5         | 0.0573               | 8.0159                      | 7.2599  | 0.6642 |
|           | 0.0500               | 6.9939                      |         |        |
|           | 0.0484               | 6.7699                      |         |        |
| 8         | 0.0770               | 10.7739                     | 11.2639 | 0.4447 |
|           | 0.0832               | 11.6419                     |         |        |
|           | 0.0813               | 11.3759                     |         |        |
| 12        | 0.0857               | 11.9919                     | 12.1553 | 0.2709 |
|           | 0.0891               | 12.4679                     |         |        |
|           | 0.0858               | 12.0059                     |         |        |
| 24        | 0.1263               | 17.6759                     | 17.8066 | 0.2263 |
|           | 0.1263               | 17.6759                     |         |        |
|           | 0.1291               | 18.0679                     |         |        |
| 36        | 0.1405               | 19.6639                     | 20.1679 | 0.7211 |
|           | 0.1418               | 19.8459                     |         |        |
|           | 0.1500               | 20.9939                     |         |        |
| 48        | 0.1613               | 22.5759                     | 22.7066 | 0.7921 |
|           | 0.1571               | 21.9879                     |         |        |
|           | 0.1683               | 23.5559                     |         |        |
| 60        | 0.1667               | 23.3319                     | 22.7829 | 0.6361 |
|           | 0.1578               | 22.0859                     |         |        |
|           | 0.1638               | 22.9310                     |         |        |
| 72        | 0.1552               | 21.7219                     | 22.6366 | 0.8604 |
|           | 0.1626               | 22.7579                     |         |        |
|           | 0.1674               | 23.4299                     |         |        |

**Table F4** Chitosan releasing profile of 25/75 chitosan/sericin blend ratio in acetic/acetate buffer at pH 5.5

| Time (hr) | Absorbance at 570 nm | Chitosan Concentration (mg) | Average | SD     |
|-----------|----------------------|-----------------------------|---------|--------|
| 0.166     | -0.0043              | -0.5646                     | 0.1417  | 0.6621 |
|           | 0.0058               | 0.7484                      |         |        |
|           | 0.0019               | 0.2414                      |         |        |
| 0.333     | 0.0156               | 2.1779                      | 2.4346  | 0.4446 |
|           | 0.0156               | 2.1779                      |         |        |
|           | 0.0211               | 2.9479                      |         |        |
| 0.5       | 0.0335               | 4.6839                      | 4.7679  | 1.7935 |
|           | 0.0216               | 3.0179                      |         |        |
|           | 0.0472               | 6.6019                      |         |        |
| 0.75      | 0.0292               | 4.0819                      | 4.3666  | 0.2737 |
|           | 0.0331               | 4.6279                      |         |        |
|           | 0.0314               | 4.3899                      |         |        |
| 1         | 0.0413               | 5.7759                      | 5.4819  | 0.4385 |
|           | 0.0407               | 5.6919                      |         |        |
|           | 0.0356               | 4.9779                      |         |        |
| 1.30      | 0.0518               | 7.2459                      | 7.5866  | 0.3017 |
|           | 0.0559               | 7.8199                      |         |        |
|           | 0.0550               | 7.6939                      |         |        |
| 2         | 0.0554               | 7.7499                      | 7.9693  | 0.3559 |
|           | 0.0556               | 7.7779                      |         |        |
|           | 0.0599               | 8.3799                      |         |        |
| 3         | 0.0552               | 7.7219                      | 7.9599  | 0.4002 |
|           | 0.0602               | 8.4219                      |         |        |
|           | 0.0553               | 7.7359                      |         |        |

| Time (hr) | Absorbance at 570 nm | Chitosan Concentration (mg) | Average | SD     |
|-----------|----------------------|-----------------------------|---------|--------|
| 5         | 0.0685               | 9.5839                      | 9.1826  | 0.7815 |
|           | 0.0592               | 8.2819                      |         |        |
|           | 0.0692               | 9.6819                      |         |        |
| 8         | 0.0725               | 10.1439                     | 10.6339 | 0.4766 |
|           | 0.0793               | 11.0959                     |         |        |
|           | 0.0762               | 10.6619                     |         |        |
| 12        | 0.0729               | 10.1999                     | 10.9093 | 2.2014 |
|           | 0.0654               | 9.1499                      |         |        |
|           | 0.0956               | 13.3779                     |         |        |
| 24        | 0.0956               | 13.3779                     | 13.9277 | 0.5053 |
|           | 0.1002               | 14.0331                     |         |        |
|           | 0.1027               | 14.3719                     |         |        |
| 36        | 0.1108               | 15.5059                     | 15.2166 | 0.3554 |
|           | 0.1095               | 15.3239                     |         |        |
|           | 0.1059               | 14.8199                     |         |        |
| 48        | 0.1226               | 17.1649                     | 15.9096 | 1.2636 |
|           | 0.1046               | 14.6379                     |         |        |
|           | 0.1138               | 15.9259                     |         |        |
| 60        | 0.1134               | 15.8699                     | 16.0379 | 1.1711 |
|           | 0.1235               | 17.2839                     |         |        |
|           | 0.1069               | 14.9599                     |         |        |
| 72        | 0.1103               | 15.4359                     | 16.0239 | 0.6691 |
|           | 0.1135               | 15.8839                     |         |        |
|           | 0.1197               | 16.7519                     |         |        |

**Table F5** Chitosan releasing profile of 0/100 chitosan/sericin blend ratio in acetic/acetate buffer at pH 5.5

| Time (hr) | Absorbance at 570 nm | Chitosan Concentration (mg) | Average | SD     |
|-----------|----------------------|-----------------------------|---------|--------|
| 0.166     | -0.0013              | -0.1746                     | -0.3003 | 0.3366 |
|           | -0.0003              | -0.0446                     |         |        |
|           | -0.0052              | -0.6816                     |         |        |
| 0.333     | -0.0003              | -0.0481                     | -0.4541 | 0.3632 |
|           | -0.0053              | -0.7481                     |         |        |
|           | -0.0040              | -0.5661                     |         |        |
| 0.5       | -0.0012              | -0.1741                     | 0.0177  | 0.3071 |
|           | 0.0027               | 0.3719                      |         |        |
|           | -0.0010              | -0.1447                     |         |        |
| 0.75      | 0.0008               | 0.1059                      | 0.2413  | 0.1402 |
|           | 0.0017               | 0.2319                      |         |        |
|           | 0.0028               | 0.3859                      |         |        |
| 1         | 0.0016               | 0.2179                      | 0.1993  | 0.0583 |
|           | 0.0010               | 0.1339                      |         |        |
|           | 0.0018               | 0.2459                      |         |        |
| 1.30      | 0.0019               | 0.2711                      | 0.2777  | 0.0493 |
|           | 0.0017               | 0.2319                      |         |        |
|           | 0.0024               | 0.3299                      |         |        |
| 2         | 0.0019               | 0.2599                      | 0.2693  | 0.1542 |
|           | 0.0009               | 0.1199                      |         |        |
|           | 0.0031               | 0.4279                      |         |        |
| 3         | 0.0024               | 0.3299                      | 0.2506  | 0.0718 |
|           | 0.0014               | 0.1899                      |         |        |
|           | 0.0017               | 0.2319                      |         |        |

| Time (hr) | Absorbance at 570 nm | Chitosan Concentration (mg) | Average | SD     |
|-----------|----------------------|-----------------------------|---------|--------|
| 5         | 0.0031               | 0.4279                      | 0.3859  | 0.0420 |
|           | 0.0025               | 0.3439                      |         |        |
|           | 0.0028               | 0.3859                      |         |        |
| 8         | 0.0068               | 0.9459                      | 0.8806  | 0.0796 |
|           | 0.0065               | 0.9039                      |         |        |
|           | 0.0057               | 0.7919                      |         |        |
| 12        | 0.0078               | 1.0859                      | 1.1233  | 0.0771 |
|           | 0.0077               | 1.0719                      |         |        |
|           | 0.0087               | 1.2119                      |         |        |
| 24        | 0.0115               | 1.6039                      | 1.4406  | 0.3200 |
|           | 0.0077               | 1.0719                      |         |        |
|           | 0.0118               | 1.6459                      |         |        |
| 36        | 0.0128               | 1.7859                      | 1.6039  | 0.1590 |
|           | 0.0110               | 1.5339                      |         |        |
|           | 0.0107               | 1.4919                      |         |        |
| 48        | 0.0118               | 1.6459                      | 1.6926  | 0.0808 |
|           | 0.0118               | 1.6459                      |         |        |
|           | 0.0128               | 1.7859                      |         |        |
| 60        | 0.0117               | 1.6319                      | 1.6926  | 0.0932 |
|           | 0.0118               | 1.6459                      |         |        |
|           | 0.0129               | 1.7999                      |         |        |
| 72        | 0.0107               | 1.4919                      | 1.7206  | 0.2040 |
|           | 0.0128               | 1.7859                      |         |        |
|           | 0.0135               | 1.8839                      |         |        |

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**Presentations:**

1. La-ongnuan, T.; and Rujiravanit, R. (2013, April 23<sup>rd</sup>) Development of Wound Dressing with Enhanced Wound Healing Properties: Preparation of Chitosan/Silk Serecin-incorporated Bacterial Cellulose. Paper presented at the 4<sup>th</sup> Research Symposium on Petroleum, Petrochemicals, and Advanced Materials and The 19<sup>th</sup> PPC Symposium on Petroleum, Petrochemicals, and Polymers, Bangkok, Thailand.