

## ***APPENDIX***

Examples of data from various trials including release studies, particle size analysis, FT-IR spectra, BET pore size and specific surface area analysis are shown.

### **A.1 POLYAMIDE MICROCAPSULES**

In the interfacial polymerisation trials, the effects of different solvents, ratio of solvents, amine to chloride ratio, and diamine to triamine ratio on processing microcapsules by interfacial polymerisation were determined and examined by SEM (raw data not showed).

**Table A-1 Preparation conditions of polyamide microcapsules**

| <b>Batch No.</b> | <b>Solvent mixture (v/v)</b> | <b>Amine:chloride</b> | <b>Diamine:triamine</b> |
|------------------|------------------------------|-----------------------|-------------------------|
| 1                | Chloroform/cyclohexane (3:1) | 1:1                   | 1:0                     |
| 2                | Chloroform/cyclohexane (3:1) | 1:1                   | 1:1                     |
| 3                | Chloroform/cyclohexane (3:1) | 1:1                   | 0:1                     |
| 4                | Chloroform/cyclohexane (3:1) | 1:1.5                 | 1:0                     |
| 5                | Chloroform/cyclohexane (3:1) | 1:1.5                 | 1:1                     |
| 6                | Chloroform/cyclohexane (3:1) | 1:1.5                 | 2:1                     |
| 7                | Chloroform/cyclohexane (3:1) | 1:1.5                 | 1:2                     |
| 8                | Benzene/xylene (2:1)         | 1:1                   | 1:0                     |
| 9                | Benzene/xylene (2:1)         | 1:1                   | 1:1                     |
| 10               | Benzene/xylene (2:1)         | 1:1                   | 0:1                     |
| 11               | Benzene/xylene (2:1)         | 1:1.5                 | 1:0                     |
| 12               | Benzene/xylene (2:1)         | 1:1.5                 | 1:1                     |
| 13               | Benzene/xylene (2:1)         | 1:1.5                 | 2:1                     |
| 14               | Benzene/xylene (2:1)         | 1:1.5                 | 1:2                     |

**Table A-2 Particle size distribution of polyamide microcapsules**

| <b>SIZE<br/>(<math>\mu\text{m}</math>)</b> | <b>Sample<br/>1</b> | <b>Sample<br/>2</b> | <b>Sample<br/>3</b> | <b>SIZE<br/>(<math>\mu\text{m}</math>)</b> | <b>Sample<br/>1</b> | <b>Sample<br/>2</b> | <b>Sample<br/>3</b> |
|--|---------------------|---------------------|---------------------|--|---------------------|---------------------|---------------------|
| 0.0582                                     | 0                   | 0                   | 0                   | 7.7219                                     | 0.31086             | 1.23962             | 1.397               |
| 0.0679                                     | 0                   | 0                   | 0                   | 8.996                                      | 0.43549             | 1.57811             | 1.86909             |
| 0.0791                                     | 0                   | 0                   | 0                   | 10.4804                                    | 0.67395             | 2.07183             | 2.5447              |
| 0.0921                                     | 0                   | 0                   | 0                   | 12.2096                                    | 1.0738              | 2.76493             | 3.44967             |
| 0.1073                                     | 0                   | 0                   | 0                   | 14.2242                                    | 1.67811             | 3.6842              | 4.61012             |
| 0.125                                      | 0                   | 0                   | 0                   | 16.5712                                    | 2.54094             | 4.85883             | 6.07705             |
| 0.1456                                     | 0                   | 0                   | 0                   | 19.3055                                    | 3.7102              | 6.30475             | 7.86791             |
| 0.1697                                     | 0                   | 0                   | 0                   | 22.4909                                    | 5.18409             | 7.96438             | 9.84957             |
| 0.1977                                     | 0                   | 0                   | 0                   | 26.2019                                    | 6.81499             | 9.60044             | 11.61123            |
| 0.2303                                     | 0                   | 0                   | 0                   | 30.5252                                    | 8.27632             | 10.87941            | 12.69583            |
| 0.2683                                     | 0                   | 0                   | 0                   | 35.5618                                    | 9.23764             | 11.6532             | 11.26015            |
| 0.3125                                     | 0                   | 0                   | 0.00353             | 41.4295                                    | 9.60342             | 10.44937            | 8.76264             |
| 0.3641                                     | 0                   | 0.0079              | 0.01223             | 48.2654                                    | 9.54262             | 8.42675             | 6.02801             |
| 0.4242                                     | 0                   | 0.01663             | 0.021               | 56.2292                                    | 9.31082             | 6.11847             | 3.62287             |
| 0.4941                                     | 0                   | 0.02922             | 0.03591             | 65.507                                     | 8.15453             | 3.88466             | 1.74876             |
| 0.5757                                     | 0                   | 0.03961             | 0.04656             | 76.3157                                    | 6.75555             | 2.05621             | 0                   |
| 0.6707                                     | 0                   | 0.04984             | 0.05704             | 88.9077                                    | 5.28442             | 0.78714             | 0                   |
| 0.7813                                     | 0                   | 0.05684             | 0.06281             | 103.5775                                   | 3.89535             | 0                   | 0                   |
| 0.9103                                     | 0                   | 0.06888             | 0.08264             | 120.6678                                   | 2.68486             | 0                   | 0                   |
| 1.0604                                     | 0                   | 0.07961             | 0.09849             | 140.578                                    | 1.69616             | 0                   | 0                   |
| 1.2354                                     | 0                   | 0.09387             | 0.11825             | 163.7733                                   | 0.95832             | 0                   | 0                   |
| 1.4393                                     | 0.04005             | 0.1167              | 0.15469             | 190.7959                                   | 0.48084             | 0                   | 0                   |
| 1.6767                                     | 0.05201             | 0.15205             | 0.20861             | 222.2773                                   | 0.00335             | 0                   | 0                   |
| 1.9534                                     | 0.07209             | 0.19956             | 0.27137             | 258.953                                    | 0                   | 0                   | 0                   |
| 2.2757                                     | 0.09762             | 0.25789             | 0.34262             | 301.6802                                   | 0                   | 0                   | 0                   |
| 2.6512                                     | 0.1281              | 0.3321              | 0.42794             | 351.4575                                   | 0                   | 0                   | 0                   |
| 3.0887                                     | 0.16077             | 0.41978             | 0.52077             | 409.4479                                   | 0                   | 0                   | 0                   |
| 3.5983                                     | 0.19136             | 0.51713             | 0.61558             | 477.0068                                   | 0                   | 0                   | 0                   |
| 4.192                                      | 0.21595             | 0.62411             | 0.70686             | 555.713                                    | 0                   | 0                   | 0                   |
| 4.8837                                     | 0.23273             | 0.73823             | 0.8015              | 647.4056                                   | 0                   | 0                   | 0                   |
| 5.6895                                     | 0.24306             | 0.86121             | 0.91851             | 754.2275                                   | 0                   | 0                   | 0                   |
| 6.6283                                     | 0.25967             | 1.01653             | 1.09848             | 878.675                                    | 0                   | 0                   | 0                   |

**Table A-3 Effect of pH on capsule size**

| <b>SIZE<br/>(<math>\mu\text{m}</math>)</b> | <b>pH3</b> | <b>pH7</b> | <b>pH10</b> | <b>SIZE<br/>(<math>\mu\text{m}</math>)</b> | <b>pH3</b> | <b>pH7</b> | <b>pH10</b> |
|--|------------|------------|-------------|--|------------|------------|-------------|
| 0.0582                                     | 0          | 0          | 0           | 7.7219                                     | 1.23962    | 1.397      | 1.24327     |
| 0.0679                                     | 0          | 0          | 0           | 8.996                                      | 1.57811    | 1.86909    | 1.61924     |
| 0.0791                                     | 0          | 0          | 0           | 10.4804                                    | 2.07183    | 2.5447     | 2.1654      |
| 0.0921                                     | 0          | 0          | 0           | 12.2096                                    | 2.76493    | 3.44967    | 2.91809     |
| 0.1073                                     | 0          | 0          | 0           | 14.2242                                    | 3.6842     | 4.61012    | 3.90383     |
| 0.125                                      | 0          | 0          | 0           | 16.5712                                    | 4.85883    | 6.07705    | 5.15359     |
| 0.1456                                     | 0          | 0          | 0           | 19.3055                                    | 6.30475    | 7.86791    | 6.66646     |
| 0.1697                                     | 0          | 0          | 0           | 22.4909                                    | 7.96438    | 9.84957    | 8.33388     |
| 0.1977                                     | 0          | 0          | 0           | 26.2019                                    | 9.60044    | 11.61123   | 9.85603     |
| 0.2303                                     | 0          | 0          | 0           | 30.5252                                    | 10.87941   | 12.69583   | 10.88703    |
| 0.2683                                     | 0          | 0          | 0           | 35.5618                                    | 11.6532    | 11.26015   | 11.36174    |
| 0.3125                                     | 0          | 0.00353    | 0.00009     | 41.4295                                    | 10.44937   | 8.76264    | 9.97223     |
| 0.3641                                     | 0.0079     | 0.01223    | 0.0088      | 48.2654                                    | 8.42675    | 6.02801    | 7.94249     |
| 0.4242                                     | 0.01663    | 0.021      | 0.01814     | 56.2292                                    | 6.11847    | 3.62287    | 5.73923     |
| 0.4941                                     | 0.02922    | 0.03591    | 0.03216     | 65.507                                     | 3.88466    | 1.74876    | 3.65363     |
| 0.5757                                     | 0.03961    | 0.04656    | 0.04371     | 76.3157                                    | 2.05621    | 0          | 1.95369     |
| 0.6707                                     | 0.04984    | 0.05704    | 0.05548     | 88.9077                                    | 0.78714    | 0          | 0.76806     |
| 0.7813                                     | 0.05684    | 0.06281    | 0.06385     | 103.5775                                   | 0          | 0          | 0           |
| 0.9103                                     | 0.06888    | 0.08264    | 0.0803      | 120.6678                                   | 0          | 0          | 0           |
| 1.0604                                     | 0.07961    | 0.09849    | 0.09423     | 140.578                                    | 0          | 0          | 0           |
| 1.2354                                     | 0.09387    | 0.11825    | 0.1108      | 163.7733                                   | 0          | 0          | 0           |
| 1.4393                                     | 0.1167     | 0.15469    | 0.13733     | 190.7959                                   | 0          | 0          | 0           |
| 1.6767                                     | 0.15205    | 0.20861    | 0.17736     | 222.2773                                   | 0          | 0          | 0           |
| 1.9534                                     | 0.19956    | 0.27137    | 0.22703     | 258.953                                    | 0          | 0          | 0           |
| 2.2757                                     | 0.25789    | 0.34262    | 0.28601     | 301.6802                                   | 0          | 0          | 0           |
| 2.6512                                     | 0.3321     | 0.42794    | 0.35956     | 351.4575                                   | 0          | 0          | 0           |
| 3.0887                                     | 0.41978    | 0.52077    | 0.44331     | 409.4479                                   | 0          | 0          | 0           |
| 3.5983                                     | 0.51713    | 0.61558    | 0.53237     | 477.0068                                   | 0          | 0          | 0           |
| 4.192                                      | 0.62411    | 0.70686    | 0.62546     | 555.713                                    | 0          | 0          | 0           |
| 4.8837                                     | 0.73823    | 0.8015     | 0.72532     | 647.4056                                   | 0          | 0          | 0           |
| 5.6895                                     | 0.86121    | 0.91851    | 0.84129     | 754.2275                                   | 0          | 0          | 0           |
| 6.6283                                     | 1.01653    | 1.09848    | 0.99949     | 878.675                                    | 0          | 0          | 0           |

**Table A-4 Effect of mechanical stirring on stability of microcapsule**

| <b>SIZES<br/>(<math>\mu\text{m}</math>)</b> | <b>Medium</b> | <b>High</b> | <b>Low</b> | <b>SIZES<br/>(<math>\mu\text{m}</math>)</b> | <b>Medium</b> | <b>High</b> | <b>Low</b> |
|---|---------------|-------------|------------|---|---------------|-------------|------------|
| 0.0582                                      | 0             | 0.00001     | 0          | 7.7219                                      | 0.39587       | 0.47482     | 0.56262    |
| 0.0679                                      | 0.00002       | 0.00003     | 0          | 8.996                                       | 0.49114       | 0.61373     | 0.74619    |
| 0.0791                                      | 0.00006       | 0.00011     | 0          | 10.4804                                     | 0.70592       | 0.88825     | 1.08435    |
| 0.0921                                      | 0.00021       | 0.00038     | 0          | 12.2096                                     | 1.09733       | 1.3559      | 1.63756    |
| 0.1073                                      | 0.0007        | 0.00131     | 0          | 14.2242                                     | 1.72059       | 2.07195     | 2.45626    |
| 0.125                                       | 0.00222       | 0.00424     | 0          | 16.5712                                     | 2.63008       | 3.08811     | 3.58113    |
| 0.1456                                      | 0.00635       | 0.01208     | 0          | 19.3055                                     | 3.86428       | 4.43007     | 5.01245    |
| 0.1697                                      | 0.01586       | 0.02955     | 0          | 22.4909                                     | 5.39285       | 6.03808     | 6.65364    |
| 0.1977                                      | 0.0345        | 0.06178     | 0          | 26.2019                                     | 7.06636       | 7.72015     | 8.29099    |
| 0.2303                                      | 0.06547       | 0.1109      | 0          | 30.5252                                     | 8.60331       | 9.15848     | 9.64874    |
| 0.2683                                      | 0.10682       | 0.16902     | 0          | 35.5618                                     | 9.71962       | 10.06735    | 10.56167   |
| 0.3125                                      | 0.14452       | 0.21165     | 0          | 41.4295                                     | 10.32158      | 10.39294    | 11.10497   |
| 0.3641                                      | 0.16051       | 0.21566     | 0          | 48.2654                                     | 10.55096      | 10.32878    | 10.06844   |
| 0.4242                                      | 0.15538       | 0.18916     | 0          | 56.2292                                     | 9.34092       | 8.84561     | 8.44132    |
| 0.4941                                      | 0.14323       | 0.15503     | 0          | 65.507                                      | 7.64777       | 6.97044     | 6.49809    |
| 0.5757                                      | 0.12602       | 0.11848     | 0          | 76.3157                                     | 5.78059       | 5.03319     | 4.55654    |
| 0.6707                                      | 0.1012        | 0.08016     | 0          | 88.9077                                     | 4.02155       | 3.31017     | 2.87452    |
| 0.7813                                      | 0.08138       | 0.05157     | 0          | 103.5775                                    | 2.57048       | 1.9712      | 1.60515    |
| 0.9103                                      | 0.0707        | 0.03319     | 0          | 120.6678                                    | 1.5106        | 1.06284     | 0.78175    |
| 1.0604                                      | 0.0644        | 0.01991     | 0          | 140.578                                     | 0.83159       | 0.53977     | 0.3455     |
| 1.2354                                      | 0.06417       | 0.00987     | 0.12819    | 163.7733                                    | 0.4811        | 0.31411     | 0          |
| 1.4393                                      | 0.07078       | 0.07973     | 0.13295    | 190.7959                                    | 0.36043       | 0.36604     | 0          |
| 1.6767                                      | 0.08249       | 0.09451     | 0.14869    | 222.2773                                    | 0.34717       | 0.32197     | 0          |
| 1.9534                                      | 0.10049       | 0.1165      | 0.1679     | 258.953                                     | 0.33223       | 0.24372     | 0          |
| 2.2757                                      | 0.13212       | 0.15271     | 0.20919    | 301.6802                                    | 0.24679       | 0.12405     | 0          |
| 2.6512                                      | 0.17511       | 0.19938     | 0.2583     | 351.4575                                    | 0.16135       | 0.04354     | 0          |
| 3.0887                                      | 0.22464       | 0.25165     | 0.31233    | 409.4479                                    | 0             | 0           | 0          |
| 3.5983                                      | 0.27635       | 0.30474     | 0.36292    | 477.0068                                    | 0             | 0           | 0          |
| 4.192                                       | 0.32097       | 0.35066     | 0.40443    | 555.713                                     | 0             | 0           | 0          |
| 4.8837                                      | 0.35015       | 0.38165     | 0.43114    | 647.4056                                    | 0             | 0           | 0          |
| 5.6895                                      | 0.36257       | 0.39964     | 0.45046    | 754.2275                                    | 0             | 0           | 0          |
| 6.6283                                      | 0.36813       | 0.41949     | 0.48163    | 878.675                                     | 0             | 0           | 0          |

**Table A-5 Pore size distribution**

| <b>Pore radius (<math>\mu\text{m}</math>)</b> | <b>Pore volume (cc/g)</b> |
|---|---------------------------|
| 44.1  | 13.9                      |
| 23.6  | 84.3                      |
| 8.2   | 37.2                      |
| 4.4   | 11.9                      |
| 3.1   | 5.8                       |
| 2.4   | 4.8                       |
| 1.9   | 4.1                       |
| 1.6   | 1.7                       |
| 1.4   | 1.6                       |
| 1.3   | 1.8                       |
| 1.2   | 1.7                       |
| 1.1   | 2                         |
| 0.9   | 2.8                       |
| 0.8   | 3.5                       |
| 0.7   | 5.4                       |

**Table A-6 Effect of stirring speeds and monomers on capsule size ( $\mu\text{m}$ )**

| <b>Stirring speed (rpm)</b> | <b>EDA</b> | <b>DETA</b> | <b>E:D(2:1)</b> | <b>E:D(1:1)</b> | <b>E:D(1:2)</b> |      |
|-----------------------------|------------|-------------|-----------------|-----------------|-----------------|------|
| 600                         | 1          | 42.6        | 36.8            | 42.2            | 40.6            | 39.8 |
|                             | 2          | 44.5        | 39.4            | 40.3            | 39.1            | 41.4 |
|                             | 3          | 42.2        | 35              | 37.1            | 37.4            | 38.8 |
|                             | Average    | 43          | 37              | 40              | 39              | 40   |
| 800                         | 1          | 31.3        | 27.2            | 30.8            | 26.1            | 30.1 |
|                             | 2          | 29.6        | 28.7            | 27.8            | 27.1            | 31.5 |
|                             | 3          | 30.8        | 25.1            | 27              | 24.9            | 28.4 |
|                             | Average    | 31          | 27              | 28              | 26              | 30   |
| 1000                        | 1          | 22.9        | 19.8            | 21.4            | 20.1            | 23.8 |
|                             | 2          | 24.7        | 22              | 20.5            | 18.4            | 22.9 |
|                             | 3          | 21.4        | 18.3            | 20              | 17              | 25.3 |
|                             | Average    | 23          | 20              | 21              | 18.5            | 24   |

E:D = EDA:DETA (in ratios of 2:1, 1:1, 1:2)

**Table A-7 Porosity of polyamide microcapsule**

| <b>No.</b> | <b>Monomers ratio</b> | <b>Density (g/cc)</b> | <b>Specific surface area (m<sup>2</sup>/g)</b> | <b>Total pore vol (e<sup>-3</sup> cc/g)</b> | <b>Average pore radius (nm)</b> | <b>Total volume (cc/g)</b> | <b>Porosity (%)</b> |
|------------|-----------------------|-----------------------|--|---|---------------------------------|----------------------------|---------------------|
| 1          | PA-E                  | 0.442                 | 57.9   | 262   | 9.1                             | 169                        | 11.6                |
| 2          | PA-E                  | 0.439                 | 58.9   | 341   | 11.6                            | 220                        | 15.0                |
| 3          | PA-E                  | 0.438                 | 74.6   | 199   | 5.3                             | 129                        | 8.7                 |
| 4          | PA-D                  | 0.416                 | 32.0   | 82  | 5.1                             | 53.2                       | 3.4                 |
| 5          | PA-D                  | 0.403                 | 43.2   | 70  | 3.2                             | 45.4                       | 2.8                 |
| 6          | PA-D                  | 0.415                 | 36.2   | 74  | 4.5                             | 48                         | 3.1                 |
| 7          | PA-E2D1               | 0.427                 | 52.4   | 171   | 6.5                             | 110                        | 7.3                 |
| 8          | PA-E2D1               | 0.435                 | 40.4   | 163   | 8.1                             | 105                        | 7.1                 |
| 7          | PA-E2D1               | 0.433                 | 46.3   | 148   | 7.2                             | 96                         | 6.4                 |
| 10         | PA-D2E1               | 0.413                 | 52.0   | 120   | 4.6                             | 77.6                       | 5.0                 |
| 11         | PA-D2E1               | 0.421                 | 32.1   | 83  | 5.2                             | 53.9                       | 3.5                 |
| 12         | PA-D2E1               | 0.429                 | 34.0   | 106   | 6.3                             | 68.7                       | 4.5                 |

PA = polyamide; E = ethylene diamine only; D = diethylene triamine only; E2D1 = EDA:DETA (2:1); D2E1 = DETA:EDA (2:1).

**Table A-8 Effect of plasma treatment time on extent of grafting**

| <b>Time (hour)</b> | <b>Plasma treated<br/>30s</b> | <b>Plasma treated<br/>60s</b> | <b>Plasma treated<br/>90s</b> |
|--------------------|-------------------------------|-------------------------------|-------------------------------|
| 2                  | 0.231                         | 0.247                         | 0.254                         |
| 4                  | 0.438                         | 0.461                         | 0.479                         |
| 6                  | 0.511                         | 0.523                         | 0.559                         |
| 8                  | 0.518                         | 0.543                         | 0.571                         |

**Table A-9 Effect of pH on vitamin B<sub>12</sub> released (mg/ml)**

| <b>Time (hour)</b> | <b>pH 7</b> | <b>pH 2</b> |
|--------------------|-------------|-------------|
| 0                  | 0.038       | 0.038       |
| 0.5                | 0.04        | 0.061       |
| 1                  | 0.041       | 0.073       |
| 2                  | 0.0415      | 0.089       |
| 3                  | 0.0412      | 0.096       |
| 4                  | 0.0414      | 0.097       |
| 5                  | 0.0418      | 0.099       |
| 6                  | 0.0417      | 0.099       |
| 7                  | 0.0419      | 0.101       |
| 8                  | 0.042       | 0.102       |
| 9                  | 0.043       | 0.103       |
| 10                 | 0.0435      | 0.105       |
| 14                 | 0.044       | 0.108       |

**Table A-10 Effect of capsule size on vitamin B<sub>12</sub> released (mg/ml)**

| <b>Time (hour)</b> | <b>28 <math>\mu</math>m</b> | <b>21 <math>\mu</math>m</b> | <b>35 <math>\mu</math>m</b> |
|--------------------|-----------------------------|-----------------------------|-----------------------------|
| 0                  | 0.038                       | 0.039                       | 0.036                       |
| 0.5                | 0.062                       | 0.065                       | 0.058                       |
| 1                  | 0.075                       | 0.079                       | 0.071                       |
| 2                  | 0.091                       | 0.095                       | 0.084                       |
| 3                  | 0.096                       | 0.099                       | 0.089                       |
| 4                  | 0.098                       | 0.101                       | 0.091                       |
| 5                  | 0.098                       | 0.102                       | 0.092                       |
| 6                  | 0.099                       | 0.103                       | 0.094                       |
| 7                  | 0.101                       | 0.104                       | 0.095                       |
| 8                  | 0.102                       | 0.104                       | 0.096                       |
| 10                 | 0.105                       | 0.107                       | 0.097                       |
| 12                 | 0.106                       | 0.108                       | 0.099                       |

**Table A-11 Effect of microcapsule pore size on vitamin B<sub>12</sub> released (mg/ml)**

| <b>Time (hour)</b> | <b>11.6 nm</b> | <b>9.1 nm</b> | <b>6.5 nm</b> | <b>3.2 nm</b> |
|--------------------|----------------|---------------|---------------|---------------|
| 0                  | 0.038          | 0.037         | 0.034         | 0.035         |
| 0.5                | 0.063          | 0.061         | 0.055         | 0.052         |
| 1                  | 0.076          | 0.072         | 0.067         | 0.063         |
| 2                  | 0.092          | 0.088         | 0.081         | 0.074         |
| 3                  | 0.096          | 0.092         | 0.085         | 0.081         |
| 4                  | 0.098          | 0.095         | 0.088         | 0.083         |
| 5                  | 0.099          | 0.097         | 0.089         | 0.085         |
| 6                  | 0.1            | 0.098         | 0.091         | 0.085         |
| 7                  | 0.101          | 0.1           | 0.093         | 0.086         |
| 8                  | 0.102          | 0.1           | 0.094         | 0.087         |
| 10                 | 0.105          | 0.102         | 0.095         | 0.088         |
| 12                 | 0.107          | 0.103         | 0.095         | 0.088         |

**Table A-12 Effect of monomer concentration on vitamin B<sub>12</sub> released**

| <b>Content released (%)</b> |          |          |                | <b>Monomer concentration (%AAc)</b> |
|-----------------------------|----------|----------|----------------|-------------------------------------|
| <b>1</b>                    | <b>2</b> | <b>3</b> | <b>Average</b> |                                     |
| 45.9                        | 49.2     | 41.1     | 45.4           | 5                                   |
| 54.4                        | 55.4     | 49.8     | 53.2           | 7.5                                 |
| 56                          | 50.2     | 61.7     | 55.967         | 10                                  |
| 68.9                        | 74.3     | 62.6     | 68.6           | 12.5                                |
| 69.8                        | 66.1     | 74.8     | 70.233         | 15                                  |
| 64.8                        | 59.4     | 71.2     | 65.133         | 20                                  |
| 50.6                        | 57.6     | 45.3     | 51.167         | 25                                  |
| 31.8                        | 36.8     | 27.5     | 32.033         | 30                                  |

**Table A-13 Effect of model drugs on vitamin B<sub>12</sub> released (mg/ml)**

| <b>Time (hour)</b> | <b>cytochrome c</b> | <b>Vitamin B12</b> |
|--------------------|---------------------|--------------------|
| 0                  | 0.034               | 0.037              |
| 0.5                | 0.053               | 0.061              |
| 1                  | 0.065               | 0.072              |
| 2                  | 0.078               | 0.088              |
| 3                  | 0.085               | 0.092              |
| 4                  | 0.088               | 0.095              |
| 5                  | 0.089               | 0.097              |
| 6                  | 0.091               | 0.098              |
| 7                  | 0.092               | 0.1                |
| 8                  | 0.093               | 0.1                |
| 10                 | 0.094               | 0.102              |
| 12                 | 0.094               | 0.103              |

## A.2 PCL AND PSF MICROCAPSULES

Table A-14 Particle size distribution of PCL microcapsules

| SIZE<br>( $\mu\text{m}$ ) | Pcl 1   | Pcl 2   | Pcl 3   | 6.6283   | 1.23676  | 1.08824  | 1.13128  |
|---------------------------|---------|---------|---------|----------|----------|----------|----------|
| 0.0582                    | 0       | 0       | 0       | 7.7219   | 1.72926  | 1.50477  | 1.58783  |
| 0.0679                    | 0       | 0       | 0       | 8.996    | 2.46776  | 2.155    | 2.38467  |
| 0.0791                    | 0       | 0       | 0       | 10.4804  | 3.49848  | 3.10912  | 3.68341  |
| 0.0921                    | 0       | 0       | 0       | 12.2096  | 4.86198  | 4.46765  | 5.16578  |
| 0.1073                    | 0       | 0       | 0       | 14.2242  | 6.5408   | 6.29896  | 6.64185  |
| 0.125                     | 0       | 0       | 0       | 16.5712  | 8.42578  | 8.47115  | 8.46237  |
| 0.1456                    | 0       | 0       | 0       | 19.3055  | 10.2902  | 10.53527 | 9.79643  |
| 0.1697                    | 0       | 0       | 0       | 22.4909  | 11.84843 | 11.96051 | 10.97503 |
| 0.1977                    | 0       | 0       | 0       | 26.2019  | 12.87229 | 12.64107 | 11.63209 |
| 0.2303                    | 0       | 0       | 0       | 30.5252  | 11.46743 | 11.08531 | 10.32018 |
| 0.2683                    | 0.00714 | 0       | 0       | 35.5618  | 8.90779  | 8.7483   | 8.14631  |
| 0.3125                    | 0.02076 | 0       | 0.02143 | 41.4295  | 6.01023  | 6.19738  | 6.10533  |
| 0.3641                    | 0.07135 | 0       | 0.06178 | 48.2654  | 3.44145  | 3.8851   | 4.10362  |
| 0.4242                    | 0.13794 | 0.04311 | 0.14879 | 56.2292  | 1.53779  | 2.08337  | 2.33095  |
| 0.4941                    | 0.28534 | 0.12973 | 0.26317 | 65.507   | 0        | 0.87028  | 1.06536  |
| 0.5757                    | 0.32941 | 0.23174 | 0.21538 | 76.3157  | 0        | 0.43812  | 0.38124  |
| 0.6707                    | 0.23746 | 0.15284 | 0.15022 | 88.9077  | 0        | 0        | 0        |
| 0.7813                    | 0.13726 | 0.10319 | 0.10176 | 103.5775 | 0        | 0        | 0        |
| 0.9103                    | 0.09367 | 0.03627 | 0.05536 | 120.6678 | 0        | 0        | 0        |
| 1.0604                    | 0.12356 | 0.04897 | 0.05832 | 140.578  | 0        | 0        | 0        |
| 1.2354                    | 0.12975 | 0.07462 | 0.06838 | 163.7733 | 0        | 0        | 0        |
| 1.4393                    | 0.15597 | 0.10974 | 0.08424 | 190.7959 | 0        | 0        | 0        |
| 1.6767                    | 0.19482 | 0.17065 | 0.10633 | 222.2773 | 0        | 0        | 0        |
| 1.9534                    | 0.24007 | 0.24665 | 0.13358 | 258.953  | 0        | 0        | 0        |
| 2.2757                    | 0.30663 | 0.33805 | 0.15922 | 301.6802 | 0        | 0        | 0        |
| 2.6512                    | 0.38236 | 0.43908 | 0.18943 | 351.4575 | 0        | 0        | 0        |
| 3.0887                    | 0.46636 | 0.53809 | 0.21634 | 409.4479 | 0        | 0        | 0        |
| 3.5983                    | 0.5484  | 0.61754 | 0.25134 | 477.0068 | 0        | 0        | 0        |
| 4.192                     | 0.63655 | 0.67663 | 0.31446 | 555.713  | 0        | 0        | 0        |
| 4.8837                    | 0.7478  | 0.73826 | 0.43882 | 647.4056 | 0        | 0        | 0        |
| 5.6895                    | 0.9313  | 0.85113 | 0.65824 | 754.2275 | 0        | 0        | 0        |
|                           |         |         |         | 878.675  | 0        | 0        | 0        |

**Table A-15 Particle size distribution of PSf microcapsules**

| <b>SIZE<br/>(<math>\mu\text{m}</math>)</b> | <b>Psf 1</b> | <b>Psf 2</b> | <b>Psf 3</b> |          |          |          |          |
|--|--------------|--------------|--------------|----------|----------|----------|----------|
|  |              |              |              | 7.7219   | 0        | 0        | 0.00512  |
| 0.0582                                     | 0            | 0            | 0            | 8.996    | 0        | 0        | 0.02139  |
| 0.0679                                     | 0            | 0            | 0            | 10.4804  | 0.03973  | 0        | 0.08579  |
| 0.0791                                     | 0            | 0            | 0            | 12.2096  | 0.11945  | 0.00421  | 0.26986  |
| 0.0921                                     | 0            | 0            | 0            | 14.2242  | 0.31941  | 0.01752  | 0.73005  |
| 0.1073                                     | 0            | 0            | 0            | 16.5712  | 0.71077  | 0.06569  | 1.82345  |
| 0.125                                      | 0            | 0            | 0            | 19.3055  | 1.43642  | 0.20537  | 4.3497   |
| 0.1456                                     | 0            | 0            | 0.00001      | 22.4909  | 2.84507  | 0.58778  | 9.63759  |
| 0.1697                                     | 0.00005      | 0            | 0.00024      | 26.2019  | 5.61754  | 1.64038  | 17.85863 |
| 0.1977                                     | 0.00072      | 0            | 0.00453      | 30.5252  | 10.53829 | 4.49767  | 24.43983 |
| 0.2303                                     | 0.00758      | 0            | 0.0539       | 35.5618  | 17.09536 | 11.34729 | 19.41819 |
| 0.2683                                     | 0.05046      | 0            | 0.36567      | 41.4295  | 21.71996 | 22.29575 | 11.11682 |
| 0.3125                                     | 0.18395      | 0            | 1.17978      | 48.2654  | 17.22048 | 28.24002 | 3.79469  |
| 0.3641                                     | 0.35549      | 0            | 1.70733      | 56.2292  | 10.56471 | 18.3752  | 0        |
| 0.4242                                     | 0.46406      | 0            | 1.4261       | 65.507   | 5.27968  | 8.42878  | 0        |
| 0.4941                                     | 0.57901      | 0            | 0.99045      | 76.3157  | 2.10126  | 3.28838  | 0        |
| 0.5757                                     | 0.68544      | 0            | 0.53353      | 88.9077  | 0        | 1.00597  | 0        |
| 0.6707                                     | 0.61482      | 0            | 0.15555      | 103.5775 | 0        | 0        | 0        |
| 0.7813                                     | 0.53745      | 0            | 0.02677      | 120.6678 | 0        | 0        | 0        |
| 0.9103                                     | 0.37083      | 0            | 0.00436      | 140.578  | 0        | 0        | 0        |
| 1.0604                                     | 0.24507      | 0            | 0.00057      | 163.7733 | 0        | 0        | 0        |
| 1.2354                                     | 0.15068      | 0            | 0.00008      | 190.7959 | 0        | 0        | 0        |
| 1.4393                                     | 0.08605      | 0            | 0            | 222.2773 | 0        | 0        | 0        |
| 1.6767                                     | 0.04192      | 0            | 0            | 258.953  | 0        | 0        | 0        |
| 1.9534                                     | 0.0183       | 0            | 0            | 301.6802 | 0        | 0        | 0        |
| 2.2757                                     | 0            | 0            | 0            | 351.4575 | 0        | 0        | 0        |
| 2.6512                                     | 0            | 0            | 0            | 409.4479 | 0        | 0        | 0        |
| 3.0887                                     | 0            | 0            | 0            | 477.0068 | 0        | 0        | 0        |
| 3.5983                                     | 0            | 0            | 0            | 555.713  | 0        | 0        | 0        |
| 4.192                                      | 0            | 0            | 0            | 647.4056 | 0        | 0        | 0        |
| 4.8837                                     | 0            | 0            | 0            | 754.2275 | 0        | 0        | 0        |
| 5.6895                                     | 0            | 0            | 0            | 878.675  | 0        | 0        | 0        |
| 6.6283                                     | 0            | 0            | 0            |          |          |          |          |

### A.3 POLYSTYLENE MICROCAPSULES

**Table A-16 Particle size distribution of PSt microcapsules**

| <b>SIZE<br/>(<math>\mu\text{m}</math>)</b> | <b>Pst 1</b> | <b>Pst 2</b> | <b>Pst 3</b> |          |          |          |          |
|--|--------------|--------------|--------------|----------|----------|----------|----------|
|  |              |              |              | 7.7219   | 0.69424  | 0.25792  | 0.50112  |
| 0.0582                                     | 0            | 0            | 0            | 8.996    | 1.61092  | 0.71292  | 1.00285  |
| 0.0679                                     | 0            | 0            | 0            | 10.4804  | 3.27186  | 1.68254  | 1.85041  |
| 0.0791                                     | 0            | 0            | 0            | 12.2096  | 5.77174  | 3.49748  | 3.18055  |
| 0.0921                                     | 0            | 0            | 0            | 14.2242  | 8.72465  | 6.42062  | 5.11626  |
| 0.1073                                     | 0            | 0            | 0            | 16.5712  | 11.38956 | 10.40071 | 7.6043   |
| 0.125                                      | 0            | 0.00001      | 0.00002      | 19.3055  | 13.27445 | 14.7571  | 10.28527 |
| 0.1456                                     | 0            | 0.00009      | 0.00011      | 22.4909  | 14.41354 | 18.2953  | 12.77254 |
| 0.1697                                     | 0            | 0.0008       | 0.0006       | 26.2019  | 12.50769 | 16.16543 | 14.73322 |
| 0.1977                                     | 0            | 0.00544      | 0.00271      | 30.5252  | 9.40541  | 11.34502 | 13.43439 |
| 0.2303                                     | 0            | 0.02899      | 0.01021      | 35.5618  | 6.05369  | 6.55443  | 10.52762 |
| 0.2683                                     | 0.00001      | 0.11434      | 0.03206      | 41.4295  | 3.26505  | 2.31675  | 7.13305  |
| 0.3125                                     | 0.0001       | 0.29832      | 0.08376      | 48.2654  | 1.37934  | 0        | 4.14394  |
| 0.3641                                     | 0.00066      | 0.50029      | 0.17683      | 56.2292  | 0        | 0        | 1.95747  |
| 0.4242                                     | 0.00356      | 0.64046      | 0.28379      | 65.507   | 0        | 0        | 0.64779  |
| 0.4941                                     | 0.01603      | 0.80175      | 0.31403      | 76.3157  | 0        | 0        | 0.07871  |
| 0.5757                                     | 0.05973      | 0.9702       | 0.27475      | 88.9077  | 0        | 0        | 0        |
| 0.6707                                     | 0.17605      | 0.95699      | 0.20412      | 103.5775 | 0        | 0        | 0        |
| 0.7813                                     | 0.37629      | 0.91537      | 0.14328      | 120.6678 | 0        | 0        | 0.19913  |
| 0.9103                                     | 0.57021      | 0.70993      | 0.09887      | 140.578  | 0        | 0        | 0.25328  |
| 1.0604                                     | 0.53381      | 0.51871      | 0.06659      | 163.7733 | 0        | 0        | 0.13915  |
| 1.2354                                     | 0.3685       | 0.34425      | 0.04493      | 190.7959 | 0        | 0        | 0.00502  |
| 1.4393                                     | 0.24699      | 0.21838      | 0.03053      | 222.2773 | 0        | 0        | 0        |
| 1.6767                                     | 0.16527      | 0.13978      | 0.02964      | 258.953  | 0        | 0        | 0        |
| 1.9534                                     | 0.10996      | 0.09563      | 0.05449      | 301.6802 | 0        | 0        | 0        |
| 2.2757                                     | 0.07363      | 0.07408      | 0.09077      | 351.4575 | 0        | 0        | 0        |
| 2.6512                                     | 0.04729      | 0.06006      | 0.1368       | 409.4479 | 0        | 0        | 0        |
| 3.0887                                     | 0.02695      | 0.04598      | 0.18555      | 477.0068 | 0        | 0        | 0        |
| 3.5983                                     | 0.00433      | 0.03176      | 0.25588      | 555.713  | 0        | 0        | 0        |
| 4.192                                      | 0.00582      | 0.01999      | 0.23487      | 647.4056 | 0        | 0        | 0        |
| 4.8837                                     | 0.02239      | 0.00569      | 0.10565      | 754.2275 | 0        | 0        | 0        |
| 5.6895                                     | 0.08447      | 0.01906      | 0.12565      | 878.675  | 0        | 0        | 0        |
| 6.6283                                     | 0.26231      | 0.07741      | 0.23676      |          |          |          |          |

**Table A-17 Effect of temperature on capsule size**

| <b>SIZE<br/>(<math>\mu\text{m}</math>)</b> | <b>Room<br/>temperature</b> | <b>37 °C</b> | <b>SIZE<br/>(<math>\mu\text{m}</math>)</b> | <b>Room<br/>temperature</b> | <b>37 °C</b> |
|--|-----------------------------|--------------|--|-----------------------------|--------------|
| 0.0582                                     | 0                           | 0            | 7.7219                                     | 0.25134                     | 1.72926      |
| 0.0679                                     | 0                           | 0            | 8.996                                      | 0.31446                     | 2.46776      |
| 0.0791                                     | 0.00001                     | 0            | 10.4804                                    | 0.43882                     | 3.49848      |
| 0.0921                                     | 0.00006                     | 0            | 12.2096                                    | 0.67137                     | 4.86198      |
| 0.1073                                     | 0.00032                     | 0            | 14.2242                                    | 1.0633                      | 6.5408       |
| 0.125                                      | 0.00151                     | 0            | 16.5712                                    | 1.66859                     | 8.42578      |
| 0.1456                                     | 0.00621                     | 0            | 19.3055                                    | 2.53839                     | 10.2902      |
| 0.1697                                     | 0.02143                     | 0            | 22.4909                                    | 3.71374                     | 11.84843     |
| 0.1977                                     | 0.06178                     | 0            | 26.2019                                    | 5.18695                     | 12.87229     |
| 0.2303                                     | 0.14879                     | 0            | 30.5252                                    | 6.85418                     | 11.46743     |
| 0.2683                                     | 0.29195                     | 0            | 35.5618                                    | 8.50878                     | 8.90779      |
| 0.3125                                     | 0.44161                     | 0            | 41.4295                                    | 9.89899                     | 6.01023      |
| 0.3641                                     | 0.5062                      | 0            | 48.2654                                    | 10.86508                    | 3.44145      |
| 0.4242                                     | 0.47795                     | 0            | 56.2292                                    | 11.45009                    | 1.53779      |
| 0.4941                                     | 0.41947                     | 0            | 65.507                                     | 10.2161                     | 0            |
| 0.5757                                     | 0.33794                     | 0            | 76.3157                                    | 8.24711                     | 0            |
| 0.6707                                     | 0.22815                     | 0            | 88.9077                                    | 6.01034                     | 0            |
| 0.7813                                     | 0.14309                     | 0            | 103.5775                                   | 3.92325                     | 0            |
| 0.9103                                     | 0.10248                     | 0            | 120.6678                                   | 2.24095                     | 0            |
| 1.0604                                     | 0.07605                     | 0.12356      | 140.578                                    | 1.05536                     | 0            |
| 1.2354                                     | 0.06285                     | 0.12975      | 163.7733                                   | 0.36572                     | 0            |
| 1.4393                                     | 0.05861                     | 0.15597      | 190.7959                                   | 0                           | 0            |
| 1.6767                                     | 0.05631                     | 0.19482      | 222.2773                                   | 0                           | 0            |
| 1.9534                                     | 0.05491                     | 0.24007      | 258.953                                    | 0                           | 0            |
| 2.2757                                     | 0.05921                     | 0.30663      | 301.6802                                   | 0                           | 0            |
| 2.6512                                     | 0.06838                     | 0.38236      | 351.4575                                   | 0                           | 0            |
| 3.0887                                     | 0.08424                     | 0.46636      | 409.4479                                   | 0                           | 0            |
| 3.5983                                     | 0.10633                     | 0.5484       | 477.0068                                   | 0                           | 0            |
| 4.192                                      | 0.13358                     | 0.63655      | 555.713                                    | 0                           | 0            |
| 4.8837                                     | 0.1619                      | 0.7478       | 647.4056                                   | 0                           | 0            |
| 5.6895                                     | 0.18943                     | 0.9313       | 754.2275                                   | 0                           | 0            |
| 6.6283                                     | 0.21634                     | 1.23676      | 878.675                                    | 0                           | 0            |

**Table A-18 Effect of PVA concentrations on capsule size**

| <b>SIZES<br/>(<math>\mu\text{m}</math>)</b> | <b>2%PVA</b> | <b>0.5%PVA</b> | <b>0.1%PVA</b> | <b>SIZES<br/>(<math>\mu\text{m}</math>)</b> | <b>2%PVA</b> | <b>0.5%PVA</b> | <b>0.1%PVA</b> |
|---|--------------|----------------|----------------|---|--------------|----------------|----------------|
| 0.0582                                      | 0            | 0              | 0              | 7.7219                                      | 0.25792      | 0.25588        | 0              |
| 0.0679                                      | 0            | 0              | 0              | 8.996                                       | 0.71292      | 0.23487        | 0              |
| 0.0791                                      | 0            | 0              | 0              | 10.4804                                     | 1.68254      | 0.10565        | 0              |
| 0.0921                                      | 0            | 0.00002        | 0              | 12.2096                                     | 3.49748      | 0.12565        | 0              |
| 0.1073                                      | 0            | 0.00011        | 0              | 14.2242                                     | 6.42062      | 0.23676        | 0              |
| 0.125                                       | 0.00001      | 0.0006         | 0              | 16.5712                                     | 10.40071     | 0.50112        | 0              |
| 0.1456                                      | 0.00009      | 0.00271        | 0              | 19.3055                                     | 14.7571      | 1.00285        | 0              |
| 0.1697                                      | 0.0008       | 0.01021        | 0              | 22.4909                                     | 18.2953      | 1.85041        | 0              |
| 0.1977                                      | 0.00544      | 0.03206        | 0              | 26.2019                                     | 16.16543     | 3.18055        | 0.07536        |
| 0.2303                                      | 0.02899      | 0.08376        | 0              | 30.5252                                     | 11.34502     | 5.11626        | 0.15933        |
| 0.2683                                      | 0.11434      | 0.17683        | 0              | 35.5618                                     | 6.55443      | 7.6043         | 0.39047        |
| 0.3125                                      | 0.29832      | 0.28379        | 0              | 41.4295                                     | 2.31675      | 10.28527       | 0.8139         |
| 0.3641                                      | 0.50029      | 0.34049        | 0              | 48.2654                                     | 0            | 12.77254       | 1.58026        |
| 0.4242                                      | 0.64046      | 0.33625        | 0              | 56.2292                                     | 0            | 14.73322       | 2.89347        |
| 0.4941                                      | 0.80175      | 0.31403        | 0              | 65.507                                      | 0            | 13.43439       | 5.36449        |
| 0.5757                                      | 0.9702       | 0.27475        | 0              | 76.3157                                     | 0            | 10.52762       | 9.62585        |
| 0.6707                                      | 0.95699      | 0.20412        | 0              | 88.9077                                     | 0            | 7.13305        | 15.8257        |
| 0.7813                                      | 0.91537      | 0.14328        | 0              | 103.5775                                    | 0            | 4.14394        | 22.12586       |
| 0.9103                                      | 0.70993      | 0.09887        | 0              | 120.6678                                    | 0            | 1.95747        | 20.05262       |
| 1.0604                                      | 0.51871      | 0.06659        | 0              | 140.578                                     | 0            | 0.64779        | 13.06458       |
| 1.2354                                      | 0.34425      | 0.04493        | 0              | 163.7733                                    | 0            | 0.07871        | 6.71007        |
| 1.4393                                      | 0.21838      | 0.03053        | 0              | 190.7959                                    | 0            | 0              | 1.31802        |
| 1.6767                                      | 0.13978      | 0.01981        | 0              | 222.2773                                    | 0            | 0              | 0              |
| 1.9534                                      | 0.09563      | 0.01478        | 0              | 258.953                                     | 0            | 0.19913        | 0              |
| 2.2757                                      | 0.07408      | 0.01671        | 0              | 301.6802                                    | 0            | 0.25328        | 0              |
| 2.6512                                      | 0.06006      | 0.02964        | 0              | 351.4575                                    | 0            | 0.13915        | 0              |
| 3.0887                                      | 0.04598      | 0.05449        | 0              | 409.4479                                    | 0            | 0.00502        | 0              |
| 3.5983                                      | 0.03176      | 0.09077        | 0              | 477.0068                                    | 0            | 0              | 0              |
| 4.192                                       | 0.01999      | 0.1368         | 0              | 555.713                                     | 0            | 0              | 0              |
| 4.8837                                      | 0.00569      | 0.18555        | 0              | 647.4056                                    | 0            | 0              | 0              |
| 5.6895                                      | 0.01906      | 0.22823        | 0              | 754.2275                                    | 0            | 0              | 0              |
| 6.6283                                      | 0.07741      | 0.25442        | 0              | 878.675                                     | 0            | 0              | 0              |

**Table A-19 Effect of monomer concentrations on graft extent (mmol/g)**

| <b>Time (hour)</b> | <b>5%AAc</b> | <b>10%AAc</b> | <b>20%AAc</b> |
|--------------------|--------------|---------------|---------------|
| 0                  | 0            | 0             | 0             |
| 1                  | 0.152        | 0.176         | 0.163         |
| 2                  | 0.307        | 0.355         | 0.347         |
| 3                  | 0.412        | 0.468         | 0.493         |
| 4                  | 0.439        | 0.496         | 0.526         |
| 5                  | 0.442        | 0.502         | 0.529         |

**Table A-20 Effect of re-immersing microcapsule in DMAa in 30 seconds on vitamin B<sub>12</sub> released (mg/ml)**

| <b>Time (hour)</b> | <b>pH 7</b> | <b>pH 2</b> |
|--------------------|-------------|-------------|
| 0                  | 0.046       | 0.048       |
| 0.5                | 0.051       | 0.055       |
| 1                  | 0.053       | 0.06        |
| 2                  | 0.061       | 0.071       |
| 3                  | 0.065       | 0.079       |
| 4                  | 0.07        | 0.085       |
| 5                  | 0.075       | 0.094       |
| 6                  | 0.077       | 0.099       |
| 7                  | 0.083       | 0.106       |
| 8                  | 0.087       | 0.11        |
| 9                  | 0.093       | 0.118       |
| 10                 | 0.095       | 0.122       |

**Table A-21 Effect of re-immersing microcapsule in DMAa in 1 minute on vitamin B<sub>12</sub> released (mg/ml)**

| <b>Time (hour)</b> | <b>pH 7</b> | <b>pH 2</b> |
|--------------------|-------------|-------------|
| 0                  | 0.046       | 0.047       |
| 0.5                | 0.053       | 0.059       |
| 1                  | 0.057       | 0.065       |
| 2                  | 0.065       | 0.077       |
| 3                  | 0.07        | 0.086       |
| 4                  | 0.077       | 0.096       |
| 5                  | 0.085       | 0.103       |
| 6                  | 0.089       | 0.112       |
| 7                  | 0.092       | 0.116       |
| 8                  | 0.098       | 0.124       |
| 9                  | 0.101       | 0.132       |
| 10                 | 0.103       | 0.136       |

**Table A-22 Effect of re-immersing microcapsule in DMAa in 2 minutes on vitamin B<sub>12</sub> released (mg/ml)**

| <b>Time (hour)</b> | <b>pH 7</b> | <b>pH 2</b> |
|--------------------|-------------|-------------|
| 0                  | 0.045       | 0.047       |
| 0.5                | 0.055       | 0.061       |
| 1                  | 0.063       | 0.072       |
| 2                  | 0.076       | 0.089       |
| 3                  | 0.087       | 0.107       |
| 4                  | 0.099       | 0.118       |
| 5                  | 0.107       | 0.127       |
| 6                  | 0.116       | 0.136       |
| 7                  | 0.121       | 0.141       |
| 8                  | 0.127       | 0.149       |
| 9                  | 0.132       | 0.153       |
| 10                 | 0.133       | 0.157       |

**Table A-23 Effect of switching pH from 2 to 7 on vitamin B<sub>12</sub> release (mg/ml)**

| <b>pH</b> | <b>Amount released (mg/ml)</b> |        |       | <b>Average</b> |
|-----------|--------------------------------|--------|-------|----------------|
| 2         | 0.091                          | 0.094  | 0.087 | 0.090667       |
| 2.5       | 0.0903                         | 0.093  | 0.087 | 0.0901         |
| 3         | 0.089                          | 0.0925 | 0.086 | 0.089167       |
| 3.5       | 0.086                          | 0.091  | 0.083 | 0.086667       |
| 4         | 0.079                          | 0.085  | 0.074 | 0.079333       |
| 4.5       | 0.058                          | 0.065  | 0.055 | 0.059333       |
| 5         | 0.045                          | 0.049  | 0.041 | 0.045          |
| 5.5       | 0.034                          | 0.038  | 0.032 | 0.034667       |
| 6         | 0.029                          | 0.035  | 0.028 | 0.030667       |
| 6.5       | 0.028                          | 0.033  | 0.027 | 0.029333       |
| 7         | 0.028                          | 0.033  | 0.026 | 0.029          |

**Table A-24 Effect of switching pH from 7 to 2 on vitamin B<sub>12</sub> release (mg/ml)**

| <b>pH</b> | <b>Amount released (mg/ml)</b> |        |        | <b>Average</b> |
|-----------|--------------------------------|--------|--------|----------------|
| 7         | 0.0235                         | 0.023  | 0.0274 | 0.024633       |
| 6.5       | 0.0248                         | 0.023  | 0.0283 | 0.025367       |
| 6         | 0.026                          | 0.024  | 0.029  | 0.026333       |
| 5.5       | 0.029                          | 0.026  | 0.032  | 0.029          |
| 5         | 0.038                          | 0.036  | 0.043  | 0.039          |
| 4.5       | 0.053                          | 0.051  | 0.058  | 0.054          |
| 4         | 0.074                          | 0.071  | 0.079  | 0.074667       |
| 3.5       | 0.085                          | 0.081  | 0.087  | 0.084333       |
| 3         | 0.0896                         | 0.0846 | 0.091  | 0.0884         |
| 2.5       | 0.0904                         | 0.086  | 0.0923 | 0.089567       |
| 2         | 0.0915                         | 0.087  | 0.093  | 0.0905         |

**Table A-25 Porosity of polystyrene microcapsule re-immersed in DMAa in various times**

| <b>No.</b> | <b>Sample dissolve time</b> | <b>Density (g/cc)</b> | <b>Specific surface area (m<sup>2</sup>/g)</b> | <b>Average pore radius (nm)</b> | <b>Total pore vol (e<sup>-3</sup> cc/g)</b> | <b>Total volume (cc/g)</b> |
|------------|-----------------------------|-----------------------|--|---------------------------------|---|----------------------------|
| 1          | 30 seconds                  | 0.467                 | 1.8  | 31.6                            | 28.4  | 18.4                       |
| 2          | 30 seconds                  | 0.410                 | 1.16   | 39                              | 22.6  | 14.6                       |
| 3          | 30 seconds                  | 0.441                 | 5.8  | 48.5                            | 18.4  | 11.9                       |
| 4          | 1 minute                    | 0.427                 | 48.5   | 840                             | 20403.5                                     | 13209.2                    |
| 5          | 1 minute                    | 0.338                 | 52.4   | 930                             | 24383.7                                     | 15786                      |
| 6          | 1 minute                    | 0.366                 | 47.0   | 1027                            | 24138.1                                     | 15627                      |
| 7          | 2 minutes                   | 0.528                 | 31.5   | 1334                            | 21013                                       | 13603.9                    |
| 8          | 2 minutes                   | 0.415                 | 34.5   | 1213                            | 20935.5                                     | 13553.6                    |
| 9          | 2 minutes                   | 0.515                 | 31.4   | 1574                            | 24733.3                                     | 16012.3                    |

**A.4 EXAMPLES OF PARTICLE SIZE ANALYSIS**



**Result: Analysis Report**

User Name: Jacinta Parenzee

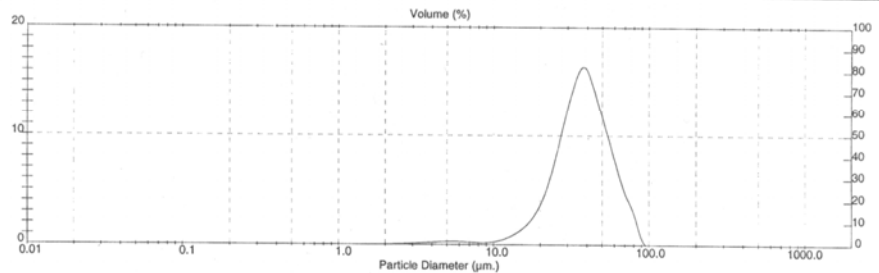
Security Level: 1

| Sample Details                       |                  |                                    |
|--------------------------------------|------------------|------------------------------------|
| Sample ID: 2deta                     | Run Number: 2    | Measured: Tue 31 Oct 2006 1:27p.m. |
| Sample File: YUEWEN                  | Record Number: 2 | Analysed: Tue 31 Oct 2006 1:27p.m. |
| Sample Path: C:\SIZERS\DATA\JACINTA\ |                  | Result Source: Analysed            |
| Sample Notes:                        |                  |                                    |

| System Details               |                                     |                           |                    |
|------------------------------|-------------------------------------|---------------------------|--------------------|
| Range Lens: 300RF mm         | Beam Length: 2.40 mm                | Sampler: MS17             | Obscuration: 7.9 % |
| Presentation: 3OHD           | [Particle R.I. = ( 1.5295, 0.1000); | Dispersant R.I. = 1.3300] |                    |
| Analysis Model: Polydisperse |                                     |                           | Residual: 0.582 %  |
| Modifications: None          |                                     |                           |                    |

| Result Statistics         |                             |                             |                                  |
|---------------------------|-----------------------------|-----------------------------|----------------------------------|
| Distribution Type: Volume | Concentration = 0.0336 %Vol | Density = 2.560 g / cub. cm | Specific S.A. = 0.0770 sq. m / g |
| Mean Diameters:           | D (v, 0.1) = 21.42 um       | D (v, 0.5) = 37.58 um       | D (v, 0.9) = 61.01 um            |
| D [4, 3] = 39.45 um       | D [3, 2] = 30.42 um         | Span = 1.054E+00            | Uniformity = 3.243E-01           |

| Size Low (um) | In % | Size High (um) | Under% | Size Low (um) | In %  | Size High (um) | Under% |
|---------------|------|----------------|--------|---------------|-------|----------------|--------|
| 0.05          | 0.00 | 0.06           | 0.00   | 6.63          | 0.23  | 7.72           | 1.77   |
| 0.06          | 0.00 | 0.07           | 0.00   | 7.72          | 0.18  | 9.00           | 1.95   |
| 0.07          | 0.00 | 0.08           | 0.00   | 9.00          | 0.24  | 10.48          | 2.19   |
| 0.08          | 0.00 | 0.09           | 0.00   | 10.48         | 0.45  | 12.21          | 2.64   |
| 0.09          | 0.00 | 0.11           | 0.00   | 12.21         | 0.85  | 14.22          | 3.49   |
| 0.11          | 0.00 | 0.13           | 0.00   | 14.22         | 1.46  | 16.57          | 4.96   |
| 0.13          | 0.00 | 0.15           | 0.00   | 16.57         | 2.46  | 19.31          | 7.41   |
| 0.15          | 0.00 | 0.17           | 0.00   | 19.31         | 4.17  | 22.49          | 11.58  |
| 0.17          | 0.00 | 0.20           | 0.00   | 22.49         | 7.02  | 26.20          | 18.60  |
| 0.20          | 0.00 | 0.23           | 0.00   | 26.20         | 10.92 | 30.53          | 29.53  |
| 0.23          | 0.00 | 0.27           | 0.00   | 30.53         | 14.56 | 35.56          | 44.09  |
| 0.27          | 0.00 | 0.31           | 0.00   | 35.56         | 16.36 | 41.43          | 60.45  |
| 0.31          | 0.00 | 0.36           | 0.00   | 41.43         | 14.15 | 48.27          | 74.59  |
| 0.36          | 0.00 | 0.42           | 0.00   | 48.27         | 10.94 | 56.23          | 85.54  |
| 0.42          | 0.00 | 0.49           | 0.00   | 56.23         | 7.58  | 65.51          | 93.12  |
| 0.49          | 0.00 | 0.58           | 0.00   | 65.51         | 4.59  | 76.32          | 97.71  |
| 0.58          | 0.00 | 0.67           | 0.00   | 76.32         | 2.29  | 88.91          | 100.00 |
| 0.67          | 0.00 | 0.78           | 0.00   | 88.91         | 0.00  | 103.58         | 100.00 |
| 0.78          | 0.00 | 0.91           | 0.00   | 103.58        | 0.00  | 120.67         | 100.00 |
| 0.91          | 0.00 | 1.06           | 0.00   | 120.67        | 0.00  | 140.58         | 100.00 |
| 1.06          | 0.00 | 1.24           | 0.00   | 140.58        | 0.00  | 163.77         | 100.00 |
| 1.24          | 0.00 | 1.44           | 0.00   | 163.77        | 0.00  | 190.80         | 100.00 |
| 1.44          | 0.00 | 1.68           | 0.00   | 190.80        | 0.00  | 222.28         | 100.00 |
| 1.68          | 0.03 | 1.95           | 0.03   | 222.28        | 0.00  | 258.95         | 100.00 |
| 1.95          | 0.04 | 2.28           | 0.07   | 258.95        | 0.00  | 301.68         | 100.00 |
| 2.28          | 0.07 | 2.65           | 0.15   | 301.68        | 0.00  | 351.46         | 100.00 |
| 2.65          | 0.11 | 3.09           | 0.26   | 351.46        | 0.00  | 409.45         | 100.00 |
| 3.09          | 0.16 | 3.60           | 0.42   | 409.45        | 0.00  | 477.01         | 100.00 |
| 3.60          | 0.23 | 4.19           | 0.65   | 477.01        | 0.00  | 555.71         | 100.00 |
| 4.19          | 0.28 | 4.88           | 0.93   | 555.71        | 0.00  | 647.41         | 100.00 |
| 4.88          | 0.32 | 5.69           | 1.25   | 647.41        | 0.00  | 754.23         | 100.00 |
| 5.69          | 0.29 | 6.63           | 1.54   | 754.23        | 0.00  | 878.67         | 100.00 |



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Malvern, UK  
Tel:01684 892456 Fax:01684 892789

Mastersizer S long bed Ver. 2.19  
Serial Number: 32913-57

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31 Oct 06 13:27

# MALVERN MASTERSIZER

## Result: Analysis Report

User Name: Jacinta Parenzee

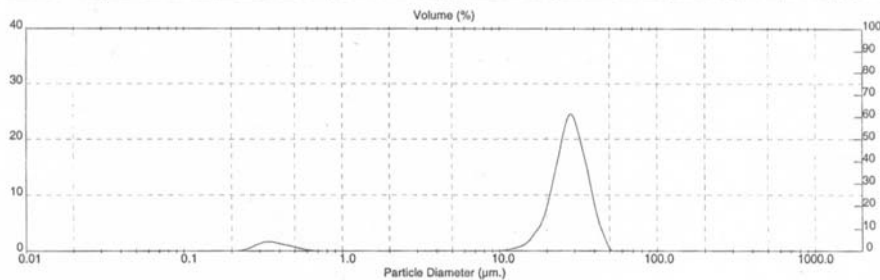
Security Level: 1

| Sample Details                       |                  |                                    |
|--------------------------------------|------------------|------------------------------------|
| Sample ID: 6PSI-d                    | Run Number: 6    | Measured: Tue 31 Oct 2006 2:00p.m. |
| Sample File: YUEWEN                  | Record Number: 7 | Analysed: Tue 31 Oct 2006 2:00p.m. |
| Sample Path: C:\SIZERS\DATA\JACINTA\ |                  | Result Source: Analysed            |
| Sample Notes:                        |                  |                                    |

| System Details               |                                     |                           |                     |
|------------------------------|-------------------------------------|---------------------------|---------------------|
| Range Lens: 300RF mm         | Beam Length: 2.40 mm                | Sampler: MS17             | Obscuration: 11.8 % |
| Presentation: 3OHD           | [Particle R.I. = ( 1.5295, 0.1000); | Dispersant R.I. = 1.3300] | Residual: 0.711 %   |
| Analysis Model: Polydisperse |                                     |                           |                     |
| Modifications: None          |                                     |                           |                     |

| Result Statistics         |                             |                             |                                  |
|---------------------------|-----------------------------|-----------------------------|----------------------------------|
| Distribution Type: Volume | Concentration = 0.0185 %Vol | Density = 2.560 g / cub. cm | Specific S.A. = 0.5028 sq. m / g |
| Mean Diameters:           | D (v, 0.1) = 17.04 um       | D (v, 0.5) = 27.71 um       | D (v, 0.9) = 37.46 um            |
| D [4, 3] = 26.84 um       | D [3, 2] = 4.66 um          | Span = 7.370E-01            | Uniformity = 2.472E-01           |

| Size Low (um) | In % | Size High (um) | Under% | Size Low (um) | In %  | Size High (um) | Under% |
|---------------|------|----------------|--------|---------------|-------|----------------|--------|
| 0.05          | 0.00 | 0.06           | 0.00   | 6.63          | 0.01  | 7.72           | 6.45   |
| 0.06          | 0.00 | 0.07           | 0.00   | 7.72          | 0.02  | 9.00           | 6.48   |
| 0.07          | 0.00 | 0.08           | 0.00   | 9.00          | 0.09  | 10.48          | 6.56   |
| 0.08          | 0.00 | 0.09           | 0.00   | 10.48         | 0.27  | 12.21          | 6.83   |
| 0.09          | 0.00 | 0.11           | 0.00   | 12.21         | 0.73  | 14.22          | 7.56   |
| 0.11          | 0.00 | 0.13           | 0.00   | 14.22         | 1.82  | 16.57          | 9.38   |
| 0.13          | 0.00 | 0.15           | 0.00   | 16.57         | 4.35  | 19.31          | 13.73  |
| 0.15          | 0.00 | 0.17           | 0.00   | 19.31         | 9.64  | 22.49          | 23.37  |
| 0.17          | 0.00 | 0.20           | 0.00   | 22.49         | 17.86 | 26.20          | 41.23  |
| 0.20          | 0.05 | 0.23           | 0.06   | 26.20         | 24.44 | 30.53          | 65.67  |
| 0.23          | 0.37 | 0.27           | 0.42   | 30.53         | 19.42 | 35.56          | 85.09  |
| 0.27          | 1.18 | 0.31           | 1.60   | 35.56         | 11.12 | 41.43          | 96.21  |
| 0.31          | 1.71 | 0.36           | 3.31   | 41.43         | 3.79  | 48.27          | 100.00 |
| 0.36          | 1.43 | 0.42           | 4.74   | 48.27         | 0.00  | 56.23          | 100.00 |
| 0.42          | 0.99 | 0.49           | 5.73   | 56.23         | 0.00  | 65.51          | 100.00 |
| 0.49          | 0.53 | 0.58           | 6.26   | 65.51         | 0.00  | 76.32          | 100.00 |
| 0.58          | 0.16 | 0.67           | 6.42   | 76.32         | 0.00  | 88.91          | 100.00 |
| 0.67          | 0.03 | 0.78           | 6.44   | 88.91         | 0.00  | 103.58         | 100.00 |
| 0.78          | 0.00 | 0.91           | 6.45   | 103.58        | 0.00  | 120.67         | 100.00 |
| 0.91          | 0.00 | 1.06           | 6.45   | 120.67        | 0.00  | 140.58         | 100.00 |
| 1.06          | 0.00 | 1.24           | 6.45   | 140.58        | 0.00  | 163.77         | 100.00 |
| 1.24          | 0.00 | 1.44           | 6.45   | 163.77        | 0.00  | 190.80         | 100.00 |
| 1.44          | 0.00 | 1.68           | 6.45   | 190.80        | 0.00  | 222.28         | 100.00 |
| 1.68          | 0.00 | 1.95           | 6.45   | 222.28        | 0.00  | 258.95         | 100.00 |
| 1.95          | 0.00 | 2.28           | 6.45   | 258.95        | 0.00  | 301.68         | 100.00 |
| 2.28          | 0.00 | 2.65           | 6.45   | 301.68        | 0.00  | 351.46         | 100.00 |
| 2.65          | 0.00 | 3.09           | 6.45   | 351.46        | 0.00  | 409.45         | 100.00 |
| 3.09          | 0.00 | 3.60           | 6.45   | 409.45        | 0.00  | 477.01         | 100.00 |
| 3.60          | 0.00 | 4.19           | 6.45   | 477.01        | 0.00  | 555.71         | 100.00 |
| 4.19          | 0.00 | 4.88           | 6.45   | 555.71        | 0.00  | 647.41         | 100.00 |
| 4.88          | 0.00 | 5.69           | 6.45   | 647.41        | 0.00  | 754.23         | 100.00 |
| 5.69          | 0.00 | 6.63           | 6.45   | 754.23        | 0.00  | 878.67         | 100.00 |



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 31 Oct 06 14:00

## A.5 EXAMPLES OF DATA FOR SPECIFIC SURFACE AREA AND PORE SIZE

(From page A-19 to A-25)

Quantachrome Corporation  
NOVA 1000 High Speed Gas Sorption Analyser  
Version 3.70

```

User ID           = 88                Sample ID         = 07.05.14.3
User setup       = USER_7           Sample Cell Number = 2
Comments:
Sample Weight    = 0.1001 g          Sample Volume     = 0.2737 cc
Sample Density   = 0.3658 g/cc
PO Type         = DEFAULT            PO               = 818.02 mm Hg
Adsorption Tolerance = 0.1000      Desorption Tolerance = 0.1000
Adsorption Equil Time = 180 sec     Desorption Equil Time = 180 sec
Adsorption Dwell Time = 366 sec     Desorption Dwell Time = 360 sec

Analysis started : Sun Jun 17 17:18:59 2007
Analysis finished : Tue Jun 19 03:02:13 2007 18/6 15:30 - point 9
Elapsed time      : 2023.23 minutes
  
```

### 7 Point BET

| Target<br>Relative<br>Pressure<br>[P/P0] | Actual<br>Relative<br>Pressure<br>[P/P0] | Total<br>Volume<br>Adsorbed<br>[cc/g] | BET<br>Transform<br>1/(W[P0/P - 1]) |
|--|--|---------------------------------------|-------------------------------------|
| 0.0250                                   | 0.0176                                   | 0.8638                                | 16.5956                             |
| 0.1250                                   | 0.1214                                   | 2.0649                                | 53.5276                             |
| 0.2250                                   | 0.2255                                   | 3.0076                                | 77.4620                             |
| 0.3250                                   | 0.3312                                   | 3.9000                                | 101.6119                            |
| 0.4250                                   | 0.4169                                   | 4.6528                                | 122.9523                            |
| 0.5250                                   | 0.5307                                   | 5.6209                                | 161.0004                            |
| 0.9900                                   | 0.9901                                   | 15627.0078                            | 5.1430                              |

```

Surface Area           = 4.7053      sq m
Specific Surface Area  = 47.0058     sq m/g

Slope                  = -4.508096
Intercept              = 78.595001
Correlation Coefficient = 0.025675
BET C                  = 0.942641
  
```

Quantachrome Corporation  
NOVA 1000 High Speed Gas Sorption Analyzer  
Version 3.70

```

User ID           = 88                Sample ID         = 07.05.14.2
User setup        = USER_7           Sample Cell Number = 2
Comments:
Sample Weight     = 0.1001 g          Sample Volume     = 0.2737 cc
Sample Density    = 0.3658 g/cc
PO Type           = DEFAULT           PO                = 818.02 mm Hg
Adsorption Tolerance = 0.1000       Desorption Tolerance = 0.1000
Adsorption Equil Time = 180 sec      Desorption Equil Time = 180 sec
Adsorption Dwell Time = 366 sec      Desorption Dwell Time = 360 sec

Analysis started   : Sun Jun 17 17:18:59 2007
Analysis finished  : Tue Jun 19 03:02:13 2007
Elapsed time       : 2023.23 minutes
    
```

Single Point BET

| Target<br>Relative<br>Pressure<br>[P/PO] | Actual<br>Relative<br>Pressure<br>[P/PO] | Total<br>Volume<br>Adsorbed<br>[cc/g] |
|--|--|---------------------------------------|
| 0.3250                                   | 0.3312                                   | 3.9000                                |

```

Surface Area           = 1.1363      sq m
Specific Surface Area = 11.3521     sq m/g
    
```



Quantachrome Corporation  
NOVA 1000 High Speed Gas Sorption Analyzer  
Version 3.70

```

User ID      = 88          Sample ID      = 07.05.14.2
User setup   = USER_7    Sample Cell Number = 2
Comments:
Sample Weight = 0.1001 g   Sample Volume   = 0.2737 cc
Sample Density = 0.3658 g/cc
PO Type      = DEFAULT    PO              = 818.02 mm Hg
Adsorption Tolerance = 0.1000   Desorption Tolerance = 0.1000
Adsorption Equil Time = 180 sec  Desorption Equil Time = 180 sec
Adsorption Dwell Time = 366 sec  Desorption Dwell Time = 360 sec

Analysis started   : Sun Jun 17 17:18:59 2007
Analysis finished  : Tue Jun 19 03:02:13 2007
Elapsed time       : 2023.23 minutes
    
```

Total Pore Volume

| Target<br>Relative<br>Pressure<br>[P/PO] | Actual<br>Relative<br>Pressure<br>[P/PO] | Total<br>Volume<br>Adsorbed<br>[cc/g] |
|--|--|---------------------------------------|
| 0.9900                                   | 0.9901                                   | 15627.0078                            |

Total Pore Volume is 24138.145 e-3 cc/g for  
all pores less than 964.614 Angstrom

Average Pore Radius is 10270.277 Angstrom

Quantachrome Corporation  
NOVA 1000 High Speed Gas Sorption Analyzer  
Version 3.70

```

User ID           = 88                Sample ID         = 07.05.14.2
User setup       = USER_7           Sample Cell Number = 2
Comments:
Sample Weight    = 0.1001 g          Sample Volume     = 0.2737 cc
Sample Density   = 0.3658 g/cc
PO Type         = DEFAULT           PO               = 818.02 mm Hg
Adsorption Tolerance = 0.1000      Desorption Tolerance = 0.1000
Adsorption Equil Time = 180 sec     Desorption Equil Time = 180 sec
Adsorption Dwell Time = 366 sec     Desorption Dwell Time = 360 sec

Analysis started   : Sun Jun 17 17:18:59 2007
Analysis finished : Tue Jun 19 03:02:13 2007
Elapsed time      : 2023.23 minutes

```

ISOTHERM DATA

| Target<br>Relative<br>Pressure<br>[P/PO] | Actual<br>Relative<br>Pressure<br>[P/PO] | Total<br>Volume<br>Adsorbed<br>[cc/g] |
|--|--|---------------------------------------|
| 0.0250                                   | 0.0176                                   | 0.8638                                |
| 0.1250                                   | 0.1214                                   | 2.0649                                |
| 0.2250                                   | 0.2255                                   | 3.0076                                |
| 0.3250                                   | 0.3312                                   | 3.9000                                |
| 0.4250                                   | 0.4169                                   | 4.6528                                |
| 0.5250                                   | 0.5307                                   | 5.6209                                |
| 0.9900                                   | 0.9901                                   | 15627.0078                            |
| 0.9524                                   | 0.9574                                   | 8195.2266                             |
| 0.9148                                   | 0.9232                                   | 181.7633                              |
| 0.8772                                   | 0.8853                                   | 75.2505                               |
| 0.8396                                   | 0.8469                                   | 37.8603                               |
| 0.8020                                   | 0.8080                                   | 20.6971                               |
| 0.7644                                   | 0.7699                                   | 11.5021                               |
| 0.7268                                   | 0.7325                                   | 6.0127                                |
| 0.6892                                   | 0.6904                                   | 2.0969                                |
| 0.6516                                   | 0.6571                                   | 0.1666                                |
| 0.6140                                   | 0.6187                                   | -1.3005                               |
| 0.5764                                   | 0.5797                                   | -2.0725                               |
| 0.5388                                   | 0.5412                                   | -2.4896                               |
| 0.5012                                   | 0.5016                                   | -2.5207                               |
| 0.4636                                   | 0.4642                                   | -2.4471                               |
| 0.4260                                   | 0.4341                                   | -2.0407                               |
| 0.3884                                   | 0.3855                                   | -1.5318                               |
| 0.3508                                   | 0.3582                                   | -1.1704                               |
| 0.3132                                   | 0.3114                                   | -0.6388                               |
| 0.2756                                   | 0.2711                                   | -0.1346                               |
| 0.2380                                   | 0.2453                                   | 0.2761                                |

Quantachrome Corporation  
NOVA 1000 High Speed Gas Sorption Analyzer  
Version 3.70

```

User ID           = 88                Sample ID         = 07.05.14.2
User setup        = USER_7           Sample Cell Number = 2
Comments:
Sample Weight     = 0.1001 g          Sample Volume     = 0.2737 cc
Sample Density    = 0.3658 g/cc
PO Type          = DEFAULT           PO                = 818.02 mm Hg
Adsorption Tolerance = 0.1000       Desorption Tolerance = 0.1000
Adsorption Equil Time = 180 sec      Desorption Equil Time = 180 sec
Adsorption Dwell Time = 366 sec      Desorption Dwell Time = 360 sec

Analysis started   : Sun Jun 17 17:18:59 2007
Analysis finished  : Tue Jun 19 03:02:13 2007
Elapsed time       : 2023.23 minutes
    
```

ISOTHERM DATA

| Target<br>Relative<br>Pressure<br>[P/PO] | Actual<br>Relative<br>Pressure<br>[P/PO] | Total<br>Volume<br>Adsorbed<br>[cc/g] |
|--|--|---------------------------------------|
| 0.2004                                   | 0.1982                                   | 0.6412                                |
| 0.1628                                   | 0.1592                                   | 0.9730                                |
| 0.1252                                   | 0.1334                                   | 1.3805                                |
| 0.0876                                   | 0.0856                                   | 1.8849                                |
| 0.0500                                   | 0.0466                                   | 2.3573                                |

## A.6 EXAMPLES OF FT-IR SPECTRA ANALYSIS

