**Supplementary Materials**

**Surface Thermodynamic Properties of Styrene–Divinylbenzene Copolymer Modified by** S**upramolecular** S**tructure of** **Melamine using Inverse Gas Chromatography**

**Tayssir Hamieh1,2\*,** **Vladimir Yu Gus’kov3**

1Faculty of Science and Engineering, Maastricht University, P.O. Box 616, 6200 MD Maastricht, Netherlands.

2Laboratory of Materials, Catalysis, Environment and Analytical Methods (MCEMA), Faculty of Sciences, Lebanese University, Hadath, Lebanon.

3Bashkir State University, Ufa, 450076 Russia.

\*Correspondence: Faculty of Science and Engineering, Maastricht University, P.O. Box 616, 6200 MD Maastricht, The Netherlands, E-mail: [t.hamieh@maastrichtuniversity.nl](mailto:t.hamieh@maastrichtuniversity.nl)

**Table S1.** Values of (kJ/mol) of n-alkanes adsorbed on silica particles as a function of the temperature

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Dowex L-285** | | | | | |
| Solvents | 443.15K | 453.15K | 463.15K | 473.15K |  |
| n-Hexane | 24.005 | 23.280 | 22.856 | 22.233 |  |
| n-Heptane | 28.415 | 27.432 | 25.977 | 25.183 |  |
| n-Octane | 34.457 | 33.120 | 30.253 | 29.225 |  |
| n-Nonane | 38.251 | 36.693 | 32.938 | 31.763 |  |
| Cyclohexane | 21.129 | 20.571 | 20.821 | 20.309 |  |
| Benzene | 18.494 | 18.091 | 18.956 | 18.546 |  |
| Toluene | 21.666 | 21.077 | 21.200 | 20.667 |  |
| Ethyl acetate | 16.262 | 15.989 | 17.377 | 17.053 |  |
| Ethanol | 5.332 | 5.698 | 9.642 | 9.740 |  |
| n-Propanol | 10.156 | 10.239 | 13.054 | 12.965 |  |
| i-Propanol | 9.595 | 9.712 | 12.659 | 12.591 |  |
| n-Butanol | 15.458 | 15.232 | 16.807 | 16.514 |  |
| i-Butanol | 14.571 | 14.396 | 16.180 | 15.921 |  |
| n-Pentanol | 20.636 | 20.107 | 20.472 | 19.979 |  |
| i-Pentanol | 19.792 | 19.312 | 19.875 | 19.414 |  |
| Pyridine | 16.250 | 15.977 | 17.368 | 17.044 |  |
| Dichloromethane | 11.991 | 11.968 | 14.358 | 14.200 |  |
| **1% Melamine on Dowex L-285** | | | | | |
| Solvents | 453.15K | 458.15K | 463.15K | 468.15K | 473.15K |
| n-Hexane | 20.024 | 20.210 | 19.998 | 19.776 | 18.582 |
| n-Heptane | 24.234 | 23.957 | 23.697 | 23.412 | 21.373 |
| n-Octane | 27.857 | 27.182 | 26.880 | 26.541 | 23.775 |
| n-Nonane | 32.821 | 31.601 | 31.241 | 30.828 | 27.066 |
| Cyclohexane | 35.938 | 34.376 | 33.980 | 33.521 | 29.132 |
| Benzene | 21.870 | 21.853 | 21.620 | 21.370 | 19.806 |
| Toluene | 19.706 | 19.927 | 19.719 | 19.501 | 18.371 |
| Ethyl acetate | 22.311 | 22.246 | 22.008 | 21.751 | 20.098 |
| Ethanol | 17.871 | 18.294 | 18.108 | 17.917 | 17.157 |
| n-Propanol | 8.894 | 10.303 | 10.220 | 10.163 | 11.204 |
| i-Propanol | 12.859 | 13.832 | 13.704 | 13.587 | 13.832 |
| n-Butanol | 12.391 | 13.415 | 13.292 | 13.183 | 13.521 |
| i-Butanol | 17.216 | 17.710 | 17.531 | 17.350 | 16.721 |
| Dichloromethane | 16.477 | 17.052 | 16.882 | 16.711 | 16.229 |
| **2% Melamine on Dowex L-285** | | | | | |
| Solvents | 453.15K | 458.15K | 463.15K | 468.15K | 473.15K |
| n-Hexane | 17.539 | 17.245 | 17.504 | 17.209 | 14.712 |
| n-Heptane | 20.970 | 20.745 | 20.933 | 20.588 | 18.000 |
| n-Octane | 23.924 | 23.759 | 23.883 | 23.497 | 20.830 |
| n-Nonane | 27.970 | 27.887 | 27.926 | 27.482 | 24.708 |
| Cyclohexane | 30.512 | 30.479 | 30.464 | 29.985 | 27.142 |
| Benzene | 19.043 | 18.779 | 19.007 | 18.690 | 16.154 |
| Toluene | 17.279 | 16.980 | 17.245 | 16.953 | 14.464 |
| Ethyl acetate | 19.406 | 19.149 | 19.369 | 19.047 | 16.501 |
| Ethanol | 15.786 | 15.456 | 15.754 | 15.482 | 13.033 |
| n-Propanol | 8.465 | 7.987 | 8.438 | 8.270 | 6.015 |
| i-Propanol | 11.703 | 11.290 | 11.673 | 11.458 | 9.117 |
| n-Butanol | 11.342 | 10.922 | 11.313 | 11.105 | 8.774 |
| i-Butanol | 15.254 | 14.913 | 15.221 | 14.956 | 12.520 |
| Dichloromethane | 14.660 | 14.307 | 14.628 | 14.372 | 11.952 |
| **3% Melamine on Dowex L-285** | | | | | |
| Solvents | 453.15K | 458.15K | 463.15K | 468.15K | 473.15K |
| n-Hexane | 19.434 | 18.763 | 18.809 | 18.682 | 18.206 |
| n-Heptane | 23.098 | 22.445 | 22.427 | 22.182 | 21.769 |
| n-Octane | 26.252 | 25.613 | 25.542 | 25.194 | 24.835 |
| n-Nonane | 30.573 | 29.955 | 29.810 | 29.322 | 29.036 |
| Cyclohexane | 33.287 | 32.681 | 32.489 | 31.913 | 31.674 |
| Benzene | 21.040 | 20.378 | 20.395 | 20.217 | 19.768 |
| Toluene | 19.158 | 18.486 | 18.536 | 18.419 | 17.938 |
| Ethyl acetate | 21.424 | 20.763 | 20.774 | 20.583 | 20.141 |
| Ethanol | 17.562 | 16.883 | 16.960 | 16.895 | 16.386 |
| n-Propanol | 9.749 | 9.033 | 9.242 | 9.429 | 8.785 |
| i-Propanol | 13.201 | 12.500 | 12.651 | 12.726 | 12.140 |
| n-Butanol | 12.795 | 12.093 | 12.250 | 12.338 | 11.746 |
| i-Butanol | 16.993 | 16.311 | 16.396 | 16.348 | 15.828 |
| Dichloromethane | 16.352 | 15.667 | 15.763 | 15.736 | 15.205 |
| **4% Melamine on Dowex L-285** | | | | | |
| Solvents | 453.15K | 458.15K | 463.15K | 468.15K | 473.15K |
| n-Hexane | 20.134 | 19.612 | 19.580 | 19.192 | 17.679 |
| n-Heptane | 24.100 | 23.616 | 23.477 | 23.084 | 20.677 |
| n-Octane | 27.514 | 27.063 | 26.832 | 26.434 | 23.258 |
| n-Nonane | 32.191 | 31.786 | 31.428 | 31.023 | 26.794 |
| Cyclohexane | 35.128 | 34.751 | 34.314 | 33.905 | 29.014 |
| Benzene | 21.874 | 21.369 | 21.290 | 20.900 | 18.995 |
| Toluene | 19.836 | 19.311 | 19.287 | 18.900 | 17.454 |
| Ethyl acetate | 22.296 | 21.795 | 21.704 | 21.314 | 19.315 |
| Ethanol | 18.106 | 17.563 | 17.586 | 17.201 | 16.146 |
| n-Propanol | 9.656 | 9.030 | 9.280 | 8.907 | 9.757 |
| i-Propanol | 13.397 | 12.807 | 12.957 | 12.578 | 12.586 |
| n-Butanol | 12.955 | 12.361 | 12.523 | 12.145 | 12.251 |
| i-Butanol | 17.497 | 16.948 | 16.987 | 16.602 | 15.685 |
| Dichloromethane | 16.800 | 16.244 | 16.302 | 15.918 | 15.157 |

**Table S2.** Variations of of different polar solvents adsorbed on Dowex L-285 and various melamine percentages as a function of temperature.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Dowex L-285** | | | | | |
| Solvents | 453.15K | 458.15K | 463.15K | 468.15K | 473.15K |
| Cyclohexane | 1.348 | 1.325 | 1.303 | 1.280 | 1.258 |
| Benzene | 0.364 | 0.358 | 0.353 | 0.347 | 0.342 |
| Toluene | 1.734 | 1.536 | 1.338 | 1.140 | 0.942 |
| Ethyl acetate | 10.106 | 9.593 | 9.079 | 8.566 | 8.052 |
| Ethanol | 11.125 | 10.220 | 9.315 | 8.410 | 7.505 |
| n-Propanol | 5.054 | 4.241 | 3.427 | 2.614 | 1.800 |
| i-Propanol | 9.726 | 8.890 | 8.055 | 7.219 | 6.384 |
| n-Butanol | 3.395 | 2.927 | 2.459 | 1.991 | 1.523 |
| i-Butanol | 9.307 | 8.678 | 8.048 | 7.419 | 6.789 |
| n-Pentanol | 2.974 | 2.802 | 2.630 | 2.458 | 2.286 |
| i-Pentanol | 7.992 | 7.558 | 7.124 | 6.690 | 6.256 |
| Pyridine | 10.306 | 9.575 | 8.843 | 8.112 | 7.380 |
| Dichloromethane | 15.274 | 15.239 | 15.204 | 15.169 | 15.134 |
| **1% Melamine on Dowex L-285** | | | | | |
| Solvents | 453.15K | 458.15K | 463.15K | 468.15K | 473.15K |
| Cyclohexane | 0.779 | 0.774 | 0.769 | 0.764 | 0.759 |
| Benzene | 0.447 | 0.434 | 0.421 | 0.408 | 0.395 |
| Toluene | 1.532 | 1.460 | 1.389 | 1.317 | 1.246 |
| Ethyl acetate | 8.503 | 8.378 | 8.253 | 8.128 | 8.003 |
| Ethanol | 12.783 | 12.128 | 11.473 | 10.818 | 10.163 |
| n-Propanol | 9.446 | 8.761 | 8.076 | 7.391 | 6.706 |
| i-Propanol | 6.214 | 5.554 | 4.894 | 4.234 | 3.574 |
| n-Butanol | 7.988 | 7.483 | 6.978 | 6.473 | 5.968 |
| i-Butanol | 3.733 | 3.113 | 2.493 | 1.873 | 1.253 |
| Dichloromethane | 15.6085 | 15.559 | 15.509 | 15.459 | 15.409 |
| **2% Melamine on Dowex L-285** | | | | | |
| Solvents | 453.15K | 458.15K | 463.15K | 468.15K | 473.15K |
| Cyclohexane | 0.406 | 0.396 | 0.386 | 0.376 | 0.366 |
| Benzene | 0.286 | 0.271 | 0.256 | 0.241 | 0.226 |
| Toluene | 3.771 | 3.691 | 3.611 | 3.531 | 3.451 |
| Ethyl acetate | 9.667 | 9.507 | 9.347 | 9.187 | 9.027 |
| Ethanol | 10.070 | 9.020 | 7.970 | 6.920 | 5.870 |
| n-Propanol | 12.489 | 11.464 | 10.439 | 9.414 | 8.389 |
| i-Propanol | 30.875 | 30.160 | 29.445 | 28.730 | 28.015 |
| n-Butanol | 11.446 | 10.516 | 9.586 | 8.656 | 7.726 |
| i-Butanol | 16.083 | 15.308 | 14.533 | 13.758 | 12.983 |
| Dichloromethane | 24.34935 | 24.294 | 24.239 | 24.184 | 24.129 |
| **3% Melamine on Dowex L-285** | | | | | |
| Solvents | 453.15K | 458.15K | 463.15K | 468.15K | 473.15K |
| Cyclohexane | 0.617 | 0.605 | 0.593 | 0.581 | 0.569 |
| Benzene | 1.374 | 1.359 | 1.344 | 1.329 | 1.314 |
| Toluene | 1.192 | 1.030 | 0.868 | 0.706 | 0.544 |
| Ethyl acetate | 10.567 | 10.314 | 10.060 | 9.807 | 9.553 |
| Ethanol | 15.627 | 14.064 | 12.502 | 10.939 | 9.377 |
| n-Propanol | 12.522 | 10.977 | 9.432 | 7.887 | 6.342 |
| i-Propanol | 10.925 | 9.518 | 8.110 | 6.703 | 5.295 |
| n-Butanol | 11.291 | 9.891 | 8.491 | 7.091 | 5.691 |
| i-Butanol | 9.549 | 8.284 | 7.019 | 5.754 | 4.489 |
| Dichloromethane | 9.737 | 9.352 | 8.967 | 8.582 | 8.197 |
| **4% Melamine on Dowex L-285** | | | | | |
| Solvents | 453.15K | 458.15K | 463.15K | 468.15K | 473.15K |
| Cyclohexane | 1.742 | 1.741 | 1.739 | 1.738 | 1.736 |
| Benzene | 2.164 | 2.139 | 2.114 | 2.089 | 2.064 |
| Toluene | 8.699 | 8.539 | 8.379 | 8.219 | 8.059 |
| Ethyl acetate | 8.371 | 8.061 | 7.751 | 7.441 | 7.131 |
| Ethanol | 20.283 | 19.048 | 17.813 | 16.578 | 15.343 |
| n-Propanol | 22.080 | 20.900 | 19.720 | 18.540 | 17.360 |
| i-Propanol | 18.025 | 16.950 | 15.875 | 14.800 | 13.725 |
| n-Butanol | 16.621 | 15.566 | 14.511 | 13.456 | 12.401 |
| i-Butanol | 11.625 | 10.600 | 9.575 | 8.550 | 7.525 |
| Dichloromethane | 19.157 | 18.837 | 18.517 | 18.197 | 17.877 |

**Table S3.** Values of , , , , and of Dowex L-285 and the different percentages of melamine on the copolymer.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Dowex L-285** | | | | | |
| T(K) |  |  |  |  |  |
| 453.15 | 143.17 | 11.61 | 81.54 | 104.03 | 185.57 |
| 458.15 | 140.35 | 10.37 | 76.29 | 99.85 | 176.14 |
| 463.15 | 137.59 | 9.20 | 71.17 | 95.68 | 166.85 |
| 468.15 | 134.90 | 8.12 | 66.19 | 91.50 | 157.69 |
| 473.15 | 132.28 | 7.11 | 61.33 | 87.33 | 148.66 |
| **1% Melamine on Dowex L-285** | | | | | |
| T(K) |  |  |  |  |  |
| 453.15 | 149.51 | 8.22 | 70.11 | 85.16 | 155.28 |
| 458.15 | 146.29 | 7.91 | 68.03 | 80.69 | 148.72 |
| 463.15 | 143.15 | 7.60 | 65.99 | 76.14 | 142.13 |
| 468.15 | 140.10 | 7.31 | 64.00 | 71.59 | 135.59 |
| 473.15 | 137.12 | 7.02 | 62.07 | 67.04 | 129.10 |
| **2% Melamine on Dowex L-285** | | | | | |
| T(K) |  |  |  |  |  |
| 453.15 | 363.86 | 10.62 | 124.35 | 44.44 | 168.79 |
| 458.15 | 356.69 | 10.18 | 120.53 | 42.39 | 162.93 |
| 463.15 | 349.71 | 9.75 | 116.81 | 36.22 | 153.03 |
| 468.15 | 342.90 | 9.34 | 113.18 | 34.99 | 148.16 |
| 473.15 | 336.25 | 8.94 | 109.63 | 31.75 | 141.38 |
| **3% Melamine on Dowex L-285** | | | | | |
| T(K) |  |  |  |  |  |
| 453.15 | 58.19 | 12.69 | 54.36 | 64.53 | 118.89 |
| 458.15 | 52.86 | 11.98 | 50.34 | 62.61 | 112.95 |
| 463.15 | 47.86 | 11.30 | 46.51 | 57.76 | 104.27 |
| 468.15 | 43.18 | 10.64 | 42.87 | 51.14 | 94.01 |
| 473.15 | 38.81 | 10.01 | 39.41 | 49.60 | 89.02 |
| **4% Melamine on Dowex L-285** | | | | | |
| T(K) |  |  |  |  |  |
| 453.15 | 225.23 | 7.97 | 84.71 | 75.60 | 160.31 |
| 458.15 | 214.45 | 7.32 | 79.24 | 74.09 | 153.33 |
| 463.15 | 204.09 | 6.71 | 73.99 | 67.00 | 140.99 |
| 468.15 | 194.14 | 6.13 | 68.97 | 63.23 | 132.20 |
| 473.15 | 184.58 | 5.58 | 64.16 | 59.12 | 123.28 |