Table 3. The obtained results based on Empirical Model of S12 and the PR-EOS.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Dye** | **T (K)** |  | **Peng-Robinson EOS** | | |  | **Critically Modified M-factor EOS** | |
|  | **k12** | **l12** | **AARD %** | | **S12** | **AARD%** |
| 1-methyl-amino-  anthraquinone | 313.15 |  | 0.501 | 0.473 | 13.05 |  | -0.77-0.0016P+0.0033T | 0.022 |
| 353.15 |  | 0.486 | 0.421 | 18.07 |  | 0.021 |
| 393.15 |  | 0.452 | 0.401 | 16.65 |  | 0.015 |
|  |  |  |  |  |  |  |  |  |
| 2-methyl-  N-phenylacetamide | 308.20 |  | 0.493 | 0.383 | 12.07 |  | -2.167-0.0017P+0.0070T | 0.105 |
| 318.20 |  | 0.476 | 0.371 | 17.90 |  | 0.108 |
| 328.20 |  | 0.435 | 0.366 | 16.33 |  | 0.071 |
|  |  |  |  |  |  |  |  |  |
| 4-methyl-  N-phenylacetamide | 308.20 |  | 0.490 | 0.381 | 19.03 |  | -2.189-0.0015P+0.0070T | 0.108 |
| 318.20 |  | 0.469 | 0.366 | 14.38 |  | 0.133 |
| 328.20 |  | 0.428 | 0.359 | 20.03 |  | 0.113 |
|  |  |  |  |  |  |  |  |  |
| AC03 | 305 |  | 0.403 | 0.216 | 13.30 |  | -0.78-0.0021P+0.0034T | 0.030 |
|  | 310 |  | 0.374 | 0.201 | 21.47 |  | 0.030 |
|  | 315 |  | 0.367 | 0.184 | 19.96 |  | 3.880 |
|  | 320 |  | 0.311 | 0.166 | 30.20 |  | 0.032 |
|  | 330 |  | 0.299 | 0.126 | 16.03 |  | 0.029 |
|  | 340 |  | 0.275 | 0.101 | 17.38 |  | 0.032 |
|  |  |  |  |  |  |  |  |  |
| APAN | 353.15 |  | 0.391 | 0.129 | 17.56 |  | -0.976-0.0012P+0.0036T | 1.183 |
|  | 373.15 |  | 0.327 | 0.137 | 23.54 |  | 1.200 |
|  |  |  |  |  |  |  |  |  |
| Blue 3 | 323.7 |  | 0.401 | 0.303 | 7.99 |  | -0.77-0.0014P+0.0032T | 0.105 |
|  | 353.7 |  | 0.376 | 0.299 | 13.76 |  | 0.064 |
|  | 383.7 |  | 0.361 | 0.274 | 21.01 |  | 0.045 |
|  | 413.7 |  | 0.352 | 0.238 | 19.81 |  | 0.048 |
|  |  |  |  |  |  |  |  |  |
| Blue 14 | 313.15 |  | 0.324 | 0.236 | 17.09 |  | -0.735-0.0016P+0.0032T | 0.094 |
|  | 353.15 |  | 0.318 | 0.217 | 12.71 |  | 0.042 |
|  | 393.15 |  | 0.301 | 0.198 | 13.10 |  | 0.026 |
|  |  |  |  |  |  |  |  |  |
| Blue 60 | 313.15 |  | 0.347 | 0.262 | 5.81 |  | -0.93-0.0011P+0.0035T | 0.137 |
|  | 333.15 |  | 0.337 | 0.249 | 19.09 |  | 0.096 |
|  | 363.15 |  | 0.319 | 0.236 | 12.03 |  | 0.070 |
|  | 393.15 |  | 0.301 | 0.211 | 11.78 |  | 0.040 |
|  | 423.15 |  | 0.289 | 0.202 | 15.91 |  | 0.038 |
|  |  |  |  |  |  |  |  |  |
| Blue 79 | 353.2 |  | 0.412 | 0.341 | 17.74 |  | -0.286-0.0013P+0.0019T | 0.207 |
|  | 373.2 |  | 0.396 | 0.311 | 11.98 |  | 0.278 |
|  | 393.2 |  | 0.378 | 0.283 | 13.13 |  | 0.304 |
|  |  |  |  |  |  |  |  |  |
| Blue 79:1 | 353.2 |  | 0.387 | 0.300 | 14.45 |  | -0.179-0.0013P+0.0016T | 0.228 |
|  | 373.2 |  | 0.359 | 0.283 | 10.93 |  | 0.287 |
|  | 393.2 |  | 0.343 | 0.271 | 6.73 |  | 0.237 |
|  |  |  |  |  |  |  |  |  |
| Blue 134 | 323.15 |  | 0.366 | 0.301 | 19.23 |  | -0.676-0.0016P+0.0031T | 0.144 |
|  | 353.15 |  | 0.348 | 0.293 | 10.99 |  | 0.067 |
|  | 383.15 |  | 0.337 | 0.278 | 16.92 |  | 0.050 |
|  |  |  |  |  |  |  |  |  |
| D1 | 308 |  | 0.368 | 0.183 | 27.30 |  | -0.95-0.0014P+0.0038T | 0.074 |
|  | 318 |  | 0.327 | 0.146 | 18.74 |  | 0.109 |
|  | 328 |  | 0.293 | 0.120 | 23.00 |  | 0.099 |
|  | 338 |  | 0.277 | 0.105 | 31.20 |  | 0.040 |
|  | 348 |  | 0.199 | 0.097 | 17.93 |  | 0.062 |
|  |  |  |  |  |  |  |  |  |
| D2 | 308 |  | 0.427 | 0.201 | 37.00 |  | -0.916-0.0014P+0.0037T | 0.210 |
|  | 318 |  | 0.401 | 0.197 | 25.72 |  | 0.093 |
|  | 328 |  | 0.389 | 0.183 | 17.93 |  | 0.127 |
|  | 338 |  | 0.377 | 0.176 | 23.33 |  | 0.092 |
|  | 348 |  | 0.356 | 0.154 | 31.02 |  | 0.084 |
|  |  |  |  |  |  |  |  |  |
| D3 | 328 |  | 0.399 | 0.187 | 28.01 |  | -0.81-0.0013P+0.0033T | 0.184 |
|  | 338 |  | 0.387 | 0.174 | 31.29 |  | 0.146 |
|  | 348 |  | 0.323 | 0.161 | 23.07 |  | 0.181 |
|  | 358 |  | 0.301 | 0.143 | 15.86 |  | 0.160 |
|  |  |  |  |  |  |  |  |  |
| Yellow 82 | 353.15 |  | 0.298 | 0.103 | 19.07 |  | -0.92-0.0012P+0.0035T | 2.162 |
|  | 373.15 |  | 0.267 | 0.116 | 15.98 |  | 0.666 |
|  |  |  |  |  |  |  |  |  |
| Modified Yellow 119 | 353.2 |  | 0.601 | 0.489 | 26.98 |  | -0.71-0.0013P+0.00298T | 0.323 |
| 373.2 |  | 0.589 | 0.470 | 23.10 |  | 0.565 |
| 393.2 |  | 0.567 | 0.457 | 29.99 |  | 0.255 |
|  |  |  |  |  |  |  |  |  |
| Mordant Brown | 333.15 |  | 0.298 | 0.223 | 23.33 |  | -0.986-0.0016P+0.0039T | 0.003 |
|  | 353.15 |  | 0.276 | 0.207 | 30.06 |  | 0.001 |
|  |  |  |  |  |  |  |  |  |
| Mordant Red 11 | 333.15 |  | 0.402 | 0.268 | 17.87 |  | -0.73-0.0017P+0.0032T | 0.029 |
|  | 353.15 |  | 0.378 | 0.234 | 13.88 |  | 0.038 |
|  |  |  |  |  |  |  |  |  |
| N-phenylacetamide | 308.2 |  | 0.499 | 0.392 | 13.09 |  | -1.708-0.0012P+0.0051T | 0.120 |
| 318.2 |  | 0.482 | 0.379 | 25.06 |  | 0.100 |
| 328.2 |  | 0.443 | 0.367 | 21.03 |  | 0.098 |
|  |  |  |  |  |  |  |  |  |
| Orange 3 | 323.7 |  | 0.388 | 0.322 | 17.76 |  | -0.825-0.0014P+0.0034T | 0.032 |
|  | 353.7 |  | 0.341 | 0.287 | 19.18 |  | 0.014 |
|  | 383.7 |  | 0.331 | 0.273 | 23.04 |  | 0.021 |
|  | 413.7 |  | 0.328 | 0.243 | 15.68 |  | 0.016 |
|  |  |  |  |  |  |  |  |  |
| Orange 11 | 333.15 |  | 0.366 | 0.301 | 14.00 |  | -0.775-0.0017P+0.0034T | 0.029 |
|  | 353.15 |  | 0.340 | 0.289 | 17.09 |  | 0.015 |
|  |  |  |  |  |  |  |  |  |
| Photochromic Dye | 308 |  | 0.313 | 0.195 | 13.00 |  | -0.345-0.0018P+0.0022T | 0.430 |
| 318 |  | 0.284 | 0.151 | 6.60 |  | 0.418 |
| 328 |  | 0.228 | 0.051 | 17.30 |  | 1.035 |
|  |  |  |  |  |  |  |  |  |
| Red 1 | 313.15 |  | 0.368 | 0.259 | 13.35 |  | -0.68-0.0017P+0.0031T | 0.124 |
|  | 353.15 |  | 0.347 | 0.233 | 15.99 |  | 0.115 |
|  | 393.15 |  | 0.325 | 0.211 | 20.32 |  | 0.109 |
|  |  |  |  |  |  |  |  |  |
| Red 60 | 313.15 |  | 0.401 | 0.298 | 15.33 |  | -0.73-0.0015P+0.0032T | 0.025 |
|  | 333.15 |  | 0.384 | 0.287 | 10.28 |  | 0.227 |
|  | 363.15 |  | 0.344 | 0.235 | 11.63 |  | 0.024 |
|  | 393.15 |  | 0.328 | 0.221 | 14.69 |  | 0.131 |
|  | 423.15 |  | 0.317 | 0.211 | 19.99 |  | 0.006 |
|  |  |  |  |  |  |  |  |  |
| Red 73 | 343 |  | 0.365 | 0.238 | 18.03 |  | -0.64-0.0014P+0.0029T | 0.053 |
|  | 363 |  | 0.349 | 0.215 | 23.49 |  | 0.059 |
|  | 383 |  | 0.327 | 0.198 | 17.88 |  | 0.039 |
|  |  |  |  |  |  |  |  |  |
| Red 82 | 353.2 |  | 0.399 | 0.289 | 15.99 |  | -0.61-0.0013P+0.0027T | 0.081 |
|  | 373.2 |  | 0.374 | 0.274 | 21.37 |  | 0.154 |
|  | 393.2 |  | 0.346 | 0.259 | 26.92 |  | 0.048 |
|  |  |  |  |  |  |  |  |  |
| Red 153 | 353.2 |  | 0.332 | 0.301 | 15.31 |  | -0.75-0.0013P+0.0031T | 0.430 |
|  | 393.2 |  | 0.325 | 0.287 | 20.28 |  | 0.224 |
|  |  |  |  |  |  |  |  |  |
| Yellow 7 | 333.15 |  | 0.499 | 0.378 | 20.10 |  | -0.58-0.00178P+0.0028T | 0.157 |
|  | 353.15 |  | 0.486 | 0.368 | 26.31 |  | 0.242 |
|  |  |  |  |  |  |  |  |  |
| Yellow 16 | 323.15 |  | 0.435 | 0.399 | 13.09 |  | -0.677-0.00166P+0.0031T | 0.116 |
|  | 353.15 |  | 0.423 | 0.383 | 23.14 |  | 0.074 |
|  | 383.15 |  | 0.402 | 0.352 | 19.34 |  | 0.046 |
|  |  |  |  |  |  |  |  |  |
| Yellow 119 | 353.2 |  | 0.463 | 0.391 | 23.95 |  | -0.73-0.0013P+0.0030T | 0.460 |
|  | 373.2 |  | 0.457 | 0.368 | 30.31 |  | 0.231 |
|  | 393.2 |  | 0.442 | 0.347 | 25.61 |  | 0.128 |