**Supplementary Materials**

**Table S1.** Kinematic viscosity (mm².s-1) analysis of chichá biodiesel blends / petroleum diesel by the methyl route.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Blends (%) | | | | | | | | |
| T (K) | B0 | B10 | B15 | B20 | B40 | B60 | B80 | B100 |
| 293.15 | 3.9366 | 4.2687 | 4.4671 | 4.7101 | 5.7996 | 6.9498 | 8.5657 | 10.5381 |
| 298.15 | 3.4020 | 3.8151 | 3.9852 | 4.1796 | 5.0868 | 6.1641 | 7.4641 | 9.1287 |
| 303.15 | 3.1590 | 3.4141 | 3.5194 | 3.7341 | 4.4955 | 5.3743 | 6.6217 | 7.6667 |
| 313.15 | 2.5920 | 2.7904 | 2.8876 | 3.0415 | 3.6166 | 4.4145 | 5.1799 | 6.1682 |
| 323.15 | 2.1870 | 2.3409 | 2.4219 | 2.5393 | 3.0172 | 3.5316 | 4.1958 | 4.9532 |
| 333.15 | 1.8711 | 1.9966 | 2.0574 | 2.1505 | 2.5353 | 2.9484 | 3.4870 | 4.0662 |
| 343.15 | 1.6281 | 1.7415 | 1.7941 | 1.8630 | 2.1789 | 2.5069 | 2.9241 | 3.4061 |
| 353.15 | 1.4256 | 1.5228 | 1.5754 | 1.6240 | 1.8873 | 2.1708 | 2.5231 | 2.9120 |

**Table S2.** Kinematic viscosity (mm².s-1) analysis of the biodiesel blends of chichá / petroleum diesel by the ethanol route.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Blends (%) | | | | | | | | |
| T (K) | B0 | B10 | B15 | B20 | B40 | B60 | B80 | B100 |
| 293.15 | 3.9366 | 4.2544 | 4.4798 | 4.7696 | 5.6551 | 6.8545 | 8.5813 | 10.5938 |
| 298.15 | 3.4020 | 3.7996 | 3.9928 | 4.2302 | 4.9507 | 6.0616 | 7.4945 | 9.1729 |
| 303.15 | 3.1590 | 3.2401 | 3.3528 | 3.5661 | 4.3671 | 5.3492 | 6.5084 | 7.6998 |
| 313.15 | 2.5920 | 2.6645 | 2.7531 | 2.9100 | 3.5178 | 4.2987 | 5.1520 | 6.2105 |
| 323.15 | 2.1870 | 2.2298 | 2.3184 | 2.4230 | 2.9020 | 3.5581 | 4.1578 | 4.9668 |
| 333.15 | 1.8711 | 1.8998 | 1.9521 | 2.0608 | 2.4472 | 2.9221 | 3.4494 | 4.0813 |
| 343.15 | 1.6281 | 1.6502 | 1.6945 | 1.8250 | 2.1010 | 2.4794 | 2.8939 | 3.4172 |
| 353.15 | 1.4256 | 1.4490 | 1.4852 | 1.5576 | 1.8072 | 2.1453 | 2.4834 | 2.9181 |

**Table S3.** Relative error calculated between experimental and predicted viscosity values.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Composition of mixtures | Eqs. | Temperature (K) | | | | | | | |
| 293.15 | 298.15 | 303.15 | 313.15 | 323.15 | 333.15 | 343.15 | 353.15 |
| B0 | Eq. (1) | 0.511 | 1.835 | 2.032 | 1.425 | 0.754 | 3.986 | 4.208 | 4.462 |
| B10 | 0.310 | 1.086 | 1.781 | 2.079 | 0.544 | 2.456 | 3.147 | 2.171 |
| B15 | 0.434 | 0.928 | 0.496 | 1.756 | 0.813 | 2.233 | 3.149 | 1.309 |
| B20 | 0.091 | 1.042 | 1.968 | 3.030 | 2.211 | 0.786 | 2.471 | 0.196 |
| B40 | 1.241 | 1.271 | 1.577 | 3.026 | 4.359 | 2.371 | 0.170 | 0.435 |
| B60 | 0.499 | 0.639 | 0.235 | 4.347 | 3.141 | 2.522 | 0.491 | 0.829 |
| B80 | 1.078 | 0.289 | 1.156 | 1.314 | 2.763 | 3.613 | 1.936 | 0.884 |
| B100 | 3.340 | 1.703 | 2.985 | 0.187 | 1.751 | 3.067 | 3.312 | 2.837 |
| B0 | Eq. (2) | 0.329 | 1.391 | 3.724 | 5.013 | 3.646 | 0.412 | 0.453 | 11.857 |
| B10 | 0.636 | 1.875 | 1.189 | 1.359 | 0.302 | 2.794 | 3.791 | 3.652 |
| B15 | 0.143 | 2.556 | 1.902 | 0.948 | 1.062 | 2.909 | 4.234 | 1.526 |
| B20 | 1.865 | 3.865 | 0.142 | 2.543 | 2.038 | 0.633 | 0.176 | 1.808 |
| B40 | 0.594 | 0.023 | 0.837 | 3.420 | 3.895 | 2.029 | 0.416 | 0.674 |
| B60 | 1.651 | 0.308 | 0.463 | 3.355 | 5.711 | 2.993 | 0.566 | 0.103 |
| B80 | 0.667 | 0.391 | 0.669 | 0.805 | 1.593 | 1.756 | 0.042 | 0.695 |
| B100 | 2.324 | 0.755 | 3.920 | 0.737 | 0.132 | 0.607 | 0.538 | 0.882 |

**Table S4.** Analysis of the density (kg.m-3) of chichá biodiesel blends / mineral diesel by the methyl route.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Blends (%) | | | | | | | | |
| T (K) | B0 | B10 | B15 | B20 | B40 | B60 | B80 | B100 |
| 283.15 | 836.3 | 841.6 | 844.3 | 847.5 | 859.1 | 870.5 | 880.9 | 895.4 |
| 288.15 | 832.6 | 838.3 | 841.1 | 844.2 | 855.8 | 867.6 | 878.1 | 892.3 |
| 293.15 | 828.6 | 834.3 | 836.8 | 839.8 | 851.7 | 863.9 | 875.0 | 888.5 |
| 298.15 | 824.2 | 830.4 | 833.4 | 836.5 | 848.3 | 860.6 | 872.4 | 885.2 |
| 303.15 | 821.5 | 827.4 | 830.1 | 833.4 | 845.2 | 857.6 | 869.9 | 881.6 |
| 308.15 | 817.9 | 823.7 | 826.3 | 829.6 | 841.6 | 853.6 | 866.0 | 878.1 |
| 313.15 | 814.3 | 820.0 | 822.3 | 825.7 | 837.5 | 849.1 | 861.8 | 874.6 |

**Table S5.** Analysis of the density (kg.m-3) of blends of chichá biodiesel / mineral diesel by ethyl route.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Blends (%) | | | | | | | | |
| T (K) | B0 | B10 | B15 | B20 | B40 | B60 | B80 | B100 |
| 283.15 | 836.3 | 840.8 | 843.6 | 847.5 | 858.4 | 868.5 | 879.3 | 890.6 |
| 288.15 | 832.6 | 837.6 | 840.5 | 843.8 | 854.9 | 865.4 | 875.7 | 887.5 |
| 293.15 | 828.6 | 833.8 | 836.3 | 839.9 | 851.0 | 861.5 | 871.5 | 883.8 |
| 298.15 | 824.2 | 830.3 | 832.6 | 835.3 | 846.7 | 858.5 | 868.7 | 880.1 |
| 303.15 | 821.5 | 827.4 | 829.1 | 832.2 | 843.5 | 855.2 | 866.1 | 876.6 |
| 308.15 | 817.9 | 823.7 | 825.3 | 828.5 | 839.9 | 851.4 | 862.1 | 873.0 |
| 313.15 | 814.3 | 820.0 | 820.9 | 823.9 | 836.0 | 847.5 | 857.8 | 869.4 |

**Table S6.** Relative error calculated between experimental and predicted density values.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Composition of mixtures | Eqs. | Temperature (K) | | | | | | |
| 283.15 | 288.15 | 293.15 | 298.15 | 303.15 | 308.15 | 313.15 |
| B0 | Eq. (3) | 0.163 | 0.139 | 0.079 | 0.029 | 0.067 | 0.055 | 0.042 |
| B10 | 0.083 | 0.107 | 0.047 | 0.001 | 0.059 | 0.034 | 0.010 |
| B15 | 0.049 | 0.085 | 0.010 | 0.001 | 0.025 | 0.011 | 0.072 |
| B20 | 0.075 | 0.098 | 0.008 | 0.015 | 0.063 | 0.027 | 0.021 |
| B40 | 0.036 | 0.059 | 0.010 | 0.001 | 0.047 | 0.035 | 0.036 |
| B60 | 0.024 | 0.044 | 0.020 | 0.043 | 0.102 | 0.043 | 0.074 |
| B80 | 0.197 | 0.118 | 0.073 | 0.028 | 0.143 | 0.097 | 0.016 |
| B100 | 0.093 | 0.138 | 0.104 | 0.127 | 0.116 | 0.116 | 0.116 |
| B0 | Eq. (4) | 0.026 | 0.015 | 0.032 | 0.129 | 0.020 | 0.020 | 0.020 |
| B10 | 0.092 | 0.045 | 0.069 | 0.057 | 0.027 | 0.015 | 0.003 |
| B15 | 0.086 | 0.027 | 0.098 | 0.111 | 0.099 | 0.124 | 0.221 |
| B20 | 0.049 | 0.037 | 0.002 | 0.116 | 0.057 | 0.069 | 0.190 |
| B40 | 0.036 | 0.048 | 0.013 | 0.068 | 0.021 | 0.021 | 0.057 |
| B60 | 0.068 | 0.010 | 0.045 | 0.024 | 0.059 | 0.036 | 0.001 |
| B80 | 0.090 | 0.091 | 0.160 | 0.068 | 0.046 | 0.001 | 0.080 |
| B100 | 0.056 | 0.001 | 0.011 | 0.022 | 0.011 | 0.011 | 0.011 |