

**ANEXOS**

# ÍNDICE

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## ANEXO I: TABLAS

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| $T = 263,15 \text{ K}$ |                                |                                            |
|------------------------|--------------------------------|--------------------------------------------|
| $p \text{ (MPa)}$      | $\rho \text{ (kg/m}^3\text{)}$ | $\eta \text{ (}\mu\text{Pa}\cdot\text{s)}$ |
| 0,02                   | 0,39821                        | 13,325                                     |
| 0,50                   | 10,321                         | 13,351                                     |
| 1,00                   | 21,52                          | 13,397                                     |
| 2,00                   | 47,62                          | 13,564                                     |
| 5,00                   | 962,92                         | 112,59                                     |
| 6,00                   | 969,18                         | 114,73                                     |
| 7,00                   | 975,08                         | 116,8                                      |
| 8,00                   | 980,65                         | 118,79                                     |
| 9,00                   | 985,94                         | 120,73                                     |
| 10,00                  | 990,98                         | 122,61                                     |
| 11,00                  | 995,8                          | 124,45                                     |
| 12,00                  | 1000,4                         | 126,24                                     |
| 13,00                  | 1004,9                         | 128                                        |
| 14,00                  | 1009,1                         | 129,73                                     |
| 15,00                  | 1013,2                         | 131,42                                     |
| 16,00                  | 1017,2                         | 133,08                                     |
| 17,00                  | 1021,1                         | 134,72                                     |
| 18,00                  | 1024,8                         | 136,33                                     |
| 19,00                  | 1028,5                         | 137,92                                     |
| 20,00                  | 1032                           | 139,49                                     |
| 21,00                  | 1035,4                         | 141,04                                     |
| 22,00                  | 1038,7                         | 142,57                                     |
| 23,00                  | 1042                           | 144,08                                     |
| 24,00                  | 1045,2                         | 145,58                                     |
| 25,00                  | 1048,3                         | 147,06                                     |
| 26,00                  | 1051,3                         | 148,53                                     |
| 27,00                  | 1054,3                         | 149,98                                     |
| 28,00                  | 1057,2                         | 151,42                                     |
| 29,00                  | 1060                           | 152,85                                     |
| 30,00                  | 1062,8                         | 154,26                                     |

| <b><math>T = 273,15 \text{ K}</math></b> |                                                  |                                                              |
|------------------------------------------|--------------------------------------------------|--------------------------------------------------------------|
| <b><math>p \text{ (MPa)}</math></b>      | <b><math>\rho \text{ (kg/m}^3\text{)}</math></b> | <b><math>\eta \text{ (}\mu\text{Pa}\cdot\text{s)}</math></b> |
| 0,02                                     | 0,38356                                          | 13,812                                                       |
| 0,50                                     | 9,8982                                           | 13,847                                                       |
| 1,00                                     | 20,522                                           | 13,899                                                       |
| 2,00                                     | 44,655                                           | 14,069                                                       |
| 3,00                                     | 74,831                                           | 14,382                                                       |
| 6,00                                     | 910,46                                           | 96,286                                                       |
| 7,00                                     | 919,16                                           | 98,682                                                       |
| 8,00                                     | 927,13                                           | 100,94                                                       |
| 9,00                                     | 934,49                                           | 103,09                                                       |
| 10,00                                    | 941,34                                           | 105,15                                                       |
| 11,00                                    | 947,77                                           | 107,13                                                       |
| 12,00                                    | 953,83                                           | 109,04                                                       |
| 13,00                                    | 959,56                                           | 110,89                                                       |
| 14,00                                    | 965,02                                           | 112,69                                                       |
| 15,00                                    | 970,22                                           | 114,44                                                       |
| 16,00                                    | 975,19                                           | 116,15                                                       |
| 17,00                                    | 979,96                                           | 117,82                                                       |
| 18,00                                    | 984,54                                           | 119,46                                                       |
| 19,00                                    | 988,96                                           | 121,06                                                       |
| 20,00                                    | 993,22                                           | 122,64                                                       |
| 21,00                                    | 997,34                                           | 124,19                                                       |
| 22,00                                    | 1001,3                                           | 125,71                                                       |
| 23,00                                    | 1005,2                                           | 127,22                                                       |
| 24,00                                    | 1008,9                                           | 128,7                                                        |
| 25,00                                    | 1012,6                                           | 130,16                                                       |
| 26,00                                    | 1016,1                                           | 131,61                                                       |
| 27,00                                    | 1019,6                                           | 133,03                                                       |
| 28,00                                    | 1023                                             | 134,44                                                       |
| 29,00                                    | 1026,3                                           | 135,84                                                       |
| 30,00                                    | 1029,5                                           | 137,22                                                       |

| <b><math>T = 283,15 \text{ K}</math></b> |                                                  |                                                              |
|------------------------------------------|--------------------------------------------------|--------------------------------------------------------------|
| <b><math>p \text{ (MPa)}</math></b>      | <b><math>\rho \text{ (kg/m}^3\text{)}</math></b> | <b><math>\eta \text{ (}\mu\text{Pa}\cdot\text{s)}</math></b> |
| 0,02                                     | 0,36996                                          | 14,297                                                       |
| 0,50                                     | 9,5121                                           | 14,339                                                       |
| 1,00                                     | 19,631                                           | 14,397                                                       |
| 2,00                                     | 42,174                                           | 14,569                                                       |
| 3,00                                     | 69,105                                           | 14,853                                                       |
| 4,00                                     | 103,74                                           | 15,35                                                        |
| 7,00                                     | 848,8                                            | 81,313                                                       |
| 8,00                                     | 861,92                                           | 84,196                                                       |
| 9,00                                     | 873,33                                           | 86,811                                                       |
| 10,00                                    | 883,49                                           | 89,227                                                       |
| 11,00                                    | 892,69                                           | 91,489                                                       |
| 12,00                                    | 901,1                                            | 93,625                                                       |
| 13,00                                    | 908,89                                           | 95,659                                                       |
| 14,00                                    | 916,14                                           | 97,606                                                       |
| 15,00                                    | 922,93                                           | 99,479                                                       |
| 16,00                                    | 929,34                                           | 101,29                                                       |
| 17,00                                    | 935,4                                            | 103,04                                                       |
| 18,00                                    | 941,16                                           | 104,74                                                       |
| 19,00                                    | 946,65                                           | 106,4                                                        |
| 20,00                                    | 951,9                                            | 108,02                                                       |
| 21,00                                    | 956,93                                           | 109,6                                                        |
| 22,00                                    | 961,76                                           | 111,14                                                       |
| 23,00                                    | 966,41                                           | 112,66                                                       |
| 24,00                                    | 970,9                                            | 114,15                                                       |
| 25,00                                    | 975,23                                           | 115,62                                                       |
| 26,00                                    | 979,42                                           | 117,06                                                       |
| 27,00                                    | 983,48                                           | 118,47                                                       |
| 28,00                                    | 987,42                                           | 119,87                                                       |
| 29,00                                    | 991,25                                           | 121,25                                                       |
| 30,00                                    | 994,97                                           | 122,61                                                       |

| <b><math>T = 293,15 \text{ K}</math></b> |                                                  |                                                   |
|------------------------------------------|--------------------------------------------------|---------------------------------------------------|
| <b><math>p \text{ (MPa)}</math></b>      | <b><math>\rho \text{ (kg/m}^3\text{)}</math></b> | <b><math>\eta \text{ (}\mu\text{Pa-s)}</math></b> |
| 0,02                                     | 0,3573                                           | 14,779                                            |
| 0,50                                     | 9,1576                                           | 14,827                                            |
| 1,00                                     | 18,828                                           | 14,89                                             |
| 2,00                                     | 40,043                                           | 15,063                                            |
| 3,00                                     | 64,601                                           | 15,328                                            |
| 4,00                                     | 94,269                                           | 15,743                                            |
| 5,00                                     | 133,06                                           | 16,452                                            |
| 6,00                                     | 195,57                                           | 18,015                                            |
| 8,00                                     | 771,35                                           | 66,79                                             |
| 9,00                                     | 793,84                                           | 70,675                                            |
| 10,00                                    | 811,54                                           | 73,922                                            |
| 11,00                                    | 826,31                                           | 76,773                                            |
| 12,00                                    | 839,09                                           | 79,35                                             |
| 13,00                                    | 850,4                                            | 81,723                                            |
| 14,00                                    | 860,6                                            | 83,938                                            |
| 15,00                                    | 869,89                                           | 86,025                                            |
| 16,00                                    | 878,46                                           | 88,007                                            |
| 17,00                                    | 886,41                                           | 89,9                                              |
| 18,00                                    | 893,84                                           | 91,718                                            |
| 19,00                                    | 900,83                                           | 93,47                                             |
| 20,00                                    | 907,42                                           | 95,164                                            |
| 21,00                                    | 913,67                                           | 96,807                                            |
| 22,00                                    | 919,62                                           | 98,405                                            |
| 23,00                                    | 925,29                                           | 99,963                                            |
| 24,00                                    | 930,72                                           | 101,48                                            |
| 25,00                                    | 935,92                                           | 102,97                                            |
| 26,00                                    | 940,92                                           | 104,43                                            |
| 27,00                                    | 945,74                                           | 105,85                                            |
| 28,00                                    | 950,38                                           | 107,26                                            |
| 29,00                                    | 954,87                                           | 108,63                                            |
| 30,00                                    | 959,21                                           | 109,99                                            |

| <b><math>T = 313,15 \text{ K}</math></b> |                                                  |                                                              |
|------------------------------------------|--------------------------------------------------|--------------------------------------------------------------|
| <b><math>p \text{ (MPa)}</math></b>      | <b><math>\rho \text{ (kg/m}^3\text{)}</math></b> | <b><math>\eta \text{ (}\mu\text{Pa}\cdot\text{s)}</math></b> |
| 0,02                                     | 0,33441                                          | 15,737                                                       |
| 0,50                                     | 8,5278                                           | 15,793                                                       |
| 1,00                                     | 17,429                                           | 15,861                                                       |
| 2,00                                     | 36,525                                           | 16,036                                                       |
| 3,00                                     | 57,732                                           | 16,276                                                       |
| 4,00                                     | 81,71                                            | 16,607                                                       |
| 5,00                                     | 109,5                                            | 17,074                                                       |
| 6,00                                     | 142,87                                           | 17,759                                                       |
| 7,00                                     | 185,29                                           | 18,836                                                       |
| 8,00                                     | 244,82                                           | 20,767                                                       |
| 9,00                                     | 345,46                                           | 25,267                                                       |
| 10,00                                    | 504,65                                           | 35,932                                                       |
| 11,00                                    | 602,31                                           | 45,053                                                       |
| 12,00                                    | 654,85                                           | 50,961                                                       |
| 13,00                                    | 689,66                                           | 55,333                                                       |
| 14,00                                    | 715,75                                           | 58,882                                                       |
| 15,00                                    | 736,75                                           | 61,925                                                       |
| 16,00                                    | 754,41                                           | 64,626                                                       |
| 17,00                                    | 769,71                                           | 67,075                                                       |
| 18,00                                    | 783,24                                           | 69,334                                                       |
| 19,00                                    | 795,39                                           | 71,44                                                        |
| 20,00                                    | 806,44                                           | 73,423                                                       |
| 21,00                                    | 816,58                                           | 75,302                                                       |
| 22,00                                    | 825,96                                           | 77,094                                                       |
| 23,00                                    | 834,7                                            | 78,81                                                        |
| 24,00                                    | 842,88                                           | 80,461                                                       |
| 25,00                                    | 850,58                                           | 82,055                                                       |
| 26,00                                    | 857,86                                           | 83,597                                                       |
| 27,00                                    | 864,75                                           | 85,094                                                       |
| 28,00                                    | 871,32                                           | 86,55                                                        |
| 29,00                                    | 877,57                                           | 87,969                                                       |
| 30,00                                    | 883,56                                           | 89,354                                                       |



| <b><math>T = 333,15 \text{ K}</math></b> |                                                  |                                                              |
|------------------------------------------|--------------------------------------------------|--------------------------------------------------------------|
| <b><math>p \text{ (MPa)}</math></b>      | <b><math>\rho \text{ (kg/m}^3\text{)}</math></b> | <b><math>\eta \text{ (}\mu\text{Pa}\cdot\text{s)}</math></b> |
| 0,02                                     | 0,31429                                          | 16,683                                                       |
| 0,50                                     | 7,9841                                           | 16,744                                                       |
| 1,00                                     | 16,246                                           | 16,817                                                       |
| 2,00                                     | 33,699                                           | 16,991                                                       |
| 3,00                                     | 52,584                                           | 17,214                                                       |
| 4,00                                     | 73,192                                           | 17,5                                                         |
| 5,00                                     | 95,911                                           | 17,868                                                       |
| 6,00                                     | 121,26                                           | 18,349                                                       |
| 7,00                                     | 149,96                                           | 18,985                                                       |
| 8,00                                     | 183                                              | 19,845                                                       |
| 9,00                                     | 221,7                                            | 21,046                                                       |
| 10,00                                    | 267,75                                           | 22,739                                                       |
| 11,00                                    | 322,57                                           | 25,166                                                       |
| 12,00                                    | 385,05                                           | 28,522                                                       |
| 13,00                                    | 448,65                                           | 32,635                                                       |
| 14,00                                    | 505,16                                           | 36,934                                                       |
| 15,00                                    | 551,61                                           | 40,965                                                       |
| 16,00                                    | 589,26                                           | 44,595                                                       |
| 17,00                                    | 620,12                                           | 47,835                                                       |
| 18,00                                    | 645,88                                           | 50,736                                                       |
| 19,00                                    | 667,8                                            | 53,359                                                       |
| 20,00                                    | 686,81                                           | 55,757                                                       |
| 21,00                                    | 703,59                                           | 57,973                                                       |
| 22,00                                    | 718,6                                            | 60,041                                                       |
| 23,00                                    | 732,19                                           | 61,985                                                       |
| 24,00                                    | 744,59                                           | 63,825                                                       |
| 25,00                                    | 756,02                                           | 65,576                                                       |
| 26,00                                    | 766,61                                           | 67,249                                                       |
| 27,00                                    | 776,48                                           | 68,855                                                       |
| 28,00                                    | 785,73                                           | 70,401                                                       |
| 29,00                                    | 794,43                                           | 71,894                                                       |
| 30,00                                    | 802,64                                           | 73,339                                                       |

| <b><math>T = 353,15 \text{ K}</math></b> |                                                  |                                                   |
|------------------------------------------|--------------------------------------------------|---------------------------------------------------|
| <b><math>p \text{ (MPa)}</math></b>      | <b><math>\rho \text{ (kg/m}^3\text{)}</math></b> | <b><math>\eta \text{ (}\mu\text{Pa-s)}</math></b> |
| 0,02                                     | 0,29646                                          | 17,617                                            |
| 0,50                                     | 7,5088                                           | 17,681                                            |
| 1,00                                     | 15,228                                           | 17,756                                            |
| 2,00                                     | 31,353                                           | 17,928                                            |
| 3,00                                     | 48,493                                           | 18,138                                            |
| 4,00                                     | 66,789                                           | 18,395                                            |
| 5,00                                     | 86,409                                           | 18,708                                            |
| 6,00                                     | 107,55                                           | 19,091                                            |
| 7,00                                     | 130,44                                           | 19,563                                            |
| 8,00                                     | 155,35                                           | 20,145                                            |
| 9,00                                     | 182,54                                           | 20,874                                            |
| 10,00                                    | 212,29                                           | 21,774                                            |
| 11,00                                    | 244,79                                           | 22,894                                            |
| 12,00                                    | 280,05                                           | 24,277                                            |
| 13,00                                    | 317,78                                           | 25,962                                            |
| 14,00                                    | 357,16                                           | 27,958                                            |
| 15,00                                    | 396,85                                           | 30,231                                            |
| 16,00                                    | 435,29                                           | 32,694                                            |
| 17,00                                    | 471,21                                           | 35,243                                            |
| 18,00                                    | 503,92                                           | 37,784                                            |
| 19,00                                    | 533,3                                            | 40,257                                            |
| 20,00                                    | 559,59                                           | 42,629                                            |
| 21,00                                    | 583,1                                            | 44,888                                            |
| 22,00                                    | 604,21                                           | 47,031                                            |
| 23,00                                    | 623,25                                           | 49,064                                            |
| 24,00                                    | 640,52                                           | 50,994                                            |
| 25,00                                    | 656,28                                           | 52,829                                            |
| 26,00                                    | 670,74                                           | 54,578                                            |
| 27,00                                    | 684,09                                           | 56,251                                            |
| 28,00                                    | 696,47                                           | 57,856                                            |
| 29,00                                    | 708,01                                           | 59,399                                            |
| 30,00                                    | 718,81                                           | 60,886                                            |

| <b><math>T = 373,15 \text{ K}</math></b> |                                                  |                                                              |
|------------------------------------------|--------------------------------------------------|--------------------------------------------------------------|
| <b><math>p \text{ (MPa)}</math></b>      | <b><math>\rho \text{ (kg/m}^3\text{)}</math></b> | <b><math>\eta \text{ (}\mu\text{Pa}\cdot\text{s)}</math></b> |
| 0,02                                     | 0,28054                                          | 18,538                                                       |
| 0,50                                     | 7,0892                                           | 18,604                                                       |
| 1,00                                     | 14,34                                            | 18,679                                                       |
| 2,00                                     | 29,359                                           | 18,848                                                       |
| 3,00                                     | 45,12                                            | 19,048                                                       |
| 4,00                                     | 61,694                                           | 19,283                                                       |
| 5,00                                     | 79,159                                           | 19,559                                                       |
| 6,00                                     | 97,597                                           | 19,885                                                       |
| 7,00                                     | 117,1                                            | 20,268                                                       |
| 8,00                                     | 137,74                                           | 20,72                                                        |
| 9,00                                     | 159,61                                           | 21,256                                                       |
| 10,00                                    | 182,76                                           | 21,881                                                       |
| 11,00                                    | 207,21                                           | 22,615                                                       |
| 12,00                                    | 232,95                                           | 23,472                                                       |
| 13,00                                    | 259,88                                           | 24,465                                                       |
| 14,00                                    | 287,81                                           | 25,604                                                       |
| 15,00                                    | 316,46                                           | 26,893                                                       |
| 16,00                                    | 345,44                                           | 28,326                                                       |
| 17,00                                    | 374,31                                           | 29,888                                                       |
| 18,00                                    | 402,59                                           | 31,554                                                       |
| 19,00                                    | 429,86                                           | 33,294                                                       |
| 20,00                                    | 455,8                                            | 35,076                                                       |
| 21,00                                    | 480,24                                           | 36,872                                                       |
| 22,00                                    | 503,08                                           | 38,658                                                       |
| 23,00                                    | 524,35                                           | 40,419                                                       |
| 24,00                                    | 544,12                                           | 42,142                                                       |
| 25,00                                    | 562,48                                           | 43,823                                                       |
| 26,00                                    | 579,56                                           | 45,456                                                       |
| 27,00                                    | 595,46                                           | 47,041                                                       |
| 28,00                                    | 610,3                                            | 48,579                                                       |
| 29,00                                    | 624,19                                           | 50,069                                                       |
| 30,00                                    | 637,21                                           | 51,515                                                       |

**Tabla A.2.** Datos  $p$ - $\rho$ - $T$  y  $p$ - $\eta$ - $T$  a cada temperatura,  $T$ , para el sistema  $\text{CO}_2 + \text{O}_2$  ( $x_{\text{CO}_2} = 0,97$  y  $x_{\text{O}_2} = 0,03$ ).

| <b><math>T = 263,15 \text{ K}</math></b> |                                             |                                  |
|------------------------------------------|---------------------------------------------|----------------------------------|
| <b><math>p</math> (MPa)</b>              | <b><math>\rho</math> (kg/m<sup>3</sup>)</b> | <b><math>\eta</math> (μPa-s)</b> |
| 0,02                                     | 0,39957                                     | 13,352                           |
| 0,50                                     | 10,355                                      | 13,38                            |
| 1,00                                     | 21,586                                      | 13,426                           |
| 2,00                                     | 47,735                                      | 13,594                           |
| 5,00                                     | 970,08                                      | 113,46                           |
| 6,00                                     | 976,38                                      | 115,62                           |
| 7,00                                     | 982,31                                      | 117,71                           |
| 8,00                                     | 987,91                                      | 119,72                           |
| 9,00                                     | 993,23                                      | 121,67                           |
| 10,00                                    | 998,3                                       | 123,58                           |
| 11,00                                    | 1003,1                                      | 125,43                           |
| 12,00                                    | 1007,8                                      | 127,24                           |
| 13,00                                    | 1012,2                                      | 129,02                           |
| 14,00                                    | 1016,5                                      | 130,76                           |
| 15,00                                    | 1020,7                                      | 132,47                           |
| 16,00                                    | 1024,7                                      | 134,15                           |
| 17,00                                    | 1028,6                                      | 135,8                            |
| 18,00                                    | 1032,3                                      | 137,43                           |
| 19,00                                    | 1036                                        | 139,03                           |
| 20,00                                    | 1039,5                                      | 140,62                           |
| 21,00                                    | 1043                                        | 142,18                           |
| 22,00                                    | 1046,3                                      | 143,72                           |
| 23,00                                    | 1049,6                                      | 145,25                           |
| 24,00                                    | 1052,8                                      | 146,76                           |
| 25,00                                    | 1055,9                                      | 148,26                           |
| 26,00                                    | 1059                                        | 149,74                           |
| 27,00                                    | 1062                                        | 151,21                           |
| 28,00                                    | 1064,9                                      | 152,66                           |
| 29,00                                    | 1067,7                                      | 154,1                            |
| 30,00                                    | 1070,5                                      | 155,53                           |

| <b><math>T = 273,15 \text{ K}</math></b> |                                                  |                                                   |
|------------------------------------------|--------------------------------------------------|---------------------------------------------------|
| <b><math>p \text{ (MPa)}</math></b>      | <b><math>\rho \text{ (kg/m}^3\text{)}</math></b> | <b><math>\eta \text{ (}\mu\text{Pa-s)}</math></b> |
| 0,02                                     | 0,38487                                          | 13,84                                             |
| 0,50                                     | 9,9307                                           | 13,876                                            |
| 1,00                                     | 20,586                                           | 13,929                                            |
| 2,00                                     | 44,771                                           | 14,1                                              |
| 3,00                                     | 74,956                                           | 14,416                                            |
| 6,00                                     | 916,97                                           | 96,914                                            |
| 7,00                                     | 925,75                                           | 99,336                                            |
| 8,00                                     | 933,78                                           | 101,62                                            |
| 9,00                                     | 941,19                                           | 103,79                                            |
| 10,00                                    | 948,1                                            | 105,87                                            |
| 11,00                                    | 954,57                                           | 107,87                                            |
| 12,00                                    | 960,67                                           | 109,79                                            |
| 13,00                                    | 966,45                                           | 111,66                                            |
| 14,00                                    | 971,94                                           | 113,48                                            |
| 15,00                                    | 977,18                                           | 115,25                                            |
| 16,00                                    | 982,18                                           | 116,97                                            |
| 17,00                                    | 986,99                                           | 118,66                                            |
| 18,00                                    | 991,6                                            | 120,31                                            |
| 19,00                                    | 996,05                                           | 121,93                                            |
| 20,00                                    | 1000,3                                           | 123,52                                            |
| 21,00                                    | 1004,5                                           | 125,09                                            |
| 22,00                                    | 1008,5                                           | 126,63                                            |
| 23,00                                    | 1012,4                                           | 128,15                                            |
| 24,00                                    | 1016,2                                           | 129,64                                            |
| 25,00                                    | 1019,8                                           | 131,12                                            |
| 26,00                                    | 1023,4                                           | 132,57                                            |
| 27,00                                    | 1026,9                                           | 134,01                                            |
| 28,00                                    | 1030,3                                           | 135,44                                            |
| 29,00                                    | 1033,6                                           | 136,85                                            |
| 30,00                                    | 1036,8                                           | 138,24                                            |

| <b><math>T = 283,15 \text{ K}</math></b> |                                                  |                                                   |
|------------------------------------------|--------------------------------------------------|---------------------------------------------------|
| <b><math>p \text{ (MPa)}</math></b>      | <b><math>\rho \text{ (kg/m}^3\text{)}</math></b> | <b><math>\eta \text{ (}\mu\text{Pa-s)}</math></b> |
| 0,02                                     | 0,37123                                          | 14,325                                            |
| 0,50                                     | 9,5434                                           | 14,368                                            |
| 1,00                                     | 19,693                                           | 14,427                                            |
| 2,00                                     | 42,289                                           | 14,601                                            |
| 3,00                                     | 69,248                                           | 14,888                                            |
| 4,00                                     | 103,82                                           | 15,387                                            |
| 7,00                                     | 854,43                                           | 81,714                                            |
| 8,00                                     | 867,71                                           | 84,635                                            |
| 9,00                                     | 879,25                                           | 87,283                                            |
| 10,00                                    | 889,52                                           | 89,727                                            |
| 11,00                                    | 898,8                                            | 92,013                                            |
| 12,00                                    | 907,3                                            | 94,173                                            |
| 13,00                                    | 915,16                                           | 96,228                                            |
| 14,00                                    | 922,47                                           | 98,195                                            |
| 15,00                                    | 929,33                                           | 100,09                                            |
| 16,00                                    | 935,79                                           | 101,91                                            |
| 17,00                                    | 941,9                                            | 103,68                                            |
| 18,00                                    | 947,71                                           | 105,4                                             |
| 19,00                                    | 953,24                                           | 107,07                                            |
| 20,00                                    | 958,53                                           | 108,71                                            |
| 21,00                                    | 963,6                                            | 110,3                                             |
| 22,00                                    | 968,47                                           | 111,86                                            |
| 23,00                                    | 973,16                                           | 113,39                                            |
| 24,00                                    | 977,68                                           | 114,9                                             |
| 25,00                                    | 982,05                                           | 116,37                                            |
| 26,00                                    | 986,27                                           | 117,83                                            |
| 27,00                                    | 990,36                                           | 119,26                                            |
| 28,00                                    | 994,33                                           | 120,67                                            |
| 29,00                                    | 998,18                                           | 122,06                                            |
| 30,00                                    | 1001,9                                           | 123,43                                            |

| <b><math>T = 293,15 \text{ K}</math></b> |                                                  |                                                              |
|------------------------------------------|--------------------------------------------------|--------------------------------------------------------------|
| <b><math>p \text{ (MPa)}</math></b>      | <b><math>\rho \text{ (kg/m}^3\text{)}</math></b> | <b><math>\eta \text{ (}\mu\text{Pa}\cdot\text{s)}</math></b> |
| 0,02                                     | 0,35852                                          | 14,808                                                       |
| 0,50                                     | 9,1879                                           | 14,857                                                       |
| 1,00                                     | 18,887                                           | 14,92                                                        |
| 2,00                                     | 40,156                                           | 15,096                                                       |
| 3,00                                     | 64,751                                           | 15,364                                                       |
| 4,00                                     | 94,411                                           | 15,782                                                       |
| 5,00                                     | 133,05                                           | 16,491                                                       |
| 8,00                                     | 775,47                                           | 66,936                                                       |
| 9,00                                     | 798,46                                           | 70,899                                                       |
| 10,00                                    | 816,47                                           | 74,2                                                         |
| 11,00                                    | 831,47                                           | 77,092                                                       |
| 12,00                                    | 844,42                                           | 79,703                                                       |
| 13,00                                    | 855,88                                           | 82,106                                                       |
| 14,00                                    | 866,2                                            | 84,346                                                       |
| 15,00                                    | 875,6                                            | 86,457                                                       |
| 16,00                                    | 884,26                                           | 88,46                                                        |
| 17,00                                    | 892,29                                           | 90,373                                                       |
| 18,00                                    | 899,8                                            | 92,209                                                       |
| 19,00                                    | 906,85                                           | 93,979                                                       |
| 20,00                                    | 913,51                                           | 95,689                                                       |
| 21,00                                    | 919,82                                           | 97,349                                                       |
| 22,00                                    | 925,82                                           | 98,962                                                       |
| 23,00                                    | 931,55                                           | 100,53                                                       |
| 24,00                                    | 937,02                                           | 102,07                                                       |
| 25,00                                    | 942,27                                           | 103,57                                                       |
| 26,00                                    | 947,31                                           | 105,04                                                       |
| 27,00                                    | 952,17                                           | 106,48                                                       |
| 28,00                                    | 956,85                                           | 107,89                                                       |
| 29,00                                    | 961,38                                           | 109,28                                                       |
| 30,00                                    | 965,76                                           | 110,65                                                       |

| <b><math>T = 313,15 \text{ K}</math></b> |                                                  |                                                              |
|------------------------------------------|--------------------------------------------------|--------------------------------------------------------------|
| <b><math>p \text{ (MPa)}</math></b>      | <b><math>\rho \text{ (kg/m}^3\text{)}</math></b> | <b><math>\eta \text{ (}\mu\text{Pa}\cdot\text{s)}</math></b> |
| 0,02                                     | 0,33556                                          | 15,767                                                       |
| 0,50                                     | 8,5562                                           | 15,824                                                       |
| 1,00                                     | 17,485                                           | 15,893                                                       |
| 2,00                                     | 36,634                                           | 16,071                                                       |
| 3,00                                     | 57,885                                           | 16,314                                                       |
| 4,00                                     | 81,889                                           | 16,648                                                       |
| 5,00                                     | 109,67                                           | 17,118                                                       |
| 6,00                                     | 142,96                                           | 17,803                                                       |
| 7,00                                     | 185,11                                           | 18,873                                                       |
| 8,00                                     | 243,81                                           | 20,765                                                       |
| 9,00                                     | 341,5                                            | 25,053                                                       |
| 10,00                                    | 499,6                                            | 35,402                                                       |
| 11,00                                    | 601,8                                            | 44,781                                                       |
| 12,00                                    | 656,34                                           | 50,855                                                       |
| 13,00                                    | 692,19                                           | 55,328                                                       |
| 14,00                                    | 718,91                                           | 58,945                                                       |
| 15,00                                    | 740,34                                           | 62,039                                                       |
| 16,00                                    | 758,33                                           | 64,779                                                       |
| 17,00                                    | 773,89                                           | 67,263                                                       |
| 18,00                                    | 787,62                                           | 69,55                                                        |
| 19,00                                    | 799,95                                           | 71,682                                                       |
| 20,00                                    | 811,15                                           | 73,687                                                       |
| 21,00                                    | 821,43                                           | 75,588                                                       |
| 22,00                                    | 830,93                                           | 77,399                                                       |
| 23,00                                    | 839,78                                           | 79,133                                                       |
| 24,00                                    | 848,06                                           | 80,801                                                       |
| 25,00                                    | 855,84                                           | 82,41                                                        |
| 26,00                                    | 863,2                                            | 83,967                                                       |
| 27,00                                    | 870,17                                           | 85,479                                                       |
| 28,00                                    | 876,81                                           | 86,948                                                       |
| 29,00                                    | 883,13                                           | 88,38                                                        |
| 30,00                                    | 889,18                                           | 89,777                                                       |



| <b><math>T = 333,15 \text{ K}</math></b> |                                                  |                                                   |
|------------------------------------------|--------------------------------------------------|---------------------------------------------------|
| <b><math>p \text{ (MPa)}</math></b>      | <b><math>\rho \text{ (kg/m}^3\text{)}</math></b> | <b><math>\eta \text{ (}\mu\text{Pa-s)}</math></b> |
| 0,02                                     | 0,31537                                          | 16,713                                            |
| 0,50                                     | 8,0108                                           | 16,776                                            |
| 1,00                                     | 16,299                                           | 16,85                                             |
| 2,00                                     | 33,803                                           | 17,027                                            |
| 3,00                                     | 52,733                                           | 17,253                                            |
| 4,00                                     | 73,378                                           | 17,542                                            |
| 5,00                                     | 96,121                                           | 17,914                                            |
| 6,00                                     | 121,48                                           | 18,397                                            |
| 7,00                                     | 150,14                                           | 19,034                                            |
| 8,00                                     | 183,07                                           | 19,891                                            |
| 9,00                                     | 221,58                                           | 21,077                                            |
| 10,00                                    | 267,3                                            | 22,746                                            |
| 11,00                                    | 321,66                                           | 25,131                                            |
| 12,00                                    | 383,78                                           | 28,427                                            |
| 13,00                                    | 447,53                                           | 32,498                                            |
| 14,00                                    | 504,7                                            | 36,795                                            |
| 15,00                                    | 551,95                                           | 40,854                                            |
| 16,00                                    | 590,32                                           | 44,522                                            |
| 17,00                                    | 621,79                                           | 47,801                                            |
| 18,00                                    | 648,04                                           | 50,741                                            |
| 19,00                                    | 670,37                                           | 53,397                                            |
| 20,00                                    | 689,72                                           | 55,826                                            |
| 21,00                                    | 706,78                                           | 58,069                                            |
| 22,00                                    | 722,03                                           | 60,161                                            |
| 23,00                                    | 735,82                                           | 62,127                                            |
| 24,00                                    | 748,41                                           | 63,987                                            |
| 25,00                                    | 760                                              | 65,757                                            |
| 26,00                                    | 770,73                                           | 67,447                                            |
| 27,00                                    | 780,73                                           | 69,069                                            |
| 28,00                                    | 790,1                                            | 70,631                                            |
| 29,00                                    | 798,91                                           | 72,138                                            |
| 30,00                                    | 807,22                                           | 73,597                                            |

| <b><math>T = 353,15 \text{ K}</math></b> |                                                  |                                                   |
|------------------------------------------|--------------------------------------------------|---------------------------------------------------|
| <b><math>p \text{ (MPa)}</math></b>      | <b><math>\rho \text{ (kg/m}^3\text{)}</math></b> | <b><math>\eta \text{ (}\mu\text{Pa-s)}</math></b> |
| 0,02                                     | 0,29747                                          | 17,648                                            |
| 0,50                                     | 7,534                                            | 17,714                                            |
| 1,00                                     | 15,279                                           | 17,789                                            |
| 2,00                                     | 31,452                                           | 17,965                                            |
| 3,00                                     | 48,636                                           | 18,179                                            |
| 4,00                                     | 66,973                                           | 18,438                                            |
| 5,00                                     | 86,627                                           | 18,755                                            |
| 6,00                                     | 107,79                                           | 19,141                                            |
| 7,00                                     | 130,7                                            | 19,615                                            |
| 8,00                                     | 155,6                                            | 20,198                                            |
| 9,00                                     | 182,76                                           | 20,923                                            |
| 10,00                                    | 212,45                                           | 21,819                                            |
| 11,00                                    | 244,86                                           | 22,931                                            |
| 12,00                                    | 280,02                                           | 24,302                                            |
| 13,00                                    | 317,65                                           | 25,971                                            |
| 14,00                                    | 356,97                                           | 27,948                                            |
| 15,00                                    | 396,7                                            | 30,203                                            |
| 16,00                                    | 435,31                                           | 32,655                                            |
| 17,00                                    | 471,49                                           | 35,2                                              |
| 18,00                                    | 504,52                                           | 37,746                                            |
| 19,00                                    | 534,26                                           | 40,228                                            |
| 20,00                                    | 560,88                                           | 42,614                                            |
| 21,00                                    | 584,71                                           | 44,889                                            |
| 22,00                                    | 606,12                                           | 47,05                                             |
| 23,00                                    | 625,43                                           | 49,1                                              |
| 24,00                                    | 642,95                                           | 51,047                                            |
| 25,00                                    | 658,94                                           | 52,899                                            |
| 26,00                                    | 673,6                                            | 54,665                                            |
| 27,00                                    | 687,13                                           | 56,354                                            |
| 28,00                                    | 699,68                                           | 57,973                                            |
| 29,00                                    | 711,37                                           | 59,531                                            |
| 30,00                                    | 722,32                                           | 61,032                                            |

| <b><math>T = 373,15 \text{ K}</math></b> |                                                  |                                                   |
|------------------------------------------|--------------------------------------------------|---------------------------------------------------|
| <b><math>p \text{ (MPa)}</math></b>      | <b><math>\rho \text{ (kg/m}^3\text{)}</math></b> | <b><math>\eta \text{ (}\mu\text{Pa-s)}</math></b> |
| 0,02                                     | 0,2815                                           | 18,569                                            |
| 0,50                                     | 7,113                                            | 18,637                                            |
| 1,00                                     | 14,388                                           | 18,713                                            |
| 2,00                                     | 29,453                                           | 18,886                                            |
| 3,00                                     | 45,258                                           | 19,089                                            |
| 4,00                                     | 61,873                                           | 19,327                                            |
| 5,00                                     | 79,375                                           | 19,607                                            |
| 6,00                                     | 97,846                                           | 19,936                                            |
| 7,00                                     | 117,37                                           | 20,321                                            |
| 8,00                                     | 138,04                                           | 20,775                                            |
| 9,00                                     | 159,91                                           | 21,31                                             |
| 10,00                                    | 183,06                                           | 21,935                                            |
| 11,00                                    | 207,51                                           | 22,668                                            |
| 12,00                                    | 233,23                                           | 23,521                                            |
| 13,00                                    | 260,14                                           | 24,51                                             |
| 14,00                                    | 288,05                                           | 25,642                                            |
| 15,00                                    | 316,7                                            | 26,923                                            |
| 16,00                                    | 345,7                                            | 28,348                                            |
| 17,00                                    | 374,62                                           | 29,903                                            |
| 18,00                                    | 402,99                                           | 31,563                                            |
| 19,00                                    | 430,39                                           | 33,299                                            |
| 20,00                                    | 456,5                                            | 35,08                                             |
| 21,00                                    | 481,12                                           | 36,877                                            |
| 22,00                                    | 504,17                                           | 38,667                                            |
| 23,00                                    | 525,64                                           | 40,433                                            |
| 24,00                                    | 545,61                                           | 42,165                                            |
| 25,00                                    | 564,18                                           | 43,854                                            |
| 26,00                                    | 581,45                                           | 45,496                                            |
| 27,00                                    | 597,54                                           | 47,092                                            |
| 28,00                                    | 612,55                                           | 48,639                                            |
| 29,00                                    | 626,6                                            | 50,14                                             |
| 30,00                                    | 639,78                                           | 51,596                                            |

**Tabla A.3.** Datos  $p$ - $\rho$ - $T$  y  $p$ - $\eta$ - $T$  a cada temperatura,  $T$ , para el sistema  $\text{CO}_2 + \text{H}_2\text{S}$  ( $x_{\text{CO}_2} = 0,985$  y  $x_{\text{H}_2\text{S}} = 0,015$ ).

| <b><math>T = 263,15 \text{ K}</math></b> |                                                  |                                                              |
|------------------------------------------|--------------------------------------------------|--------------------------------------------------------------|
| <b><math>p \text{ (MPa)}</math></b>      | <b><math>\rho \text{ (kg/m}^3\text{)}</math></b> | <b><math>\eta \text{ (}\mu\text{Pa}\cdot\text{s)}</math></b> |
| 0,02                                     | 0,40153                                          | 13,193                                                       |
| 0,50                                     | 10,428                                           | 13,215                                                       |
| 1,00                                     | 21,799                                           | 13,256                                                       |
| 2,00                                     | 48,646                                           | 13,419                                                       |
| 3,00                                     | 977,84                                           | 118,66                                                       |
| 4,00                                     | 983,78                                           | 120,84                                                       |
| 5,00                                     | 989,39                                           | 122,95                                                       |
| 6,00                                     | 994,7                                            | 124,99                                                       |
| 7,00                                     | 999,75                                           | 126,97                                                       |
| 8,00                                     | 1004,6                                           | 128,9                                                        |
| 9,00                                     | 1009,2                                           | 130,78                                                       |
| 10,00                                    | 1013,6                                           | 132,62                                                       |
| 11,00                                    | 1017,9                                           | 134,43                                                       |
| 12,00                                    | 1022                                             | 136,2                                                        |
| 13,00                                    | 1025,9                                           | 137,94                                                       |
| 14,00                                    | 1029,8                                           | 139,65                                                       |
| 15,00                                    | 1033,5                                           | 141,34                                                       |
| 16,00                                    | 1037,1                                           | 143                                                          |
| 17,00                                    | 1040,6                                           | 144,63                                                       |
| 18,00                                    | 1044                                             | 146,25                                                       |
| 19,00                                    | 1047,3                                           | 147,85                                                       |
| 20,00                                    | 1050,5                                           | 149,42                                                       |
| 21,00                                    | 1053,7                                           | 150,98                                                       |
| 22,00                                    | 1056,8                                           | 152,53                                                       |
| 23,00                                    | 1059,8                                           | 154,06                                                       |
| 24,00                                    | 1062,7                                           | 155,57                                                       |
| 25,00                                    | 1065,6                                           | 157,07                                                       |
| 26,00                                    | 1068,4                                           | 158,56                                                       |
| 27,00                                    | 1071,1                                           | 160,04                                                       |
| 28,00                                    | 1073,8                                           | 161,5                                                        |
| 29,00                                    | 1076,5                                           | 162,95                                                       |
| 30,00                                    | 1079,1                                           | 164,39                                                       |

| <b><math>T = 273,15 \text{ K}</math></b> |                                                  |                                                   |
|------------------------------------------|--------------------------------------------------|---------------------------------------------------|
| <b><math>p \text{ (MPa)}</math></b>      | <b><math>\rho \text{ (kg/m}^3\text{)}</math></b> | <b><math>\eta \text{ (}\mu\text{Pa-s)}</math></b> |
| 0,02                                     | 0,38677                                          | 13,677                                            |
| 0,50                                     | 9,9979                                           | 13,708                                            |
| 1,00                                     | 20,774                                           | 13,757                                            |
| 2,00                                     | 45,49                                            | 13,923                                            |
| 3,00                                     | 77,21                                            | 14,249                                            |
| 4,00                                     | 925,44                                           | 101,07                                            |
| 5,00                                     | 933,8                                            | 103,53                                            |
| 6,00                                     | 941,45                                           | 105,84                                            |
| 7,00                                     | 948,52                                           | 108,05                                            |
| 8,00                                     | 955,12                                           | 110,16                                            |
| 9,00                                     | 961,31                                           | 112,19                                            |
| 10,00                                    | 967,15                                           | 114,16                                            |
| 11,00                                    | 972,68                                           | 116,06                                            |
| 12,00                                    | 977,95                                           | 117,91                                            |
| 13,00                                    | 982,97                                           | 119,71                                            |
| 14,00                                    | 987,78                                           | 121,47                                            |
| 15,00                                    | 992,39                                           | 123,19                                            |
| 16,00                                    | 996,83                                           | 124,88                                            |
| 17,00                                    | 1001,1                                           | 126,53                                            |
| 18,00                                    | 1005,2                                           | 128,16                                            |
| 19,00                                    | 1009,2                                           | 129,75                                            |
| 20,00                                    | 1013,1                                           | 131,33                                            |
| 21,00                                    | 1016,9                                           | 132,88                                            |
| 22,00                                    | 1020,5                                           | 134,41                                            |
| 23,00                                    | 1024                                             | 135,91                                            |
| 24,00                                    | 1027,5                                           | 137,4                                             |
| 25,00                                    | 1030,8                                           | 138,88                                            |
| 26,00                                    | 1034,1                                           | 140,33                                            |
| 27,00                                    | 1037,3                                           | 141,77                                            |
| 28,00                                    | 1040,4                                           | 143,2                                             |
| 29,00                                    | 1043,5                                           | 144,61                                            |
| 30,00                                    | 1046,5                                           | 146,01                                            |

| <b><math>T = 283,15 \text{ K}</math></b> |                                                  |                                                              |
|------------------------------------------|--------------------------------------------------|--------------------------------------------------------------|
| <b><math>p \text{ (MPa)}</math></b>      | <b><math>\rho \text{ (kg/m}^3\text{)}</math></b> | <b><math>\eta \text{ (}\mu\text{Pa}\cdot\text{s)}</math></b> |
| 0,02                                     | 0,37305                                          | 14,159                                                       |
| 0,50                                     | 9,6057                                           | 14,198                                                       |
| 1,00                                     | 19,861                                           | 14,253                                                       |
| 2,00                                     | 42,882                                           | 14,421                                                       |
| 3,00                                     | 70,863                                           | 14,713                                                       |
| 4,00                                     | 108,36                                           | 15,258                                                       |
| 5,00                                     | 862,59                                           | 84,741                                                       |
| 6,00                                     | 875,64                                           | 87,774                                                       |
| 7,00                                     | 886,91                                           | 90,508                                                       |
| 8,00                                     | 896,9                                            | 93,024                                                       |
| 9,00                                     | 905,91                                           | 95,372                                                       |
| 10,00                                    | 914,15                                           | 97,588                                                       |
| 11,00                                    | 921,76                                           | 99,694                                                       |
| 12,00                                    | 928,85                                           | 101,71                                                       |
| 13,00                                    | 935,48                                           | 103,65                                                       |
| 14,00                                    | 941,73                                           | 105,51                                                       |
| 15,00                                    | 947,65                                           | 107,32                                                       |
| 16,00                                    | 953,27                                           | 109,08                                                       |
| 17,00                                    | 958,63                                           | 110,79                                                       |
| 18,00                                    | 963,75                                           | 112,46                                                       |
| 19,00                                    | 968,66                                           | 114,1                                                        |
| 20,00                                    | 973,37                                           | 115,69                                                       |
| 21,00                                    | 977,91                                           | 117,26                                                       |
| 22,00                                    | 982,29                                           | 118,8                                                        |
| 23,00                                    | 986,52                                           | 120,31                                                       |
| 24,00                                    | 990,62                                           | 121,8                                                        |
| 25,00                                    | 994,58                                           | 123,26                                                       |
| 26,00                                    | 998,43                                           | 124,7                                                        |
| 27,00                                    | 1002,2                                           | 126,13                                                       |
| 28,00                                    | 1005,8                                           | 127,53                                                       |
| 29,00                                    | 1009,3                                           | 128,92                                                       |
| 30,00                                    | 1012,8                                           | 130,3                                                        |

| <b><math>T = 293,15 \text{ K}</math></b> |                                                  |                                                              |
|------------------------------------------|--------------------------------------------------|--------------------------------------------------------------|
| <b><math>p \text{ (MPa)}</math></b>      | <b><math>\rho \text{ (kg/m}^3\text{)}</math></b> | <b><math>\eta \text{ (}\mu\text{Pa}\cdot\text{s)}</math></b> |
| 0,02                                     | 0,36028                                          | 14,639                                                       |
| 0,50                                     | 9,246                                            | 14,684                                                       |
| 1,00                                     | 19,039                                           | 14,744                                                       |
| 2,00                                     | 40,66                                            | 14,914                                                       |
| 3,00                                     | 66,004                                           | 15,183                                                       |
| 4,00                                     | 97,352                                           | 15,625                                                       |
| 5,00                                     | 140,76                                           | 16,443                                                       |
| 6,00                                     | 778,03                                           | 68,122                                                       |
| 7,00                                     | 803,41                                           | 72,655                                                       |
| 8,00                                     | 822,26                                           | 76,256                                                       |
| 9,00                                     | 837,58                                           | 79,345                                                       |
| 10,00                                    | 850,62                                           | 82,099                                                       |
| 11,00                                    | 862,05                                           | 84,613                                                       |
| 12,00                                    | 872,29                                           | 86,946                                                       |
| 13,00                                    | 881,57                                           | 89,135                                                       |
| 14,00                                    | 890,1                                            | 91,208                                                       |
| 15,00                                    | 897,99                                           | 93,183                                                       |
| 16,00                                    | 905,36                                           | 95,076                                                       |
| 17,00                                    | 912,26                                           | 96,898                                                       |
| 18,00                                    | 918,78                                           | 98,658                                                       |
| 19,00                                    | 924,95                                           | 100,36                                                       |
| 20,00                                    | 930,81                                           | 102,02                                                       |
| 21,00                                    | 936,4                                            | 103,63                                                       |
| 22,00                                    | 941,74                                           | 105,21                                                       |
| 23,00                                    | 946,86                                           | 106,75                                                       |
| 24,00                                    | 951,78                                           | 108,26                                                       |
| 25,00                                    | 956,52                                           | 109,73                                                       |
| 26,00                                    | 961,08                                           | 111,18                                                       |
| 27,00                                    | 965,5                                            | 112,61                                                       |
| 28,00                                    | 969,76                                           | 114,01                                                       |
| 29,00                                    | 973,9                                            | 115,39                                                       |
| 30,00                                    | 977,91                                           | 116,75                                                       |

| <b><math>T = 313,15 \text{ K}</math></b> |                                                  |                                                   |
|------------------------------------------|--------------------------------------------------|---------------------------------------------------|
| <b><math>p \text{ (MPa)}</math></b>      | <b><math>\rho \text{ (kg/m}^3\text{)}</math></b> | <b><math>\eta \text{ (}\mu\text{Pa-s)}</math></b> |
| 0,02                                     | 0,3372                                           | 15,592                                            |
| 0,50                                     | 8,6077                                           | 15,646                                            |
| 1,00                                     | 17,613                                           | 15,712                                            |
| 2,00                                     | 37,019                                           | 15,885                                            |
| 3,00                                     | 58,739                                           | 16,127                                            |
| 4,00                                     | 83,581                                           | 16,469                                            |
| 5,00                                     | 112,9                                            | 16,967                                            |
| 6,00                                     | 149,24                                           | 17,733                                            |
| 7,00                                     | 198,46                                           | 19,049                                            |
| 8,00                                     | 280,38                                           | 22,005                                            |
| 9,00                                     | 495,79                                           | 35,112                                            |
| 10,00                                    | 628,74                                           | 47,925                                            |
| 11,00                                    | 681,52                                           | 54,325                                            |
| 12,00                                    | 714,73                                           | 58,823                                            |
| 13,00                                    | 739,36                                           | 62,429                                            |
| 14,00                                    | 759,15                                           | 65,509                                            |
| 15,00                                    | 775,8                                            | 68,238                                            |
| 16,00                                    | 790,24                                           | 70,715                                            |
| 17,00                                    | 803,03                                           | 72,998                                            |
| 18,00                                    | 814,53                                           | 75,128                                            |
| 19,00                                    | 825,01                                           | 77,135                                            |
| 20,00                                    | 834,64                                           | 79,039                                            |
| 21,00                                    | 843,56                                           | 80,855                                            |
| 22,00                                    | 851,88                                           | 82,595                                            |
| 23,00                                    | 859,68                                           | 84,271                                            |
| 24,00                                    | 867,03                                           | 85,889                                            |
| 25,00                                    | 873,98                                           | 87,456                                            |
| 26,00                                    | 880,57                                           | 88,978                                            |
| 27,00                                    | 886,86                                           | 90,459                                            |
| 28,00                                    | 892,85                                           | 91,902                                            |
| 29,00                                    | 898,59                                           | 93,312                                            |
| 30,00                                    | 904,1                                            | 94,692                                            |



| <b><math>T = 333,15 \text{ K}</math></b> |                                                  |                                                   |
|------------------------------------------|--------------------------------------------------|---------------------------------------------------|
| <b><math>p \text{ (MPa)}</math></b>      | <b><math>\rho \text{ (kg/m}^3\text{)}</math></b> | <b><math>\eta \text{ (}\mu\text{Pa-s)}</math></b> |
| 0,02                                     | 0,3169                                           | 16,534                                            |
| 0,50                                     | 8,0572                                           | 16,594                                            |
| 1,00                                     | 16,41                                            | 16,664                                            |
| 2,00                                     | 34,114                                           | 16,837                                            |
| 3,00                                     | 53,374                                           | 17,061                                            |
| 4,00                                     | 74,54                                            | 17,353                                            |
| 5,00                                     | 98,096                                           | 17,737                                            |
| 6,00                                     | 124,72                                           | 18,249                                            |
| 7,00                                     | 155,41                                           | 18,945                                            |
| 8,00                                     | 191,66                                           | 19,922                                            |
| 9,00                                     | 235,71                                           | 21,357                                            |
| 10,00                                    | 290,78                                           | 23,536                                            |
| 11,00                                    | 359,44                                           | 26,914                                            |
| 12,00                                    | 436,38                                           | 31,653                                            |
| 13,00                                    | 506,13                                           | 36,913                                            |
| 14,00                                    | 560,72                                           | 41,744                                            |
| 15,00                                    | 602,59                                           | 45,924                                            |
| 16,00                                    | 635,49                                           | 49,529                                            |
| 17,00                                    | 662,12                                           | 52,674                                            |
| 18,00                                    | 684,36                                           | 55,468                                            |
| 19,00                                    | 703,41                                           | 57,995                                            |
| 20,00                                    | 720,09                                           | 60,312                                            |
| 21,00                                    | 734,93                                           | 62,463                                            |
| 22,00                                    | 748,31                                           | 64,478                                            |
| 23,00                                    | 760,49                                           | 66,38                                             |
| 24,00                                    | 771,69                                           | 68,186                                            |
| 25,00                                    | 782,05                                           | 69,908                                            |
| 26,00                                    | 791,7                                            | 71,56                                             |
| 27,00                                    | 800,72                                           | 73,148                                            |
| 28,00                                    | 809,21                                           | 74,68                                             |
| 29,00                                    | 817,22                                           | 76,162                                            |
| 30,00                                    | 824,81                                           | 77,6                                              |

| <b><math>T = 353,15 \text{ K}</math></b> |                                                  |                                                              |
|------------------------------------------|--------------------------------------------------|--------------------------------------------------------------|
| <b><math>p \text{ (MPa)}</math></b>      | <b><math>\rho \text{ (kg/m}^3\text{)}</math></b> | <b><math>\eta \text{ (}\mu\text{Pa}\cdot\text{s)}</math></b> |
| 0,02                                     | 0,29892                                          | 17,465                                                       |
| 0,50                                     | 7,5764                                           | 17,527                                                       |
| 1,00                                     | 15,377                                           | 17,6                                                         |
| 2,00                                     | 31,713                                           | 17,771                                                       |
| 3,00                                     | 49,146                                           | 17,983                                                       |
| 4,00                                     | 67,846                                           | 18,243                                                       |
| 5,00                                     | 88,018                                           | 18,566                                                       |
| 6,00                                     | 109,91                                           | 18,966                                                       |
| 7,00                                     | 133,83                                           | 19,465                                                       |
| 8,00                                     | 160,13                                           | 20,093                                                       |
| 9,00                                     | 189,22                                           | 20,893                                                       |
| 10,00                                    | 221,52                                           | 21,905                                                       |
| 11,00                                    | 257,37                                           | 23,197                                                       |
| 12,00                                    | 296,85                                           | 24,836                                                       |
| 13,00                                    | 339,45                                           | 26,872                                                       |
| 14,00                                    | 383,74                                           | 29,302                                                       |
| 15,00                                    | 427,48                                           | 32,036                                                       |
| 16,00                                    | 468,47                                           | 34,918                                                       |
| 17,00                                    | 505,43                                           | 37,801                                                       |
| 18,00                                    | 538,11                                           | 40,589                                                       |
| 19,00                                    | 566,82                                           | 43,236                                                       |
| 20,00                                    | 592,09                                           | 45,729                                                       |
| 21,00                                    | 614,45                                           | 48,069                                                       |
| 22,00                                    | 634,36                                           | 50,266                                                       |
| 23,00                                    | 652,23                                           | 52,333                                                       |
| 24,00                                    | 668,39                                           | 54,285                                                       |
| 25,00                                    | 683,11                                           | 56,135                                                       |
| 26,00                                    | 696,63                                           | 57,896                                                       |
| 27,00                                    | 709,11                                           | 59,578                                                       |
| 28,00                                    | 720,7                                            | 61,19                                                        |
| 29,00                                    | 731,51                                           | 62,74                                                        |
| 30,00                                    | 741,65                                           | 64,234                                                       |

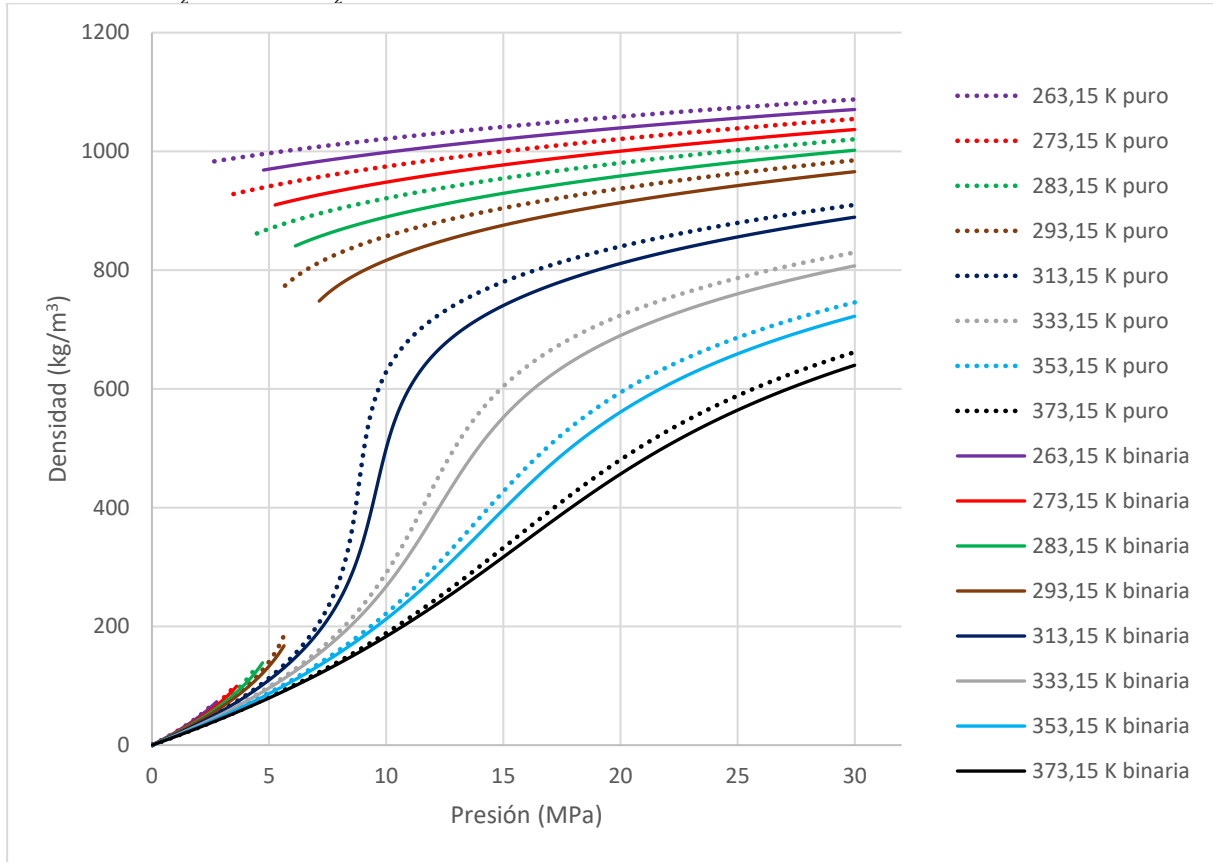
| <b><math>T = 373,15 \text{ K}</math></b> |                                                  |                                                   |
|------------------------------------------|--------------------------------------------------|---------------------------------------------------|
| <b><math>p \text{ (MPa)}</math></b>      | <b><math>\rho \text{ (kg/m}^3\text{)}</math></b> | <b><math>\eta \text{ (}\mu\text{Pa-s)}</math></b> |
| 0,02                                     | 0,28287                                          | 18,382                                            |
| 0,50                                     | 7,1521                                           | 18,447                                            |
| 1,00                                     | 14,477                                           | 18,521                                            |
| 2,00                                     | 29,679                                           | 18,689                                            |
| 3,00                                     | 45,68                                            | 18,89                                             |
| 4,00                                     | 62,567                                           | 19,128                                            |
| 5,00                                     | 80,435                                           | 19,411                                            |
| 6,00                                     | 99,388                                           | 19,747                                            |
| 7,00                                     | 119,54                                           | 20,147                                            |
| 8,00                                     | 141                                              | 20,623                                            |
| 9,00                                     | 163,89                                           | 21,193                                            |
| 10,00                                    | 188,3                                            | 21,868                                            |
| 11,00                                    | 214,28                                           | 22,67                                             |
| 12,00                                    | 241,82                                           | 23,618                                            |
| 13,00                                    | 270,81                                           | 24,731                                            |
| 14,00                                    | 301,03                                           | 26,02                                             |
| 15,00                                    | 332,07                                           | 27,489                                            |
| 16,00                                    | 363,4                                            | 29,128                                            |
| 17,00                                    | 394,39                                           | 30,91                                             |
| 18,00                                    | 424,42                                           | 32,798                                            |
| 19,00                                    | 452,99                                           | 34,747                                            |
| 20,00                                    | 479,8                                            | 36,717                                            |
| 21,00                                    | 504,7                                            | 38,677                                            |
| 22,00                                    | 527,71                                           | 40,604                                            |
| 23,00                                    | 548,91                                           | 42,483                                            |
| 24,00                                    | 568,46                                           | 44,306                                            |
| 25,00                                    | 586,5                                            | 46,069                                            |
| 26,00                                    | 603,18                                           | 47,773                                            |
| 27,00                                    | 618,65                                           | 49,417                                            |
| 28,00                                    | 633,03                                           | 51,004                                            |
| 29,00                                    | 646,45                                           | 52,537                                            |
| 30,00                                    | 659,01                                           | 54,019                                            |

**Tabla A.4.** Valores del equilibrio líquido-vapor ( $p_{\text{sat}}$ ,  $p_{\text{rocío}}$ ,  $p_{\text{burbuja}}$ ,  $\rho_L$  y  $\rho_V$ ) a cada temperatura,  $T$ , para el  $\text{CO}_2$  puro, la mezcla ternaria  $\text{CO}_2 + \text{O}_2 + \text{H}_2\text{S}$  ( $x_{\text{CO}_2} = 0,955$ ,  $x_{\text{O}_2} = 0,03$  y  $x_{\text{H}_2\text{S}} = 0,015$ ) y las mezclas binarias  $\text{CO}_2 + \text{O}_2$  ( $x_{\text{CO}_2} = 0,97$  y  $x_{\text{O}_2} = 0,03$ ) y  $\text{CO}_2 + \text{H}_2\text{S}$  ( $x_{\text{CO}_2} = 0,985$  y  $x_{\text{H}_2\text{S}} = 0,015$ ).

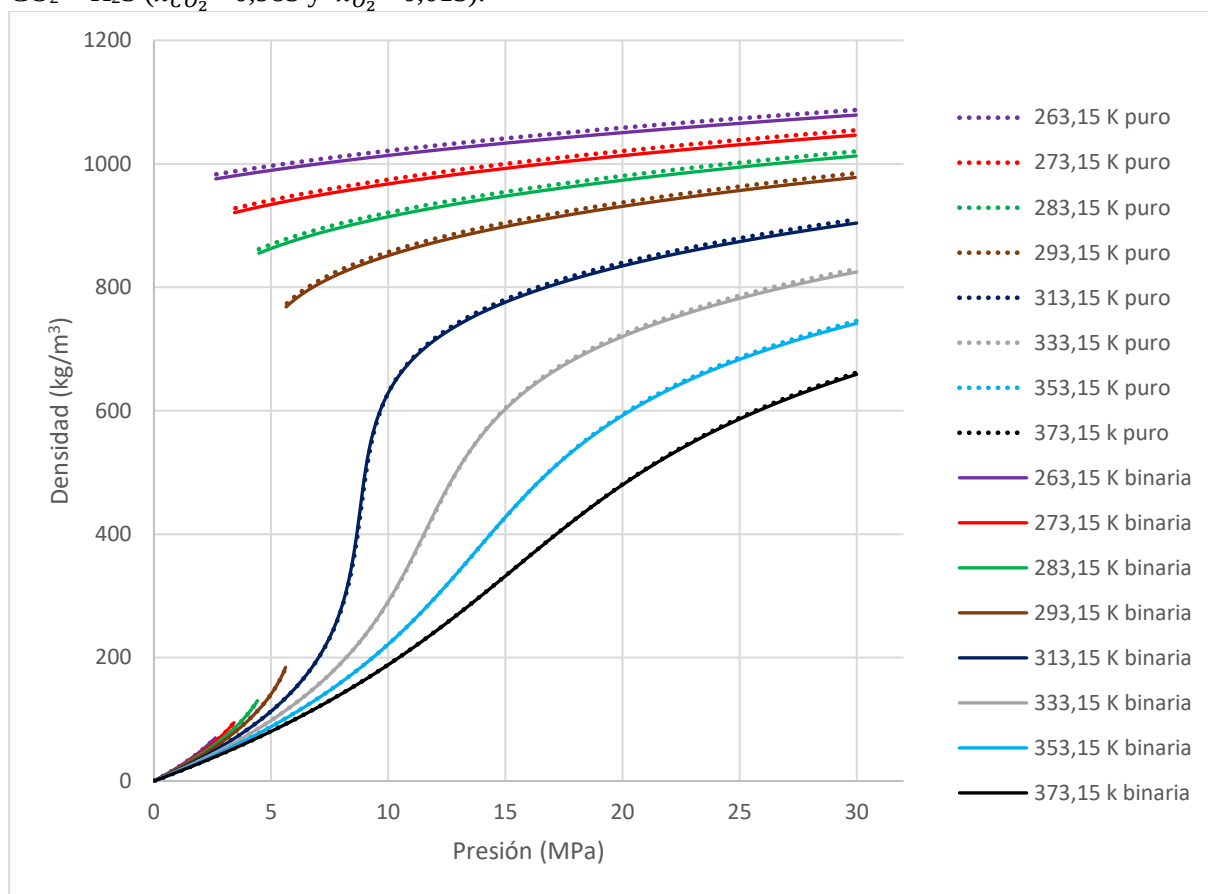
| CO <sub>2</sub> puro                                |                          |                            |                               |                               |
|-----------------------------------------------------|--------------------------|----------------------------|-------------------------------|-------------------------------|
| $T$ (K)                                             | $p_{\text{sat}}$ (MPa)   |                            | $\rho_L$ (kg/m <sup>3</sup> ) | $\rho_V$ (kg/m <sup>3</sup> ) |
| 263,15                                              | 2,6487                   |                            | 982,93                        | 71,185                        |
| 273,15                                              | 3,4851                   |                            | 927,43                        | 97,647                        |
| 283,15                                              | 4,5022                   |                            | 861,12                        | 135,16                        |
| 293,15                                              | 5,7291                   |                            | 773,39                        | 194,2                         |
| CO <sub>2</sub> + O <sub>2</sub> + H <sub>2</sub> S |                          |                            |                               |                               |
| $T$ (K)                                             | $p_{\text{rocío}}$ (MPa) | $p_{\text{burbuja}}$ (MPa) | $\rho_L$ (kg/m <sup>3</sup> ) | $\rho_V$ (kg/m <sup>3</sup> ) |
| 263,15                                              | 4,5383                   | 2,7444                     | 959,88                        | 72,384                        |
| 273,15                                              | 5,2263                   | 3,6224                     | 903,09                        | 99,39                         |
| 283,15                                              | 6,0764                   | 4,7018                     | 834,50                        | 137,81                        |
| 293,15                                              | 7,0935                   | 6,0323                     | 742,70                        | 198,61                        |
| CO <sub>2</sub> + O <sub>2</sub>                    |                          |                            |                               |                               |
| $T$ (K)                                             | $p_{\text{rocío}}$ (MPa) | $p_{\text{burbuja}}$ (MPa) | $\rho_L$ (kg/m <sup>3</sup> ) | $\rho_V$ (kg/m <sup>3</sup> ) |
| 263,15                                              | 4,5730                   | 2,7598                     | 967,26                        | 75,083                        |
| 273,15                                              | 5,2610                   | 3,6440                     | 909,89                        | 100,42                        |
| 283,15                                              | 6,1128                   | 4,7311                     | 840,55                        | 139,35                        |
| 293,15                                              | 7,1334                   | 6,0715                     | 747,54                        | 201,12                        |
| CO <sub>2</sub> + H <sub>2</sub> S                  |                          |                            |                               |                               |
| $T$ (K)                                             | $p_{\text{rocío}}$ (MPa) | $p_{\text{burbuja}}$ (MPa) | $\rho_L$ (kg/m <sup>3</sup> ) | $\rho_V$ (kg/m <sup>3</sup> ) |
| 263,15                                              | 2,6374                   | 2,6344                     | 975,59                        | 70,531                        |
| 273,15                                              | 3,4692                   | 3,4652                     | 920,66                        | 96,683                        |
| 283,15                                              | 4,4801                   | 4,4753                     | 854,84                        | 133,71                        |
| 293,15                                              | 5,6986                   | 5,6936                     | 767,96                        | 191,81                        |

## ANEXO II: FIGURAS

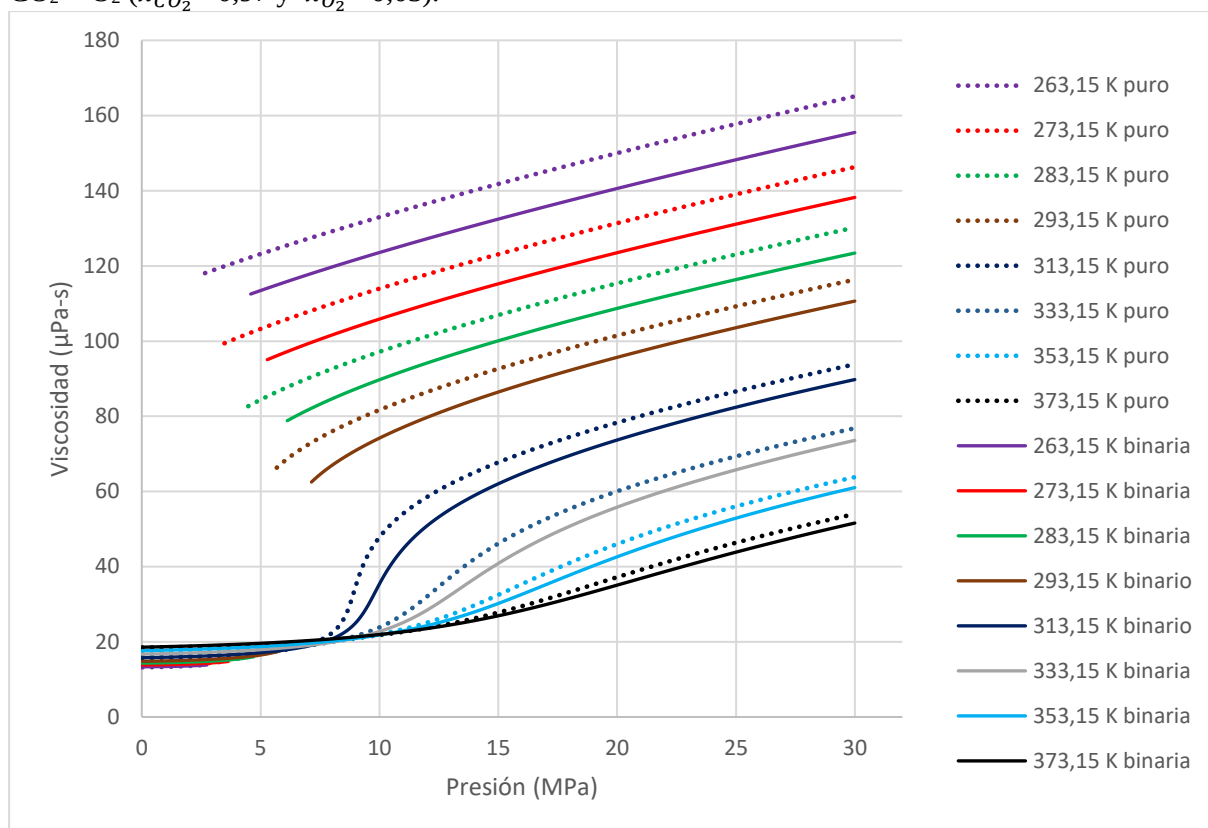
**Figura A.1.** Densidad frente a presión a cada temperatura,  $T$ , para el  $\text{CO}_2$  puro y la mezcla binaria  $\text{CO}_2 + \text{O}_2$  ( $x_{\text{CO}_2} = 0,97$  y  $x_{\text{O}_2} = 0,03$ ).



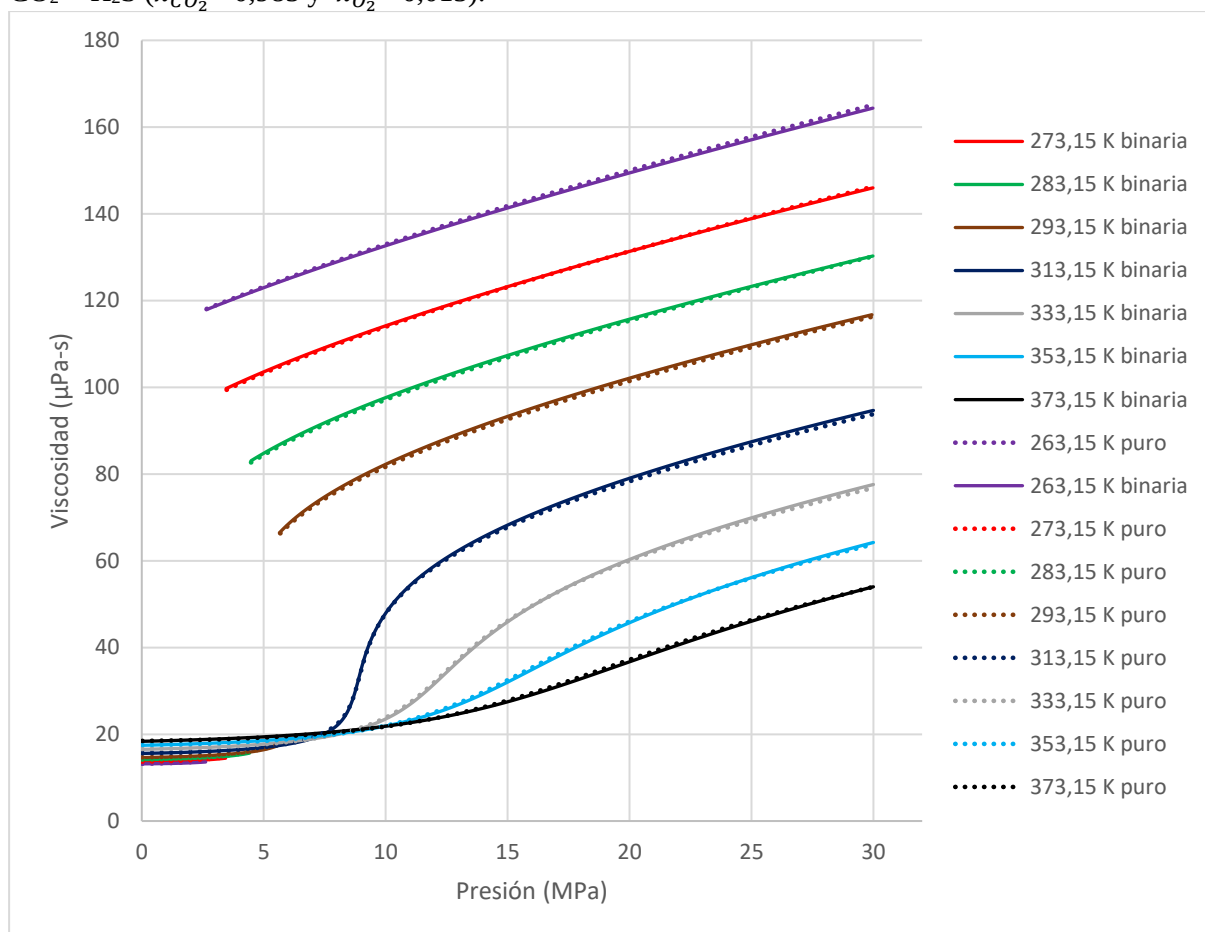
**Figura A.2.** Densidad frente a presión a cada temperatura,  $T$ , para el  $\text{CO}_2$  puro y la mezcla binaria  $\text{CO}_2 + \text{H}_2\text{S}$  ( $x_{\text{CO}_2} = 0,985$  y  $x_{\text{O}_2} = 0,015$ ).



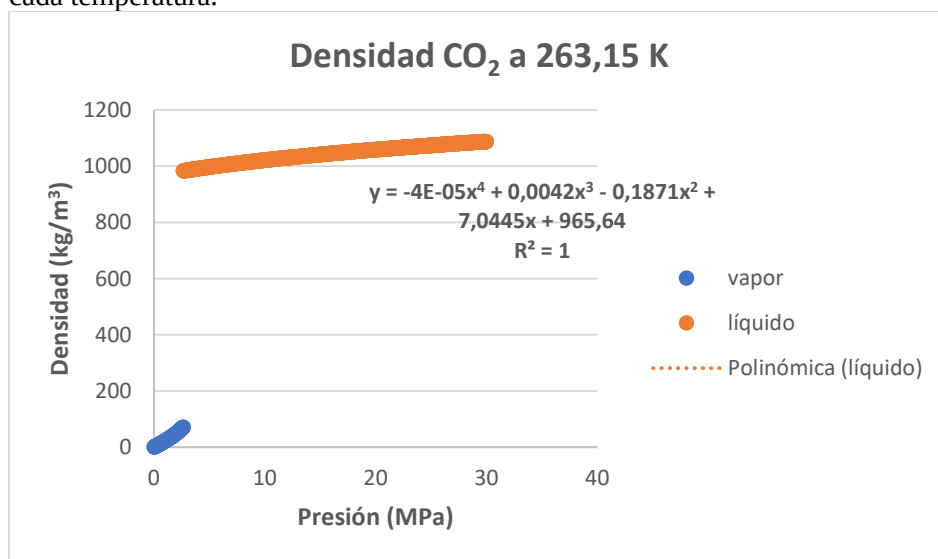
**Figura A.3.** Viscosidad frente a presión a cada temperatura,  $T$ , para el  $\text{CO}_2$  puro y la mezcla binaria  $\text{CO}_2 + \text{O}_2$  ( $x_{\text{CO}_2} = 0,97$  y  $x_{\text{O}_2} = 0,03$ ).



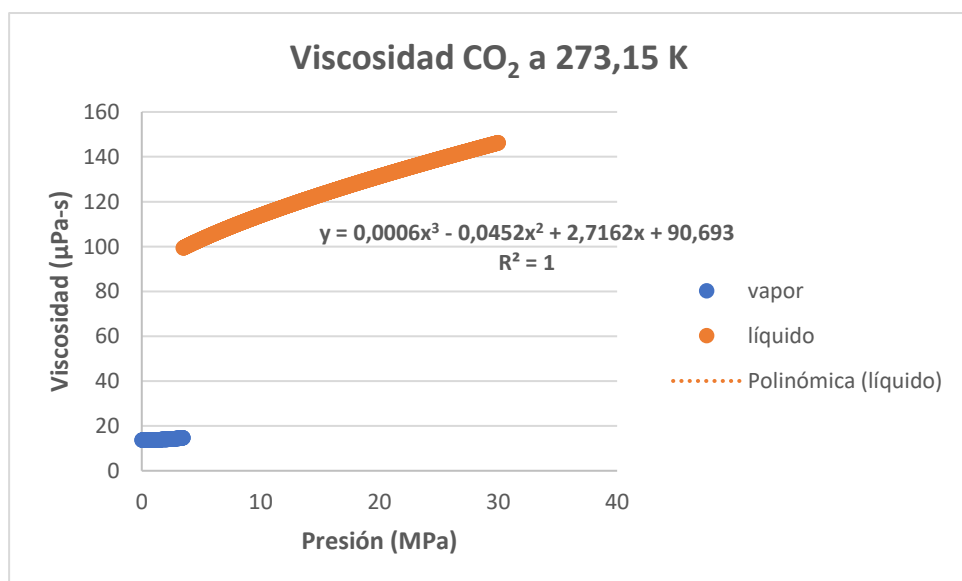
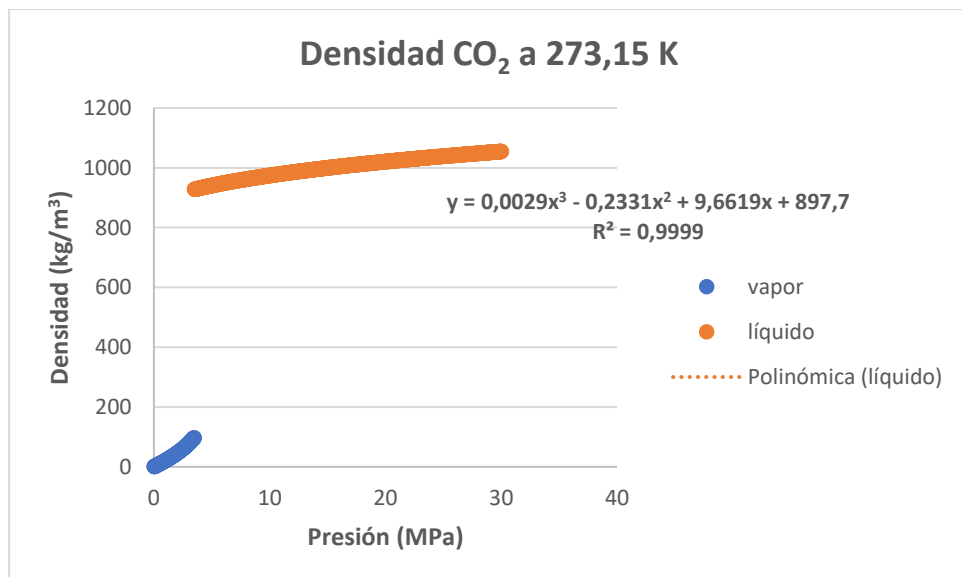
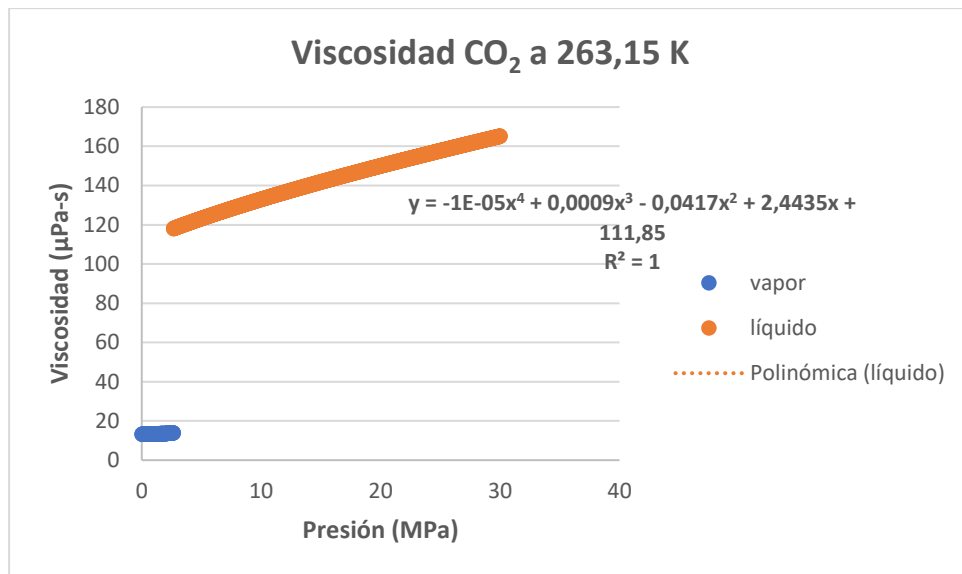
**Figura A.4.** Viscosidad frente a presión a cada temperatura,  $T$ , para el  $\text{CO}_2$  puro y la mezcla binaria  $\text{CO}_2 + \text{H}_2\text{S}$  ( $x_{\text{CO}_2} = 0,985$  y  $x_{\text{O}_2} = 0,015$ ).

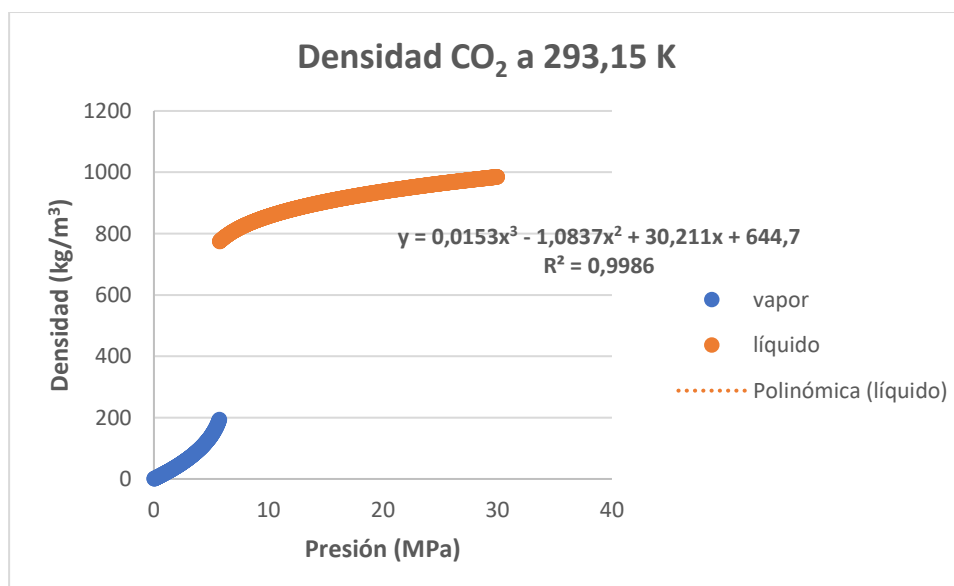
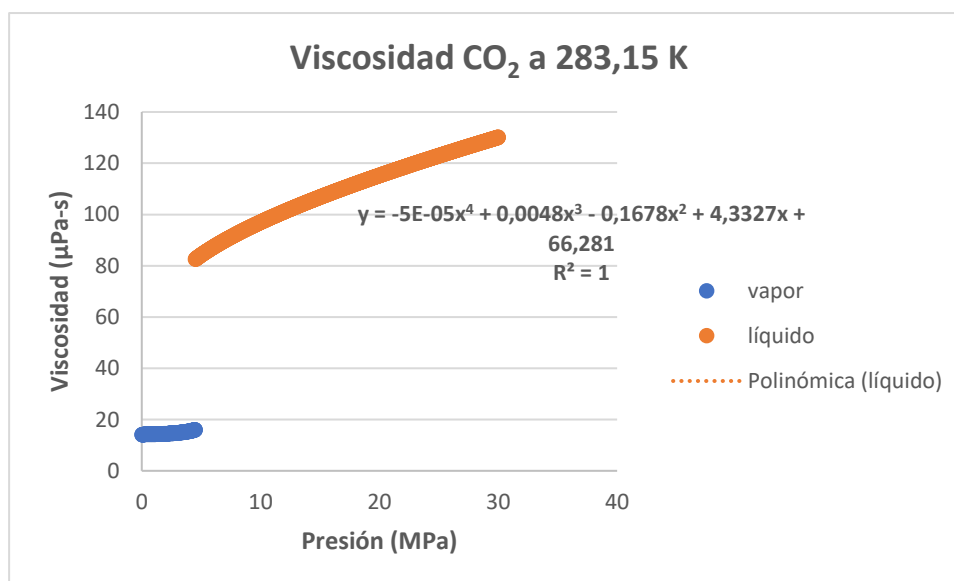
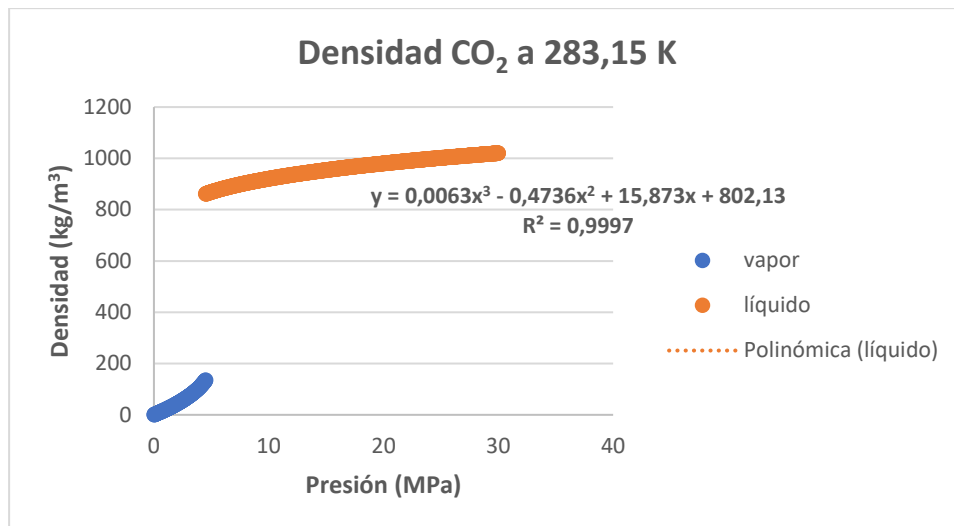


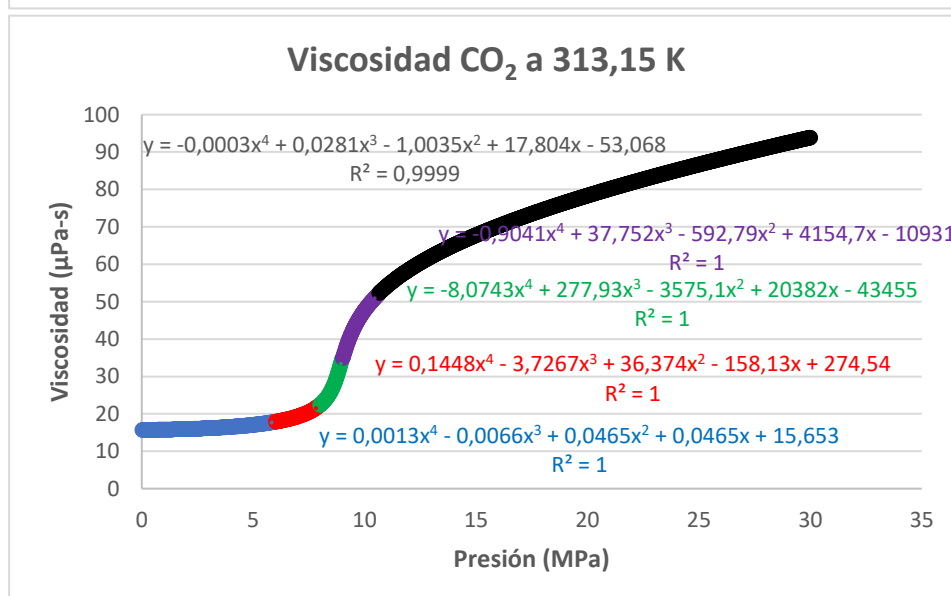
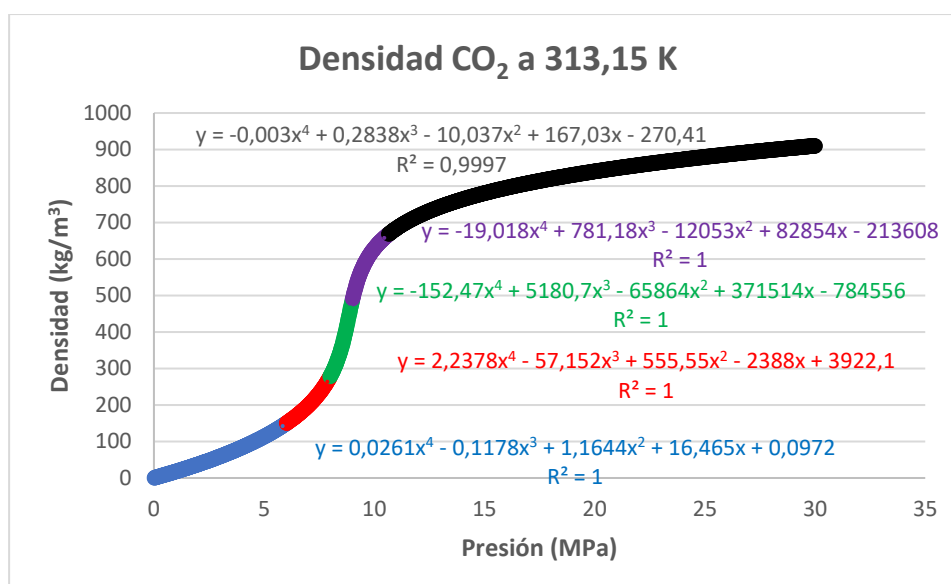
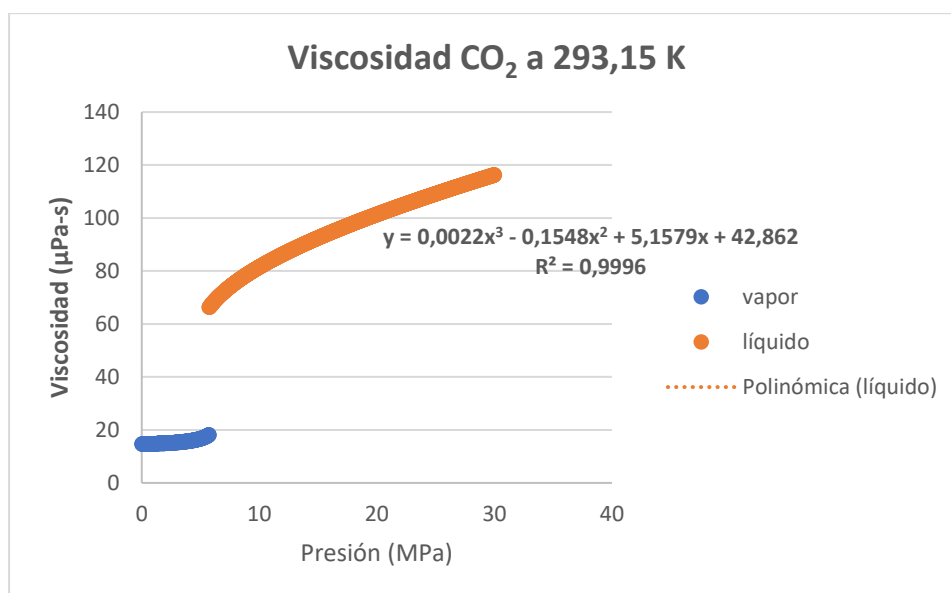
**Figura A.5.** Ajustes polinómicos de la densidad y viscosidad del  $\text{CO}_2$  puro, en función de la presión a cada temperatura.



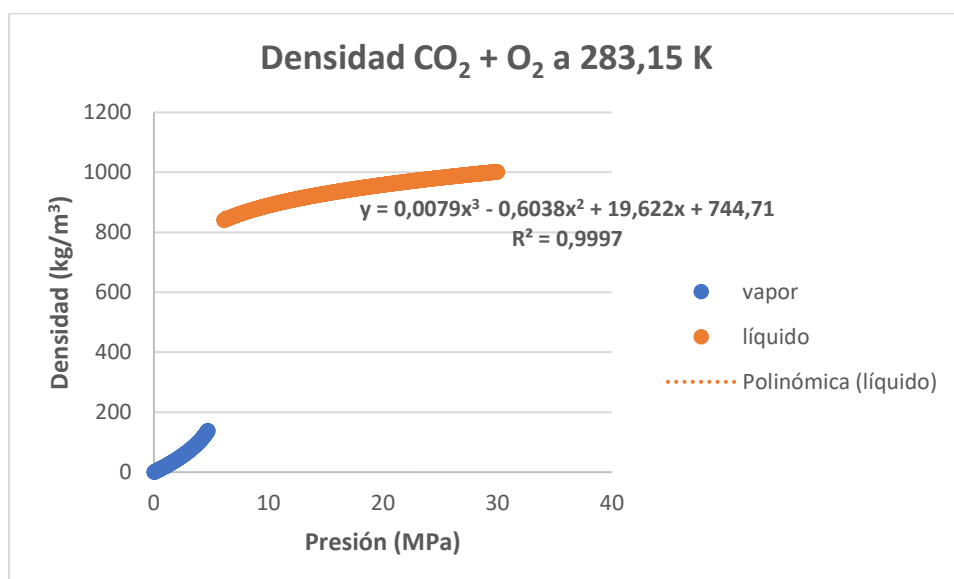
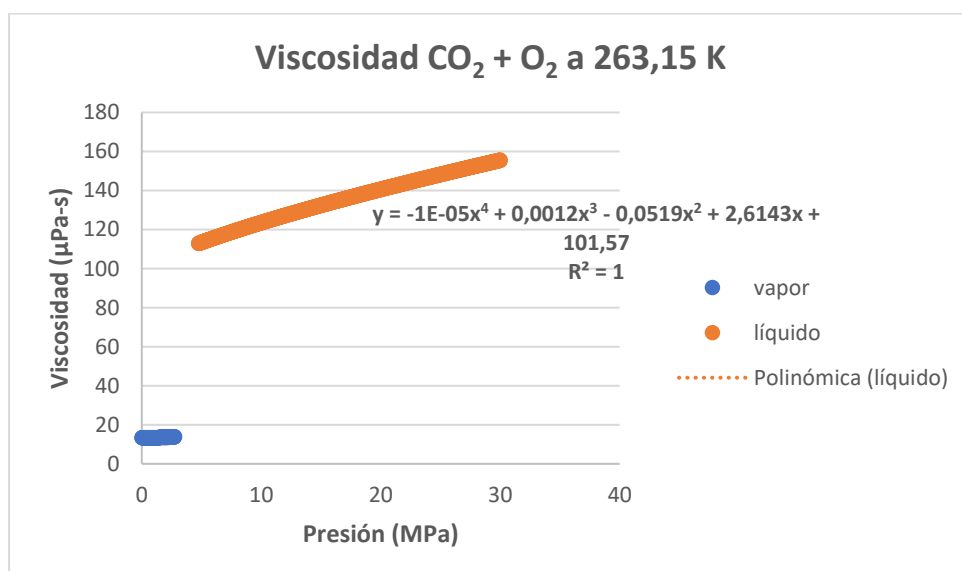
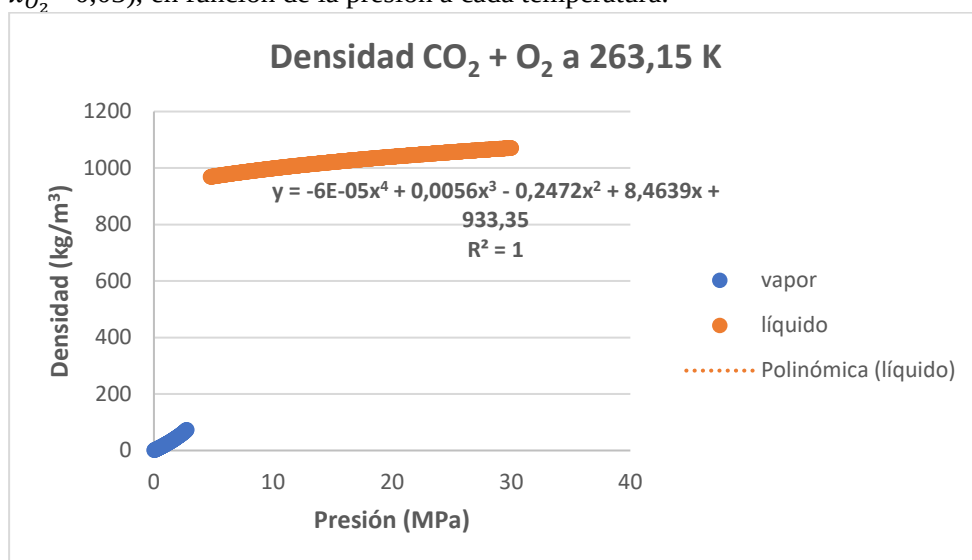


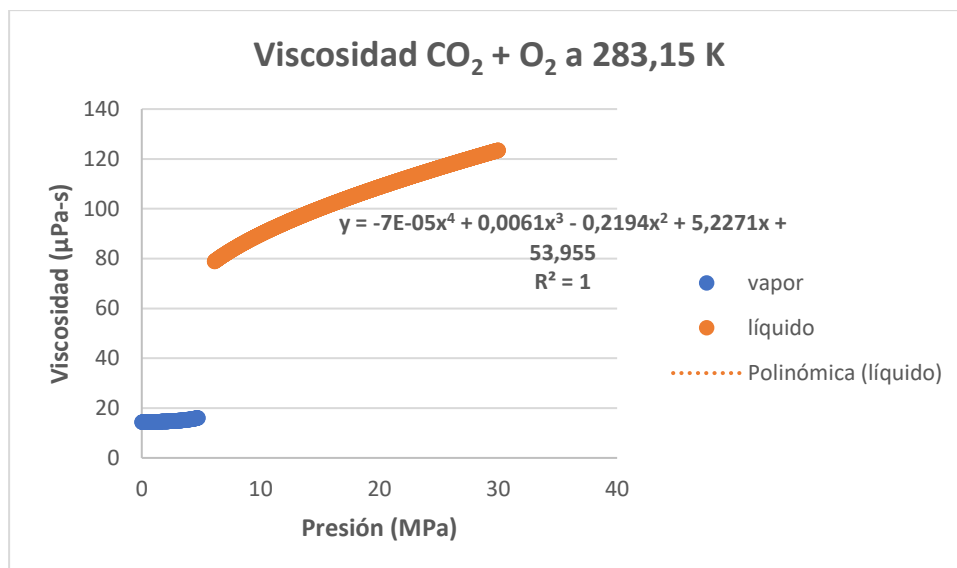




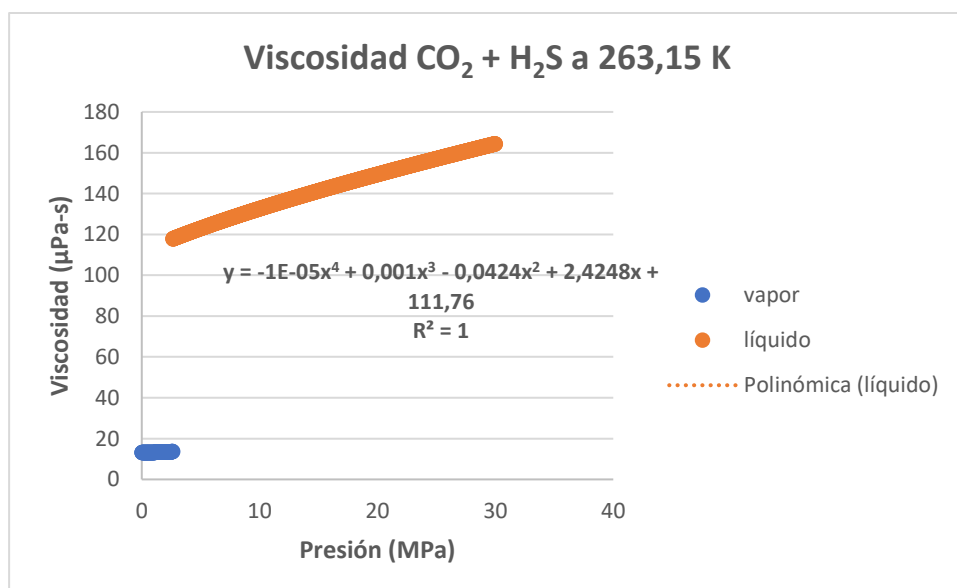
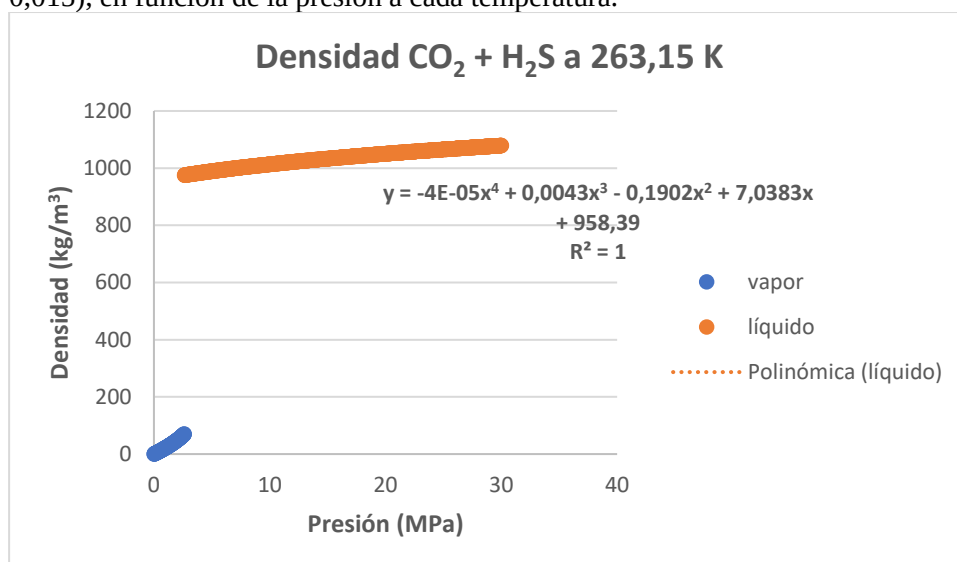


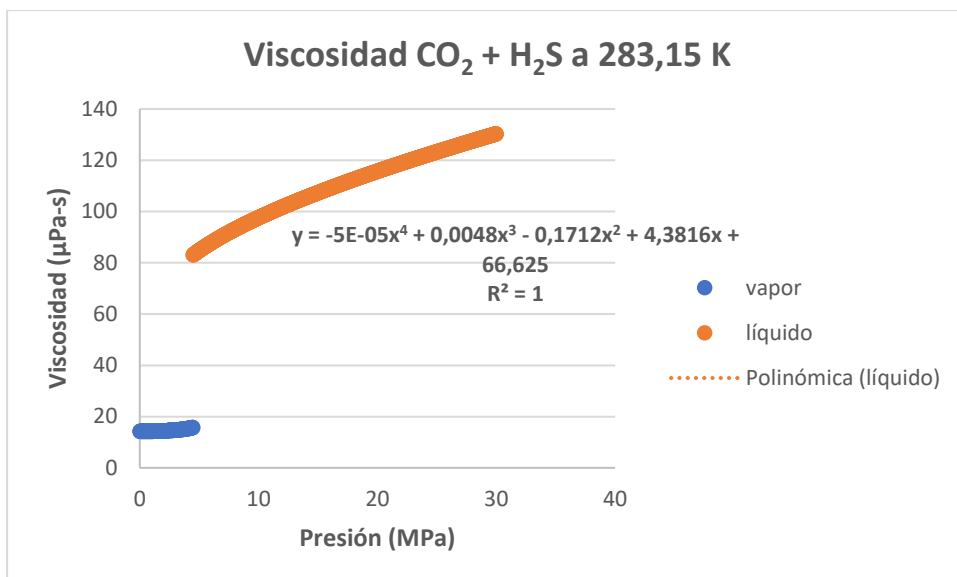
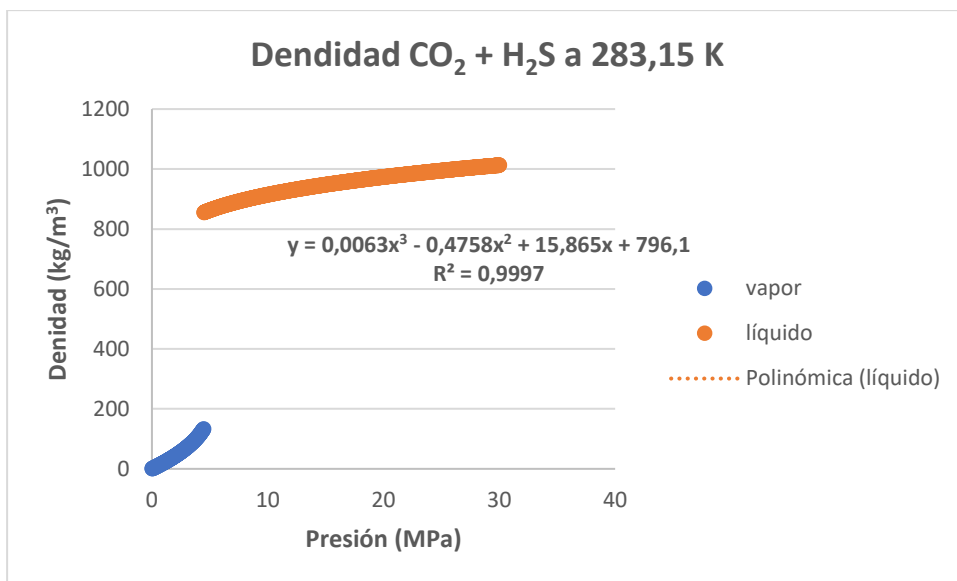
**Figura A.6.** Ajustes polinómicos de la densidad y viscosidad del sistema  $\text{CO}_2 + \text{O}_2$  ( $x_{\text{CO}_2} = 0,97$  y  $x_{\text{O}_2} = 0,03$ ), en función de la presión a cada temperatura.



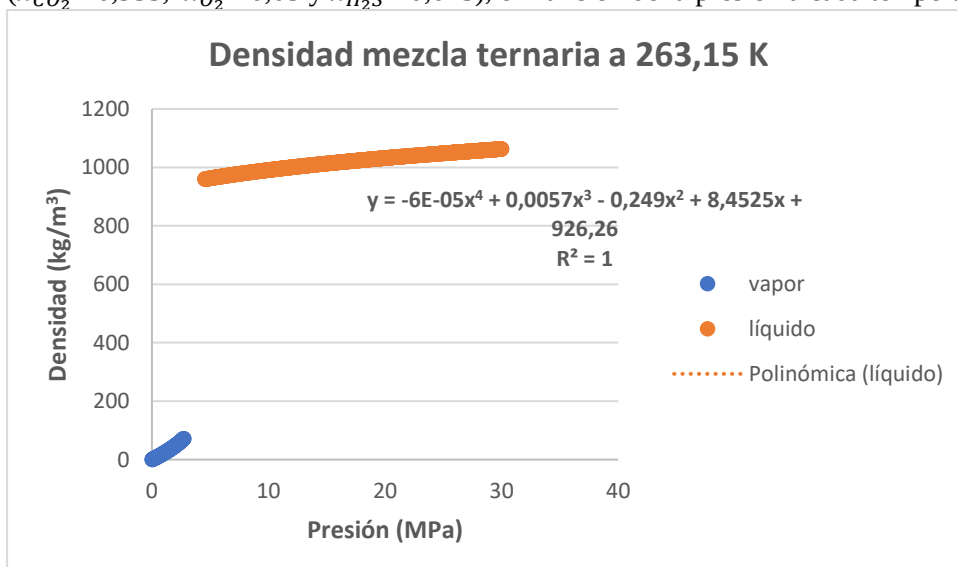


**Figura A.7.** Ajustes polinómicos de la densidad y viscosidad del CO<sub>2</sub> + H<sub>2</sub>S ( $x_{\text{CO}_2} = 0,985$  y  $x_{\text{O}_2} = 0,015$ ), en función de la presión a cada temperatura.

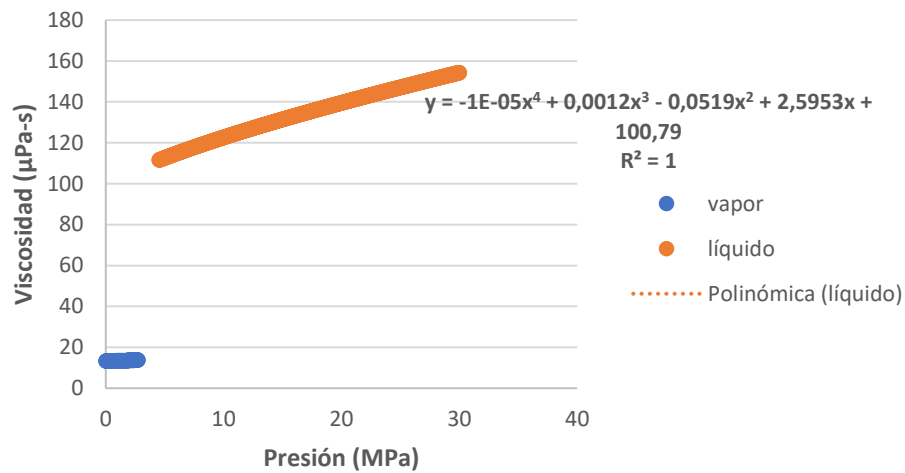




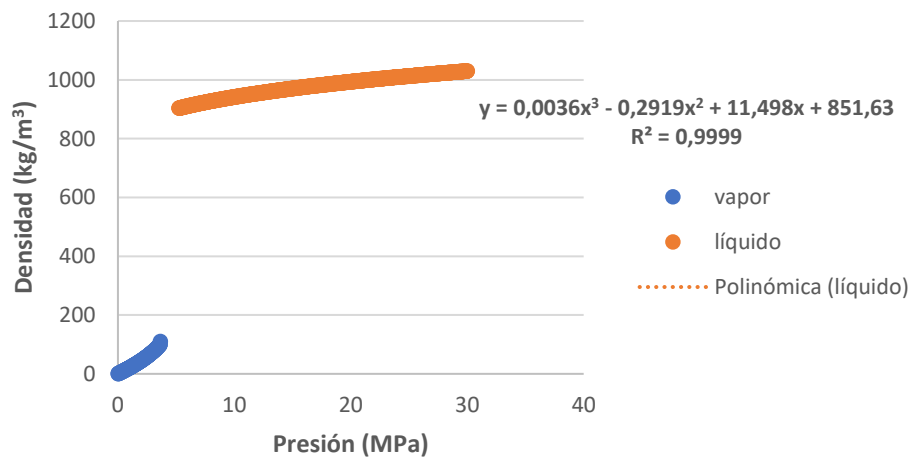
**Figura A.8.** Ajustes polinómicos de la densidad y viscosidad de la mezcla ternaria CO<sub>2</sub> + O<sub>2</sub> + H<sub>2</sub>S ( $x_{CO_2} = 0,955$ ,  $x_{O_2} = 0,03$  y  $x_{H_2S} = 0,015$ ), en función de la presión a cada temperatura.



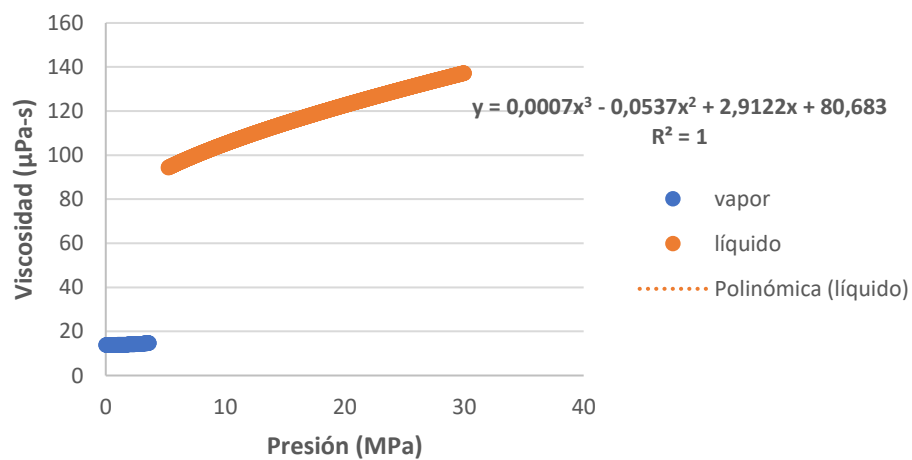
### Viscosidad mezcla ternaria a 263,15 K



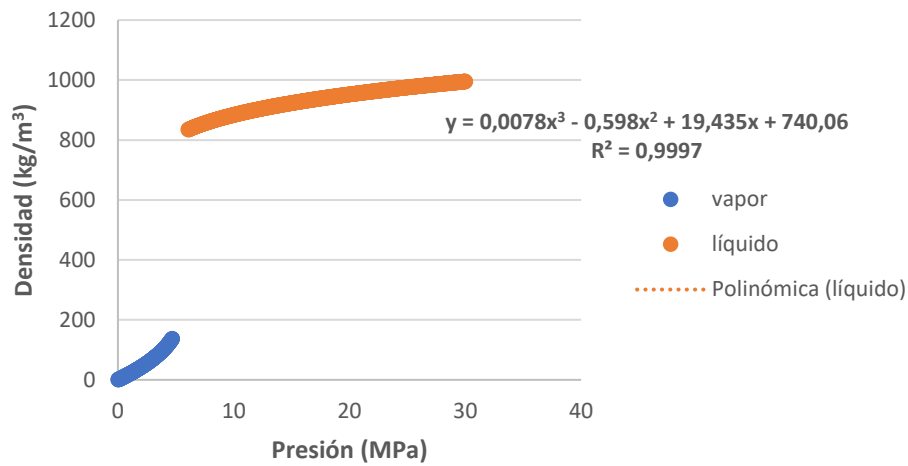
### Densidad mezcla ternaria a 273,15 K



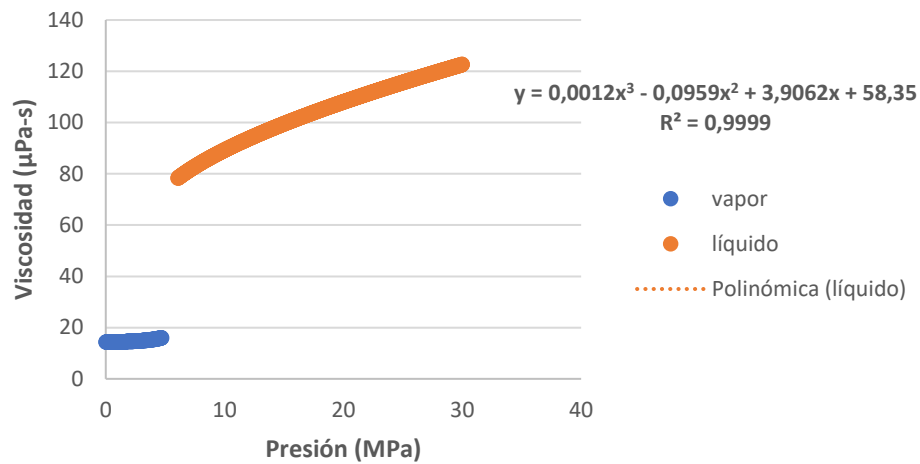
### Viscosidad mezcla ternaria a 273,15 K



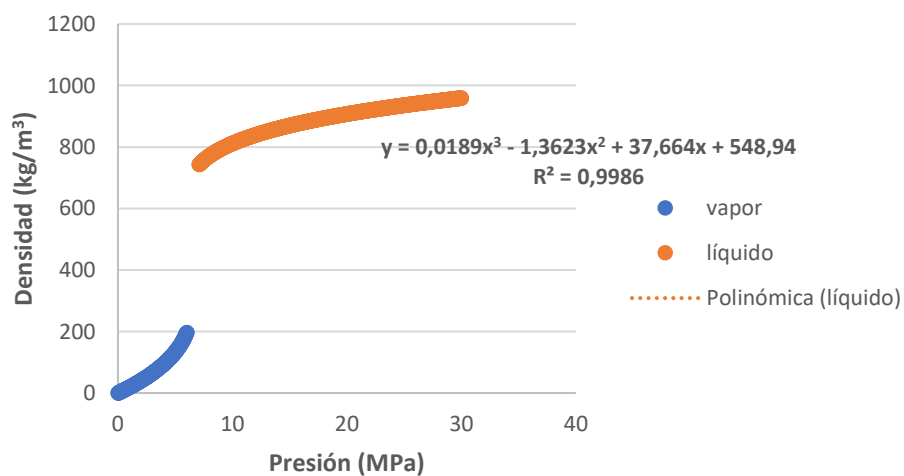
### Densidad mezcla ternaria a 283,15 K



### Viscosidad mezcla ternaria a 283,15 K

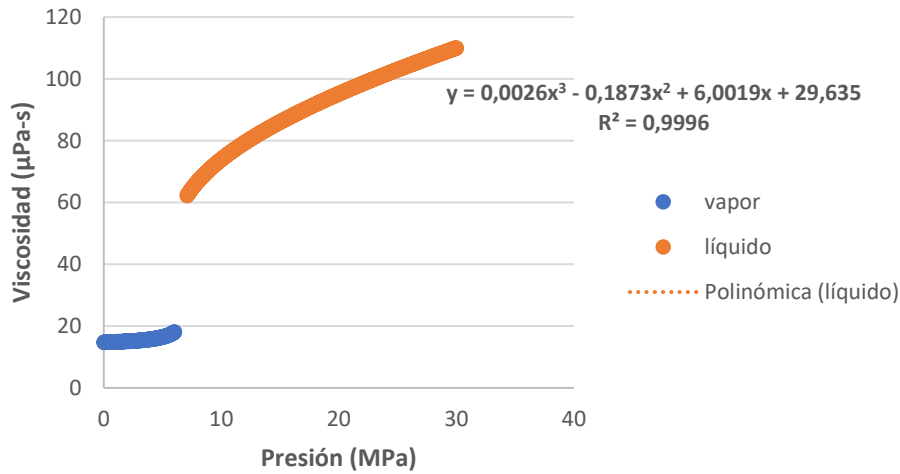


### Densidad mezcla ternaria a 293,15 K

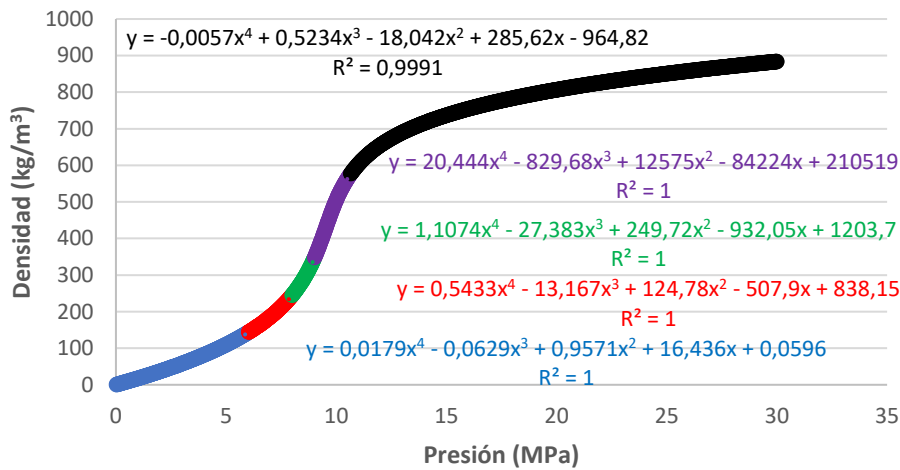




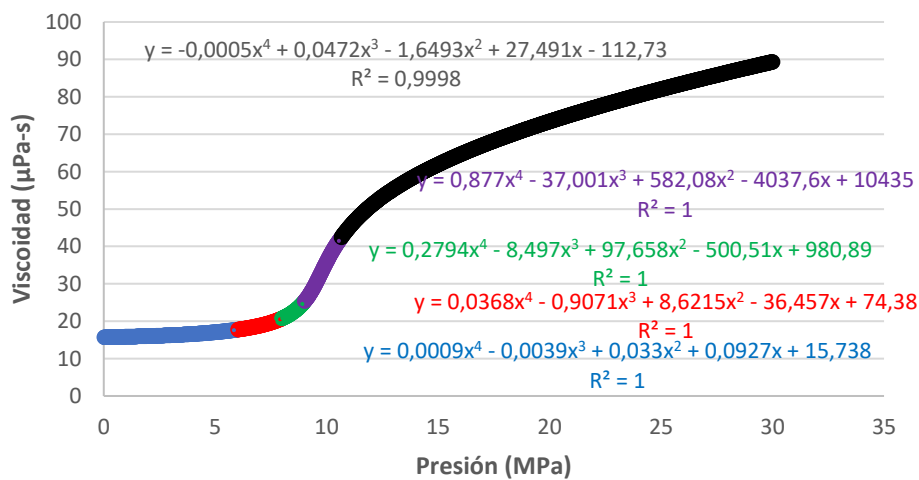
### Viscosidad mezcla ternaria a 293,15 K



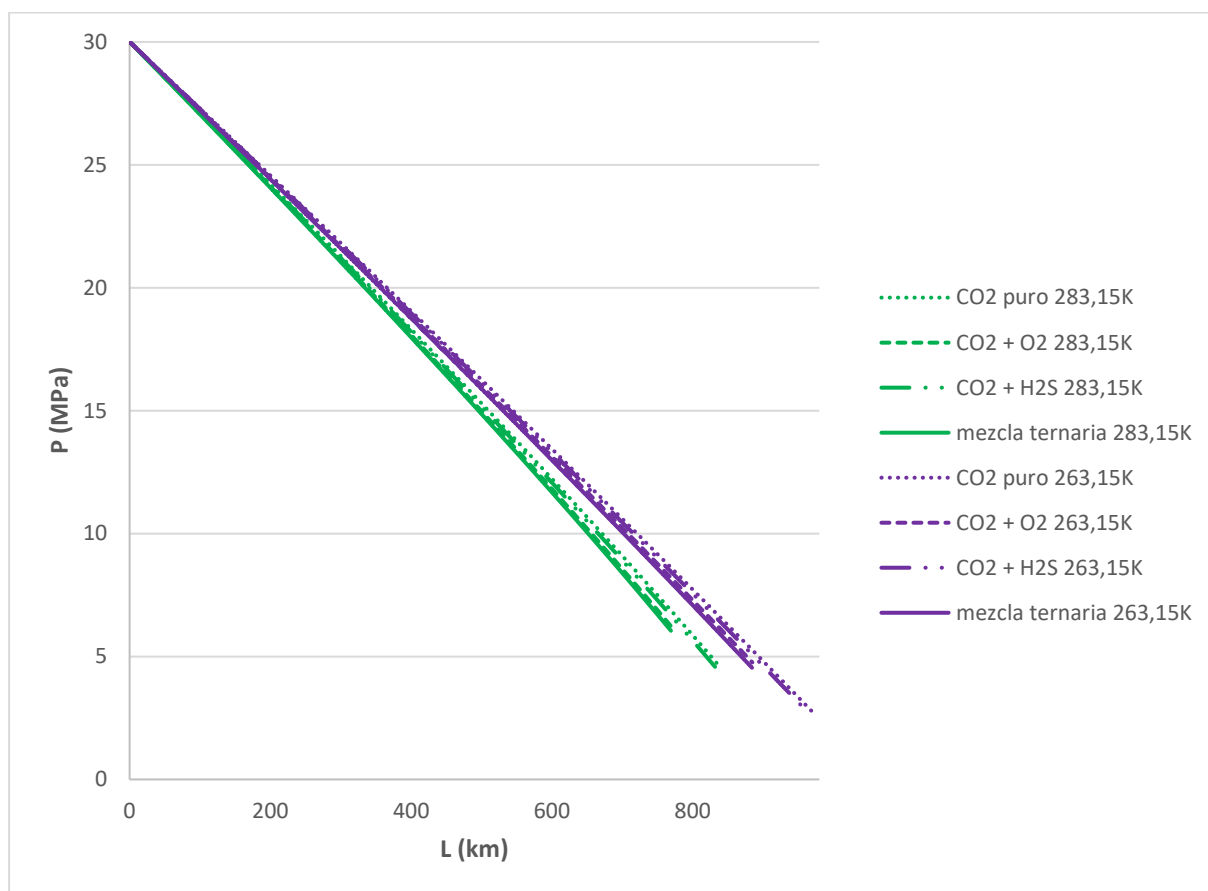
### Densidad mezcla ternaria a 313,15 K



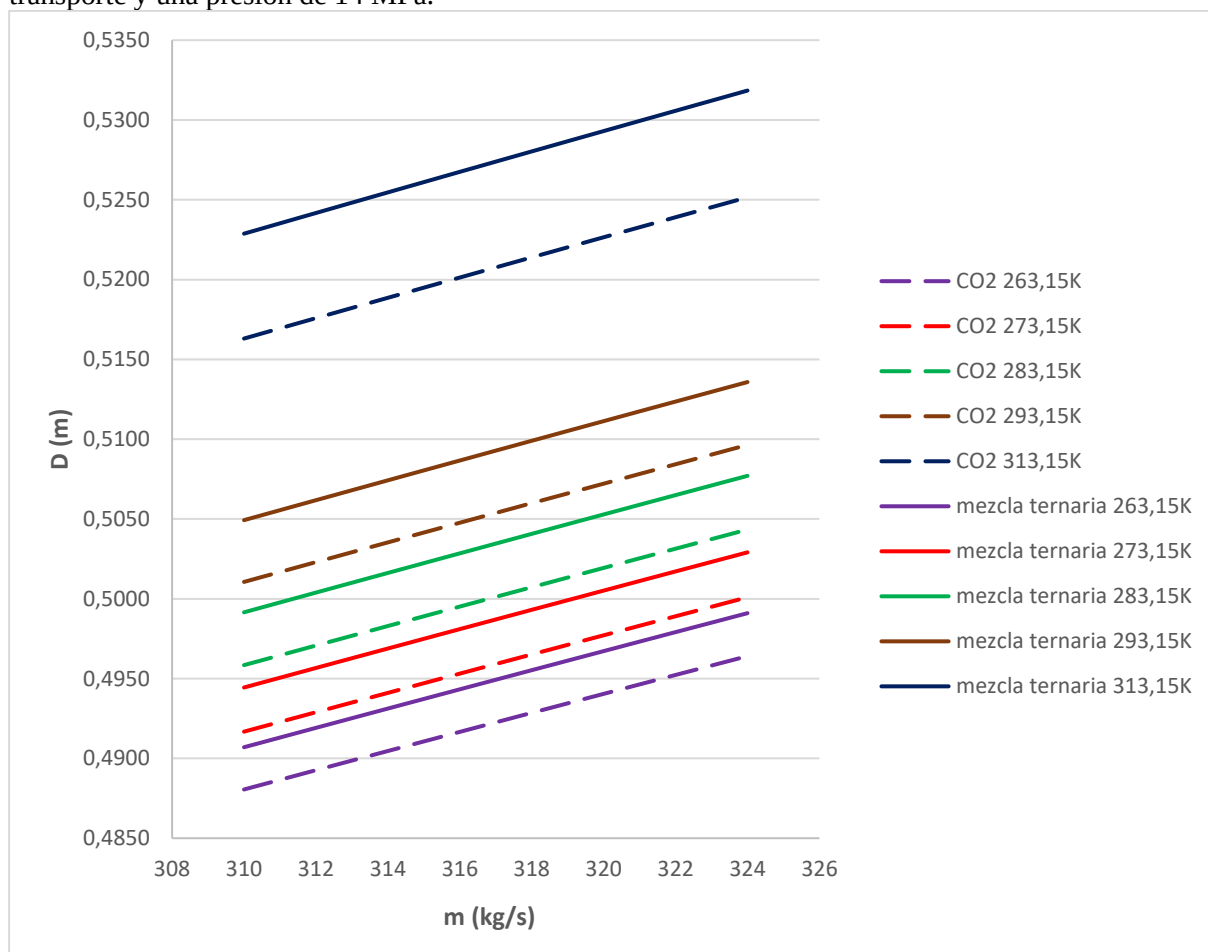
### Viscosidad mezcla ternaria a 313,15 K



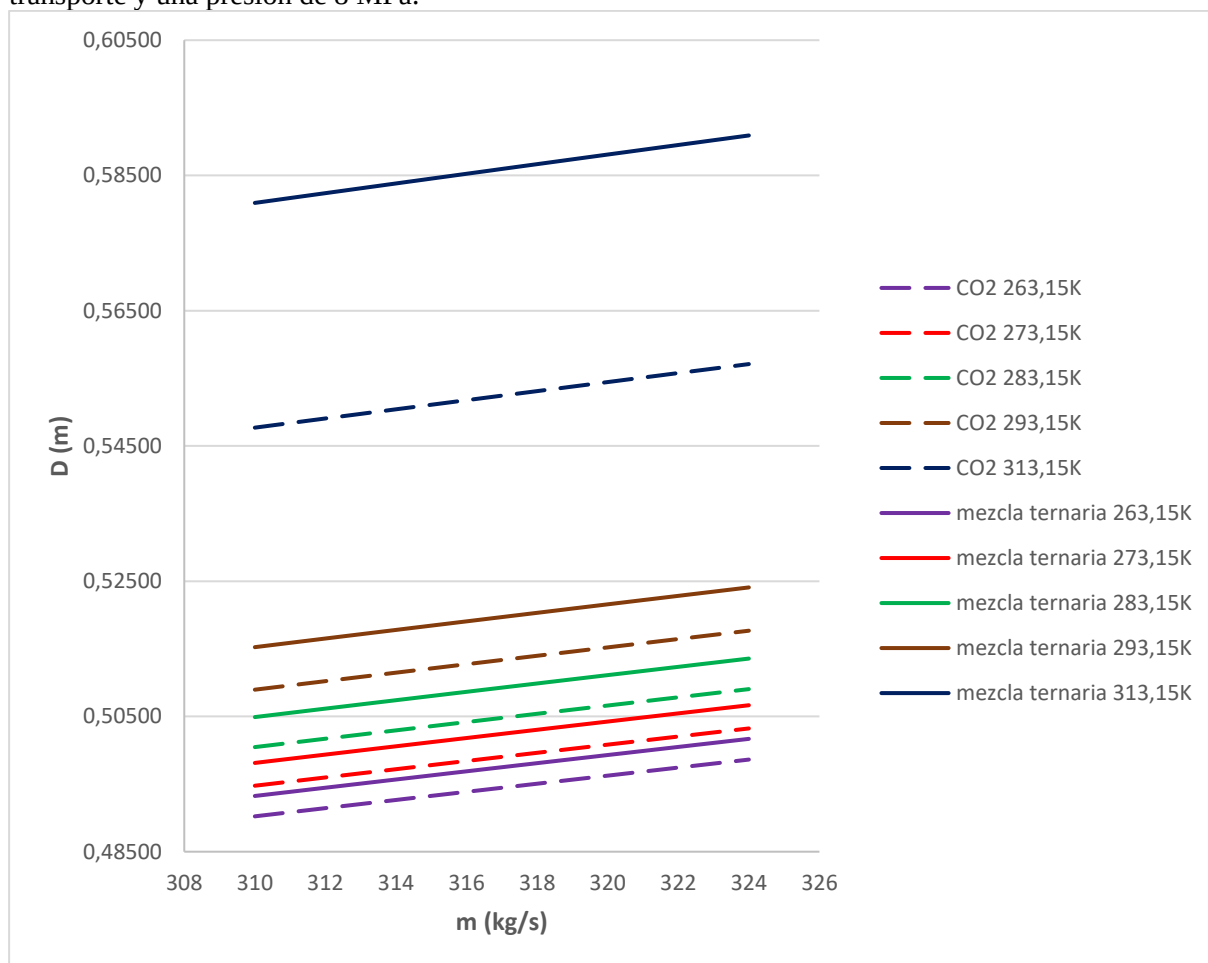
**Figura A.9.** Variación de la presión con la distancia a 263,15 y 283,15 K para los 4 sistemas: CO<sub>2</sub> puro, CO<sub>2</sub> + O<sub>2</sub> + H<sub>2</sub>S ( $x_{CO_2} = 0,955$ ,  $x_{O_2} = 0,03$  y  $x_{H_2S} = 0,015$ ), CO<sub>2</sub> + O<sub>2</sub> ( $x_{CO_2} = 0,97$  y  $x_{O_2} = 0,03$ ) y CO<sub>2</sub> + H<sub>2</sub>S ( $x_{CO_2} = 0,985$  y  $x_{H_2S} = 0,015$ ).



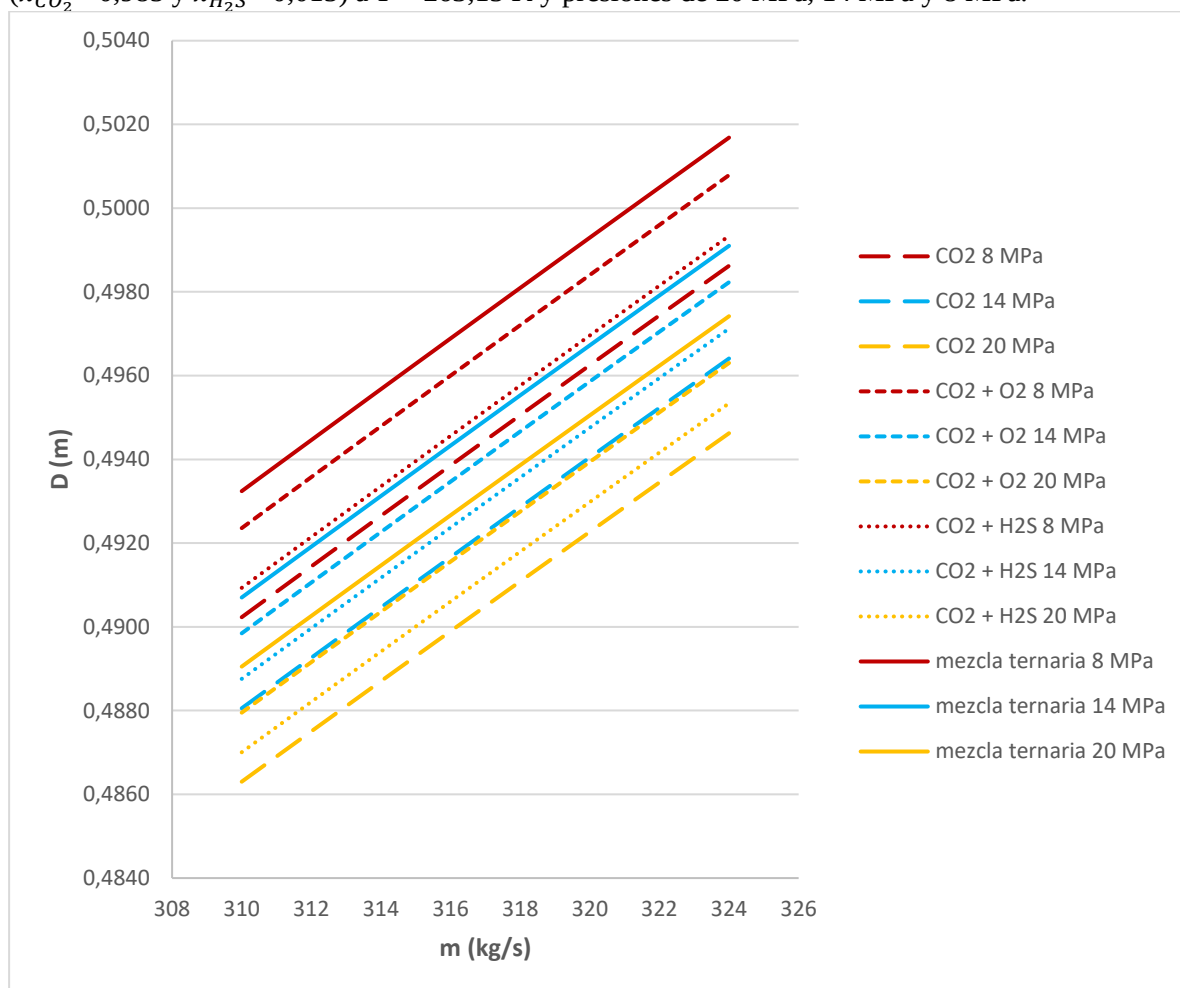
**Figura A.10.** Representación del diámetro de tubería frente al flujo másico para el CO<sub>2</sub> puro y la mezcla ternaria CO<sub>2</sub> + O<sub>2</sub> + H<sub>2</sub>S ( $x_{CO_2} = 0,955$ ,  $x_{O_2} = 0,03$  y  $x_{H_2S} = 0,015$ ) a las temperaturas de transporte y una presión de 14 MPa.



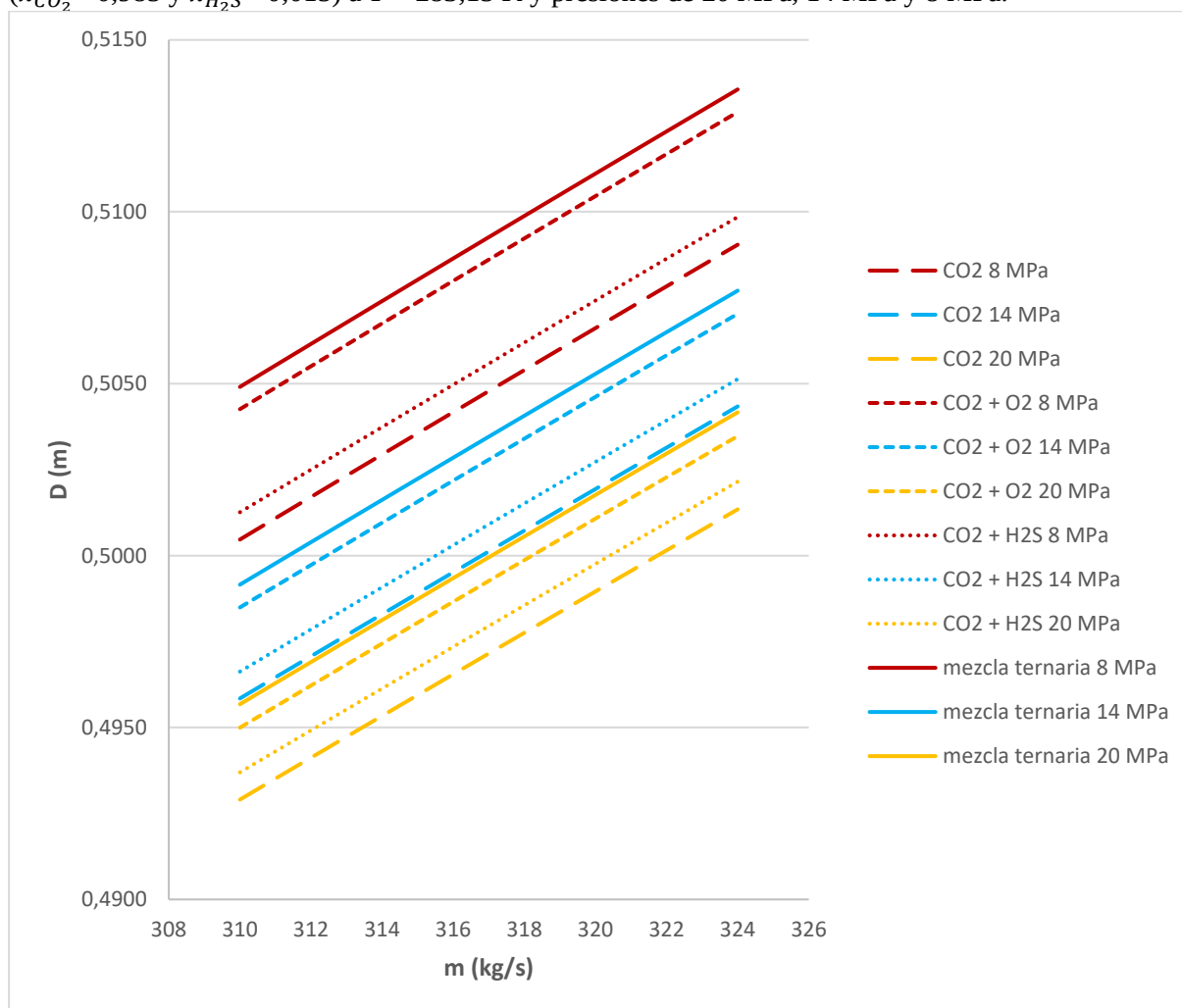
**Figura A.11.** Representación del diámetro de tubería frente al flujo másico para el CO<sub>2</sub> puro y la mezcla ternaria CO<sub>2</sub> + O<sub>2</sub> + H<sub>2</sub>S ( $x_{CO_2} = 0,955$ ,  $x_{O_2} = 0,03$  y  $x_{H_2S} = 0,015$ ) a las temperaturas de transporte y una presión de 8 MPa.



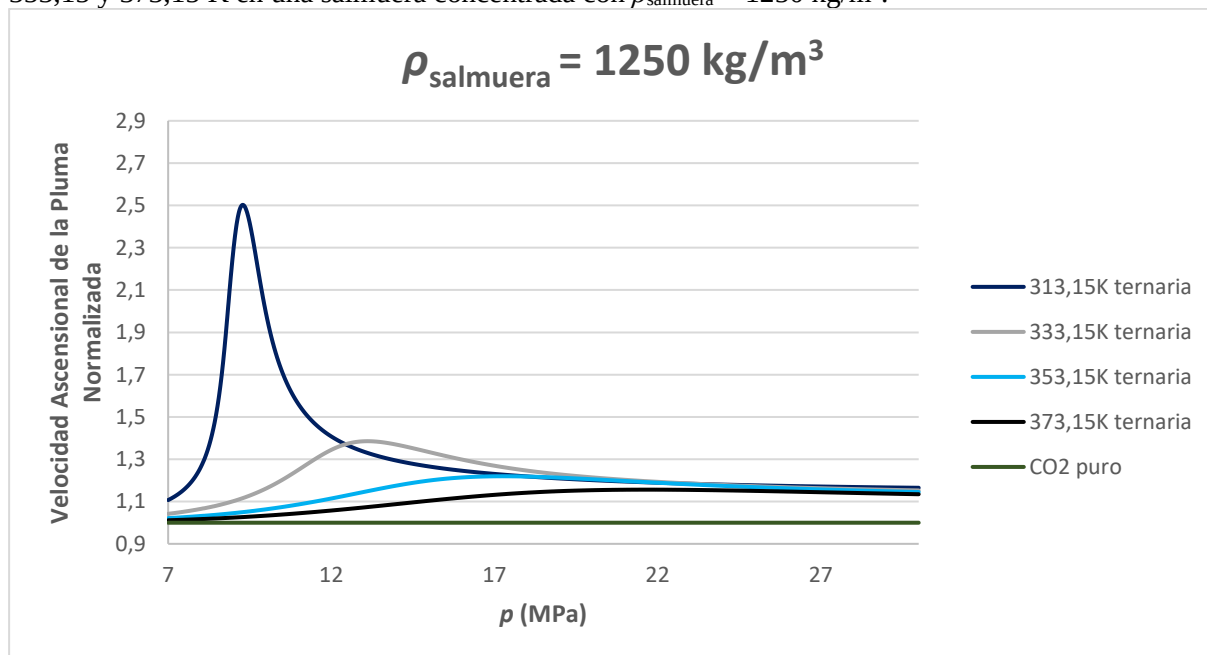
**Figura A.12.** Representación del diámetro de tubería frente al flujo másico para el  $\text{CO}_2$  puro,  $\text{CO}_2 + \text{O}_2 + \text{H}_2\text{S}$  ( $x_{\text{CO}_2} = 0,955$ ,  $x_{\text{O}_2} = 0,03$  y  $x_{\text{H}_2\text{S}} = 0,015$ ),  $\text{CO}_2 + \text{O}_2$  ( $x_{\text{CO}_2} = 0,97$  y  $x_{\text{O}_2} = 0,03$ ) y  $\text{CO}_2 + \text{H}_2\text{S}$  ( $x_{\text{CO}_2} = 0,985$  y  $x_{\text{H}_2\text{S}} = 0,015$ ) a  $T = 263,15 \text{ K}$  y presiones de 20 MPa, 14 MPa y 8 MPa.



**Figura A.13.** Representación del diámetro de tubería frente al flujo másico para el CO<sub>2</sub> puro, CO<sub>2</sub> + O<sub>2</sub> + H<sub>2</sub>S ( $x_{CO_2} = 0,955$ ,  $x_{O_2} = 0,03$  y  $x_{H_2S} = 0,015$ ), CO<sub>2</sub> + O<sub>2</sub> ( $x_{CO_2} = 0,97$  y  $x_{O_2} = 0,03$ ) y CO<sub>2</sub> + H<sub>2</sub>S ( $x_{CO_2} = 0,985$  y  $x_{H_2S} = 0,015$ ) a  $T = 283,15$  K y presiones de 20 MPa, 14 MPa y 8 MPa.



**Figura A.14.** Representación de la velocidad ascensional de la pluma normalizada frente a la presión para la mezcla ternaria  $\text{CO}_2 + \text{O}_2 + \text{H}_2\text{S}$  ( $x_{\text{CO}_2} = 0,955$ ,  $x_{\text{O}_2} = 0,03$  y  $x_{\text{H}_2\text{S}} = 0,015$ ) a 313,15, 333,15 K, 353,15 y 373,15 K en una salmuera concentrada con  $\rho_{\text{salmuera}} = 1250 \text{ kg/m}^3$ .



**Figura A.15.** Representación de la velocidad ascensional de la pluma normalizada frente a la presión para la mezcla ternaria  $\text{CO}_2 + \text{O}_2 + \text{H}_2\text{S}$  ( $x_{\text{CO}_2} = 0,955$ ,  $x_{\text{O}_2} = 0,03$  y  $x_{\text{H}_2\text{S}} = 0,015$ ) y las binarias  $\text{CO}_2 + \text{O}_2$  ( $x_{\text{CO}_2} = 0,97$  y  $x_{\text{O}_2} = 0,03$ ) y  $\text{CO}_2 + \text{H}_2\text{S}$  ( $x_{\text{CO}_2} = 0,985$  y  $x_{\text{H}_2\text{S}} = 0,015$ ) a 313,15 y 333,15 K en una salmuera concentrada con  $\rho_{\text{salmuera}} = 1250 \text{ kg/m}^3$ .

