

## A Modified Frenkel approach for Viscometric Prediction of Binary and Multicomponent Liquid Mixtures

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### SUPPLEMENTARY INFORMATION

**Table S1 : AAPD values of viscosity models for all the binary systems at different temperatures.**

| S.No.  | SYSTEMS  | Temp (K) | Frenkel AAPD | Frenkel modified AAPD | Nhaesi-Asfour AAPD | SW AAPD | Ref |
|--------|--|----------|--------------|-----------------------|--------------------|---------|-----|
| 1      | exo-tetrahydrodicyclopentadiene (JP-10) + n-octane               | 293.15   | 26.74        | 1.24                  | 27.04              | 7.24    | 22  |
|        |  | 298.15   | 25.64        | 1.36                  | 24.53              | 7.28    |     |
|        |  | 303.15   | 24.77        | 1.31                  | 22.40              | 7.46    |     |
|        |  | 308.15   | 23.92        | 1.37                  | 20.40              | 7.62    |     |
|        |  | 313.15   | 23.12        | 1.49                  | 18.56              | 7.76    |     |
| 2      | exo-tetrahydrodicyclopentadiene (JP-10) + 3-methylheptane        | 293.15   | 28.67        | 0.49                  | 27.93              | 7.30    | 22  |
|        |  | 298.15   | 27.54        | 0.38                  | 25.44              | 7.41    |     |
|        |  | 303.15   | 26.67        | 0.66                  | 23.37              | 7.70    |     |
|        |  | 308.15   | 25.56        | 0.82                  | 21.13              | 7.69    |     |
|        |  | 313.15   | 24.73        | 1.07                  | 19.32              | 7.93    |     |
| 3      | exo-tetrahydrodicyclopentadiene (JP-10) + 2,4-dimethylhexane     | 293.15   | 30.37        | 1.05                  | 28.47              | 6.91    | 22  |
|        |  | 298.15   | 29.46        | 0.47                  | 26.37              | 7.48    |     |
|        |  | 303.15   | 28.30        | 0.35                  | 24.05              | 7.62    |     |
|        |  | 308.15   | 27.31        | 0.44                  | 22.05              | 7.90    |     |
|        |  | 313.15   | 26.29        | 0.82                  | 20.26              | 8.21    |     |
| 4      | exo-tetrahydrodicyclopentadiene (JP-10) + 2,2,4-trimethylpentane | 293.15   | 23.82        | 3.82                  | 23.50              | 3.63    | 22  |
|        |  | 298.15   | 22.71        | 3.52                  | 21.12              | 3.74    |     |
|        |  | 303.15   | 22.02        | 2.88                  | 19.31              | 4.18    |     |
|        |  | 308.15   | 21.32        | 2.32                  | 17.58              | 4.57    |     |
|        |  | 313.15   | 20.52        | 1.94                  | 15.87              | 4.82    |     |
| 5      | Phenetole + 1-Octanol  | 293.15   | 43.72        | 6.46                  | 51.86              | 12.81   | 23  |
| 308.15 | 38.20  | 8.39     | 47.81        | 14.25                 |                    |         |     |
| 6      | Phenetole + 1-Nonanol  | 293.15   | 52.07        | 6.88                  | 62.52              | 15.22   |     |
| 7      | Pyridine + m-Xylene  | 303.15   | 9.05         | 6.44                  | 1.14               | 8.49    |     |
| 8      | Pyridine + o-Xylene  | 303.15   | 3.66         | 3.20                  | 5.57               | 3.90    |     |
| 9      | Pyridine + p-Xylene  | 303.15   | 7.05         | 4.85                  | 2.28               | 6.81    |     |
| 10     | Tetrahydropyran + 2,2,4,Trimethylpentane                         | 293.15   | 7.99         | 5.32                  | 1.76               | 4.27    | 24  |
| 11     | 2-Propanol + Tetrahydropyran                                     | 293.15   | 41.14        | 29.11                 | 35.36              | 26.55   |     |
| 12     | 2-Propanol + 2,2,4, Trimethylpentane                             | 293.15   | 51.94        | 24.50                 | 41.21              | 15.72   |     |
| 13     | Tetrahydrofuran +1 Propanol                                      | 293.15   | 9.09         | 6.70                  | *                  | 53.80   | 27  |
|        |  | 303.15   | 11.05        | 5.53                  | *                  | 54.95   |     |
|        |  | 313.15   | 11.39        | 6.93                  | *                  | 53.14   |     |
| 14     | Tetrahydrofuran +2 Propanol                                      | 293.15   | 29.43        | 8.86                  | *                  | 100.20  | 27  |
|        |  | 303.15   | 39.93        | 21.67                 | *                  | 109.49  |     |
|        |  | 313.15   | 30.80        | 18.55                 | *                  | 95.21   |     |

|    |   |        |       |       |       |        |    |    |
|----|---|--------|-------|-------|-------|--------|----|----|
| 15 | Phenetole + 1-Pentanol  | 293.15 | 35.37 | 21.82 | 35.00 | 19.81  | 23 |    |
|    |   | 308.15 | 35.41 | 22.42 | 34.49 | 20.73  |    |    |
| 16 | Phenetole + 1-Hexanol   | 293.15 | 46.66 | 24.35 | 49.67 | 25.02  |    |    |
|    |   | 308.15 | 43.24 | 23.36 | 48.16 | 23.92  |    |    |
| 17 | Phenetole + 1-Heptanol  | 293.15 | 46.06 | 16.07 | 51.96 | 19.76  |    |    |
|    |   | 308.15 | 38.87 | 12.81 | 46.91 | 16.18  |    |    |
| 18 | Acetone+ Cyclohexane  | 298.15 | 18.79 | 6.89  | 24.63 | 15.74  |    | 19 |
| 19 | Methyl Ethyl Ketone + Methylcyclohexane                                   | 298.15 | 5.74  | 4.28  | 4.39  | 4.99   |    |    |
| 20 | Acetone +cis-1,2-Dimethylcyclohexane                                      | 298.15 | 6.22  | 4.64  | 20.22 | 10.36  |    |    |
| 21 | Ethyl Acetate + Cyclohexane   | 298.15 | 22.52 | 16.29 | 23.36 | 21.15  |    |    |
| 22 | Ethyl Acetate + 1,2-Dimethylcyclohexane (Mixture of Cis and Trans)        | 298.15 | 10.45 | 4.71  | 10.84 | 9.01   |    |    |
| 23 | Propyl Propionate + 1,2,4-Trimethylcyclohexane (Mixture of Cis and Trans) | 298.15 | 5.19  | 4.59  | 1.79  | 4.72   |    |    |
| 24 | Acetone + Benzene   | 298.15 | 4.83  | 0.79  | 2.04  | 4.34   | 19 |    |
| 25 | Methyl Ethyl Ketone + Benzene   | 298.15 | 5.34  | 3.25  | 0.64  | 4.97   |    |    |
| 26 | Methyl Ethyl Ketone + Toluene   | 298.15 | 1.10  | 0.25  | 4.73  | 1.20   |    |    |
| 27 | 1-Chlorohexane + Toluene  | 298.15 | 2.52  | 2.04  | 4.45  | 2.56   |    |    |
| 28 | Ethyl Acetate + Benzene   | 298.15 | 5.67  | 4.34  | 0.50  | 4.47   |    |    |
| 29 | Ethyl Acetate + o-Xylene  | 298.15 | 1.67  | 1.31  | 1.72  | 0.46   |    |    |
| 30 | Methyl Ethyl Ketone + Ethyl Acetate                                       | 298.15 | 0.37  | 0.25  | 7.14  | 0.52   |    |    |
| 31 | Ethyl Acetate + 1-Chlorohexane  | 298.15 | 2.13  | 0.18  | 2.88  | 1.32   |    |    |
| 32 | Propyl Propionate + 1-Chlorohexane  | 298.15 | 1.02  | 0.83  | 6.35  | 0.93   | 25 |    |
| 33 | m-xylene+decane   | 308.15 | 3.27  | 2.23  | 1.44  | 3.37   |    |    |
| 34 | Cyclohexane + m-xylene  | 308.15 | 10.58 | 9.04  | 1.72  | 9.18   |    |    |
| 35 | Cyclohexane + cyclooctane   | 308.15 | 5.74  | 1.23  | 0.8   | 3.02   |    |    |
| 36 | Cyclohexane + chlorobenzene   | 308.15 | 7.91  | 7.48  | 1.00  | 7.66   |    |    |
| 37 | m-xylene + cyclooctane  | 308.15 | 28.71 | 12.11 | 13.54 | 16.14  |    |    |
| 38 | Cyclooctane + chlorobenzene   | 308.15 | 15.05 | 5.01  | 4.33  | 7.47   |    |    |
| 39 | Cyclooctane + decane  | 308.15 | 14.15 | 6.11  | 2.04  | 5.89   | 20 |    |
| 40 | Diisopropyl Ether + Ethanol   | 288.15 | 28.48 | 10.89 | 31.09 | 2.50   |    |    |
|    |   | 298.15 | 26.37 | 10.93 | 28.63 | 2.52   |    |    |
|    |   | 308.15 | 24.35 | 10.87 | 27.84 | 2.59   |    |    |
| 41 | Diisopropyl Ether + 2,2,4-Trimethylpentane                                | 288.15 | 2.35  | 0.68  | 2.15  | 1.56   |    |    |
|    |   | 298.15 | 2.22  | 0.61  | 2.12  | 1.46   |    |    |
|    |   | 308.15 | 2.01  | 0.44  | 2.14  | 1.28   |    |    |
| 42 | 1-Butanol + 1-Butylamine  | 298.15 | 13.97 | 10.12 | *     | 70.11  | 28 |    |
| 43 | 2-Methyl-1-propanol + 1-Butylamine  | 298.15 | 27.72 | 6.70  | *     | 103.85 |    |    |
| 44 | Propyl Propanoate + Hexane  | 298.15 | 8.13  | 2.33  | 1.50  | 6.09   | 29 |    |
| 45 | Propyl Propanoate + Benzene   | 298.15 | 2.92  | 2.71  | 4.94  | 2.87   |    |    |
| 46 | Hexane + Benzene  | 298.15 | 15.78 | 10.68 | 6.42  | 11.11  |    |    |
| 47 | Cyclohexane + Benzene   | 298.15 | 19.61 | 17.29 | 6.44  | 18.87  | 26 |    |
| 48 | n-Hexane + Cyclohexane  | 298.15 | 23.76 | 10.06 | 10.16 | 12.94  |    |    |

|    |  |        |        |        |        |        |    |
|----|--|--------|--------|--------|--------|--------|----|
| 49 | n- Hexane + Benzene  | 298.15 | 27.33  | 21.32  | 16.57  | 21.88  |    |
| 50 | 2Butoxyethanol + 1 Decanol   | 298.15 | 11.61  | 3.52   | 7.97   | 2.83   | 31 |
| 51 | 2Butoxyethanol + 1 hexanol   | 298.15 | 8.76   | 6.68   | 3.11   | 6.84   |    |
| 52 | 2Butoxyethanol + 1 Octanol   | 298.15 | 11.15  | 3.30   | 6.60   | 5.85   |    |
| 53 | Tri n butylamine + Pyridine  | 298.15 | 3.12   | 2.24   | 7.21   | 5.12   | 40 |
| 54 | 2Ethoxyethanol + Dioxane   | 298.15 | 12.65  | 10.65  | 6.05   | 11.25  | 33 |
| 55 | 2 Ethoxyethanol + Butanol  | 298.15 | 4.84   | 4.02   | 0.79   | 4.42   | 39 |
| 56 | 2 Ethoxyethanol + Pentanol   | 298.15 | 8.00   | 4.71   | 4.58   | 6.54   |    |
| 57 | 2 Ethoxyethanol + Hexanol  | 298.15 | 9.12   | 2.96   | 6.92   | 6.25   |    |
| 58 | 2 Ethoxyethanol + Heptanol   | 298.15 | 8.88   | 1.24   | 7.49   | 4.22   |    |
| 59 | 2 Ethoxyethanol + Octanol  | 298.15 | 7.86   | 5.47   | 7.14   | 1.81   |    |
| 60 | N,N-dimethylaniline + p-methylacetophenone                               | 303.15 | 2.42   | 1.59   | 4.38   | 2.10   | 32 |
|    |  | 308.15 | 2.72   | 1.74   | 4.01   | 2.31   |    |
| 61 | N,N-dimethylaniline + propiophenone                                      | 303.15 | 1.89   | 1.29   | 5.03   | 1.70   |    |
|    |  | 308.15 | 2.26   | 1.53   | 4.62   | 2.00   |    |
| 62 | N,N-dimethylaniline + p-chloroacetophenone                               | 303.15 | 3.01   | 1.20   | 3.36   | 1.38   |    |
|    |  | 308.15 | 3.36   | 1.27   | 2.91   | 1.52   |    |
| 63 | Ethanol + Ethylacetate   | 298.15 | 26.72  | 18.27  | 28.34  | 12.97  | 34 |
| 64 | Ethanol + Methylacetate  | 298.15 | 30.33  | 18.85  | 37.00  | 15.20  |    |
| 65 | Methanol + Ethylacetate  | 298.15 | 8.36   | 7.85   | 2.92   | 4.96   |    |
| 66 | Methanol + Methylacetate   | 298.15 | 12.01  | 10.62  | 9.20   | 6.84   |    |
| 67 | 1-Chlorohexadecane +1,2,4, Trimethylcyclohexane (mixture of cis & trans) | 298.15 | 204.73 | 139.84 | 201.17 | 193.89 | 19 |
| 68 | 1-Chlorohexane + Benzene   | 298.15 | 5.96   | 5.70   | 2.47   | 5.81   |    |
| 69 | 1-Chlorohexane + o-Xylene  | 298.15 | 1.78   | 1.69   | 5.09   | 1.86   |    |
| 70 | Ethylacetate +Toluene  | 298.15 | 1.31   | 0.69   | 4.83   | 1.18   |    |
| 71 | Propylpropionate +Toluene  | 298.15 | 0.17   | 0.10   | 6.93   | 0.25   |    |
| 72 | Ethyl Chloroacetate + Hexane   | 298.15 | 17.26  | 2.65   | 9.93   | 10.29  | 35 |
|    |  | 303.15 | 15.66  | 2.01   | 7.50   | 9.32   |    |
|    |  | 308.15 | 15.01  | 1.95   | 5.98   | 9.05   |    |
| 73 | Ethyl Chloroacetate + Heptane  | 298.15 | 16.12  | 5.56   | 5.66   | 10.62  | 35 |
| 74 | Ethyl Chloroacetate + Octane   | 298.15 | 12.24  | 6.26   | 0.96   | 8.23   |    |
| 75 | Ethyl Chloroacetate + Nonane   | 298.15 | 11.25  | 8.60   | 0.91   | 8.97   |    |
| 76 | Ethyl Chloroacetate + Decane   | 298.15 | 7.42   | 6.47   | 4.28   | 6.48   |    |
| 77 | Ethyl Chloroacetate + Dodecane   | 298.15 | 5.86   | 5.50   | 4.70   | 5.87   |    |
| 78 | 1,4-Dioxane + 1-Propanol   | 298.15 | 36.32  | 33.01  | 32.86  | 31.04  | 36 |
| 79 | 1,4-Dioxane + 2-Propanol   | 298.15 | 28.51  | 24.67  | 39.80  | 36.19  |    |
|    |  | 303.15 | 38.85  | 35.98  | 35.81  | 33.82  |    |
| 80 | 1,4-Dioxane + Ethanediol   | 298.15 | 69.55  | 8.63   | 77.29  | 10.67  | 37 |
|    |  | 303.15 | 62.12  | 10.55  | 69.17  | 11.96  |    |
|    |  | 308.15 | 63.57  | 16.15  | 70.16  | 14.29  |    |
| 81 | 1,4-Dioxane + Tributylamine  | 298.15 | 9.88   | 9.63   | 3.34   | 10.22  |    |
|    |  | 303.15 | 8.57   | 8.39   | 4.18   | 8.77   |    |
|    |  | 308.15 | 9.76   | 9.58   | 3.30   | 9.98   |    |
| 82 | 1,4-Dioxane + Hexane   | 298.15 | 29.16  | 11.07  | 20.98  | 14.82  |    |
|    |  | 303.15 | 27.00  | 10.02  | 17.70  | 13.61  |    |
|    |  | 308.15 | 26.08  | 10.11  | 15.76  | 13.54  |    |
|    | 1,4-Dioxane + Triethylamine  | 298.15 | 20.83  | 7.04   | 12.32  | 7.88   |    |

|     |                               |        |       |       |       |       |    |
|-----|-------------------------------|--------|-------|-------|-------|-------|----|
|     |                               | 303.15 | 19.70 | 6.91  | 11.11 | 7.67  |    |
|     |                               | 308.15 | 19.04 | 6.98  | 10.43 | 7.68  |    |
| 84  | 3-Pentanone + Ethylbenzene    | 293.15 | 1.17  | 0.29  | 3.84  | 0.99  | 38 |
|     |                               | 303.15 | 2.23  | 1.13  | 2.74  | 2.09  |    |
|     |                               | 313.15 | 4.05  | 2.97  | 1.41  | 3.93  |    |
| 85  | 3-Pentanone + o-Xylene        | 293.15 | 2.25  | 0.45  | 2.00  | 1.37  |    |
|     |                               | 303.15 | 3.28  | 0.98  | 1.39  | 2.46  |    |
|     |                               | 313.15 | 2.58  | 0.85  | 1.86  | 1.87  |    |
| 86  | Ethymethylketone + 2-Propanol | 298.15 | 25.63 | 4.08  | 41.13 | 2.33  | 41 |
| 87  | Ethymethylketone + 2-Butanol  | 298.15 | 19.61 | 13.41 | 39.36 | 9.61  |    |
| 88  | Ethymethylketone + 2-Pentanol | 298.15 | 49.95 | 5.77  | 77.98 | 13.21 |    |
| 89  | Ethymethylketone + 2-Hexanol  | 298.15 | 41.55 | 6.13  | 69.47 | 6.26  |    |
| 90  | Ethymethylketone + 2-Heptanol | 298.15 | 49.15 | 8.26  | 80.80 | 12.68 |    |
| 91  | Ethylbenzene +1 Butanol       | 298.15 | 35.86 | 14.97 | 16.18 | 12.19 | 42 |
| 92  | ethylbenzene+1 propanol       | 298.15 | 33.56 | 19.01 | 17.21 | 13.54 |    |
| 93  | Cyclohexane + Acetone         | 298.15 | 14.18 | 4.75  | 5.87  | 10.45 | 43 |
| 94  | Cyclohexane + 2 pentanone     | 298.15 | 12.23 | 8.69  | 3.33  | 9.37  |    |
| 95  | Cyclohexane + 2 butanone      | 298.15 | 13.87 | 7.59  | 4.89  | 10.27 |    |
| 96  | Cyclopentane + Acetone        | 298.15 | 6.63  | 5.84  | 1.47  | 6.54  |    |
| 97  | Cyclopentane + 2 butanone     | 298.15 | 4.50  | 4.42  | 1.94  | 4.42  |    |
| 98  | Cyclopentane + 2 pentanone    | 298.15 | 3.76  | 3.64  | 0.89  | 3.86  | 44 |
| 99  | Chloroform + 1 propanol       | 298.15 | 13.87 | 4.27  | 12.02 | 10.27 |    |
| 100 | Chloroform + 1 butanol        | 298.15 | 17.88 | 3.27  | 60.82 | 5.30  |    |

\*Insufficient Data