**Supplementary Data**

**Table S1. Design in single-factor experiment**

|  |  |
| --- | --- |
| **Factors (units)** | **Levels** |
| X1: molar ratio | 2:1 | 1:1 | 1:2 | 1:3 |
| X2: water addition in NADES (%, v/v) | 20 | 40 | 60 | 80 |
| X3: temperature (°C) | 30 | 40 | 50 | 60 |

**Table S2. Design in RSM study**

|  |  |
| --- | --- |
| **Factors (units)** | **Levels** |
| Low (-1) | Medium (0) | High (+1) |
| X1: molar ratio | 1:1 | 1:2 | 1:3 |
| X2: water addition in NADES (%, v/v) | 20 | 40 | 60 |
| X3: temperature (°C) | 30 | 45 | 60 |

**Table S3.** The pH and viscosity value of the NADES in this study.

|  |  |  |
| --- | --- | --- |
| **Sampels** | **pH** | **Viscosity (mPa.s)** |
| ChCl-U (1:2) | 9.29 | 7.90 |
| ChCl-Gly (1:2) | 3.02 | 18.42 |
| ChCl-CA (1:2) | 1.39 | 238.40 |
| ChCl-Sor (1:1) | 2.88 | 54.32 |
| ChCl-LA (1:1) | 1.40 | nd |
| ChCl-1,3 but (1:6) | 2.90 | 20.76 |
| ChCl-MA (1:1) | 1.55 | 39.41 |
| ChCl-Glu (1:1) | 2.55 | 86.69 |
| Glyc-LA (1:5) | 2.72 | 15.89 |
| Glyc-Gly(2:5) | 5.23 | 18.79 |
| Glu-CA (1:1) | 1.73 | nd |
| Glu-LA (1:5) | 1.23 | 23.80 |
| Gly-LA (1:1) | 1.85 | 14.98 |
| Gly-CA (1:1) | 1.67 | 132.20 |
| Gly-U (1:1) | 8.95 | 14.19 |
| Sor-CA (1:1) | 1.97 | nd |
| Sor-LA (1:1) | 1.90 | 81.56 |

Note: nd = not detected due to too high torque

**Table S4.** Box-Behnken design and experimental results from NADES-based ChCl-U extracts of PIL

|  |  |  |
| --- | --- | --- |
| **Run** | **Variables** | **Response** |
| **X1: Molar ratio** | **X2: Temp.****(°C)** | **X3: Water addition (%)** | **TPC mg GAE/g DW** | **TFC mg QE/g DW** | **DPPH mmol QE/g DW** | **FRAP(mmol TE/g DW)** | **ABTS(mmol TE/g DW)** | **RP(mmol TE/g DW)** |
| 1 | 2 | 45 | 40 | 45.883±6.990 | 38.325±9.190 | 120.333±3.870 | 207.322±1.272 | 260.602±0.532 | 183.426±1.890 |
| 2 | 2 | 30 | 60 | 50.176±6.503 | 33.398±1.777 | 121.504±2.434 | 176.969±2.212 | 260.743±0.801 | 167.907±5.916 |
| 3 | 2 | 30 | 20 | 41.135±5.981 | 20.096±8.597 | 118.693±3.514 | 95.073±6.953 | 264.128±0.244 | 132.858±4.726 |
| 4 | 1 | 30 | 40 | 32.931±4.668 | 6.169±2.136 | 114.008±2.029 | 128.480±4.385 | 262.436±0.244 | 141.769±9.766 |
| 5 | 2 | 45 | 40 | 46.645±0.552 | 52.533±5.483 | 120.098±2.811 | 194.515±1.158 | 261.378±0.440 | 185.654±0.630 |
| 6 | 1 | 45 | 60 | 37.230±6.311 | 36.190±4.025 | 125.720±2.534 | 189.439±2.294 | 261.872±0.244 | 183.426±1.575 |
| 7 | 1 | 45 | 20 | 34.162±1.857 | 17.179±1.269 | 120.801±1.859 | 92.608±4.340 | 262.083±2.262 | 140.878±3.884 |
| 8 | 3 | 45 | 20 | 46.128±2.593 | 27.533±0.771 | 124.549±2.259 | 174.231±5.024 | 261.166±0.122 | 186.916±0.257 |
| 9 | 3 | 60 | 40 | 48.475±3.373 | 50.908±2.641 | 124.081±1.463 | 201.403±2.269 | 261.237±0.122 | 196.124±0.630 |
| 10 | 2 | 60 | 20 | 45.040±5.317 | 36.950±0.472 | 123.378±2.926 | 162.140±4.866 | 261.307±1.178 | 224.861±7.920 |
| 11 | 1 | 60 | 40 | 43.747±3.795 | 38.710±2.800 | 127.594±0.406 | 189.270±1.367 | 261.448±0.646 | 184.020±6.243 |
| 12 | 3 | 45 | 60 | 42.550±6.464 | 45.148±4.865 | 120.098±1.859 | 215.347±3.462 | 260.461±0.212 | 179.862±0.000 |
| 13 | 2 | 45 | 40 | 41.910±2.449 | 37.575±0.866 | 125.252±3.606 | 201.298±1.351 | 261.307±0.366 | 169.837±2.205 |
| 14 | 3 | 30 | 40 | 54.094±7.281 | 37.992±1.787 | 124.783±3.246 | 206.585±6.791 | 261.448±0.801 | 167.758±2.009 |
| 15 | 2 | 60 | 60 | 50.910±5.587 | 42.481±3.910 | 126.657±0.406 | 186.827±7.142 | 260.532±0.122 | 242.682±0.945 |

**Table S5.** ANOVA for respon surface from order polynominal model for investigated items.

| **Source** | **Sum of squares** | **df** | **Mean sequare** | **F value** | **p-value****(Prob > F)** |
| --- | --- | --- | --- | --- | --- |
| **TPC**Model A  B  CResidualLack of FitPure ErrorCor Total |  271.05 233.03 12.10 25.92 232.73 219.80 12.93 503.78 |  3 1 1 1 11 9 2 14 |  90.35 233.03 12.10 25.92 21.16 24.42 6.46 |  4.27 11.01 0.57 1.23 3.78 |  0.0315 *(sig.)* 0.0068 0.4655 0.2919 0.2268 *(not sig.)* |
| **TFC**Model A B CResidualLack of FitPure ErrorCor Total |  1522.98 501.38 637.14 384.46 670.35 528.29 142.06 2193.34 |  3 1 1 1 11 9 2 14 |  507.66 501.38 637.14 384.46 60.94 58.70 71.03 |  8.33 8.23 10.45 6.31 0.83 |  0.0036 *(sig.)* 0.0153 0.0080 0.0289 0.6576 *(not sig.)* |
| **DPPH**ModelABCABACBCResidualLack of FitPure ErrorCor Total |  146.59 3.63 64.54 5.38 51.04 21.95 0.05533.99 17.05 16.94 180.58 |  6 1 1 1 1 1 18 6 2 14 |  24.43 3.63 64.54 5.38 51.04 21.95 0.0554.25 2.84 8.47 |  5.750.85 15.19 1.27 12.01 5.17 0.013 0.34 |  0.0136 *(sig.)* 0.3824 0.0046 0.2932 0.0085 0.0527 0.9123 0.8737 *(not sig.)* |
| **FRAP**Model A B C AB AC BC A2 B2 C2ResidualLack of FitPure ErrorCor Total |  21202.14 4888.99 2195.62 7474.29 1088.06 776.00 818.22 44.67 960.91 3248.26299.25 217.14 82.10 21501.38 |  9 1 1 1 1 1 1 1 1 15 3 2 14 |  2355.79 4888.99 2195.62 7474.29 1088.06 776.00 818.22 44.67 960.91 3248.2659.85 72.38 41.05 |  39.36 81.69 36.69 124.89 18.18 12.97 13.67 0.75 16.06 54.27 1.76 |  0.0004 *(sig.)* 0.0003 0.0018 0.0001 0.0080 0.0155 0.0140 0.4271 0.0103 0.0007 0.3819 *(not sig.)* |
| **ABTS**Model A B CResidualLack of FitPure ErrorCor Total |   7.01 1.55 2.24 3.22 4.91 4.54 0.37 11.92 |  3 1 1 1 11 9 2 14 |  2.34 1.55 2.24 3.22 0.45 0.50 0.18 |  5.24 3.48 5.01 7.22 2.74 |  0.0173 *(sig.)* 0.0889 0.0468 0.0211 0.2958 *(not sig.)* |
| **RP**Model A B CResidualLack of FitPure ErrorCor Total |  8831.97 811.39 7044.56 976.03 3093.29 2946.70 146.59 11925.26 |  3 1 1 1 11 9 2 14 |  2943.99 811.39 7044.56 976.03 281.21 327.41 73.30 |  10.47 2.89 25.05 3.47 4.47 |  0.0015 *(sig.)* 0.1175 0.0004 0.0894 0.1963 *(not sig.)* |



**Fig. S1.** 3D-surface of TPC and TFC shows the interaction between variables with each response



**Fig. S2.** 3D-surface of antioxidant activity shows the interaction between variables with each response