

ELECTRONIC SUPPLEMENTARY INFORMATION (ESI)

**Deep Eutectic Solvents as Extraction Media for Metal Salts and Oxides Exemplarily Shown for Phosphorous from Incinerated Sewage Sludge Ash**

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**Table S1.** References for used DES compounds that can be extracted or produces from plants.

Compound	Reference
tartaric acid, malic acid	<u>H. Müller, <i>Fette, Seifen, Anstrichmittel</i>, 1977, <b>79</b>, 259-261.</u>
citric acid	<u>M. Palma and C. G. Barroso, <i>Anal. Chim. Acta</i>, 2002, <b>458</b>, 119-130.</u>
malonic acid	<u>F. H. Verhoff and H. Bauweleers, <i>Citric Acid. Ullmann's Encyclopedia of Industrial Chemistry</i>, 2014.</u>
oxalic acid	<u>J. Chlopicka, J. Dobrowolska-Iwanek, M. Wozniakiewicz and P. Zagrodzki, <i>Food Analytical Methods</i>, 2014, <b>7</b>, 1323-1327.</u>
xylitol	<u>H. Werner, A. Waehling, K. Kabrodt, NIG Nahrungs-Ingenieurtechnik G.m.b.H., Germany; Prof. Hellriegel Institut e.V. 1999, pp. 8.</u>
D-sorbitol	<u>H. Jain, S. Mulay, <i>International Journal of Food Sciences and Nutrition</i>, 2014, <b>65</b>, 135-143.</u>
D-fructose	<u>H. H. Strain, <i>J. Am. Chem. Soc.</i> 1934, <b>56</b>, 1756-1759.</u>
D-glucose	<u>T. Becker, D. Breithaupt, <i>Biotechnology. Ullmann's Encyclopedia of Industrial Chemistry</i>, Wiley-VCH, 2011.</u>
mannose	<u>P. J. Fellows, <i>Food Processing Technology</i>, Woodhead Publishing, 2016.</u>
galactose	<u>X. Hu, Y. Shi, P. Zhang, M. Miao, T. Zhang, B. Jiang, <i>Comprehensive Reviews in Food Science and Food Safety</i>, 2016, <b>15</b>, 773-785.</u>
choline	<u>Z. M. Senu, M. Husin, A. R. Li, R. Samsuddin, M. R. Ahmad, N. R. Nik Abd Rashid, N. Z. Mohd Taza, Springer Singapore, Singapore, 2015, 123-130.</u>

**Table S2.** Mass fraction  $\omega_{\max}$  [wt%] of 26 different metal salts and oxides in DES.

$\omega_{\max}$ [wt%]	ChCl/ D-sorbitol	ChCl/ tartaric acid	ChCl/ citric acid	ChCl/ urea	DMU/ D-fructose	DMU/ mannose	DMU/ citric acid
Al <sub>2</sub> O <sub>3</sub>	0.1±0.0	0.1±0.0	0.2±0.1	0.1±0.0	0.1±0.0	0.1±0.0	0.2±0.1
AlPO <sub>4</sub>	0.7±0.5	1.0±0.5	0.2±0.2	0.7±0.4	2.0±0.9	2.8±0.7	1.1±0.7
CaCO <sub>3</sub>	2.1±0.4	2.5±0.7	2.0±0.5	4.4±2.5	4.0±1.1	3.5±1.8	4.1±0.5
CaO	1.7±0.6	2.1±0.5	1.2±0.4	2.9±0.4	1.4±0.1	4.1±0.4	2.8±0.6
Ca <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub>	1.7±0.6	0.6±0.2	0.7±0.2	5.7±1.0	3.3±1.3	1.8±0.5	3.8±0.6
CaSO <sub>4</sub>	2.6±0.6	2.5±0.6	3.1±2.0	3.1±1.1	3.8±0.7	2.4±0.9	4.2±1.3
Fe <sub>2</sub> O <sub>3</sub>	0.2±0.1	0.4±0.2	0.2±0.0	0.1±0.0	0.1±0.1	0.2±0.1	0.1±0.0
FeCl <sub>3</sub>	8.2±2.6	8.8±6.8	12.1±4.8	23.3±12.2	-	-	21.4±3.0
CuO	0.6±0.4	2.9±0.3	2.7±0.2	0.4±0.2	0.7±0.5	0.6±0.3	0.9±0.3
Cu(OAc) <sub>2</sub>	1.7±0.9	8.8±4.3	8.2±3.9	3.2±0.5	3.8±0.8	2.7±0.9	2.2±0.5
CuCl <sub>2</sub>	4.8±0.7	5.3±2.7	10.3±2.6	9.4±2.6	-	18.8±2.3	14.0±3.7
ZnO	0.5±0.2	1.5±0.4	1.9±0.7	0.9±0.5	0.7±0.2	0.4±0.3	3.2±0.5
Zn(OAc) <sub>2</sub> · 2 H <sub>2</sub> O	38.2±1.2	24.0±10.8	22.6±4.1	54.2±2.7	-	39.6±5.5	5.9±4.4
ZnCl <sub>2</sub>	7.2±0.7	-	5.9±1.8	58.7±5.2	33.6±2.1	24.1±3.8	25.8±9.4
MoO <sub>3</sub>	0.1±0.1	0.3±0.2	0.2±0.1	0.5±0.1	0.2±0.1	0.1±0.0	0.6±0.3
RuO <sub>2</sub>	0.1±0.1	0.3±0.2	0.4±0.0	0.1±0.1	0.1±0.0	0.2±0.1	0.3±0.2
SnO <sub>2</sub>	0.0±0.0	0.1±0.0	0.1±0.0	0.1±0.0	0.1±0.0	0.1±0.0	0.1±0.0
LaCl <sub>3</sub> · 7 H <sub>2</sub> O	49.7±7.7	5.5±1.5	12.8±4.2	42±4.3	37.4±2.4	38.5±6.8	18.4±0.9
CeO <sub>2</sub>	0.2±0.1	0.2±0.1	0.4±0.1	0.1±0.1	0.2±0.1	0.4±0.2	0.2±0.1
CeCl <sub>3</sub>	2.1±0.6	0.5±0.2	0.7±0.4	3.1±1.0	8.9±1.4	12.0±0.3	4.8±1.1
EuCl <sub>3</sub>	1.8±0.8	2.6±2.1	0.4±0.3	1.8±0.5	1.8±0.9	3.3±1.3	2.4±1.9
PtO <sub>2</sub>	0.1±0.0	0.1±0.1	0.2±0.1	0.1±0.0	0.1±0.1	0.2±0.1	0.2±0.0
PbO	-	0.2±0.2	0.2±0.1	0.4±0.3	-	-	2.0±0.8
PbO <sub>2</sub>	-	0.5±0.1	0.2±0.1	0.6±0.2	-	-	1.9±0.4
Pb(OAc) <sub>3</sub> · 3 H <sub>2</sub> O	8.1±2.8	10.3±0.8	3.3±1.5	7.9±1.2	-	-	1.5±0.3
PbCl <sub>2</sub>	0.5±0.4	0.5±0.5	0.5±0.3	3.2±2.2	4.3±1.8	3.3±0.6	4.7±6.6

Determination of metal content in the filtered DES: (a) via inductively coupled plasma - optical emission spectroscopy (ICP-OES) of a solution with half-concentrated fuming nitric acid (10.7 M) or (b) via reweighing after complete combustion of the organic components in a muffle furnace. The mass fractions represent an average of three independent measurements.