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SOLVOMET's selective extraction of lithium over alkali and alkaline earth ions by solvent extraction

Nand Peeters, Stijn Raiguel, Peter Tom Jones, Koen Binnemans
Prometia Annual Seminar 26.11.2025





KU Leuven

- Belgian university founded in 1425
- Active over 10 cities, with 13 campuses and 15 faculties
 - Science, Engineering and Technology
- **Department of Chemistry**

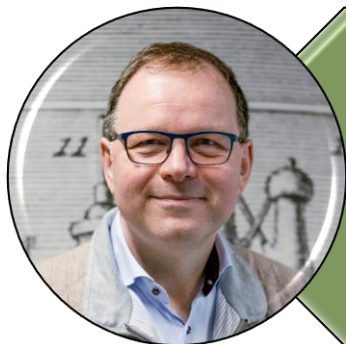
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SOLVOMET

- **KUL's Research and Innovation Centre for Circular Hydrometallurgy**
- Support mining, metallurgical and recycling companies in the development of **more sustainable hydrometallurgical processes**
 - Using state-of-the-art lab and mini-pilot scale experimental facilities and modelling capabilities
- <https://solvomet.eu/>



Prof. Dr. Koen Binnemans
Head of group
Author of >600 articles, H-index = 109



Dr. Peter Tom Jones
Project Director
Coordinator in >30 EU-funded projects



Dr. Nand Peeters
Post doctoral Researcher
Project manager & researcher for Li technology

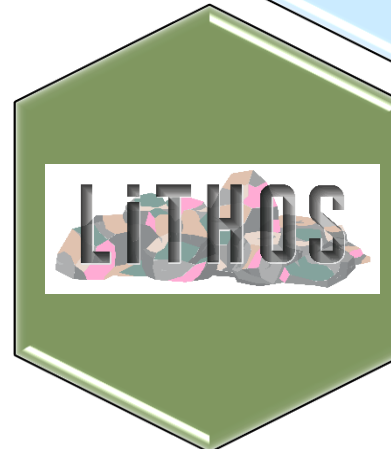
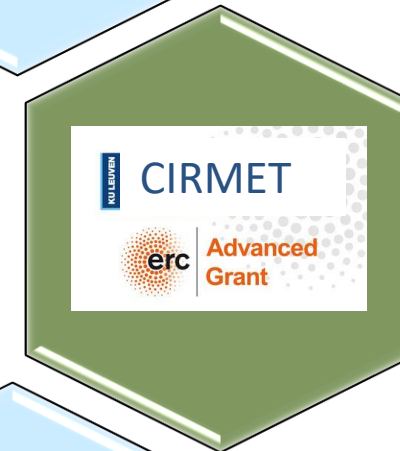
SOLVOMET Lithium Research



Industrial bilateral projects



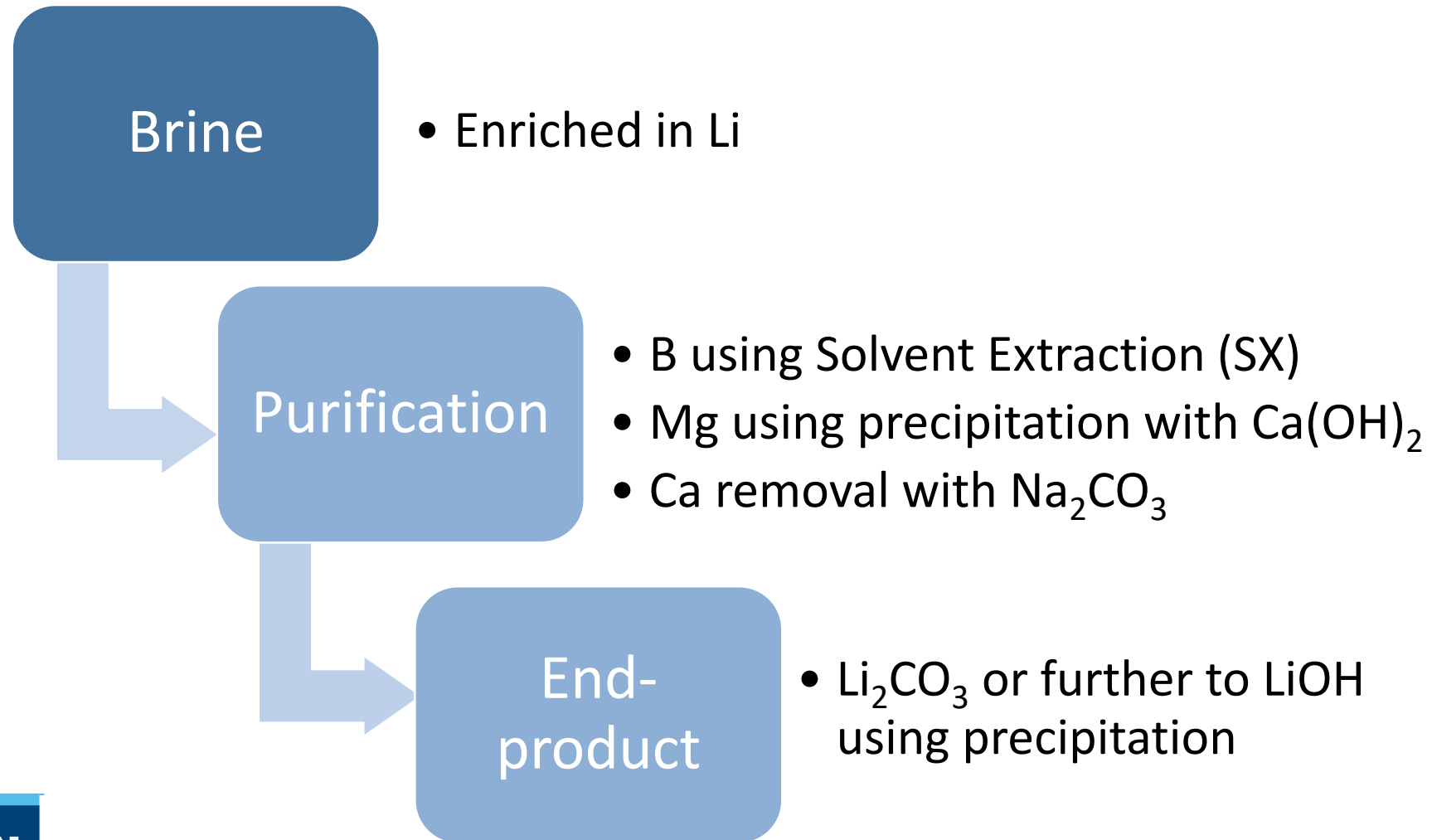
European projects



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Lithium processing from salar brines



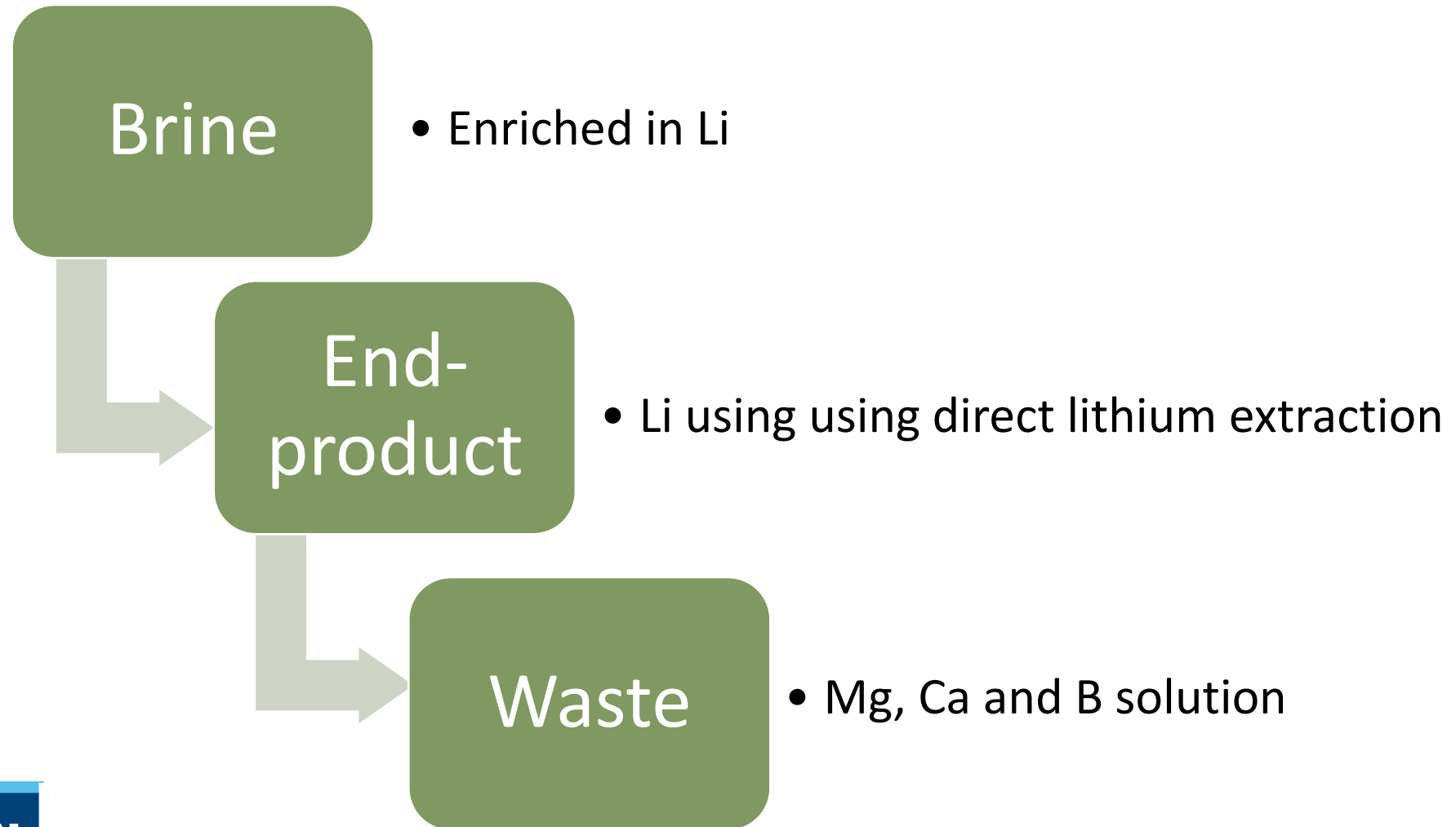
Lithium processing from salar brines



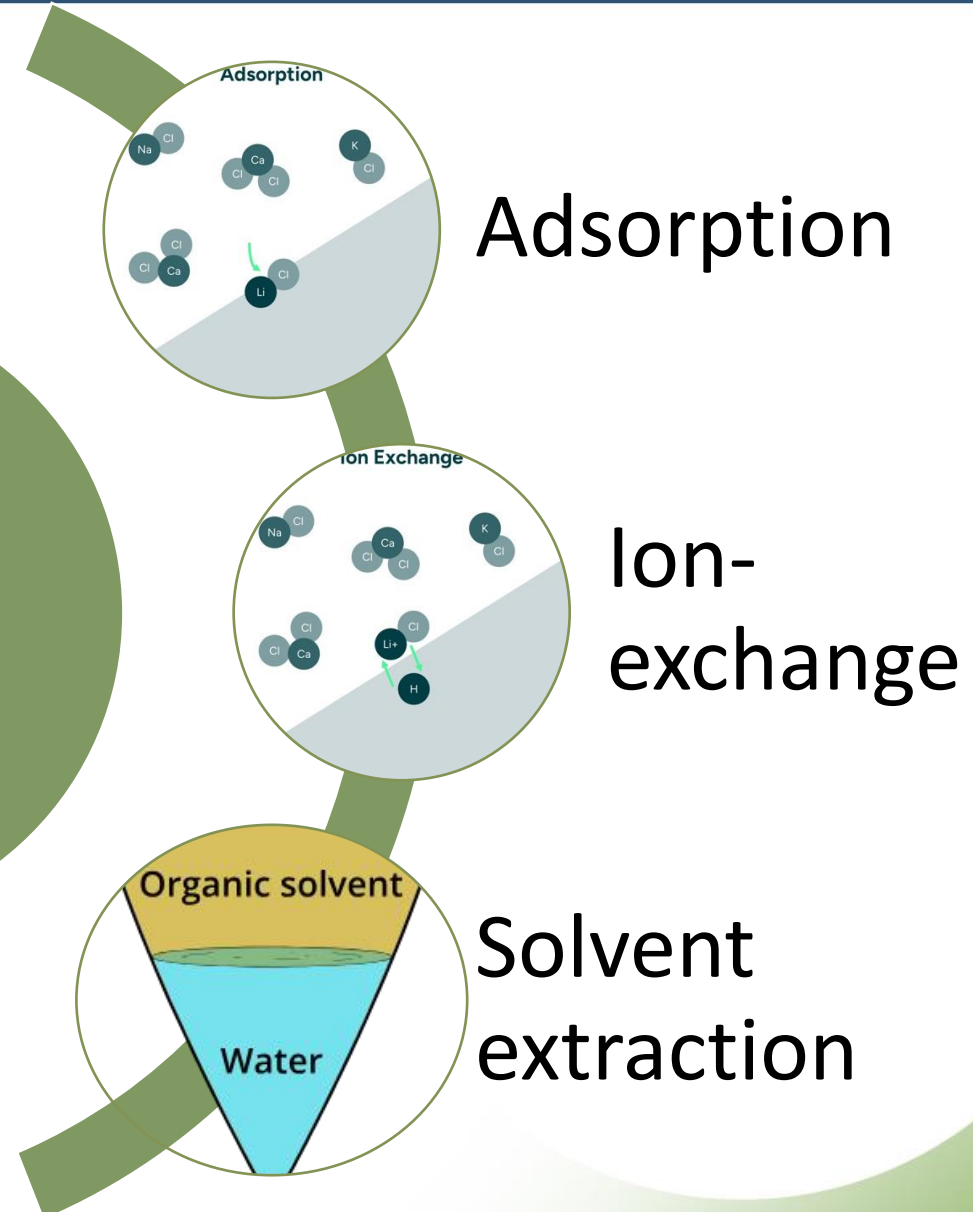
0 months

18 months

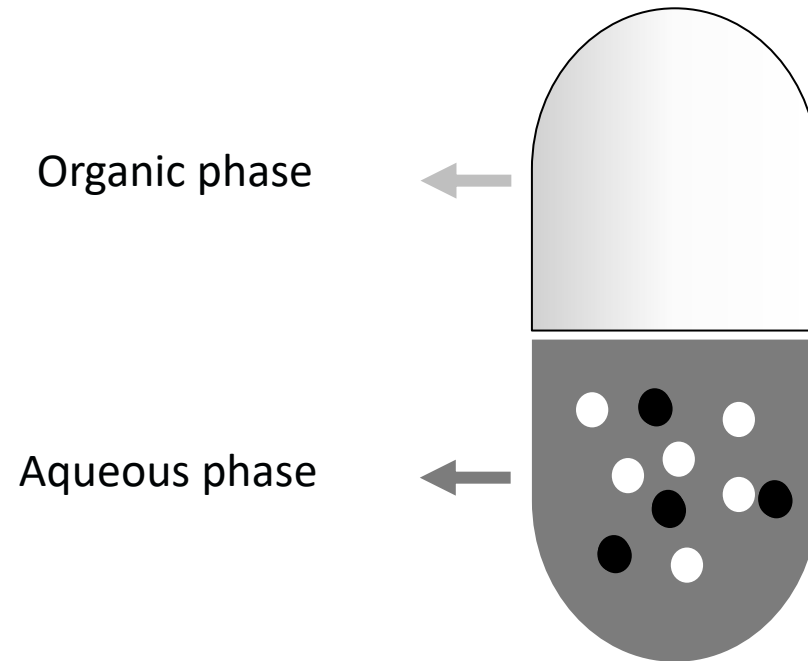
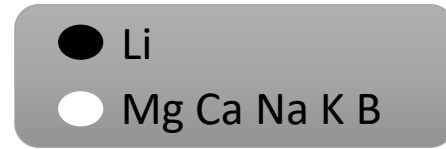
Direct lithium extraction (DLE)



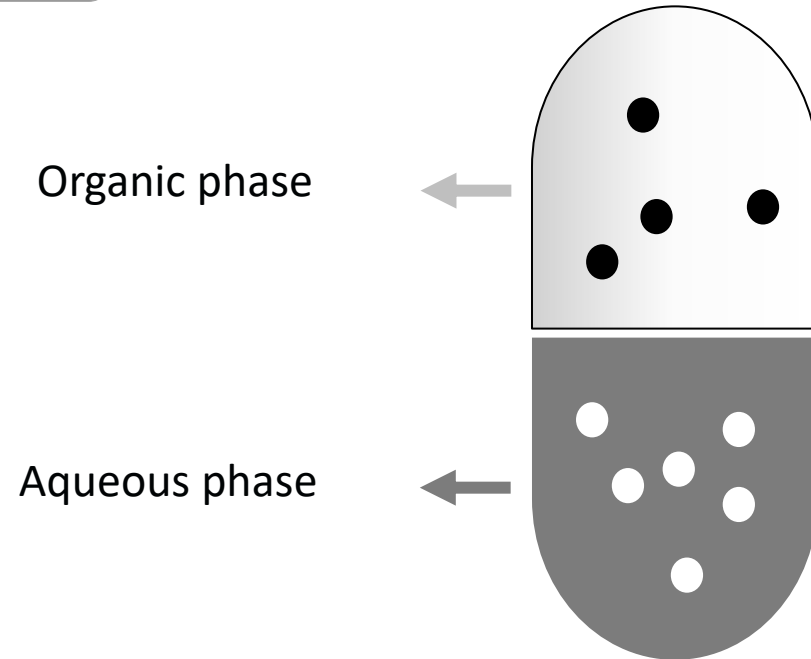
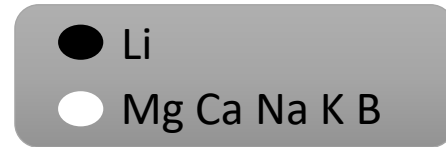
Direct lithium extraction (DLE)



DLE using solvent extraction (SX)

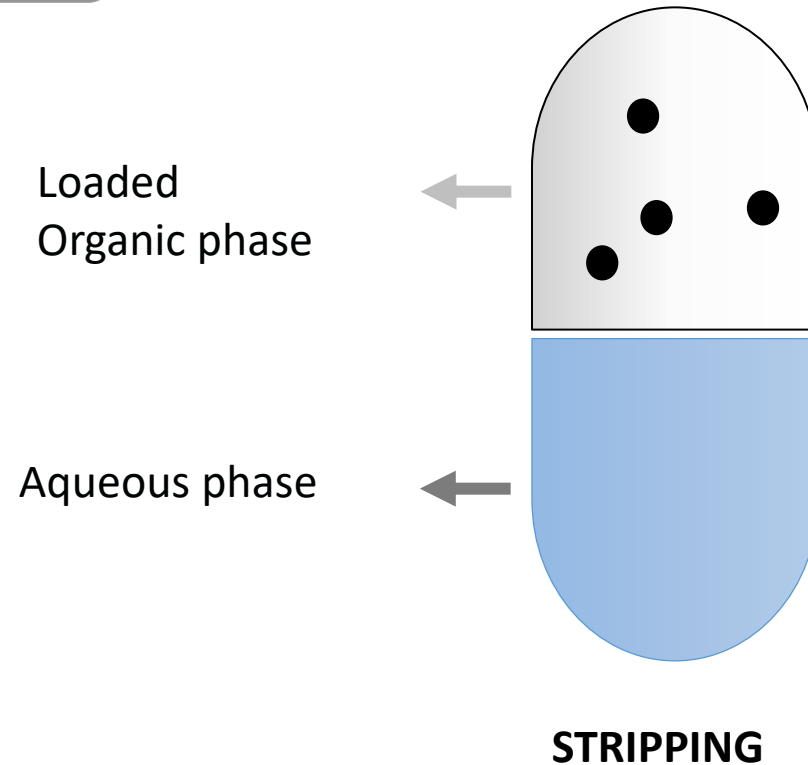
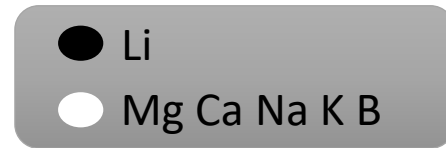


DLE using solvent extraction (SX)

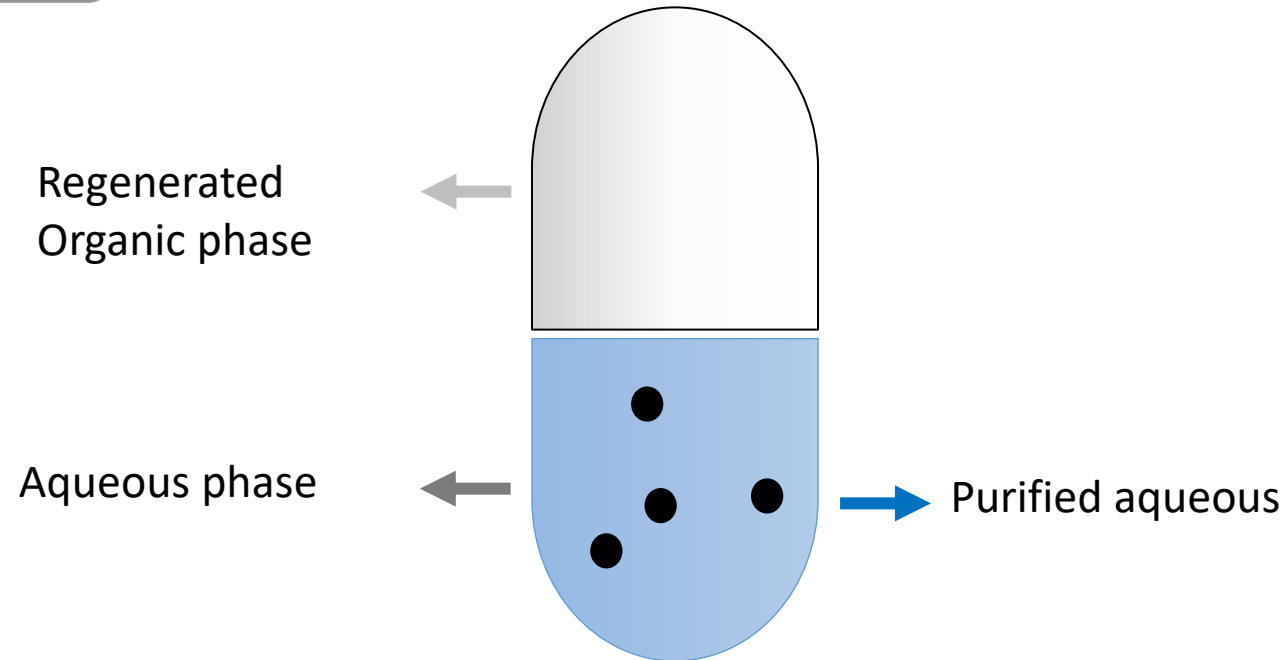
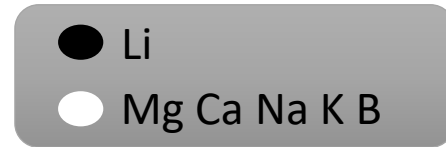


EXTRACTION

DLE using solvent extraction (SX)

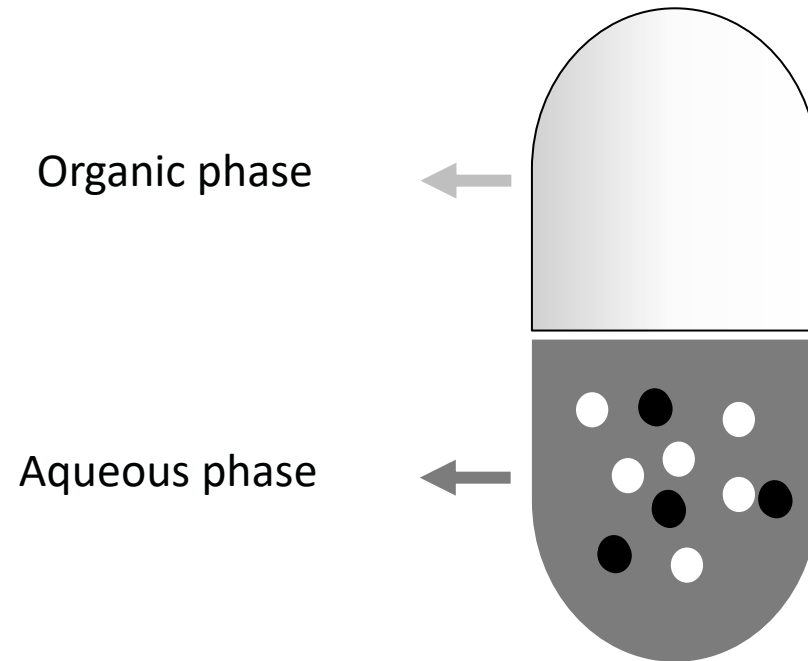


DLE using solvent extraction (SX)



DLE using solvent extraction (SX)

● Li
 ○ Mg Ca Na K B



RECYCLING OF REAGENTS

DLE using solvent extraction (SX)

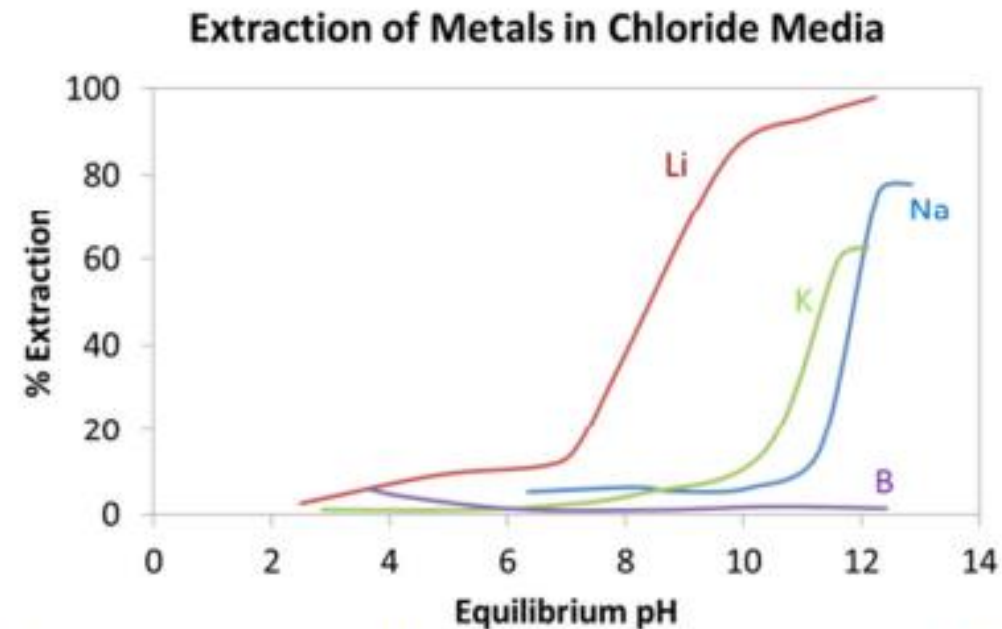
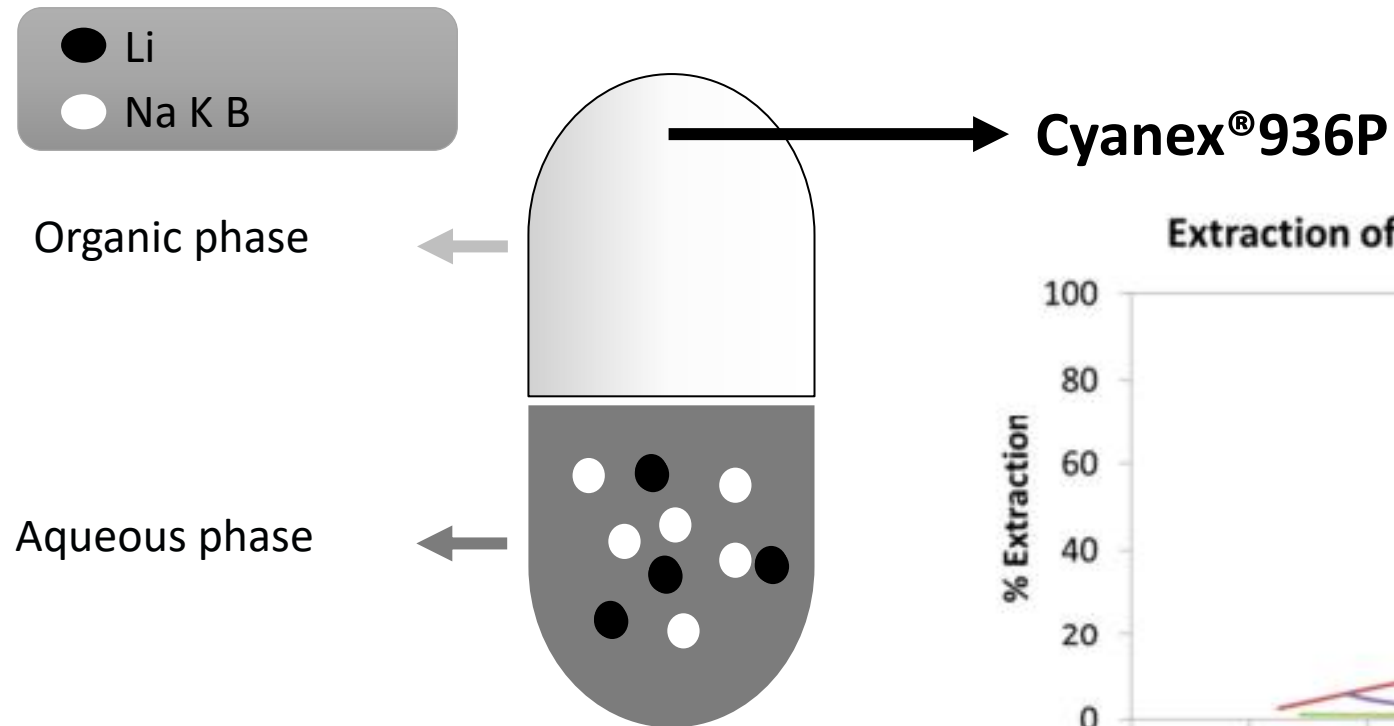


Figure 3. S-curves for CYANEX®936P reagent in chloride media

One needs to first remove Mg and Ca!
DLE of Li over Mg, Ca, Na, K and B?

SOLVOMET's DLE using SX

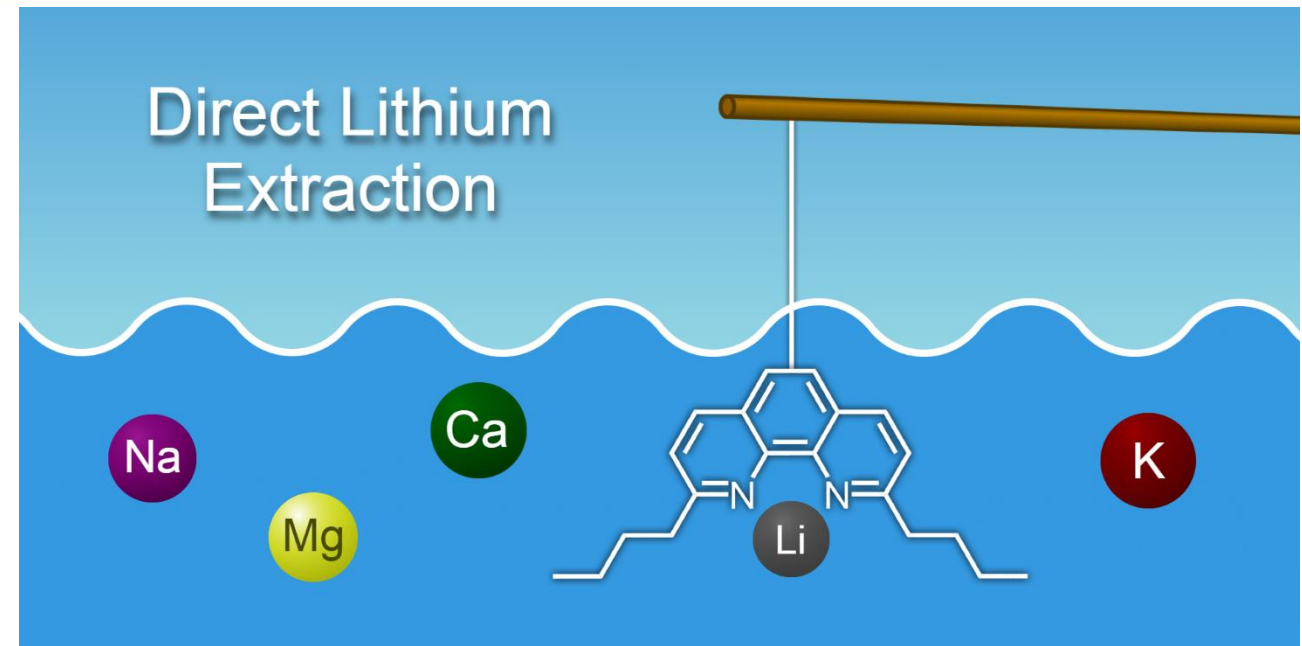
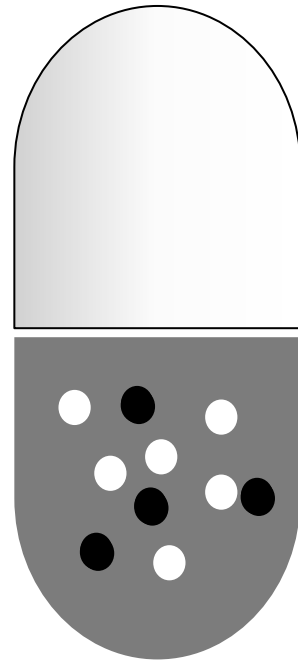
● Li

○ Mg Ca Na K B

Organic phase



Aqueous phase



Green Chemistry



PAPER

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Selective extraction of lithium over alkali and alkaline earth ions by synergistic solvent extraction†

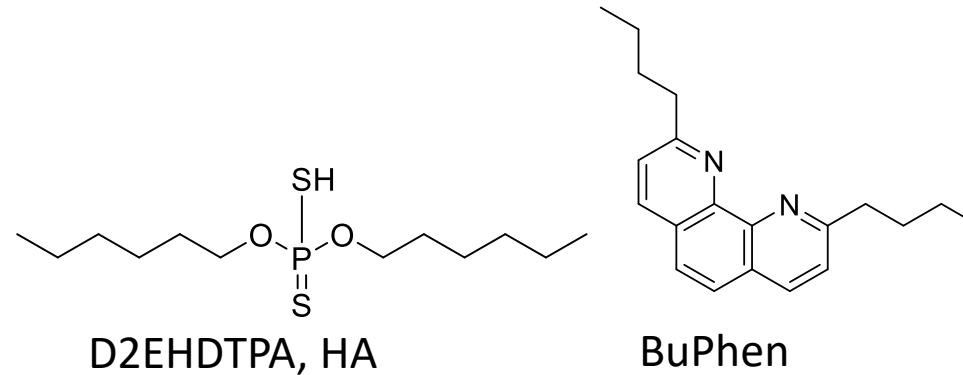
Stijn Raiguel,  * Laura Van Bogaert,  Tim Balcaen  and Koen Binnemans 

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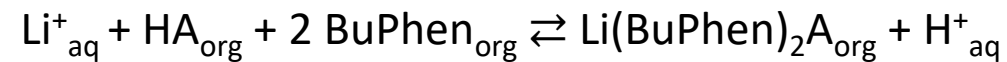
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S. Raiguel, L. Van Bogaert, T. Balcaen and K. Binnemans, *Green Chemistry*, **2025**.

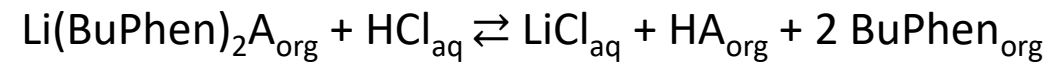
SOLVOMET's DLE using SX



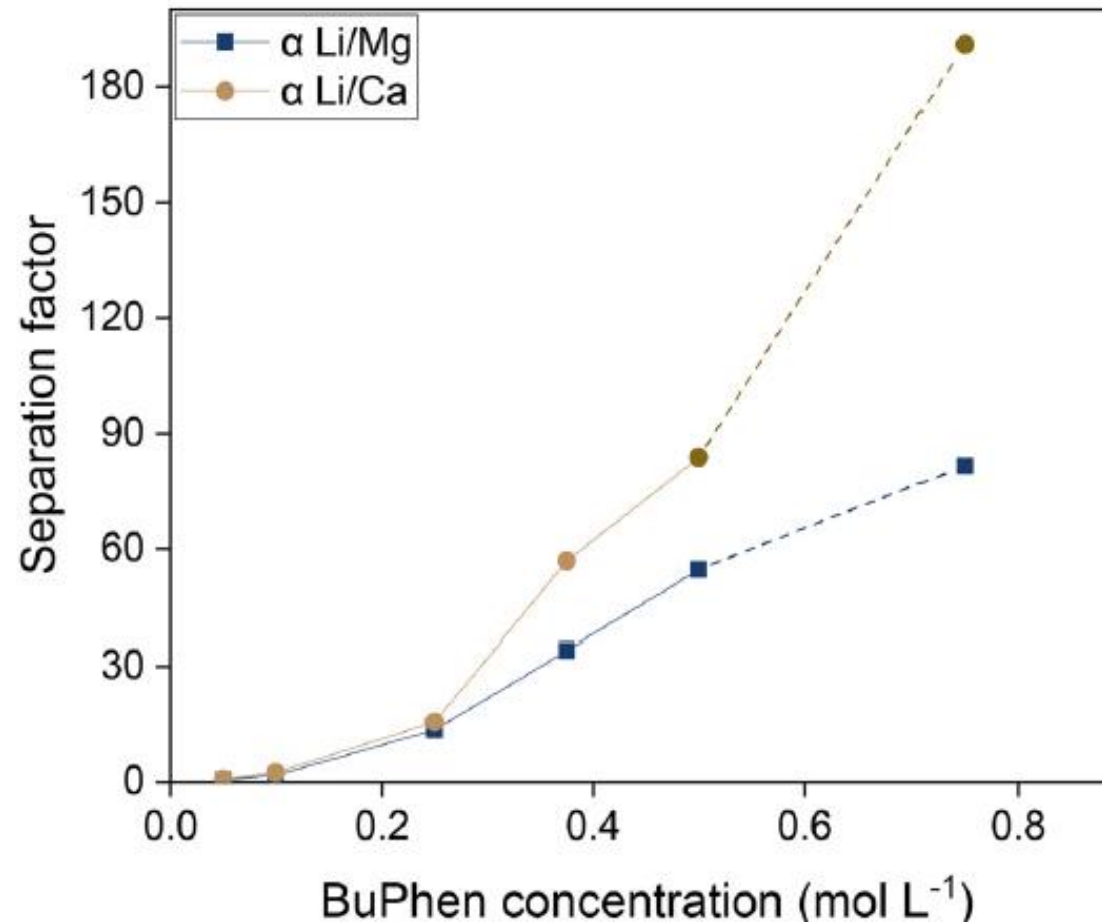
EXTRACTION



STRIPPING



SOLVOMET's DLE using SX



Parameters

Org: 0.05 mol L⁻¹ D2EHDTPA (saponified with NaOH) + 0.095 mol L⁻¹ BuPhen + 2.5 vol% 1-octanol + 20 vol% 2-octanol in *n*-dodecane

Aq: 0.05 mol L⁻¹ of each LiCl, KCl, RbCl, MgCl₂ and CaCl₂

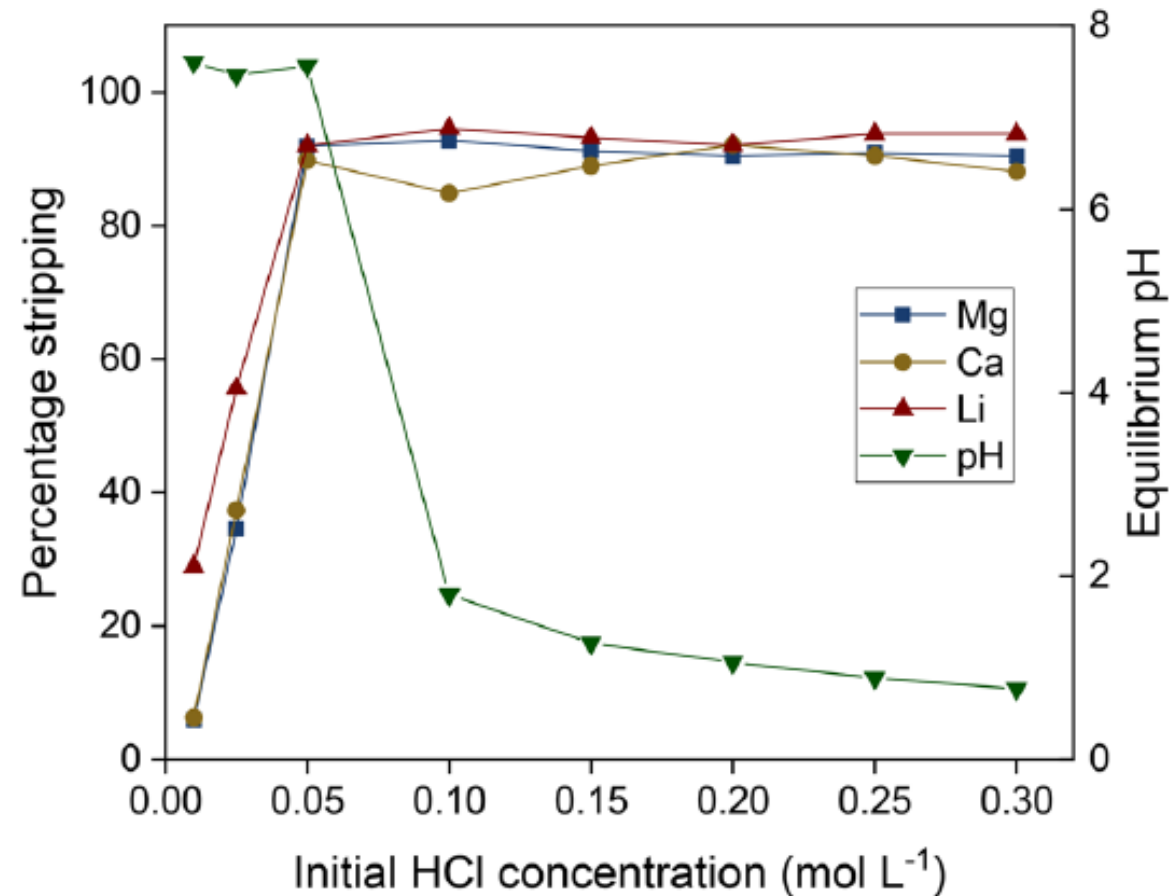
O:A = 1:1, 25 °C, 1 h, 2000 rpm

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S. Raiguel, L. Van Bogaert, T. Balcaen and K. Binnemans, *Green Chemistry*, **2025**.

SOLVOMET's DLE using SX



Parameters

Org: 0.05 mol L⁻¹ D2EHDTPA (saponified with NaOH) + 0.095 mol L⁻¹ BuPhen + 2.5 vol% 1-octanol + 20 vol% 2-octanol in *n*-dodecane loaded with 0.05 mol L⁻¹ of each LiCl, KCl, RbCl, MgCl₂ and CaCl₂

O:A = 1:1, 25 °C, 1 h, 2000 rpm

SOLVOMET's DLE using SX on brine

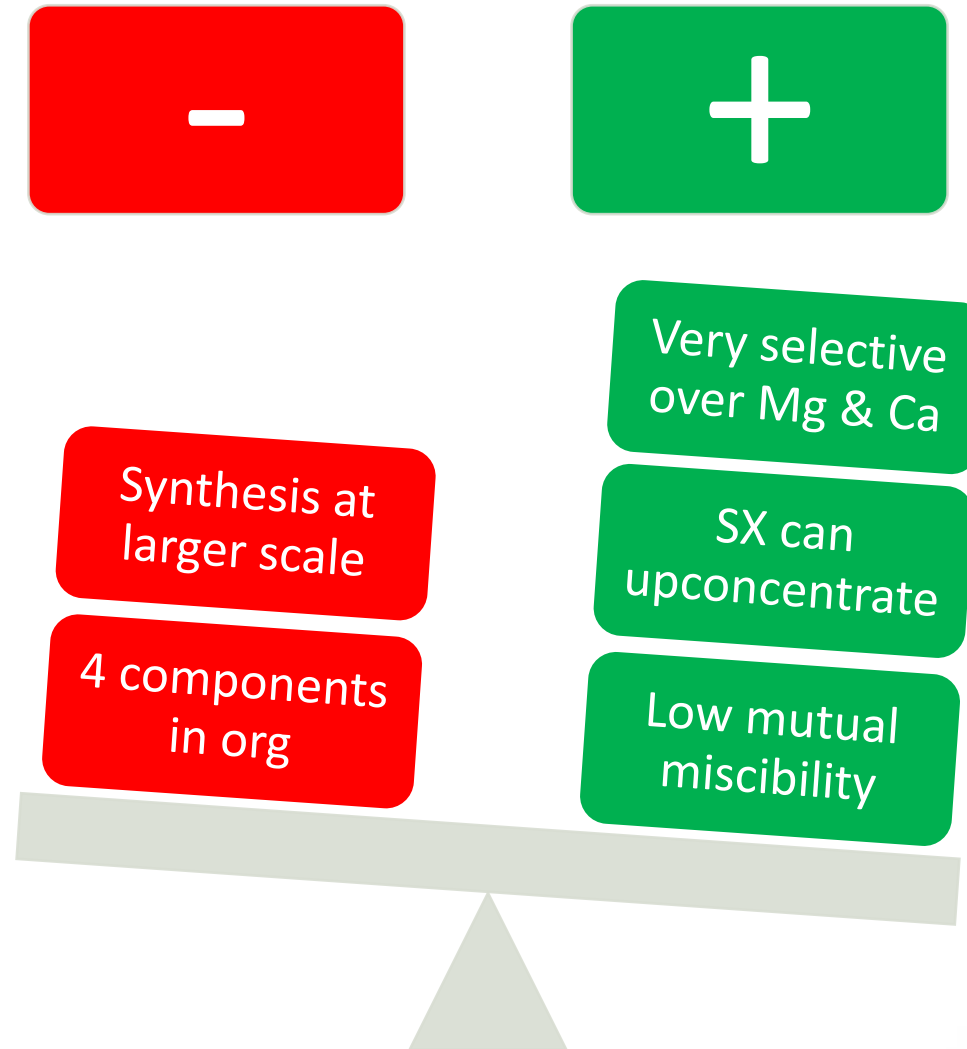
Table 1 Extraction stripping results from a synthetic brine using 0.032 mmol L⁻¹ of saponified thioD2EHPA and 1.00 mol L⁻¹ of BuPhen in *n*-dodecane, modified by 5 vol% 1-octanol and 20 vol% 2-octanol. Phase volume ratio: 1: 1, equilibrium temperature: 25 °C

Element	Conc. in feed (g L ⁻¹)	Conc. in strip (ppm)	%E	<i>D</i>	α (lithium to element)
Li	0.22	139	67.9 ± 0.6	2.12 ± 0.06	1
Na	46.8	174	0.341 ± 0.003	3.42 × 10 ^{-3a}	620 ± 18
K	23.1	18	0.069 ± 0.004	(6.9 ± 0.4) × 10 ⁻⁴	3100 ± 200
Mg	9.5	38	0.36 ± 0.01	(3.6 ± 0.1) × 10 ⁻³	600 ± 10
Ca	58.8	62	0.093 ± 0.003	(9.3 ± 0.3) × 10 ⁻⁴	2300 ± 8

^a Standard error <1%.

	Solubility (mg L ⁻¹)
D2EHDTPA in brine	< DL
BuPhen in brine	3.2

Conclusions SOLVOMET's DLE using SX



Thank you!



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<https://kuleuven.sim2.be/>

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