

Strategic Ion Separation from Li-Ion Battery Waste with over 90% Recovery of Cobalt

Author: Anna Siekierka, DSc. Eng., PhD

Scale.PL Top1000 Innovators of Poland in Silicon Valey, 9-12 December 2025



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Infrastructure Sharing

Problem Solving and Societal
Impact

Funding and Grants
Events and Networks

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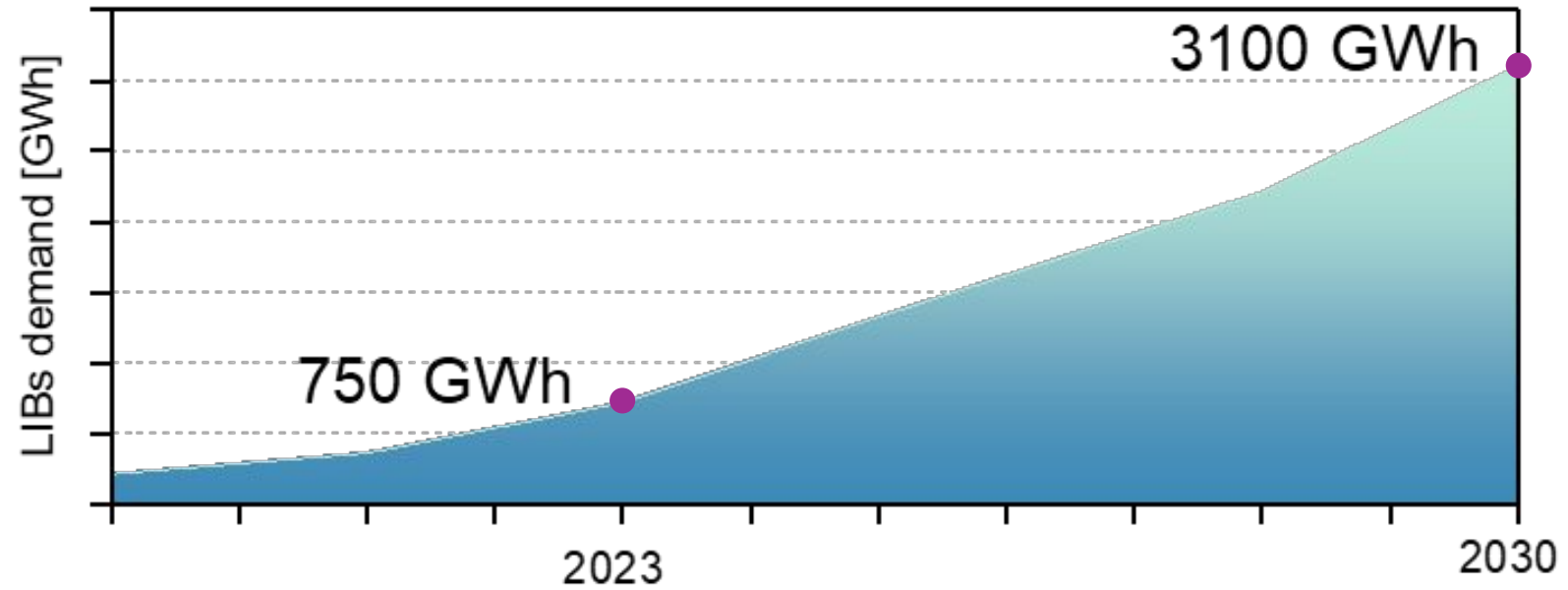
<https://sites.google.com/pwr.edu.pl/annasiekierka/welcome>

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Where is the problem?



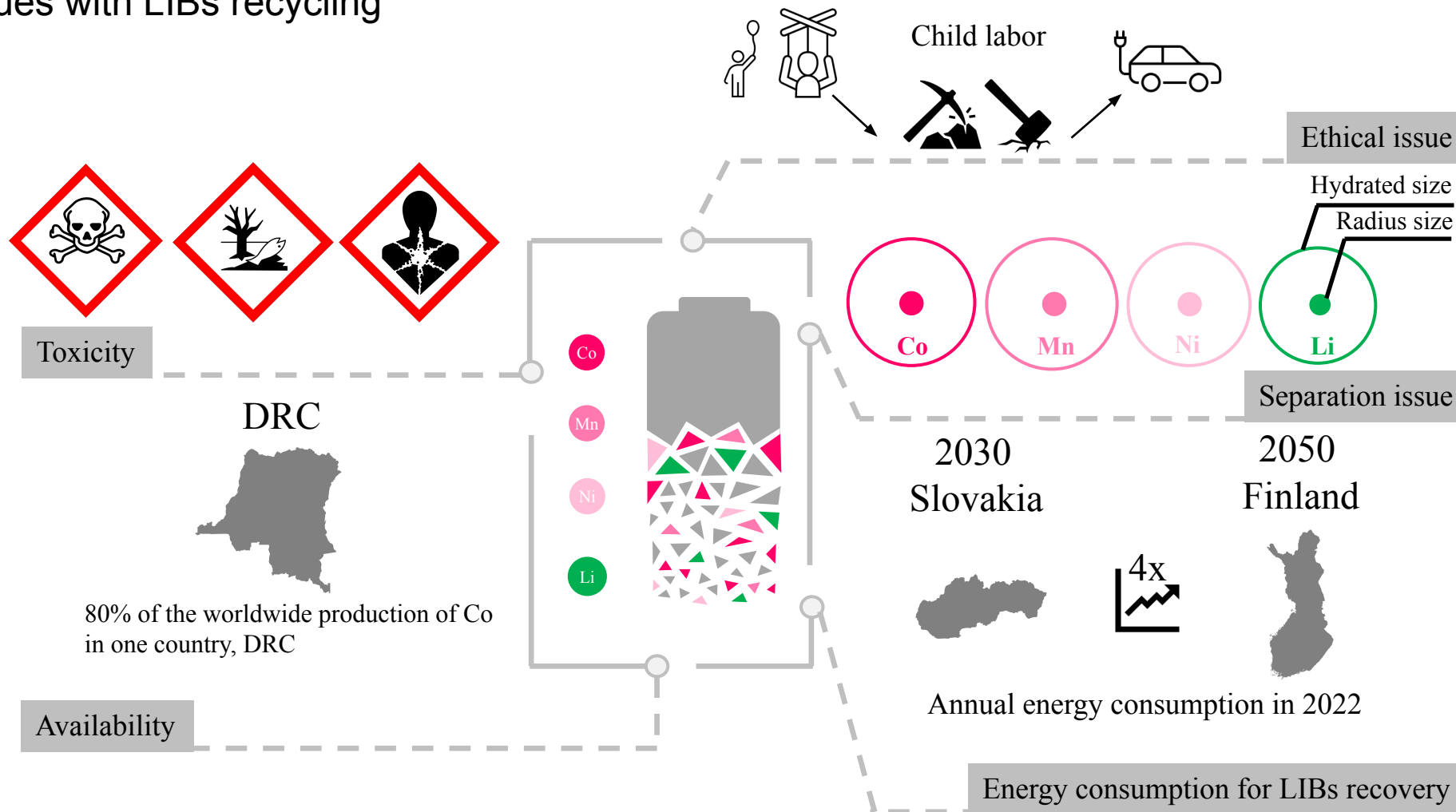
LIBs – lithium-ion batteries

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Issues with LIBs recycling

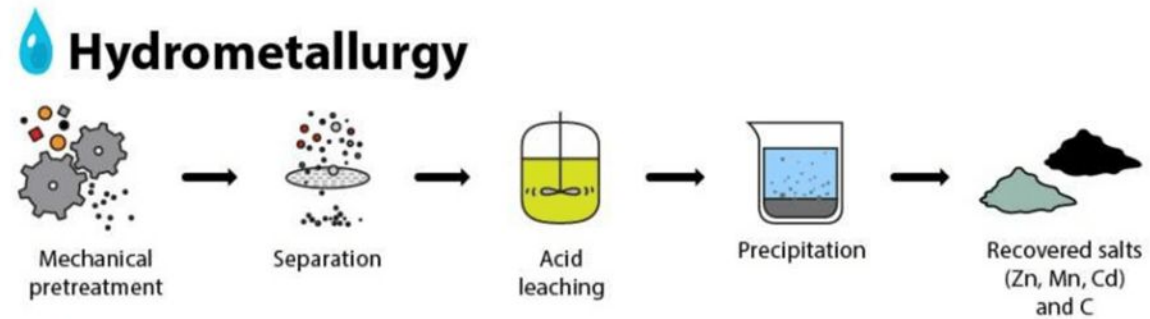
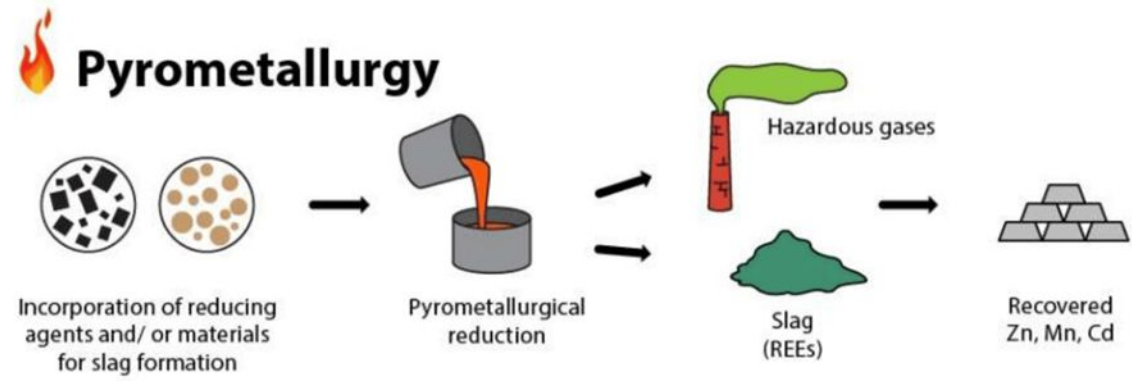


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Current solution

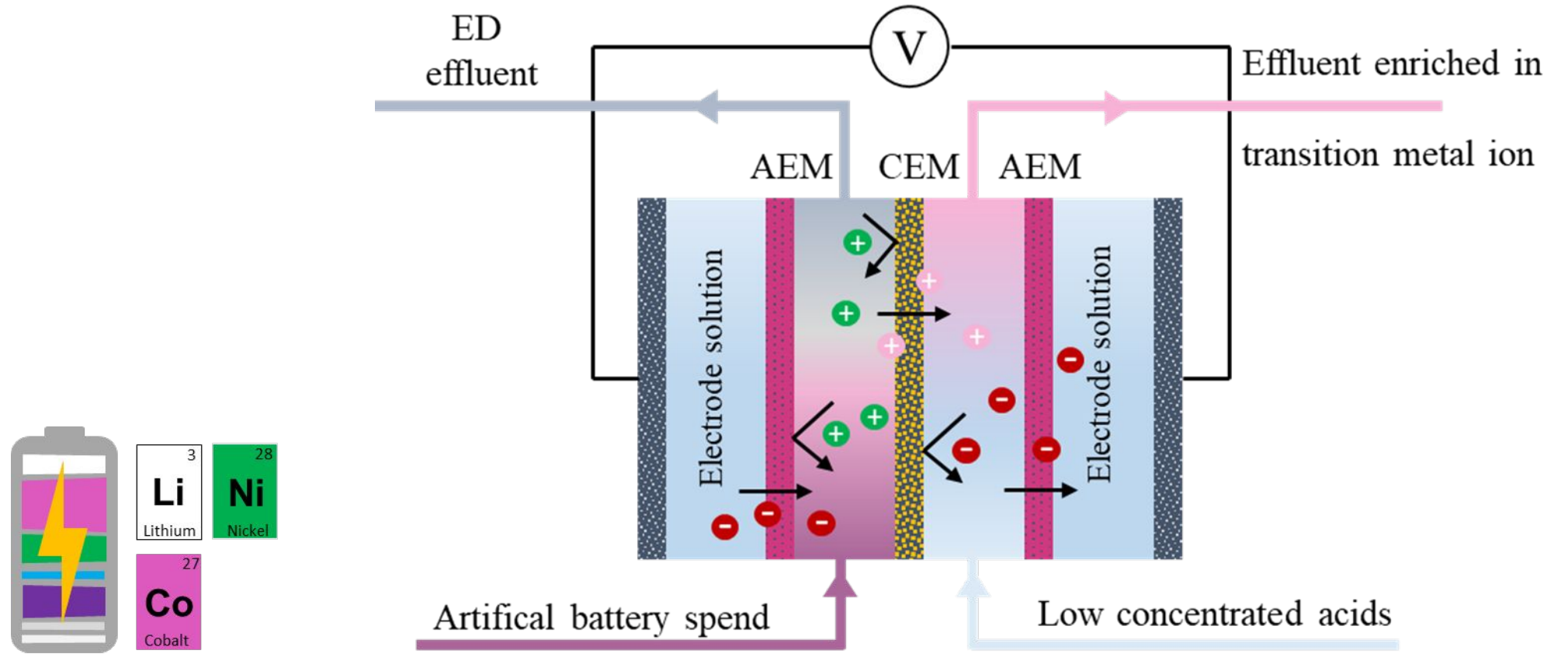


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Current solution in electro dialysis



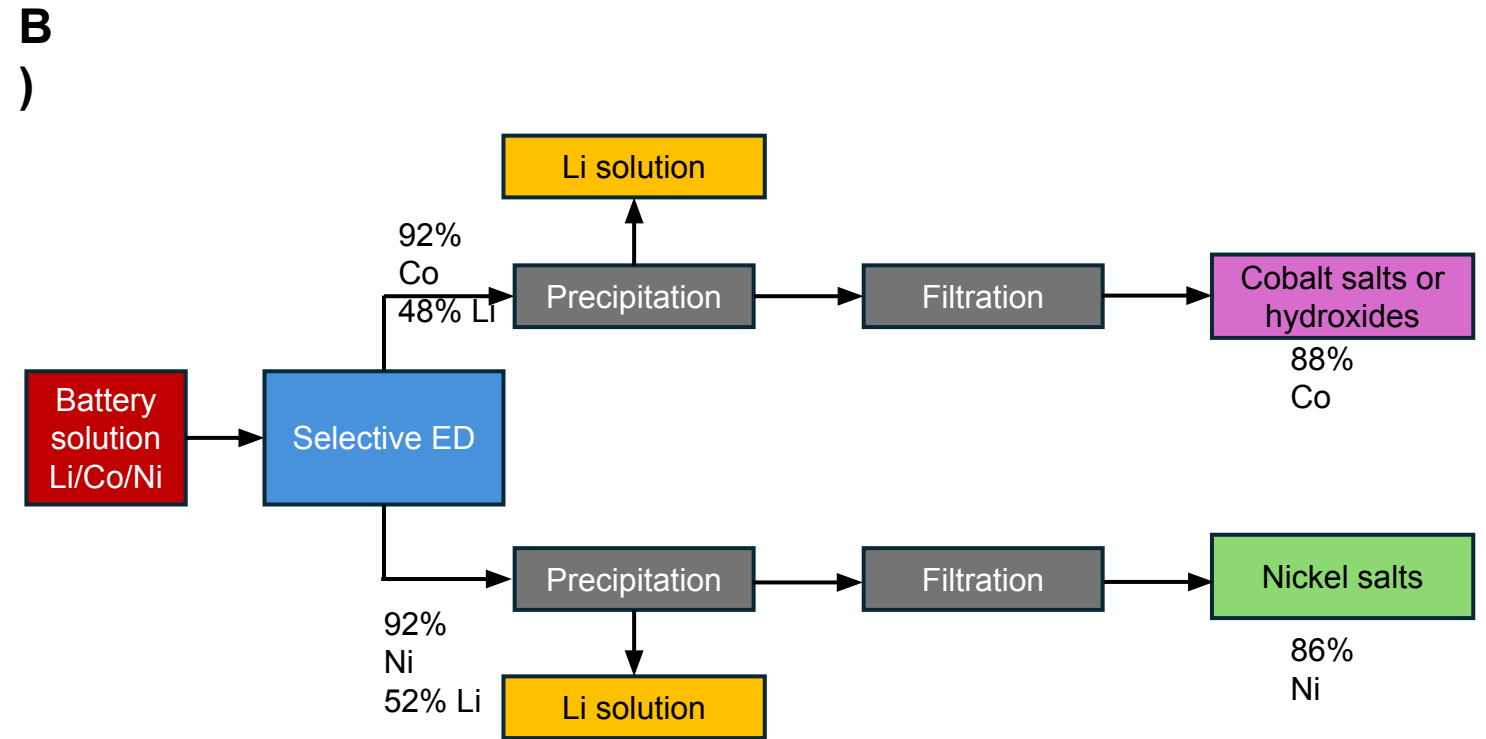
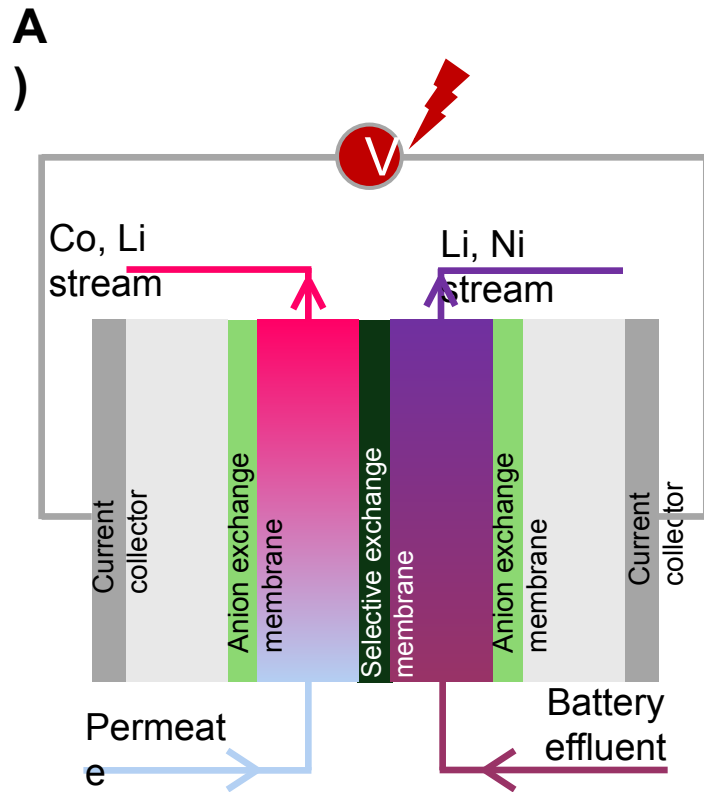
A.Siekierka, F. Yalcinkaya, Separation and Purification Technology 299 (2022) 121695

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Proposed novel solution



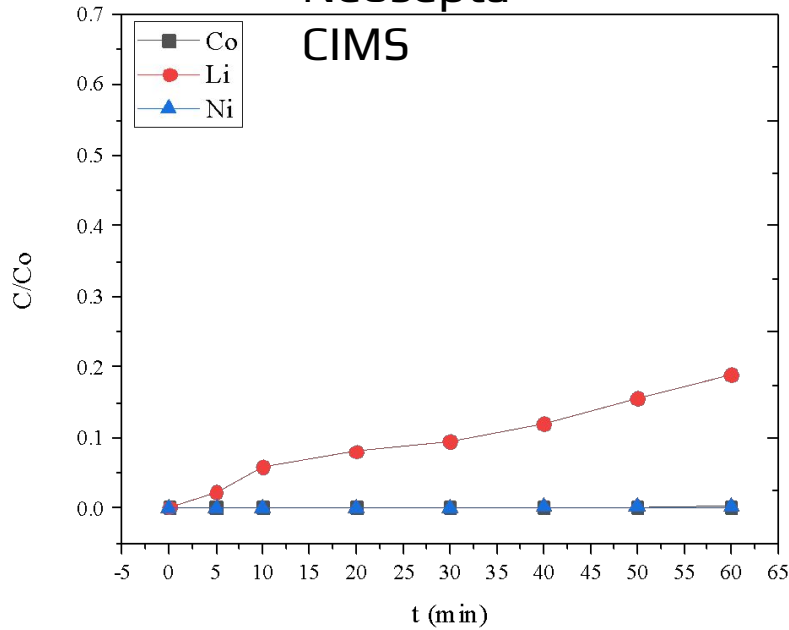
General ED cell (A) and technology scheme of proposed novel solution for transition metal ions recovery from battery wastewater effluents (B).

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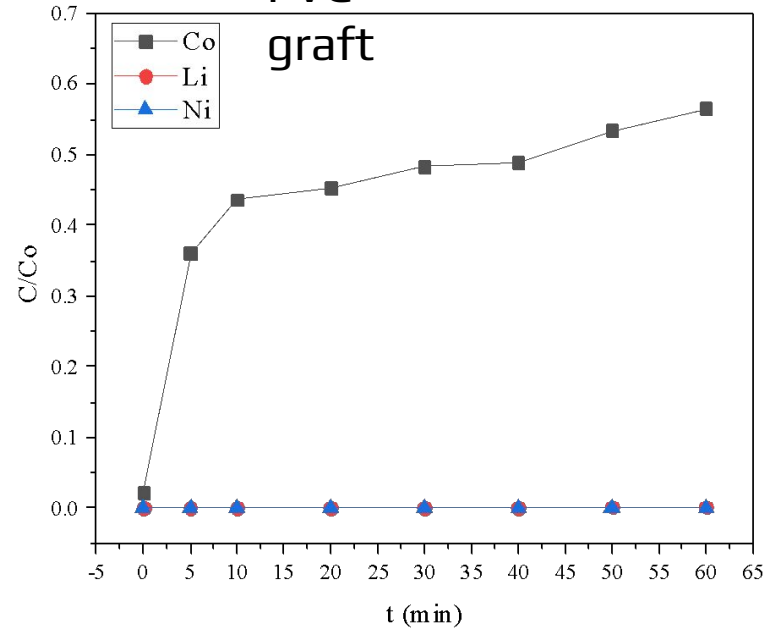


Neosepta - CIMS



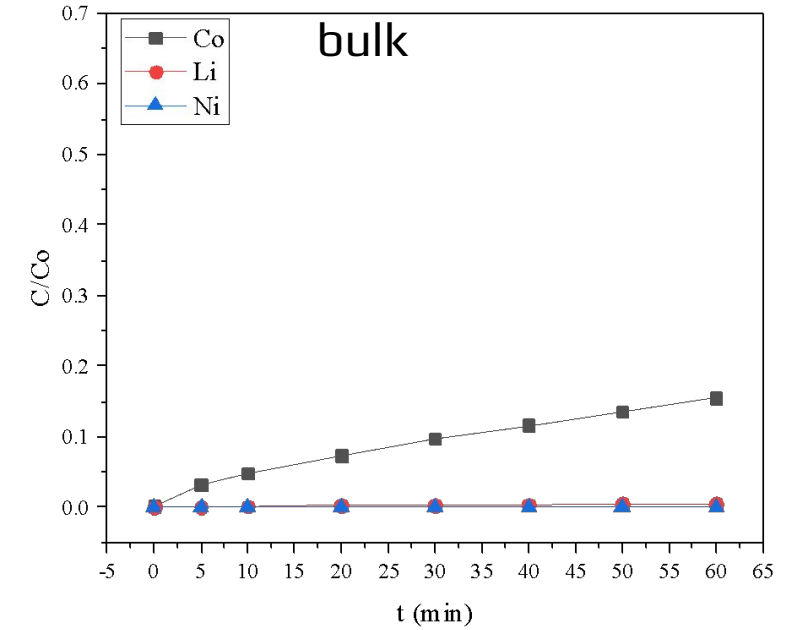
Factors	CIMS
Permselectivity Li/Co	77
Permselectivity Co/Li	0.01
Flux Li [g/cm ² min]	1.03
Flux Co [g/cm ² min]	0.007

PVC - graft



Factors	PVC-graft
Permselectivity Li/Co	0,004
Permselectivity Co/Li	258
Flux Li [g/cm ² min]	0.01
Flux Co [g/cm ² min]	1.36

PVC - bulk

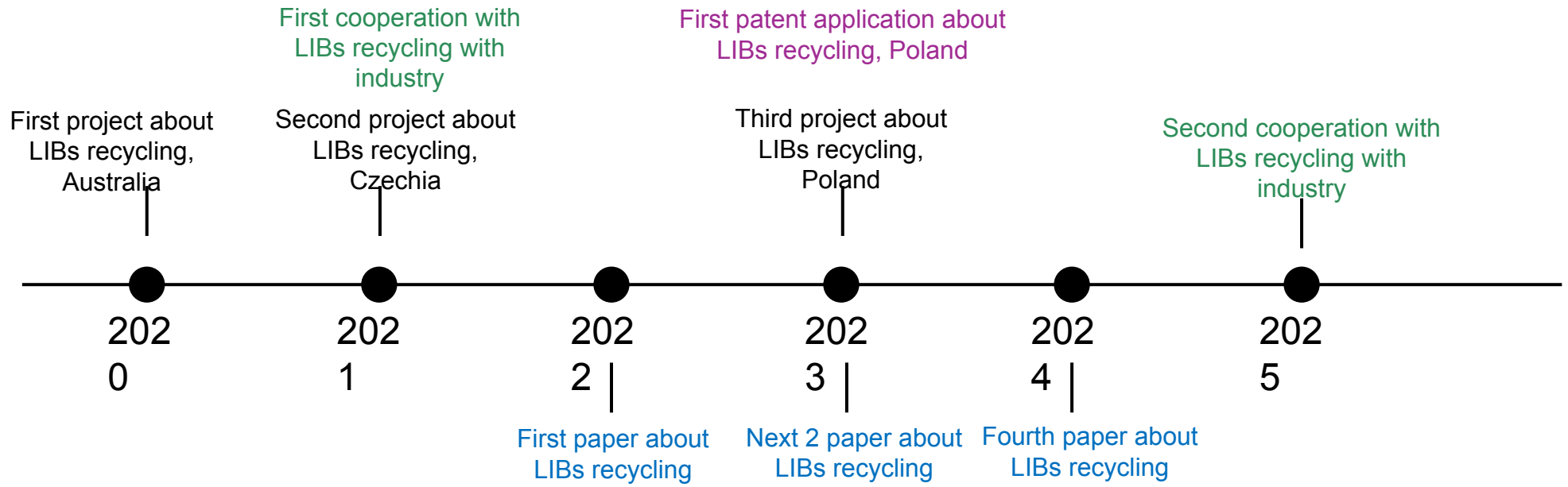


Factors	PVC-bulk
Permselectivity Li/Co	0.04
Permselectivity Co/Li	26.8
Flux Li [g/cm ² min]	0.03
Flux Co [g/cm ² min]	0.37

A.Siekierka, D. Callahan, W. Kujawski, L. Dumeé, Desalination 556 (2023) 116561

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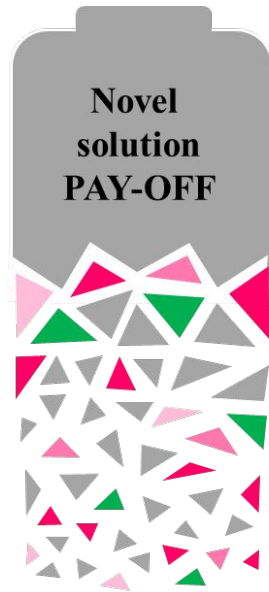


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Pay-off from novel battery waste recovery method



Experimental demonstration of the performance of the novel ED system for selective separation/recovery of TMIs from battery effluent spent

The perm-selective system for TMIs recovery over 0.9

Development of a sustainable, technically efficient, cost-effective, and environmentally sound electro-membrane process for TMIs recovery from alternative resources in the EU and Worldwide

Contribution to reducing the dependency on TMIs from DRC and securing the supply chain by exploiting battery wastes

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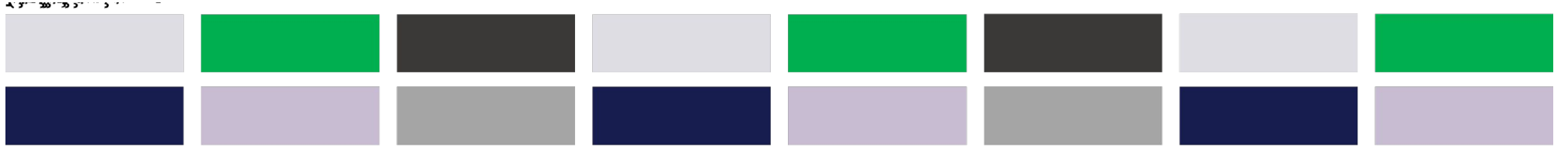
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Patent application beneficiaries present in every field of industry

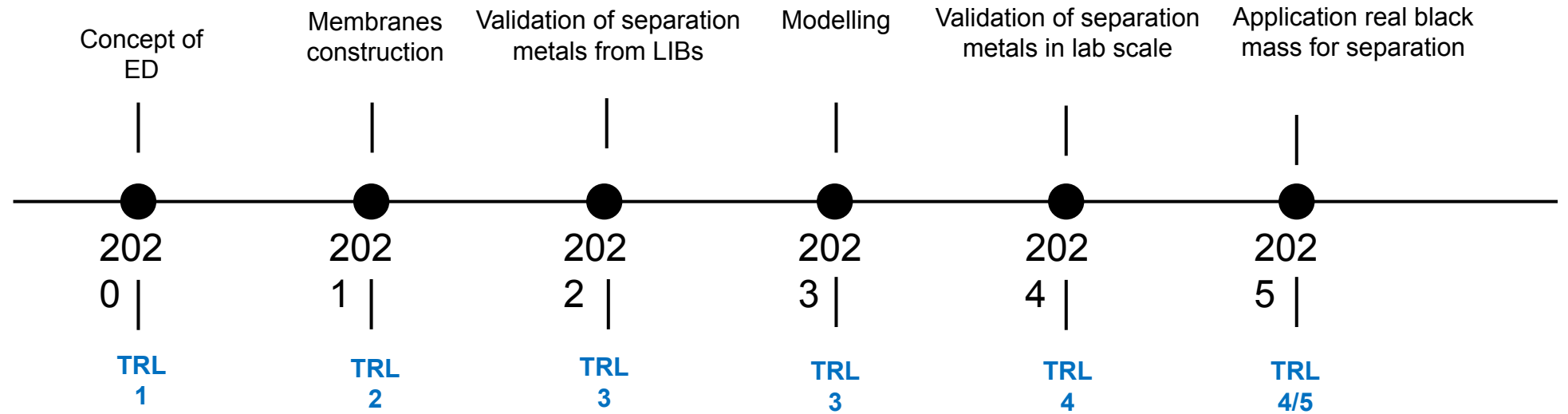


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Timeline if



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Problem: Recycling processes struggle with the efficient and selective separation of metals, especially in achieving high-purity cobalt recovery.

Solution: High-selective and energy-effective method for metal ions fractionation

Traction: one patent and 5 papers, recovery cobalt with over 90% efficiency.

TRL: 4 - Technology validated in lab

Ask: Academy – project participation

Industrial partner – validation of technology at large scale

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