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PTKA
Projektträger Karlsruhe
Karlsruher Institut für Technologie

HighCon

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Brines from industrial water recycling: New ways to resource recovery

WavE online seminar: Managements of concentrates

26th April 2021, Berlin

Presented by Malena Kieselbach (TU Berlin, Chair of Environmental Process Engineering)

An Initiative of the Federal Ministry of Education and Research

WavE
WATER REUSE DESALINATION

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HighCon demonstration at the site of DEK Berlin, project meeting in October 2018

Project data

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Concentrates from industrial water recycling

Research partners:	4
Industry partners:	4
Associated partners:	4
Project scope:	2,7 Mio EUR
Founding amount:	2,3 Mio EUR (85%)
Founding programme:	FONA WavE
Project term:	09/2016 – 12/2019

HighCon associated partners

DEK Deutsche Extrakt Kaffee GmbH

Food industry

MEWA Textil-Service AG & Co. Management OHG

Industrial laundry

Clariant Produkte (Deutschland) GmbH

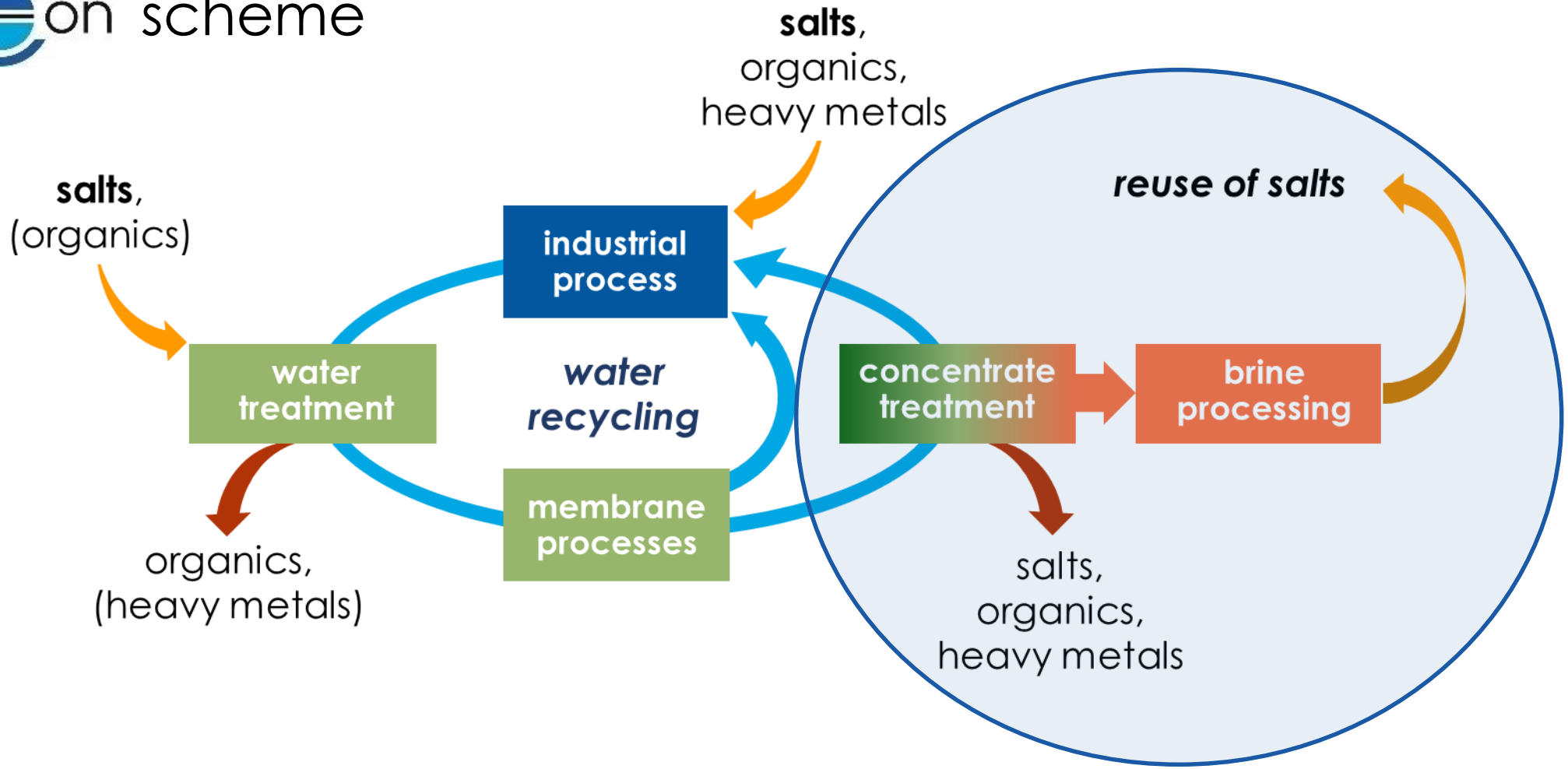
Industrial biotechnology

L'Oréal Produktion Deutschland GmbH & Co. KG

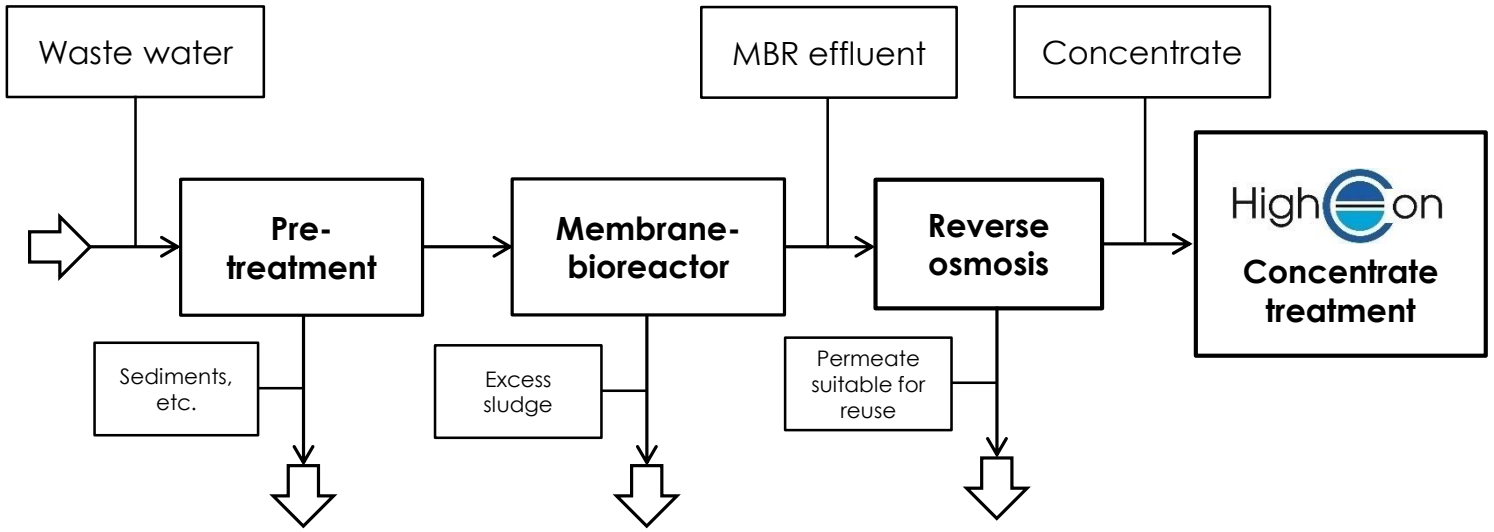
Cosmetics manufacturer

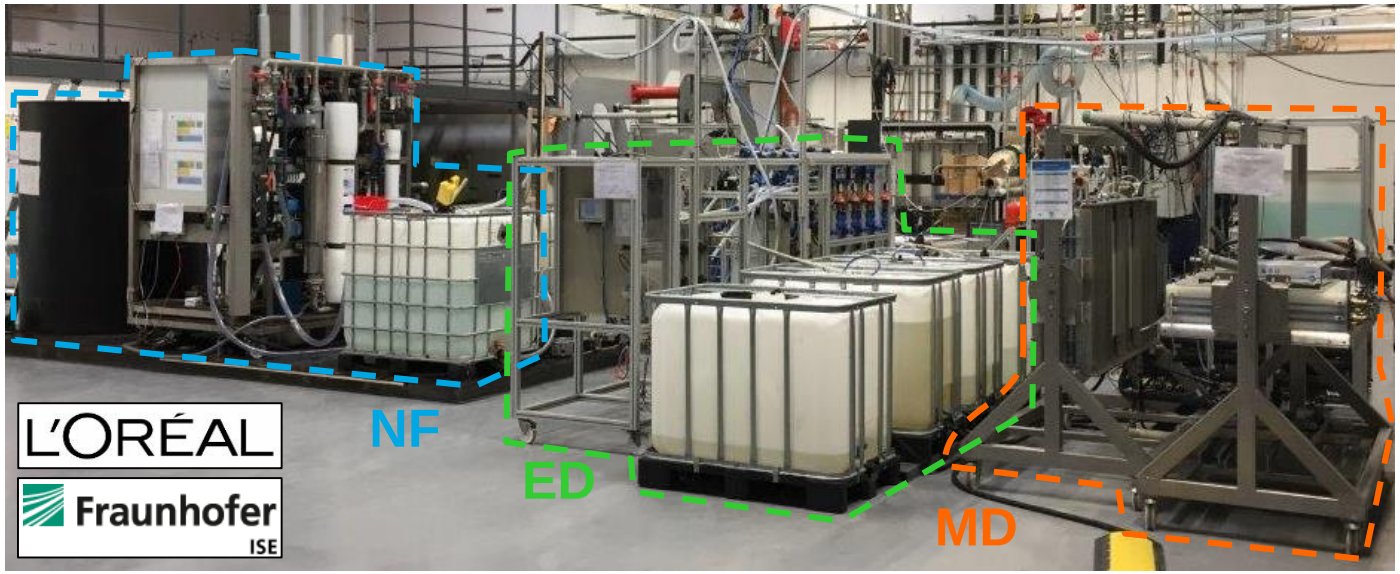
Water recycling & concentrate treatment

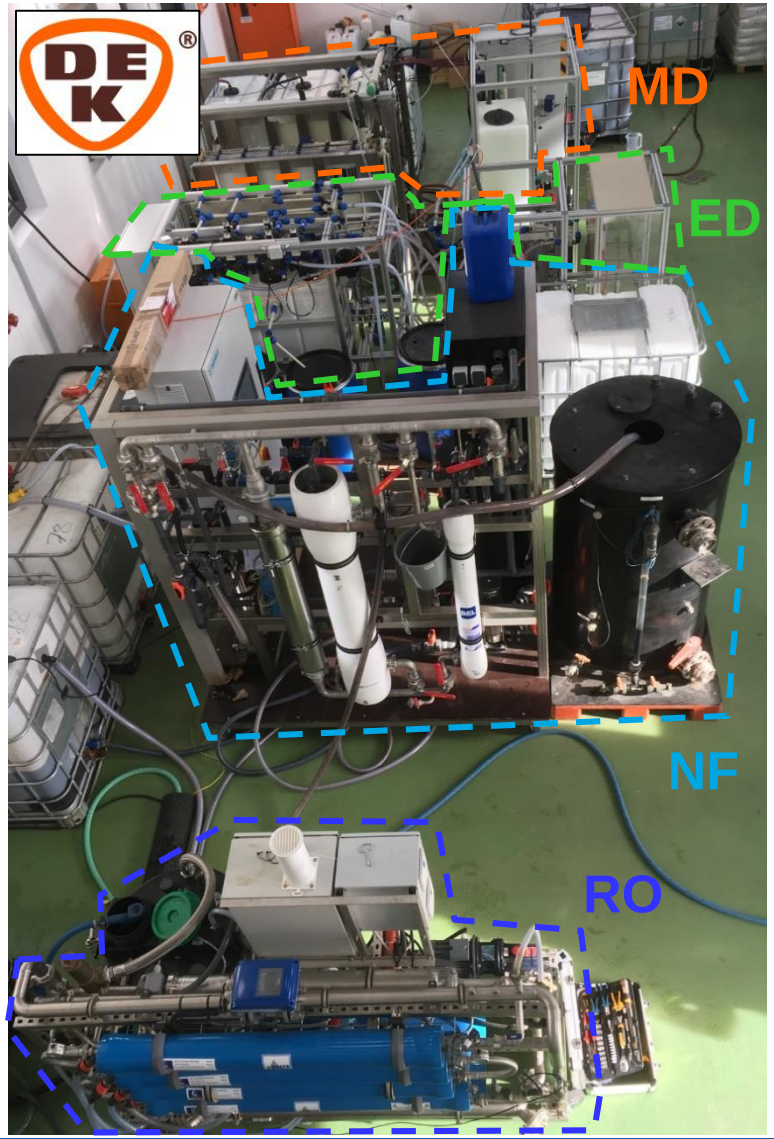
HighCon scheme



HighCon demonstration

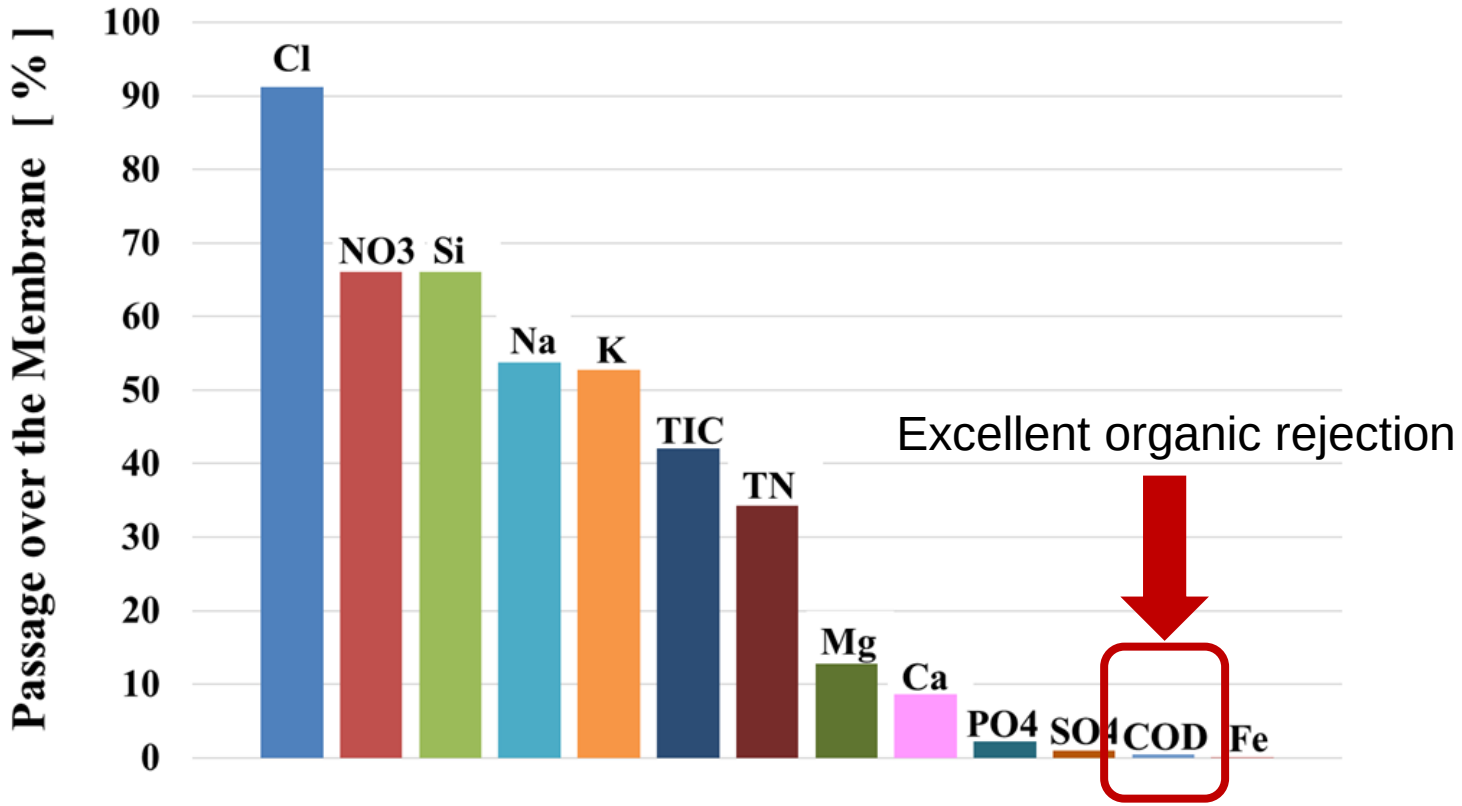






Separation of organics and salts by nanofiltration

Results of the nanofiltration from demonstration at DEK Berlin



Average passage of ions over the membrane, expressed as % of feed concentration (source: WEHRLE Umwelt GmbH)

Samples from the demonstration at DEK: concentrate (left) and permeate (right)

Selective salt recovery by crystallisation
Technical feasibility

Permeate and concentrate from reverse osmosis

HighCon process

Salt-mixture obtained from RO concentrate

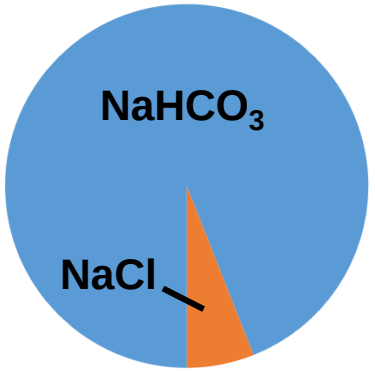
Complete crystallisation:

Organic free salt-mixture

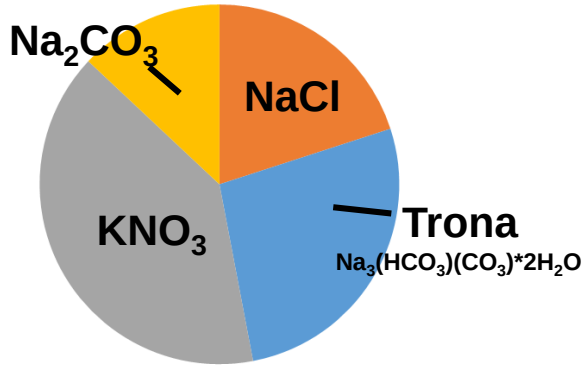
- Sodium (hydrogen) carbonate
- Sodium chloride
- Potassium nitrate
- Other salts

Single-stage selective crystallisation:

Fraction I ca. 80 wt%

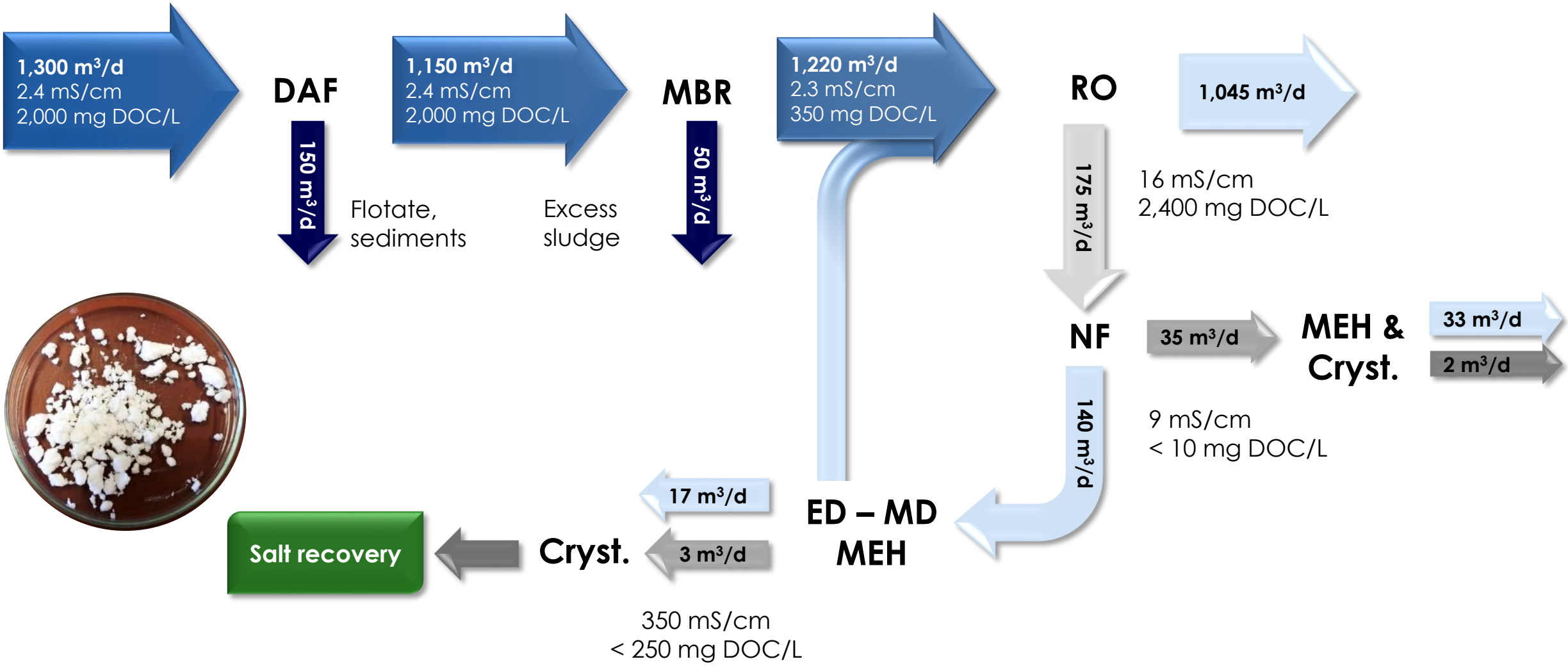


Fraction II ca. 20 wt%



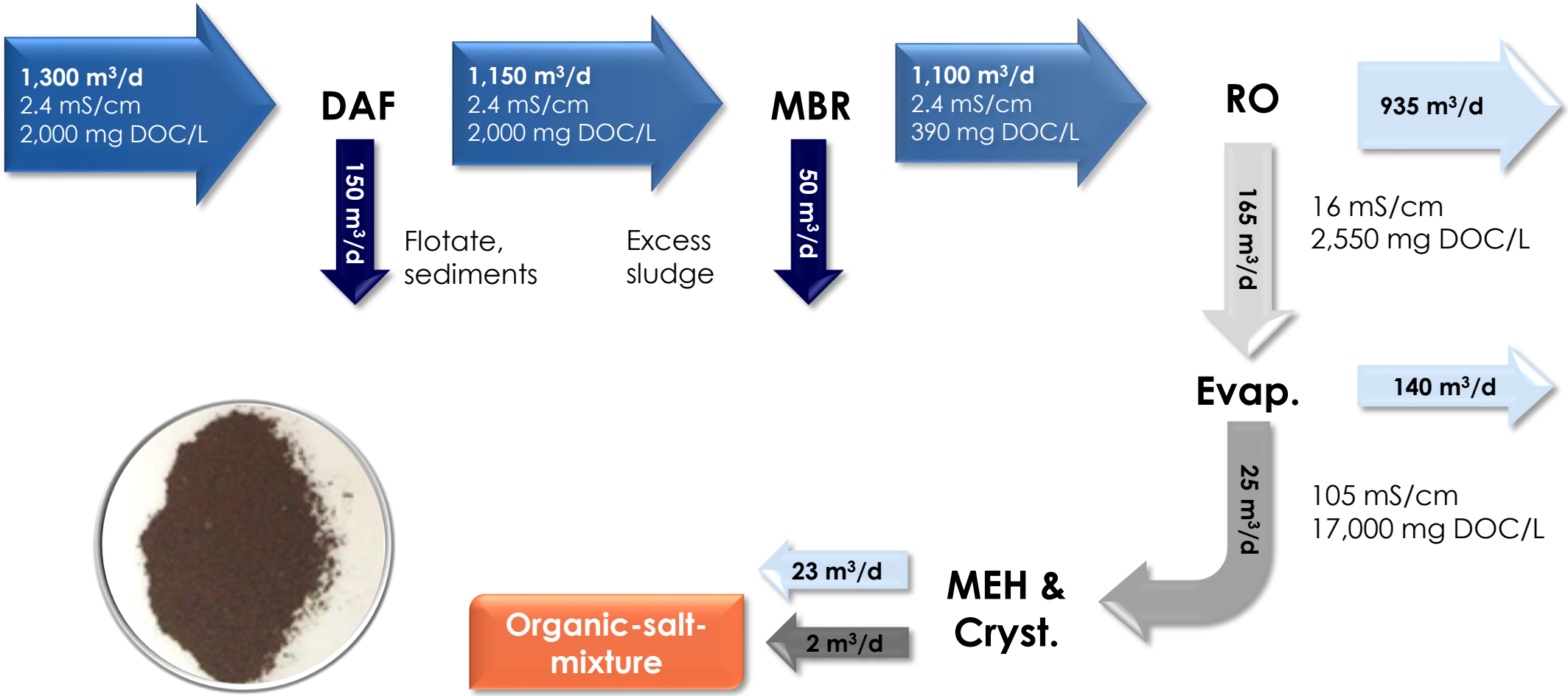
HighCon process

Full-scale process design based on the demonstration results

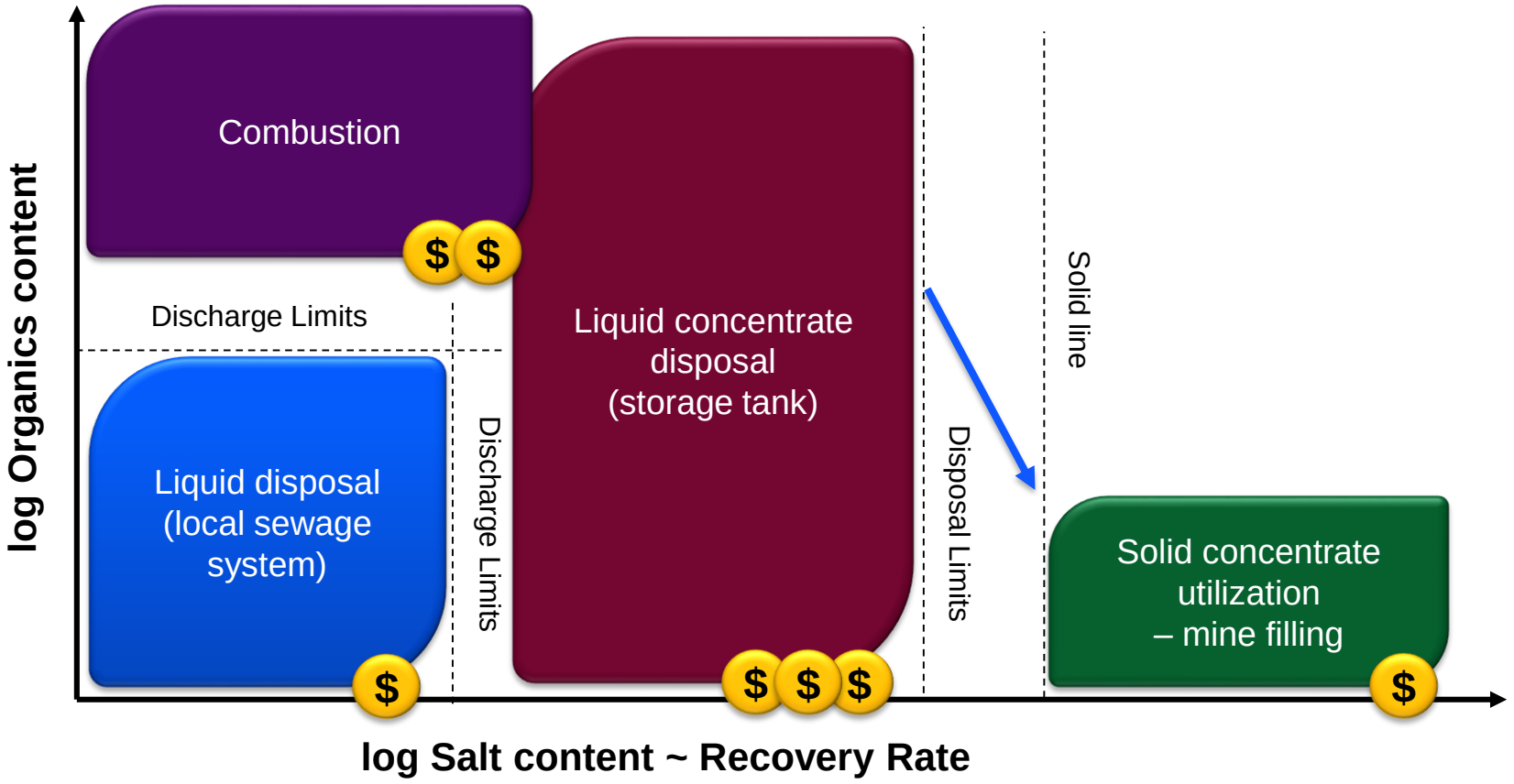


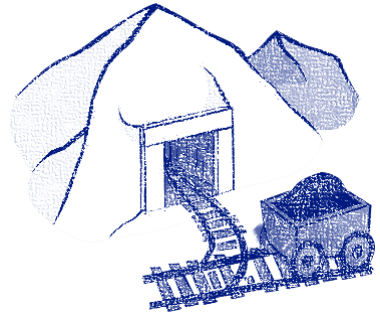
Conventional Zero Liquid Discharge

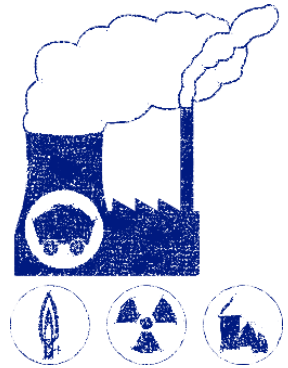
Full-scale process design as comparison to the HighCon process



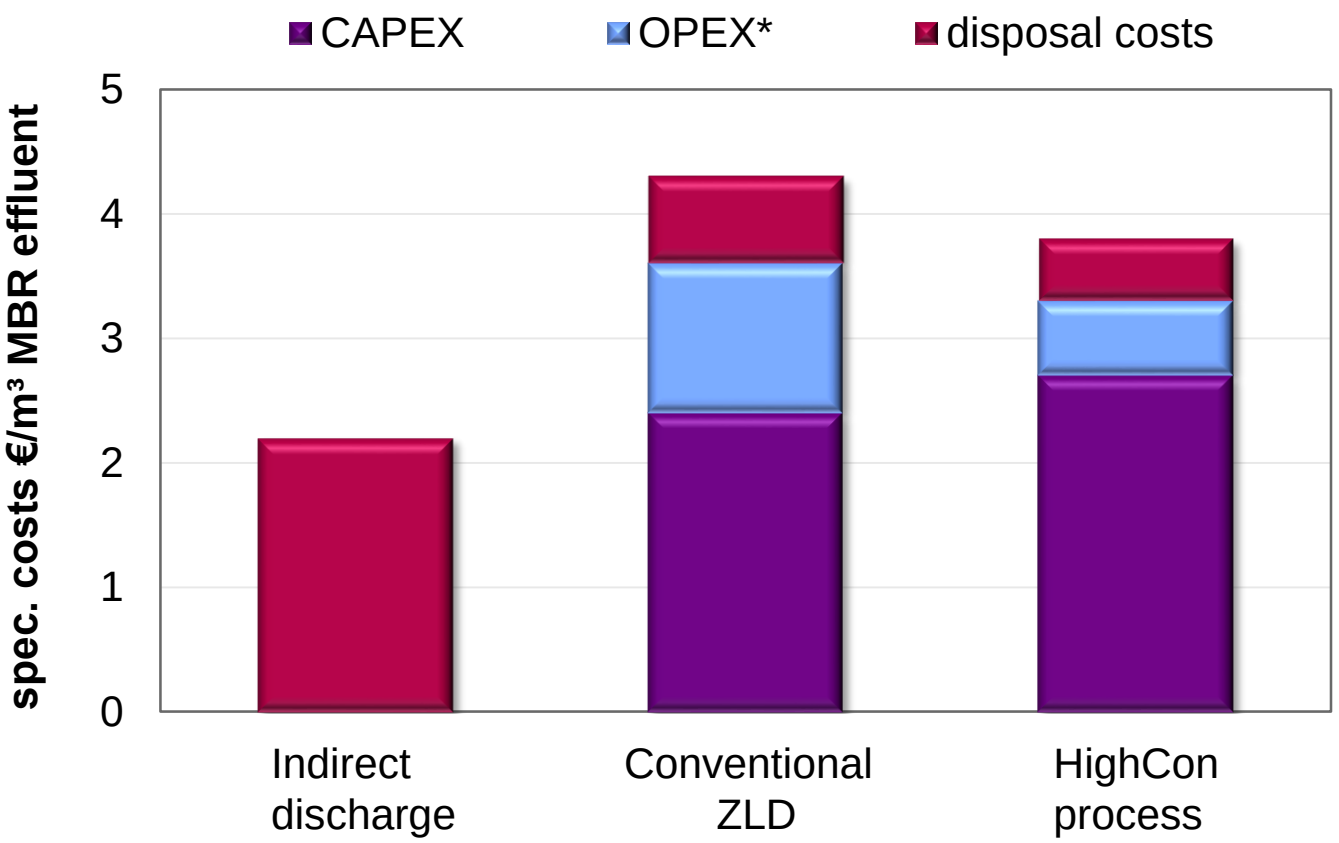
Concentrate conditioning for disposal







Cost calculation
water recycling and concentrate treatment



*excluding disposal costs; including: energy, personnel, chemicals (incl. cleaning), replacement membranes; amortisation over 7 years

Advantages of concentrate treatment

- Maximisation of the water recycling rate
  - Substitution of tap water
  - Water treatment before production can be significantly reduced
- No wastewater disposal → relief of the wwtp
  - Relief of water bodies from salts and refractory organic matter
- Advantages of HighCon:
  - Reduction of disposal amounts
  - Increase in disposal safety
  - Contribution to closing of recoverable substance cycles (green labelling)

Conclusion

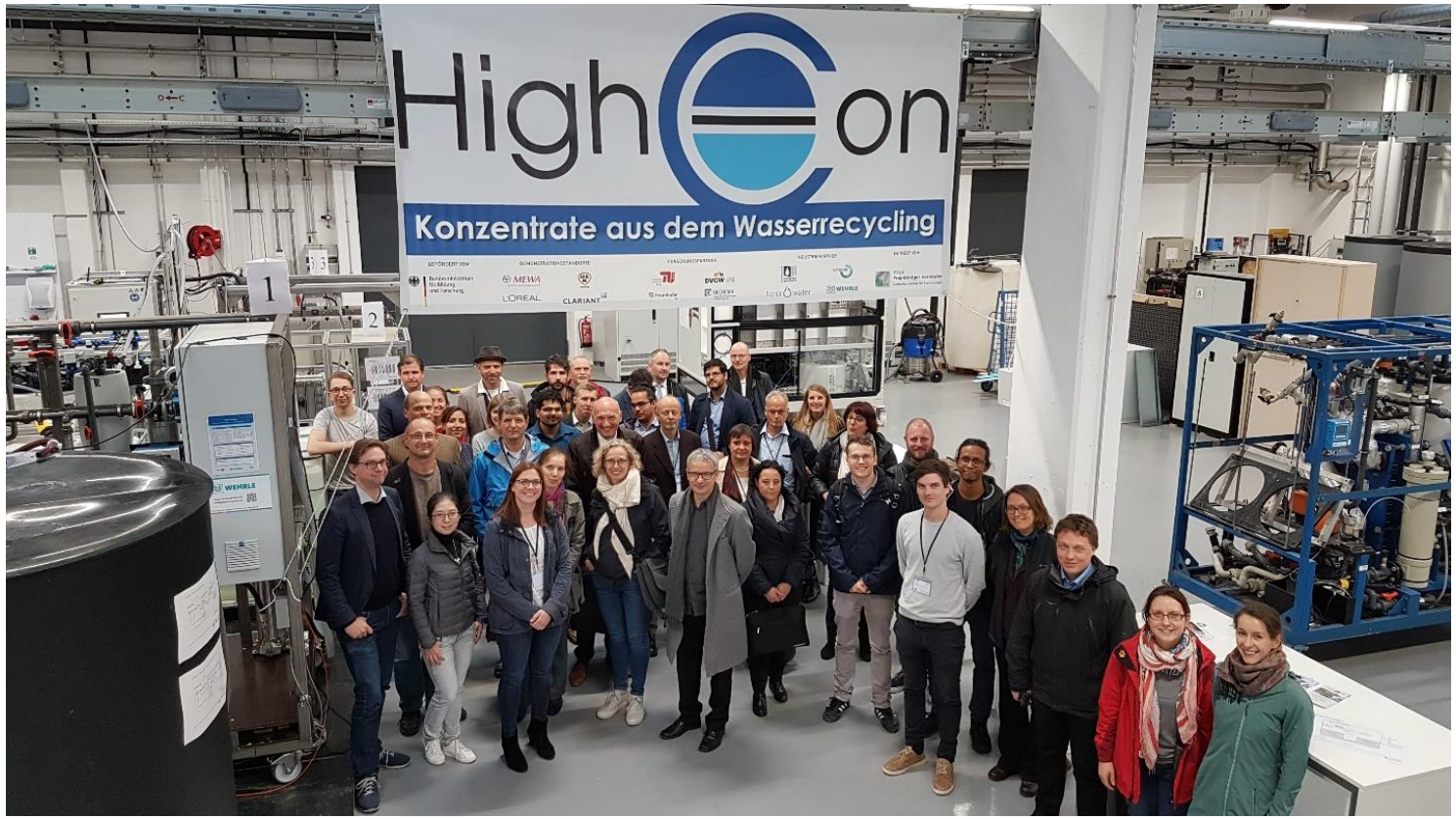
- Pure salt recovery is possible through the HighCon process (separation of organics and salts is necessary)

- Recycling of salts alone will not cover the costs of concentrate treatment (prices for salts ~ 30 – 300 €/t)
- Disposal costs can be reduced
- Water recycling and concentrate treatment may be possible at < 5 €/m³ MBR effluent

- The relief of water bodies with regard to salt loads is possible through ZLD and HighCon
- The sustainability of these processes cannot be assessed conclusively at the moment (there are no usable assessment tools for salt emissions)

- Further investigations are necessary to enable the transfer to other fields of application, e.g.:
  - Concentrates from drinking water production: KONTRISOL
  - Concentrates from cooling water management: WEISS 4.0

Thank you for listening!



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