

intelWATT - Intelligent water treatment technologies for water preservation: Case study 3 presentation

Josipa Lisičar Vukušić, Roxanne Engstler, Sven Johann Bohr, Philip Andrew Davies, Andreas Sapalidis, Stéphan Barbe
Faculty of applied natural sciences, Technische Hochschule Köln (Campus Leverkusen, Germany)

Introduction

- increasing industrial activities result in challenges of water waste treatment methods used to remediate contaminants in the water in order to limit its **environmental impact** [1]
- water demand is increasing due to:
 - the population growth
 - economic development
 - changing consumption patterns
- global water demand has increased by **600%** over the past 100 years [2]

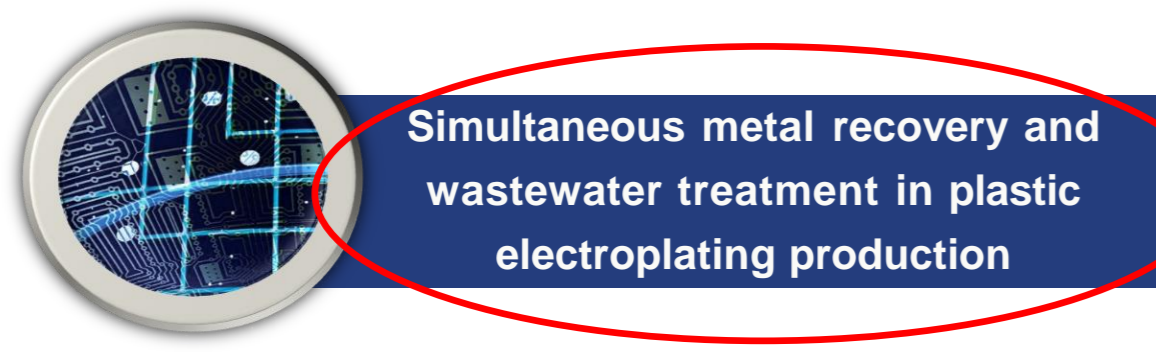
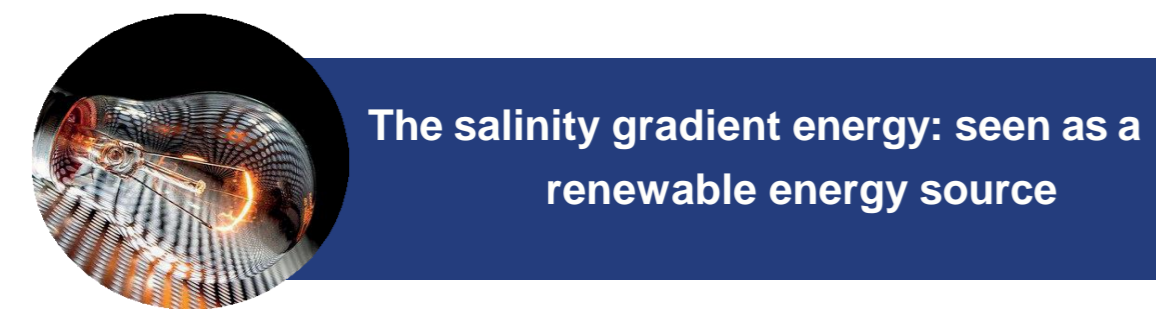


Fig. 1 Three TRL7 case studies

PROJECT intelWATT

- **Horizon 2020 funded project**
- aims to create intelligent water treatment technologies for water preservation combined with simultaneous energy production and material recovery in energy intensive industries (Fig.1)

Case study 3

Simultaneous metal recovery and wastewater treatment in plastic electroplating production

- electroplating industry → one of the most hazardous chemical-intensive industries (wastewater containing **heavy metals**)
- Fig 2. shows typical plating lane consists of treatment and rinsing baths, while Fig. 3 depicts the circular economy approach

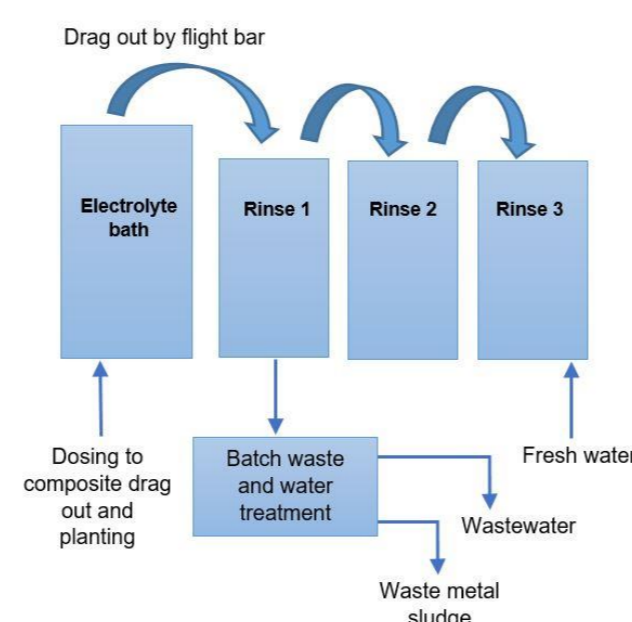


Fig. 2 Typical work flow of a plastic electroplating bath series

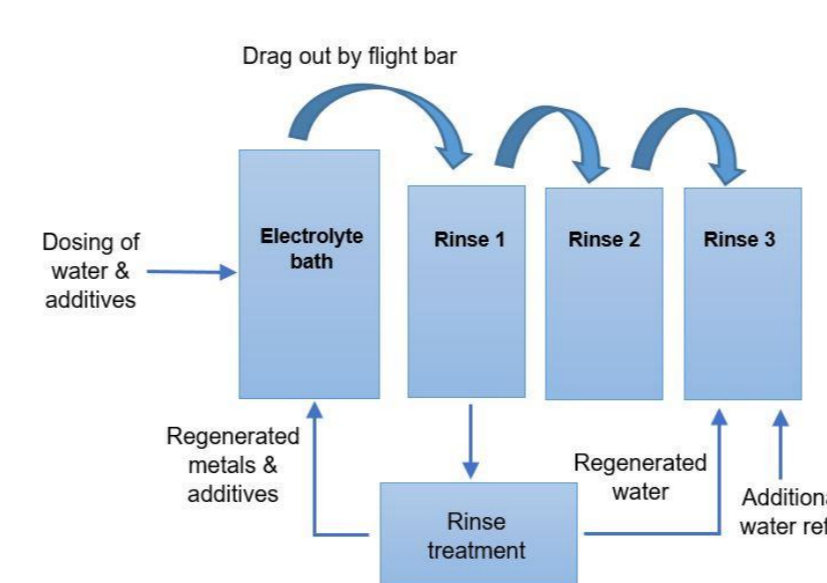


Fig. 3 Proposed approach for the recycling of metal in plastic electroplating

- **Membrane technologies** → increasing interest due to their simplicity, low cost, energy efficiency and ability to fulfill large-scale process requirements [4]

Results

- reverse osmosis membrane (Filmtec SW30-2540, DuPont) was used in the treatment of a diluted Cr(III) electroplating electrolyte → artificial rinse water (0.77 g/L Cr)
- economically relevant fluxes up to 30 L/(m²*h) were investigated
- in the process the chromium concentration in the retained wastewater increased by a factor of 10.92 (8.40 g/L Cr)
- the membrane showed **superior rejection** for Cr (max. 99.96%) and sulphate (max. 99.63%) even at high feed concentrations (Fig. 4)

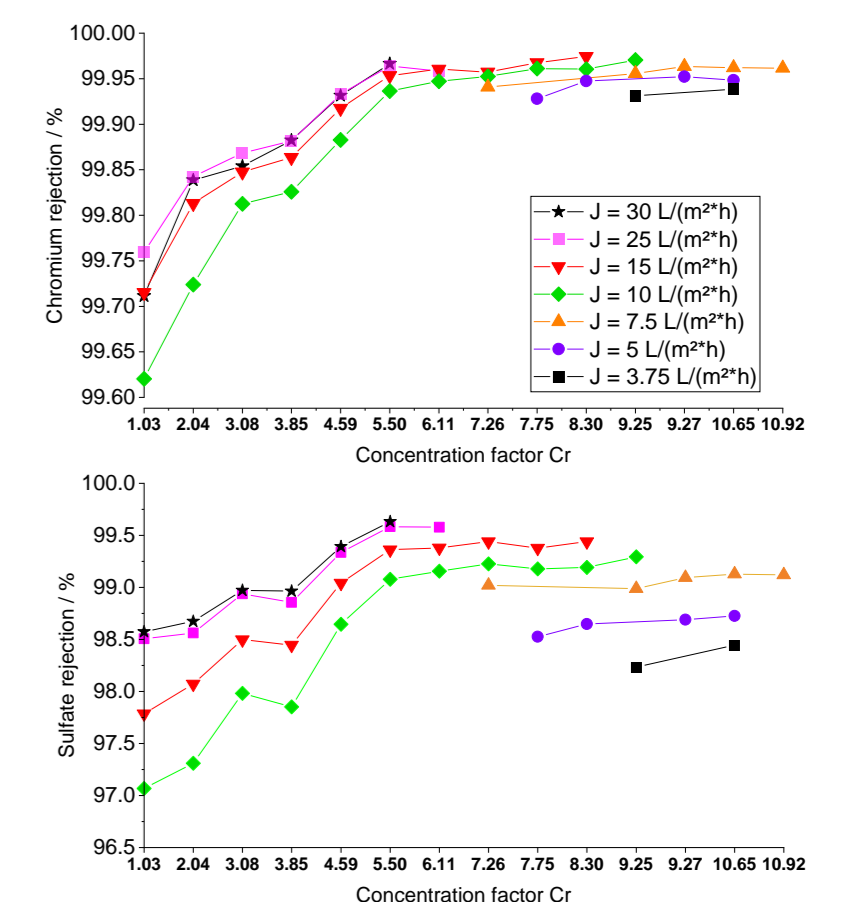


Fig. 4 Chromium and sulphate rejection with increasing concentration in the retentate (concentration factor chromium) and permeate flux [5].

- **Proof of feasibility:** The investigated RO membrane is feasible to treat contaminated wastewater and generate water with minimum contamination. This water can be reused in the plating processes, following a closed-loop approach for fresh water preservation [5].

PARTNERS



CONTACTS

PROJECT COORDINATOR
Andreas Sapalidis
National center for scientific research demokritos, greece
a.sapalidis@im.demokritos.gr

DISSEMINATION MANAGER
Isella Vicini
Warrant Hub s.p.a
isella.vicini@warrantHub.it

References

- [1] Barbera, M., & Gurnari, G. (2018) Wastewater treatment and reuse in the food industry. (1st ed.) Springer Briefs in Molecular Science, (Chapter 1). DOI: 10.1007/978-3-319-68442-0_1
- [2] Boretti, A., & Rosa, L. (2019). Reassessing the projections of the world water development report. *npj Clean Water*, 15 (1-6). DOI: 10.1038/s41545-019-0039-9
- [3] IntelWatt project. (2022). <https://www.intelwatt.eu/> Accessed 08.06.22.
- [4] Srisuwan, G., & Thongchai, P. (2002) Removal of heavy metals from electroplating wastewater by membrane. *Membrane Science and Technology*, 24 (suppl.), 965-976. DOI: 10.1021/ie402387u
- [5] Engstler, R., Reipert, J., Karimi, S., Lisičar Vukušić, J., Heinzler, F., Davies, P., Ulbricht, M., Barbe, S. (2022). A reverse osmosis process to recover and recycle trivalent chromium from electroplating wastewater. *Membranes*. 12(9). DOI: 10.3390/membranes12090853

DETAILS

PROJECT TITLE: Intelligent Water Treatment for water preservation combined with simultaneous energy production and material recovery in energy intensive industries.
START DATE: 01/10/2020
END DATE: 31/03/2024
TOPIC: Preserving fresh water, recycling industrial waters industry
SECTOR: Water technology
EU CONTRIBUTION: 10 308 277.38 Euro

