

Metal recovery by adsorption-desorption from industrial sidestreams

Kokkola Material Week, WaterPRO project
endseminar

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Programme for Sustainable Growth and Jobs

Leverage from
the EU
2014–2020



European Union
European Regional
Development Fund

Metal recovery – not precipitation



Rio Tinto near Huelva, AMD

- Conventional industrial wastewater treatment often includes neutralization by lime, while this method removes potentially harmful metals by coprecipitation with gypsum, we lose valuable metals in a difficult, calciumrich matrix, which will be difficult to rework later
- Initially research was focused on battery chemicals, e.g. on Cu and Co

Adsorbent regeneration

Adsorption not a zero-waste technology

selectivity difficult

opex high due to recurrent buying of fresh adsorbents

Regeneration necessary to reduce waste sludge, reduce costs, and to recover material

Revenue of material/Circular economy

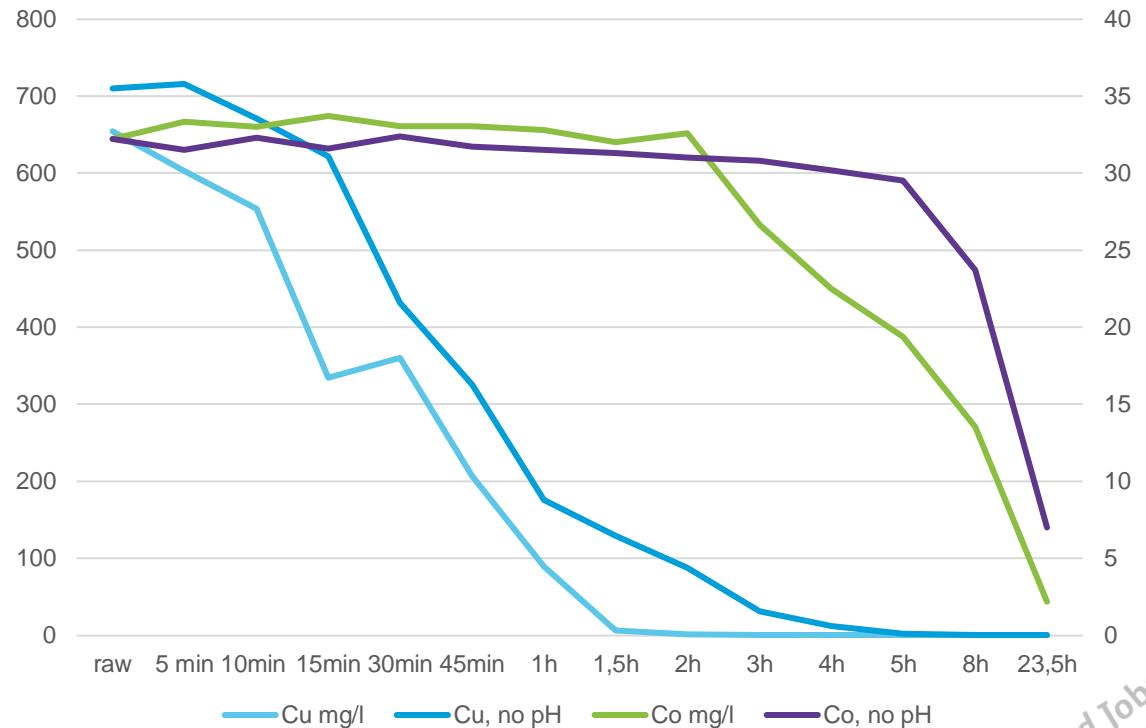
Co 59 500 €/t

Cu 4 400 €/t

We started research with a mine water sample from Zambia

element	mg/l
Co	37,552
Cu	895,05
Mn	105,14
Fe	15,434
Ca	59
Mg	940
K	-
Zn	2,36

Cobalt and Copper selectivity

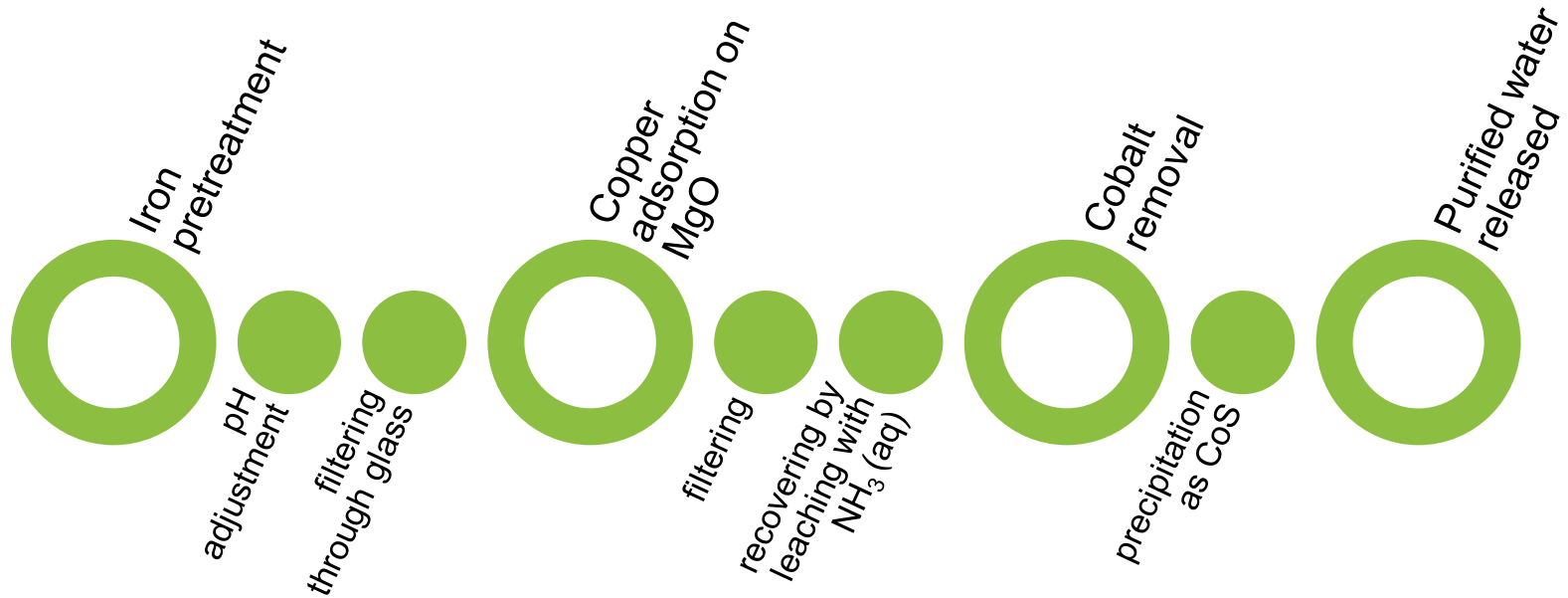


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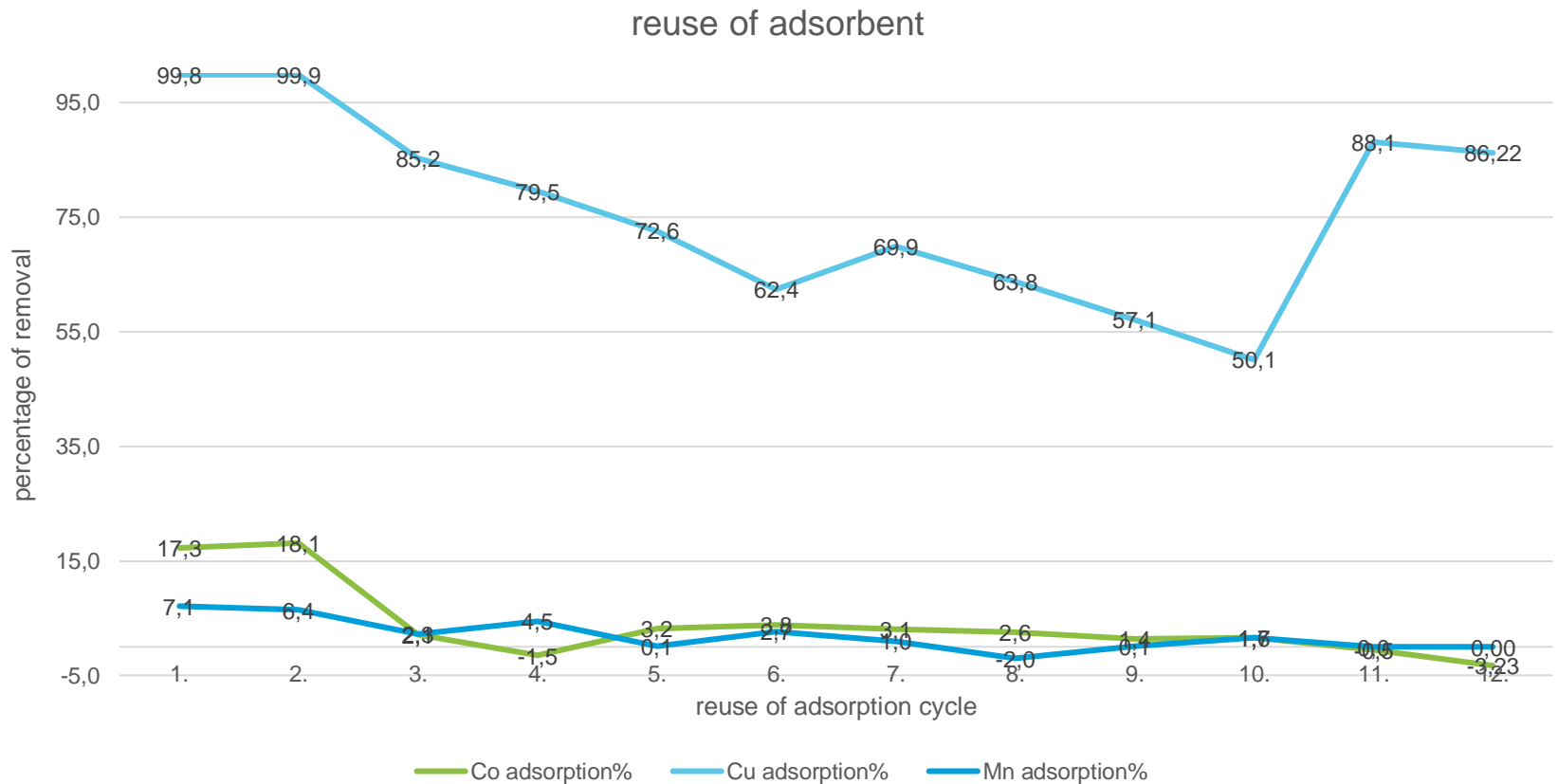
New Treatment Concept, Sambian water



Possible ozonation, filtering through different materials, diatomaceous earth

Possible reuse of adsorbent until saturated, leaching with acid

Adsorbent efficiency after desorption in loop



Pyhäsalmen mine water

Value of metals dissolved, Co, Cu, Zn
= 1,09 €/m³



element mg/l	
Al	370
Ca	390
Cd	1
Co	1
Cu	29
Fe	350
Mg	690
Mn	27
Ni	1
Zn	370

Iron removal a bit more problematic....

	Zn mg/l	Cu mg/l	Mn mg/l	Fe mg/l
Raw water pH 2	340	28,6	26,4	153,05
pH5 + filtr	315	11,6	25	7,613
adsorption	295	0,36	23,6	3,2738

	Zn mg/l	Cu mg/l	Mn mg/l	Fe mg/l
Raw water pH2	320	27,2	28,4	154,1
pH5 + filtration	310	12,6	11,8	6,744
1. adsorption	275	0,49	10,2	2,578
2. adsorption	0,08	0	0	2,716

More tests!

pH adsorption
with dolomite
Cu remains at
same
concentration

	pH	Cu	Zn	Fe
Raw water	n.2	28,6	455	176,14
dolomite1 g/l	3,06	28,6	430	166,14
Dolomite 5 g/l	3,24	28,8	430	77,6
Dolomite 10 g/l	3,76	28,2	460	7,545

Can we also remove Zinc?

	Fe mg/l	Cu mg/l	Zn mg/l	Mn mg/l
raw	314	28,2	352	29,6
1. ads	0,75	15,8	356	32,2
2. ads	0,01	0,3	285	32,6
3. ads	0,01	0,06	0,03	2,1

- 1.ads: poltettu dolomiittiraetta 10g/l eli 5g, sekoitus hitaalla 2h, suodatus, analyysit
- 2.ads: suodatettu ps vesi 400ml ja 1 g/l MgO eli 400mg, sekoitus 2h, suodatus, analyysit
- 3.ads: suodatettu ps vesi 300ml ja 5g/l MgO eli 1,5g, sekoitus 24h, suodatus, analyysit

Ready for piloting! Waiting for results :-D

