

We build the
FACTORY
of the **FUTURE**

TRATAMIENTO DE EFFLUENTES PROVENIENTES DE LA LIMPIEZA DE GASES EN PLANTAS DE ACIDO SULFURICO DE FUNDICIONES DE COBRE.

Dr.-Ing. Jochen Schumacher, Paul Nador

24. October 2018

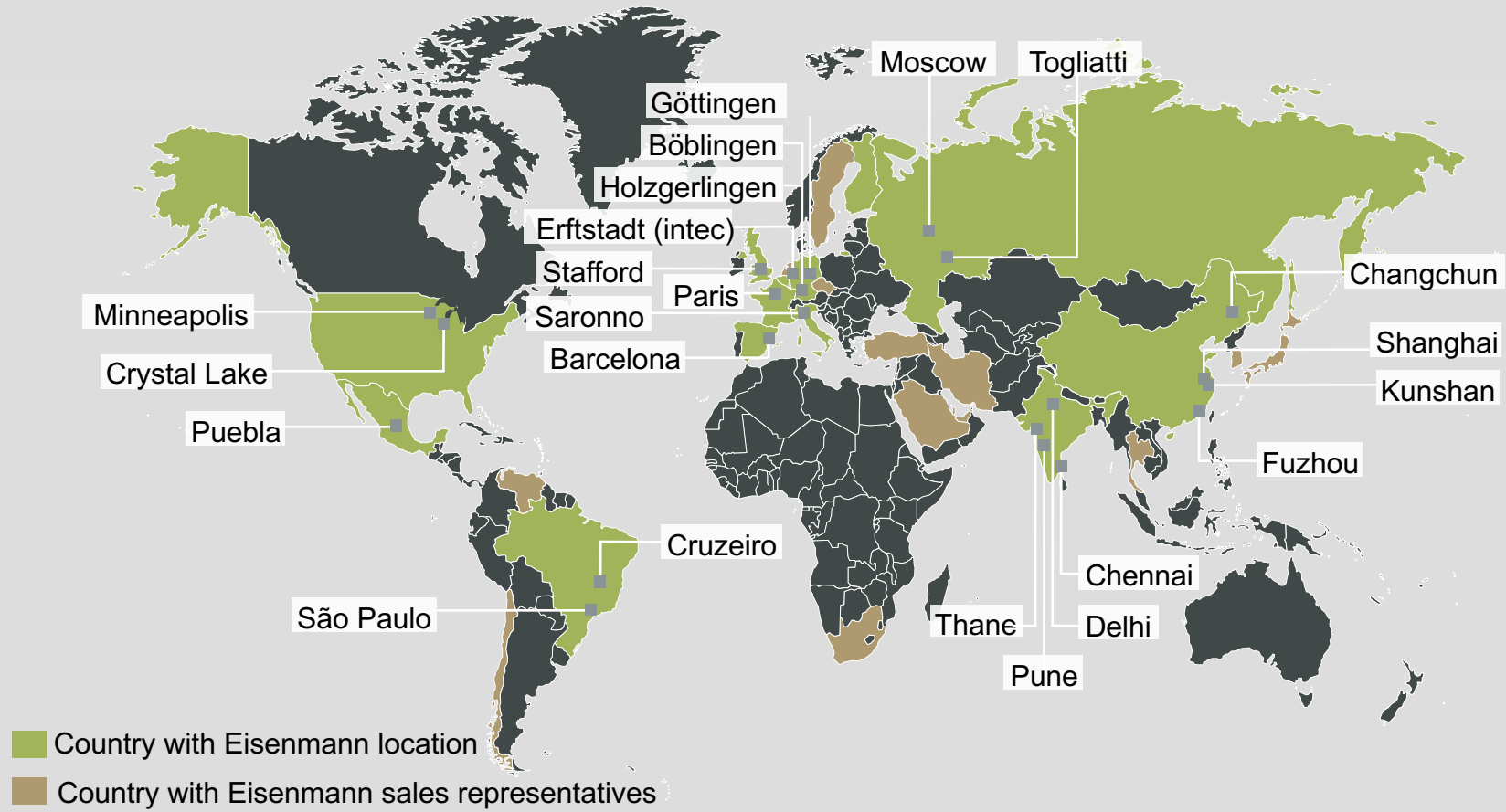
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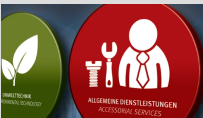
Empresa Eisenmann

- ➔ No.1 in the world market for paint shops for plastic parts
- ➔ No.1 in the world market for ammunition disposal plants
- ➔ € 862 million in sales revenue in 2016
- ➔ More than 1,500 engineers and technicians
- ➔ 3,200 employees (2016)
- ➔ 25 locations worldwide

Locación



Productos

	<p>AUTOMOTIVE SYSTEMS</p>	<p>Surface finishing, end assembly lines, conveyor system for shell construction</p>
	<p>APPLICATION & ROBOTICS</p>	<p>Application, robotics, paint supply</p>
	<p>ENVIRONMENTAL TECHNOLOGY</p>	<p>Exhaust air purification, waste water treatment, waste disposal and recycling, munition disposal, biogas plants, energy from biomass</p>
	<p>THERMAL SOLUTIONS</p>	<p>Heat treatment plants from automotive lightweight materials, production of carbon fibers, high-temperature plants for high-performance ceramics, enameling systems as well as pretreatment & coating systems</p>
	<p>CONVEYOR SYSTEMS</p>	<p>Complete solutions for intralogistics, electrified monorail systems, RGV conveying systems, LogiMover</p>
	<p>SERVICE</p>	<p>Classic customer service, plant modernization and optimization, customized solutions, full service, BOT models</p>

Ingeniería ambiental

EXHAUST AIR PURIFICATION

All exhaust air purification processes from one source



WATER TREATMENT & WASTE WATER TREATMENT

Waste water treatment and process water treatment; the correct process for every single application



WASTE DISPOSAL & RECYCLING

All processes for the thermal disposal of waste material and recycling



ADVANCED OXIDATION TECHNOLOGIES

Wet oxidation plants based on our FENTOX and UV-FENTOX Processes



MUNITION DISPOSAL

Turn-key systems for the disposal of conventional and chemical combat agents

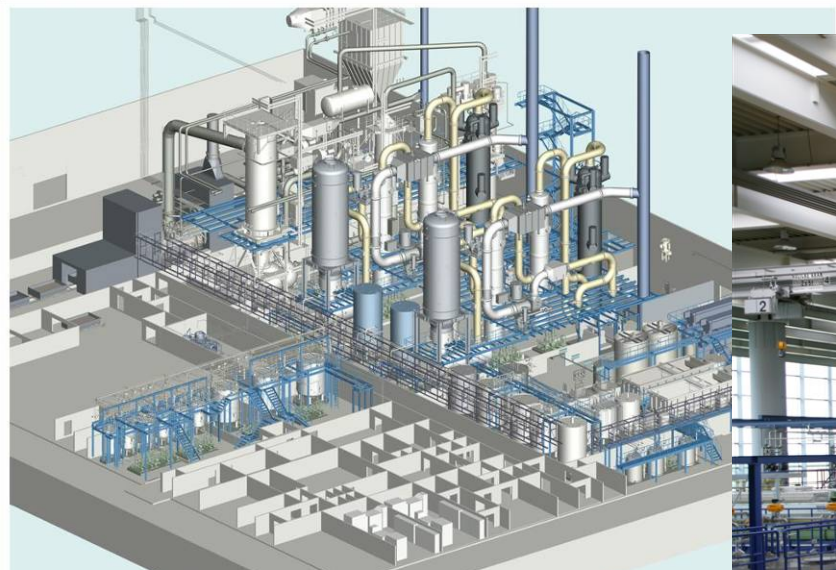


ANAEROBIC TREATMENT

Production of electricity, purified biogas and heat from organic waste material and organic liquids.



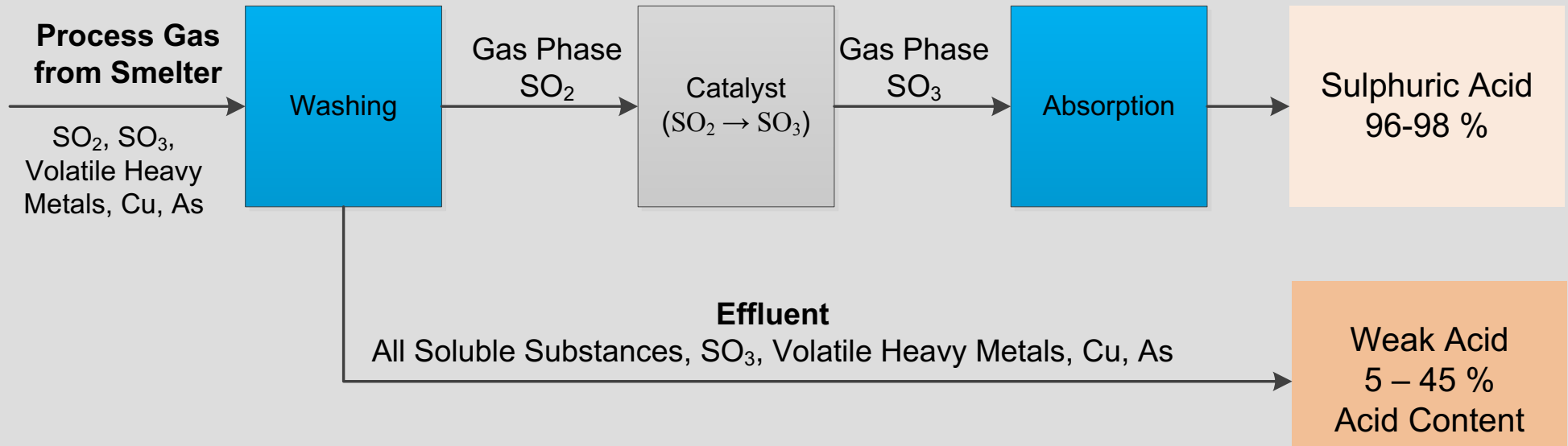
Ingeniería Ambiental – Destrucción de las Armas Químicas



*Incineration of toxic liquids
(f.e. chemical ammunition)
with water treatment system
Potchep, Russia*



Ácidos Débiles en el Proceso de Fundiciones de Cobre.



Característica de Ácidos Débiles

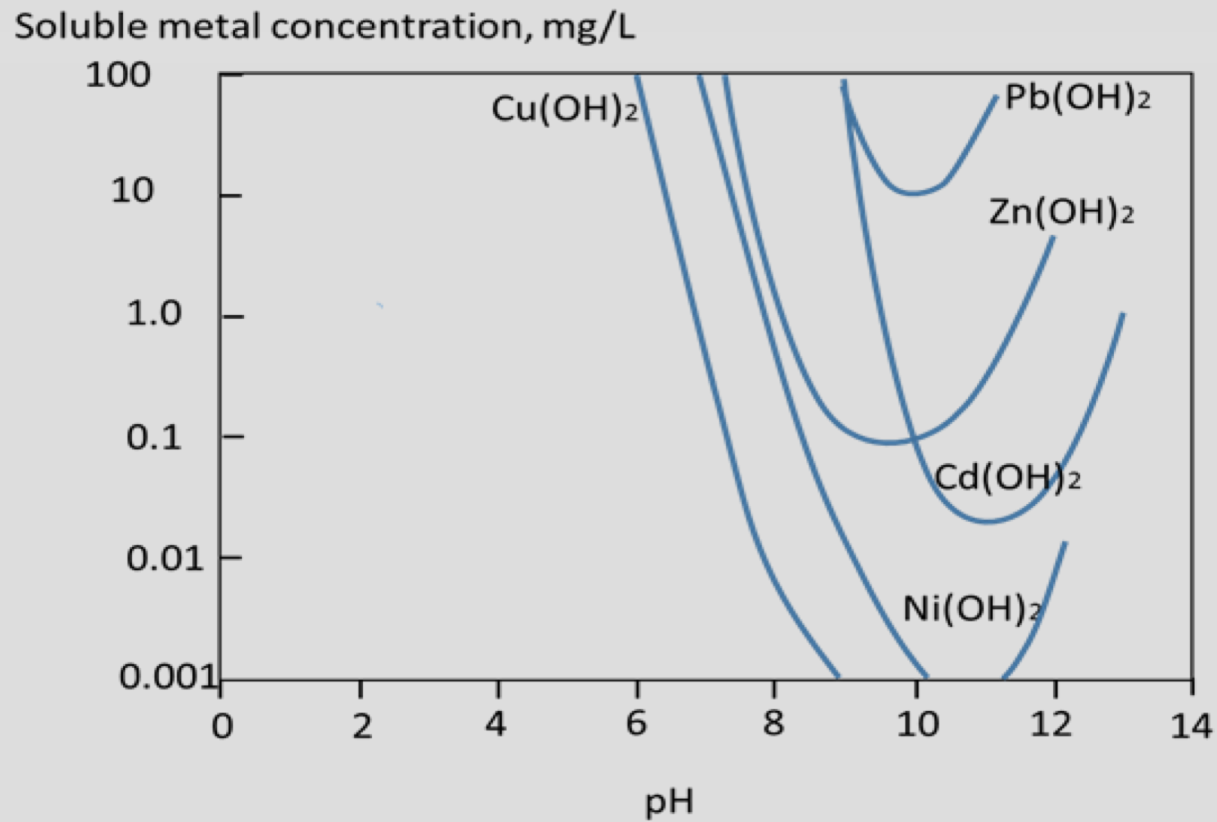
H₂SO₄ Concentration: 5-45 %

Cu-Concentration: 0.3-10 g/L

As-Concentration: 1-18 g/L

Other Heavy Metals: Fe, Zn, Cd, Mo, Pb

Precipitación Hidróxido – Leche de Cal – (Soda Cáustica)

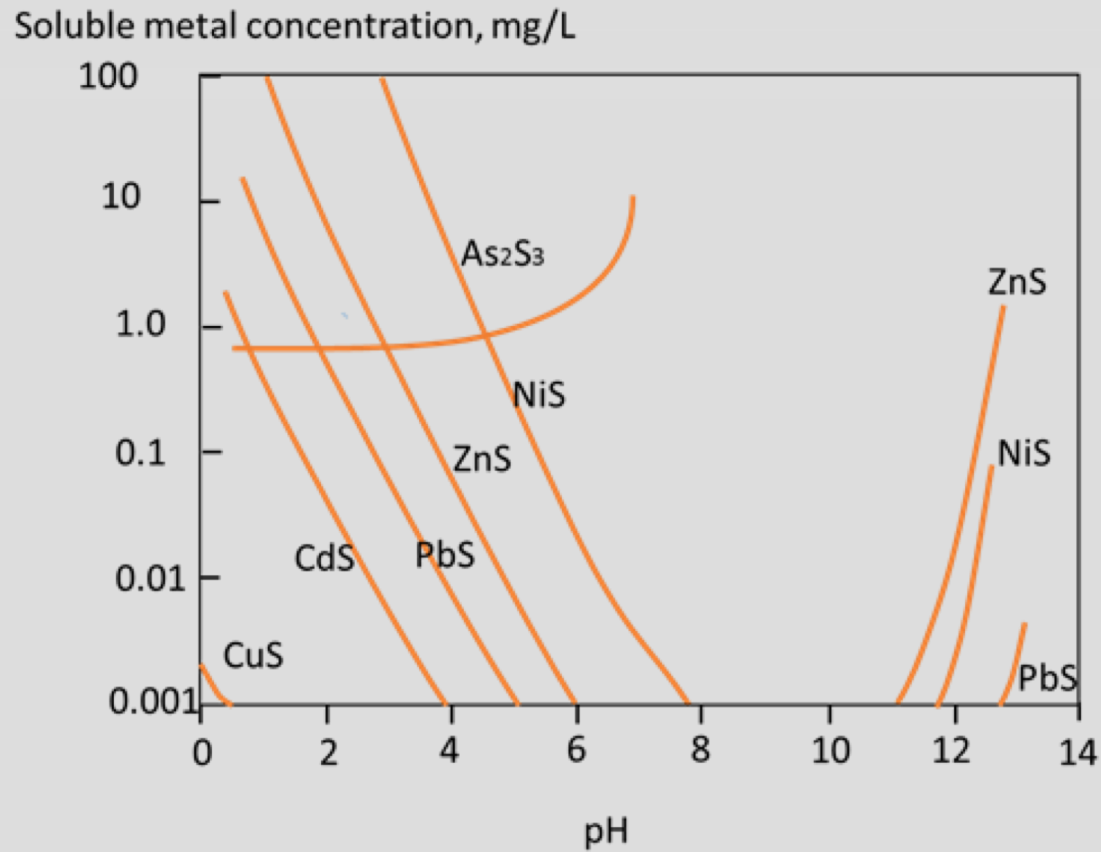


Destino de los Sustancias Mientras Precipitación Hidróxido

H₂SO₄ Concentration:	5-45 %	Gypsum - Yeso
Cu-Concentration:	0.3-10 g/L	Cu(OH)₂
As-Concentration:	1-18 g/L	Fe(AsO₃)
Other Heavy Metals:	Fe, Zn, Cd, Mo, Pb	M(OH)_x

**Producto de la precipitación hydroxido:
Yeso contaminado de arsénico y metales**

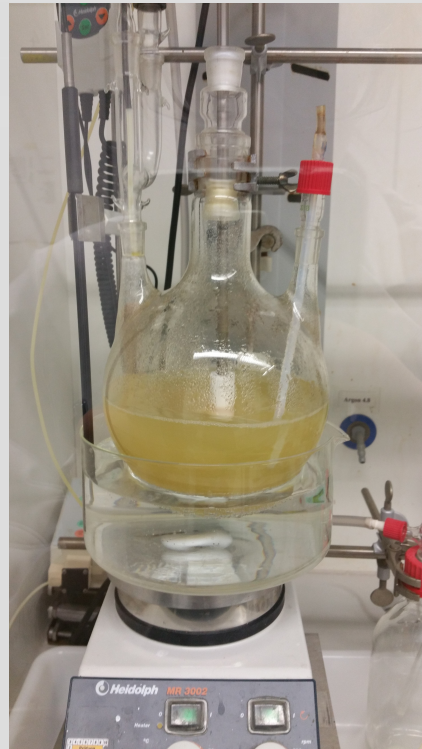
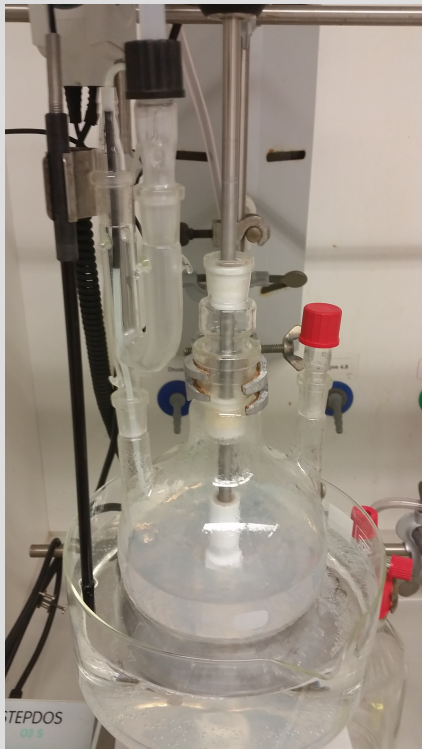
Precipitación Sulfurada – Sodio hydrogen sulfuro



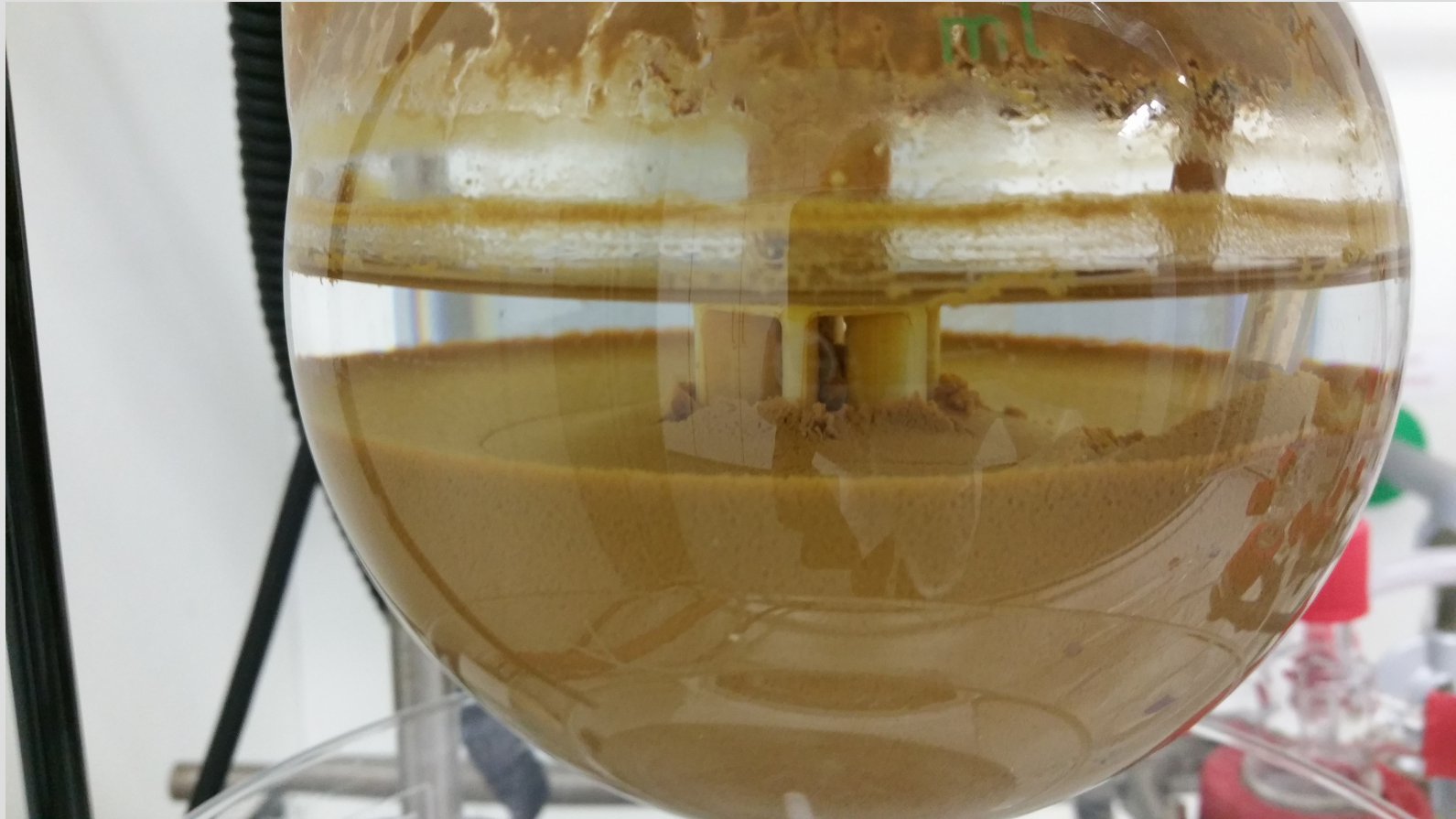
Experimentos



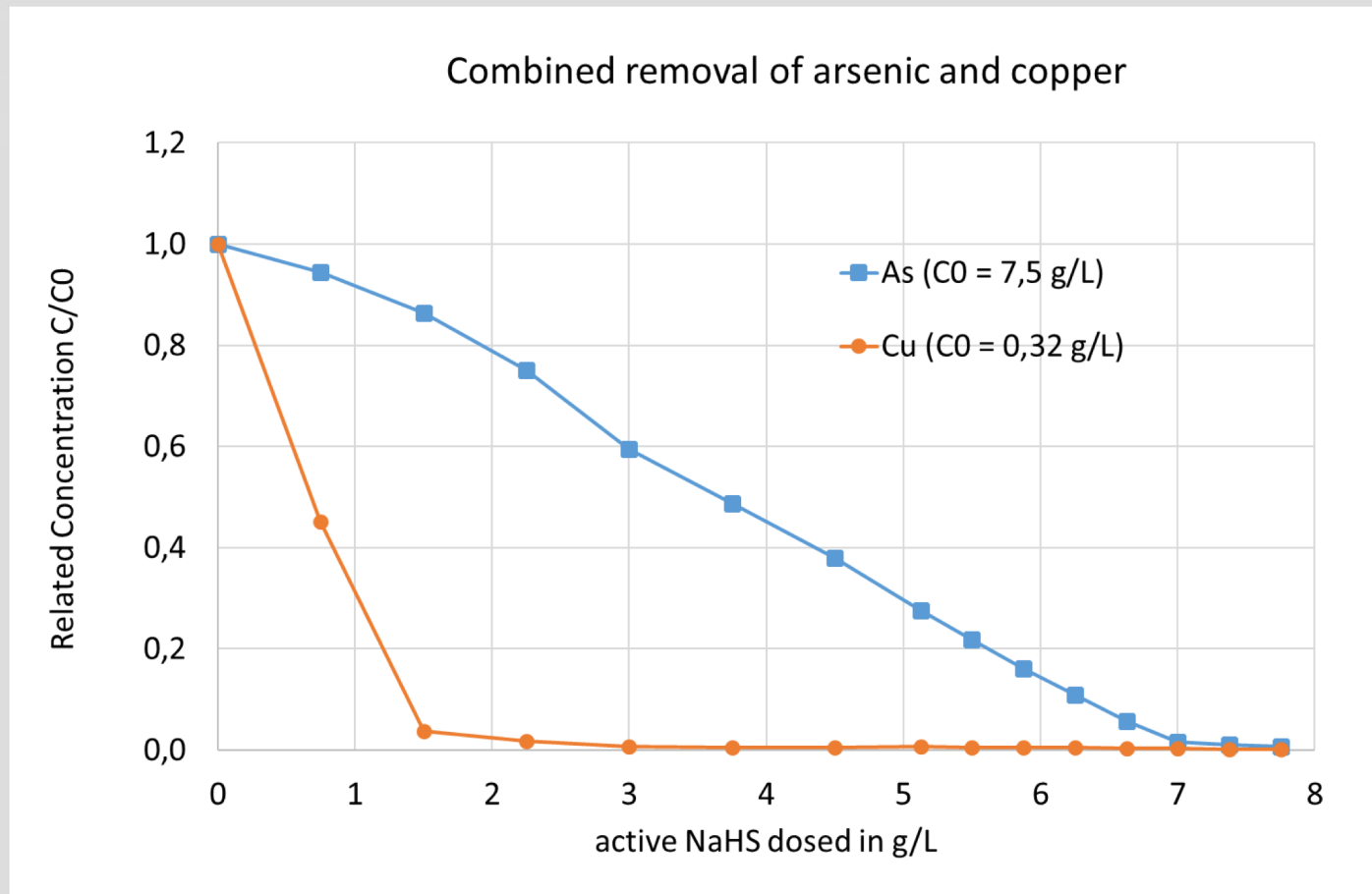
Experimentos



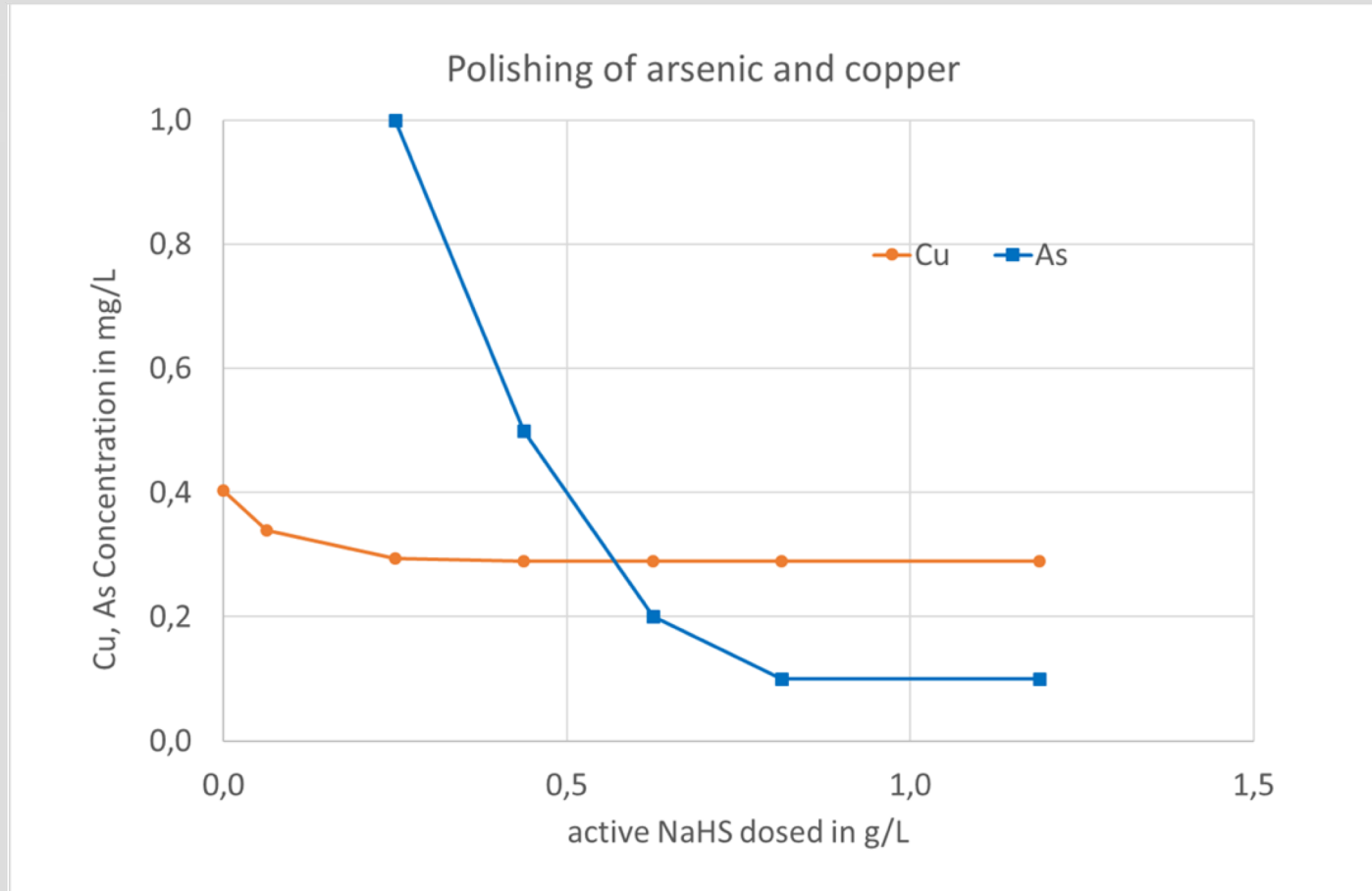
Experimentos



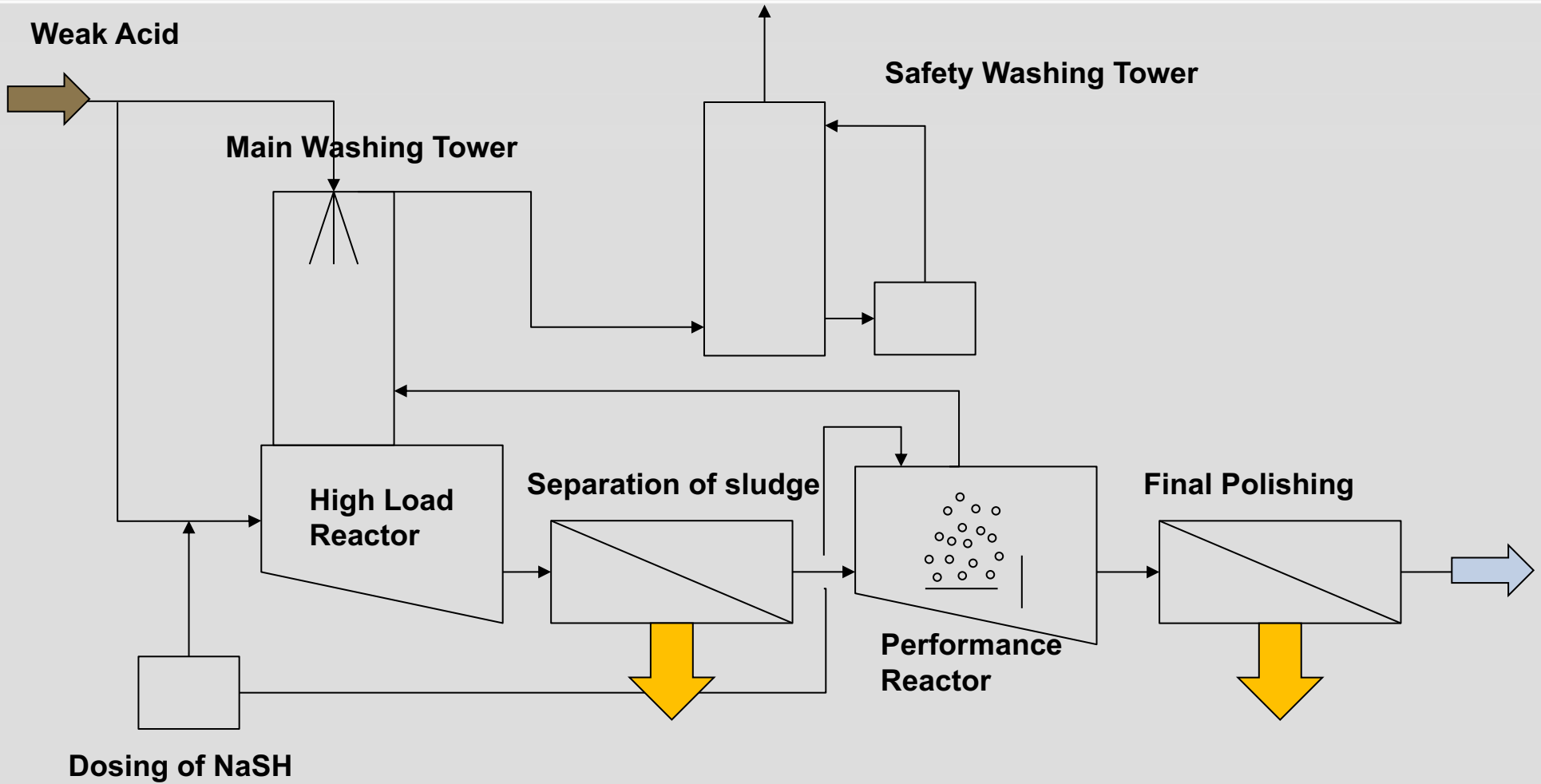
Reducción de Arsénico y de Cobre



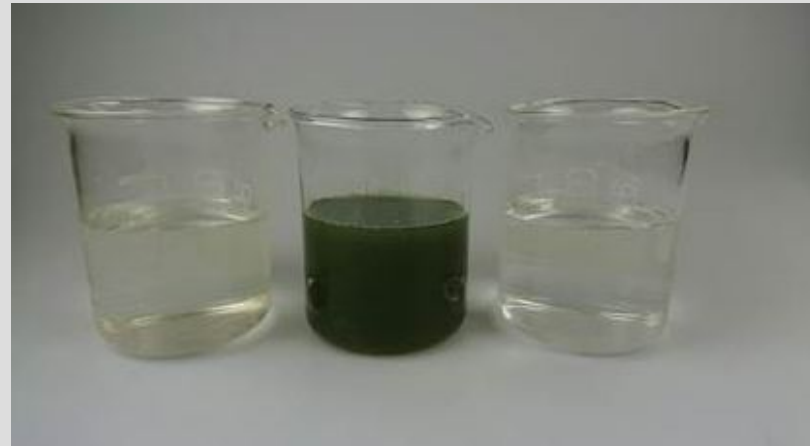
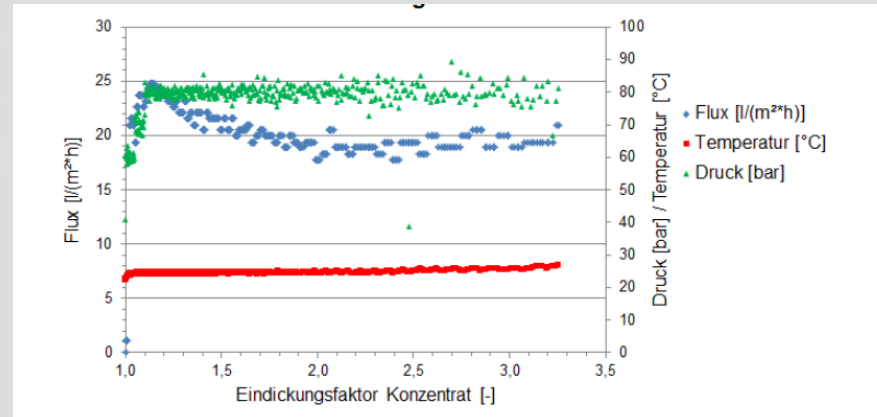
Reducción de Arsénico et de Cobre



Proceso REMAS



Proceso REMAS - POL



Reduction of Iron, Zinc, Nickel, Cadmium by > 90 % in one treatment step

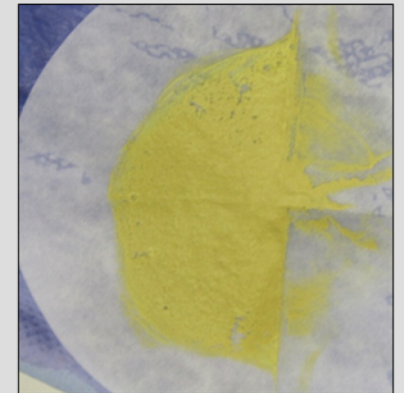
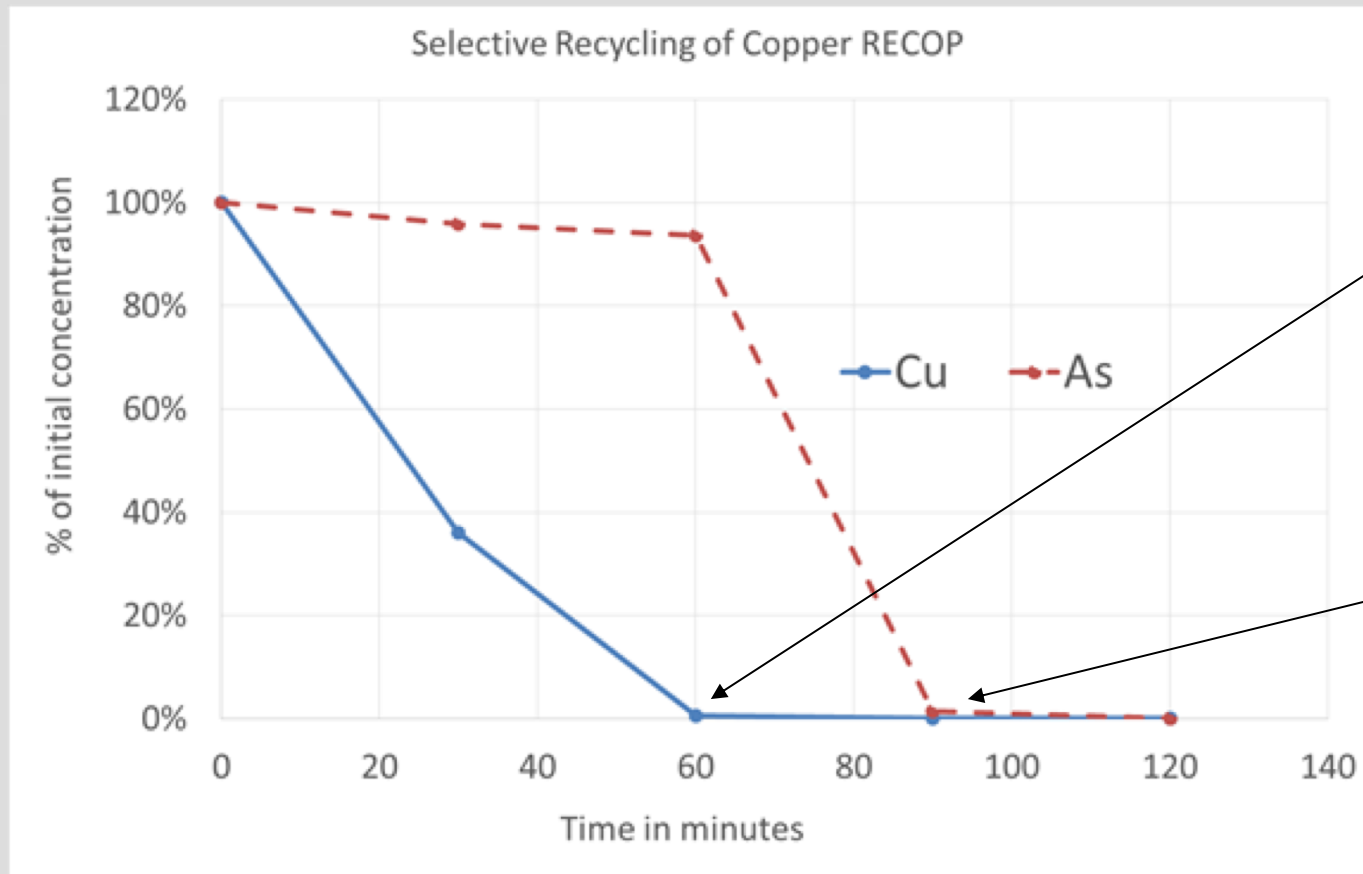
Proceso REMAS - PLUS



Proceso REMAS - PLUS



Proceso RECOP



Proceso RECOP

Copper recycling

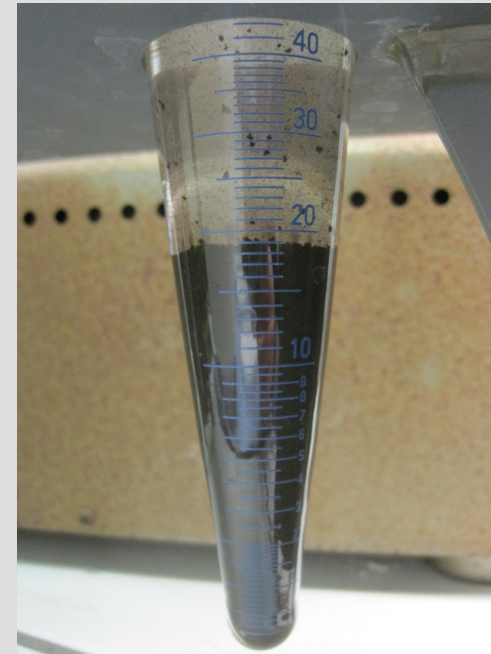
Cu-Content : 90-100 % of Load

As-Content : 0-10 % of Load

Output :

Cu-Content : ≈ 40 % DS

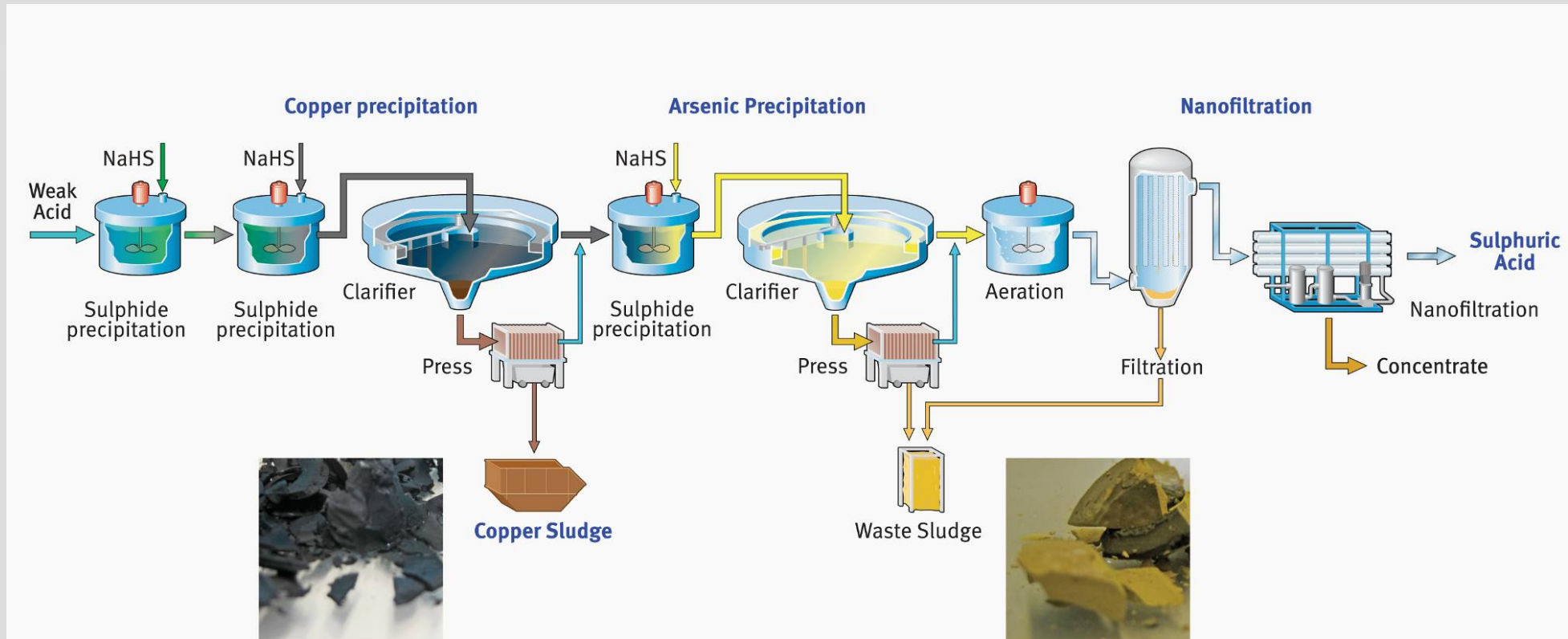
Note: Cu in Cu-Ore : 1,5 – 3 %
(or less)



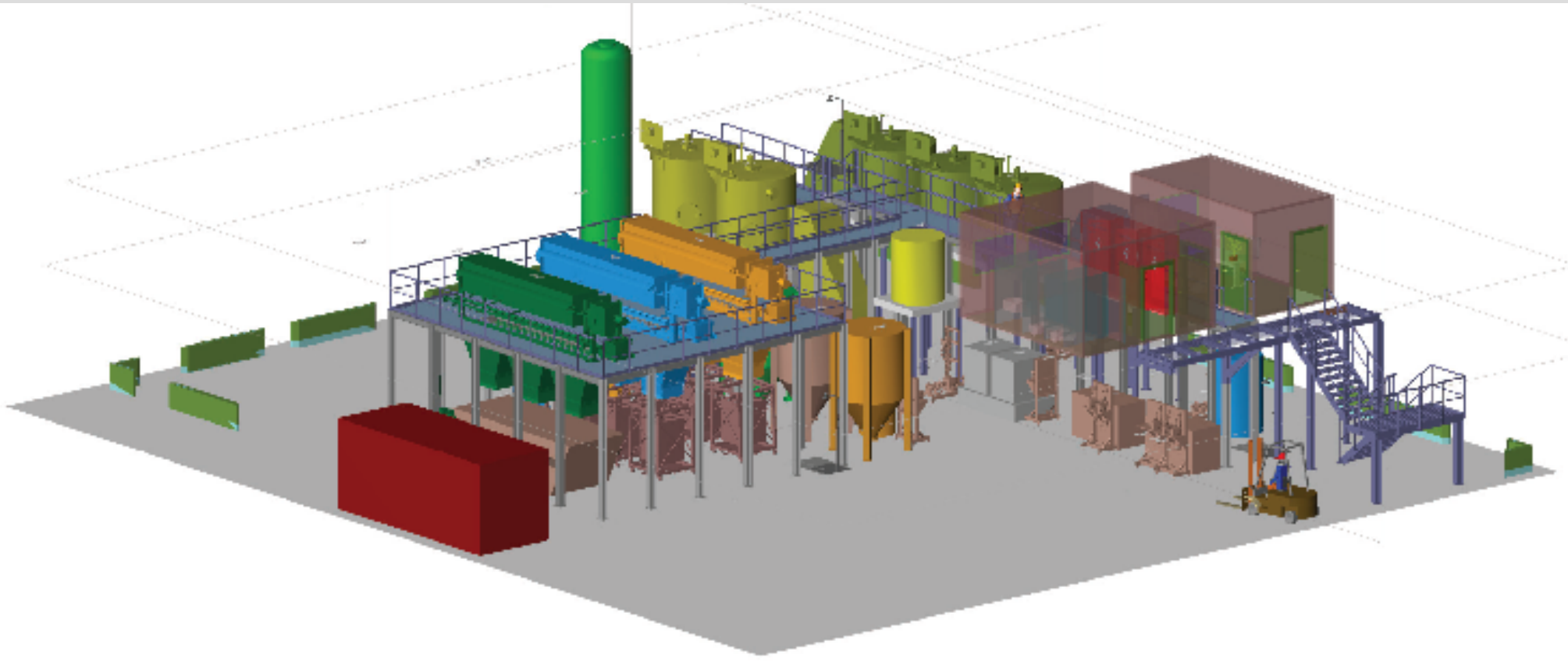
Transformación de desechos en fracciones con valor!

H₂SO₄ Concentration:	5-45 %
Recycable Fraction	Value: 5 - 10 US\$/t
Cu-Concentration:	0.3-10 g/L
Recycable Fraction	Value: 500 - 2.000 US\$/t
As-Concentration:	1-18 g/L
Waste Fraction	Disposal Cost: 10 -280 US\$/t
Other Heavy Metals:	Fe, Zn, Cd, Mo, Pb
Recycable Fraction/ Waste	Disposal Cost: 10-280 US\$/t

Precipitación Sulfurada – Recuperación de Ácido Sulfúrico y Cobre



Precipitación Sulfurada – Recuperación de Ácido Sulfúrico y Cobre



Comparación de OPEX:

Debit: 4 ton/h, 20% Acido, 2 g/L cobre

Reduction of sludge volume

Hydroxide precipitation	20,000 tons/a
Sulfide precipitation	1,100 tons/a
Difference	18,900 Tons/a

Annual savings for disposal (150 USD/t) **2.84 Mio USD**

Reduction of costs for chemicals

Hydroxide precipitation	5,000 tons/a	Ca(OH) ₂ @ 200 USD/t
Sulfide precipitation	260 tons/a	NaSH @ 800 USD/t

Annual savings for chemicals **0.79 Mio USD**

Comparación de OPEX:

Debit: 4 ton/h, 20% Acido, 2 g/L cobre

Recovery of Acid

Sulfuric Acid

33,600 tons/a

Annual savings (10 USD/t)

0.32 Mio USD

Recovery of Copper

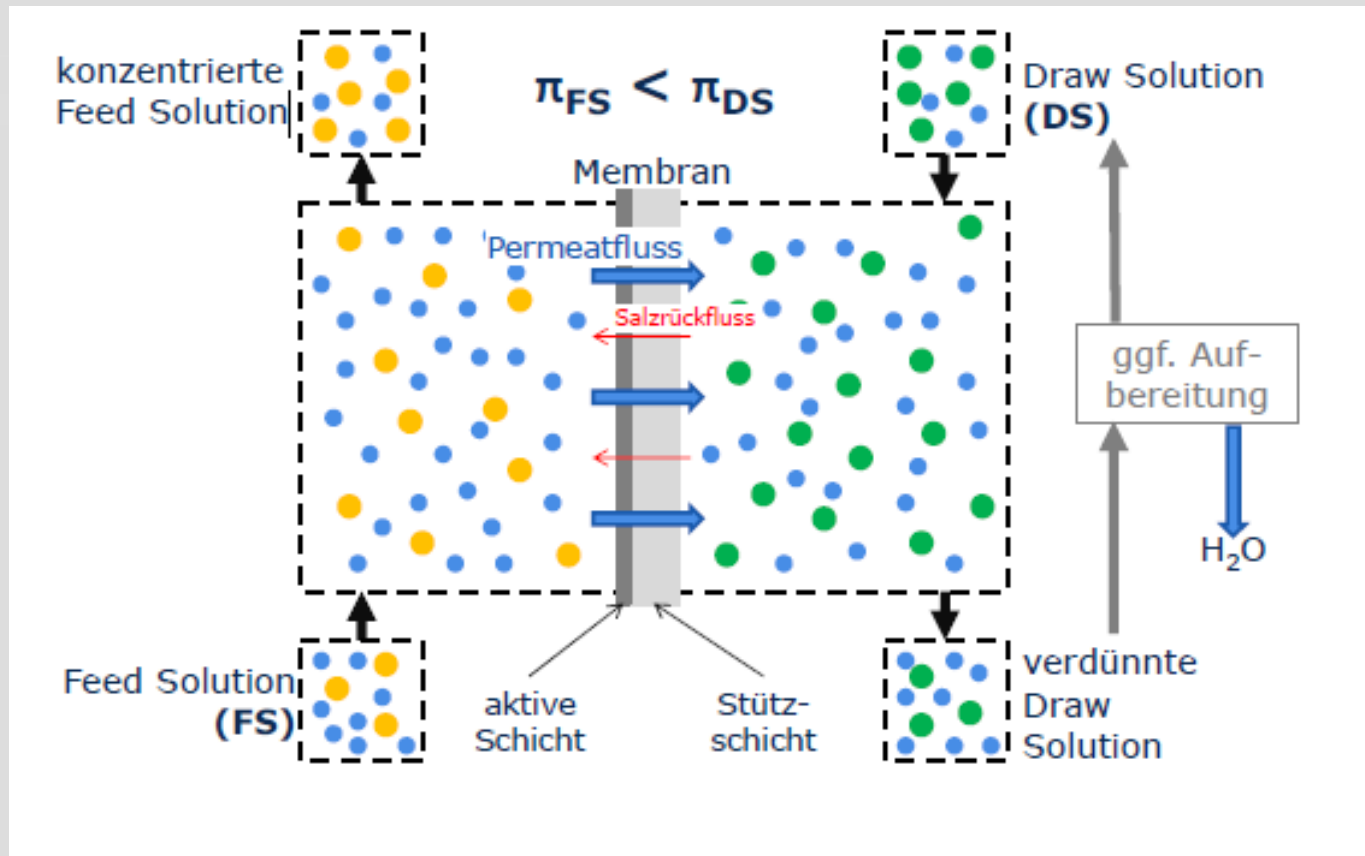
Copper (100%)

165 tons/a

Annual savings (1500 USD/t)

0.25 Mio USD**Total Annual Savings: 4.55 Mio. USD**

Perspectiva futuro: Ninguna Descarga Liquida (ZLD)



Eisenmann References CP

Process	Toxic components	Customer	Country	Capacity
C/P + Sulphide	Heavy metals	Barth, Oberursel	Germany	3 m ³ /h
C/P + Sulphide	Heavy metals	Schwann-Bagel, Mönchengladbach	Germany	5 m ³ /h
C/P + Sulphide	Heavy metals	Schäfer, Neunkirchen	Germany	6 m ³ /h
C/P + Sulphide	As, Heavy metals	Auswärtiges Amt, Kambarka	Russia	10 m ³ /h
C/P + Sulphide	Heavy metals	Solidor, Dresden	Germany	10 m ³ /h
C/P + Sulphide	Heavy metals	Ford, St. Petersburg	Russia	15 m ³ /h
C/P + Sel. Ionexch.	Heavy metals	Prym, Stolberg	Germany	20 m ³ /h
C/P + Sulphide	Heavy metals, Ni	Porsche, Stuttgart	Germany	24 m ³ /h
C/P	Sulfate	Hagen Batterie, Kassel	Germany	25 m ³ /h
C/P + Flotation	Oil, Solvents	Mewa, Rodgau	Germany	30 m ³ /h
C/P	Heavy metals	Salzgitter, Watenstedt	Germany	40 m ³ /h
C/P	Phosphate	Degussa, Wesseling	Germany	50 m ³ /h
C/P + UF + Sel. IX	Heavy metals, Oil	Opel, Bochum	Germany	50 m ³ /h
C/P + Sulphide	Pb	Varta, Hagen	Germany	50 m ³ /h
C/P	Sulfate, Phosphate	AW, Potschep	Russia	60 m ³ /h
C/P + UF	Heavy metals, Oil	GM, Zaragoza	Spain	60 m ³ /h
C/P	Cr, Heavy metals	Stahlwerke, Salzgitter	Germany	60 m ³ /h
C/P + Sulphide	Cr, Zn, Phosphate, Oil	Nedcar, Born	Netherlands	70 m ³ /h
C/P	Heavy metals, Oil	Autoeuropa, Palmela	Portugal	75 m ³ /h
C/P + Evaporator	Heavy metals, Oil	Sko, Energo, Mlada Bol.	Cheque Republic	100 m ³ /h
C/P + Flotation	Oil	Opel, Rüsselsheim	Germany	140 m ³ /h
C/P + Biology	Cr, F, Organic	Philips, Hranice	Cheque Republic	160 m ³ /h
C/P + UF	Heavy metals, Cr, Oil	SEAT, Barcelona	Spain	160 m ³ /h
C/P Coagulation	Heavy metals, Paint	BMW, Landshut	Germany	570 m ³ /h
C/P Coagulation	Heavy metals, Paint	Peguform, Bötzingen	Germany	2000 m ³ /h

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