

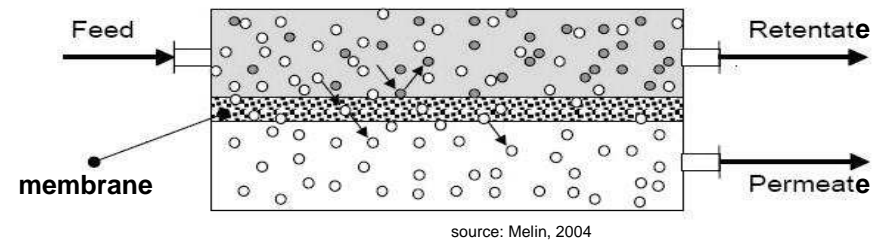


Sulfatabreicherung mittels Nanofiltration

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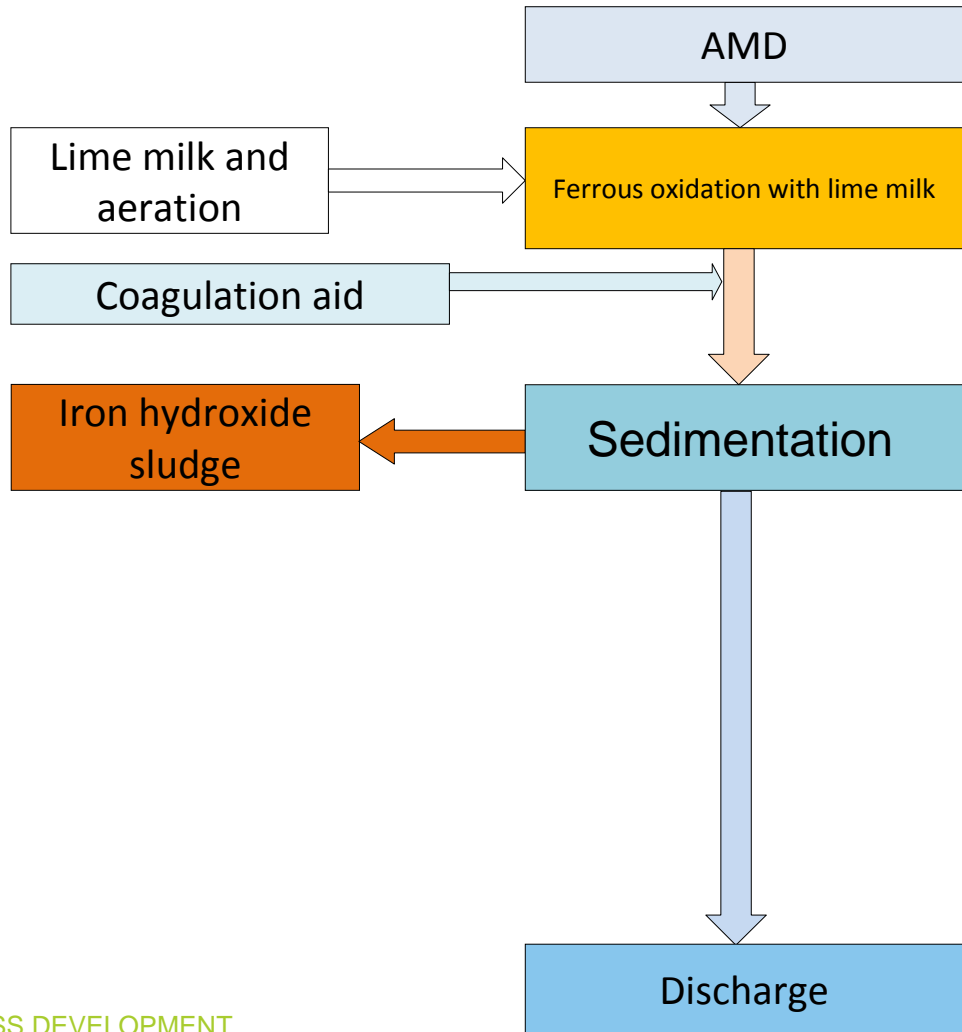
NANOFILTRATION

- high retention of multivalent ions by nanofiltration
- typical pressure range 3 – 30 bar
- regular cross-flow-filtration: discharge of salt-rich retentate → not possible
- typical mine water quality implies problems by scaling



Parameter	Sample value	Parameter	Sample value
pH	7.67	Sodium, mg/l	15.2
Electrical conductivity, $\mu\text{S}/\text{cm}$	2,760	Potassium, mg/l	8.9
Temperature, $^{\circ}\text{C}$	21	Magnesium, mg/l	97
Alkalinity, mmol/l	2.57	Calcium, mg/l	605
Silicate, mg/l	6.3	Iron, mg/l	0.3
Chloride, mg/l	10.4	Manganese, mg/l	1.4
Sulphate, mg/l	1,850	TOC, mg/l	6.8

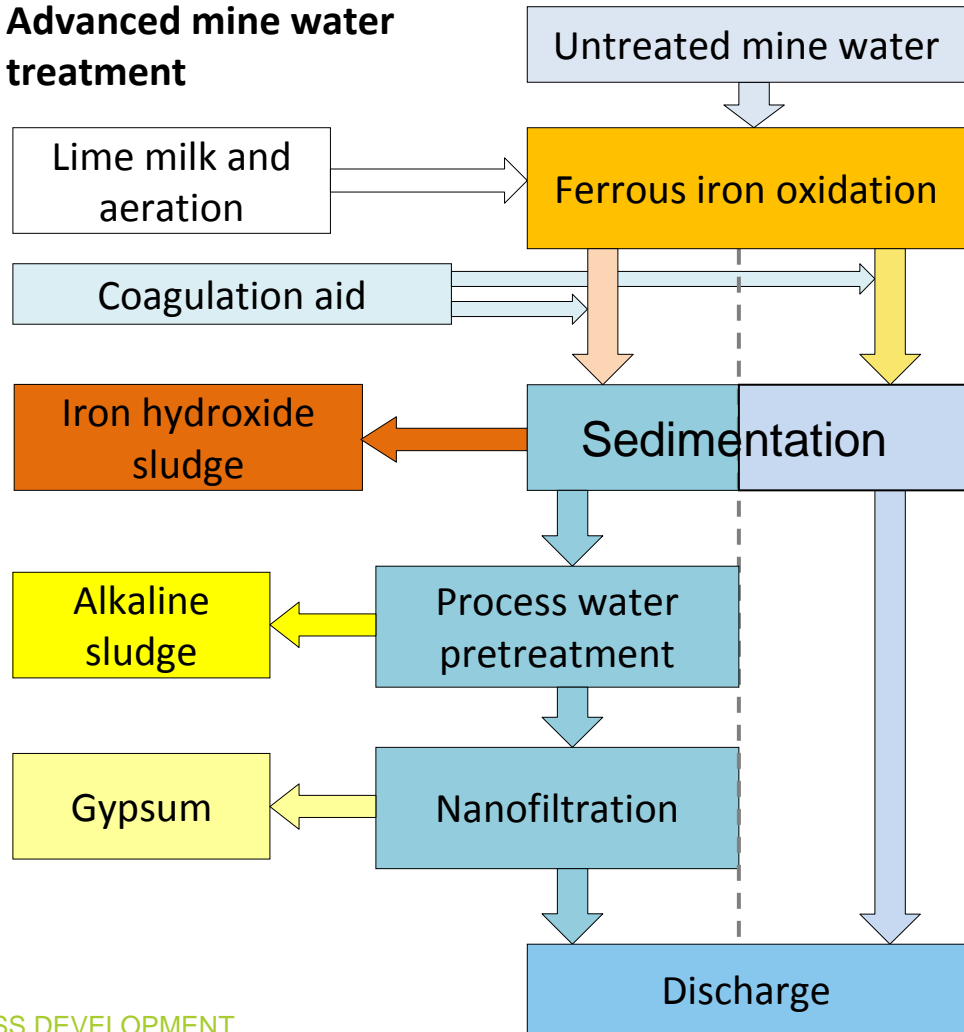
TREATMENT STEPS



Conventional mine water treatment

TREATMENT STEPS

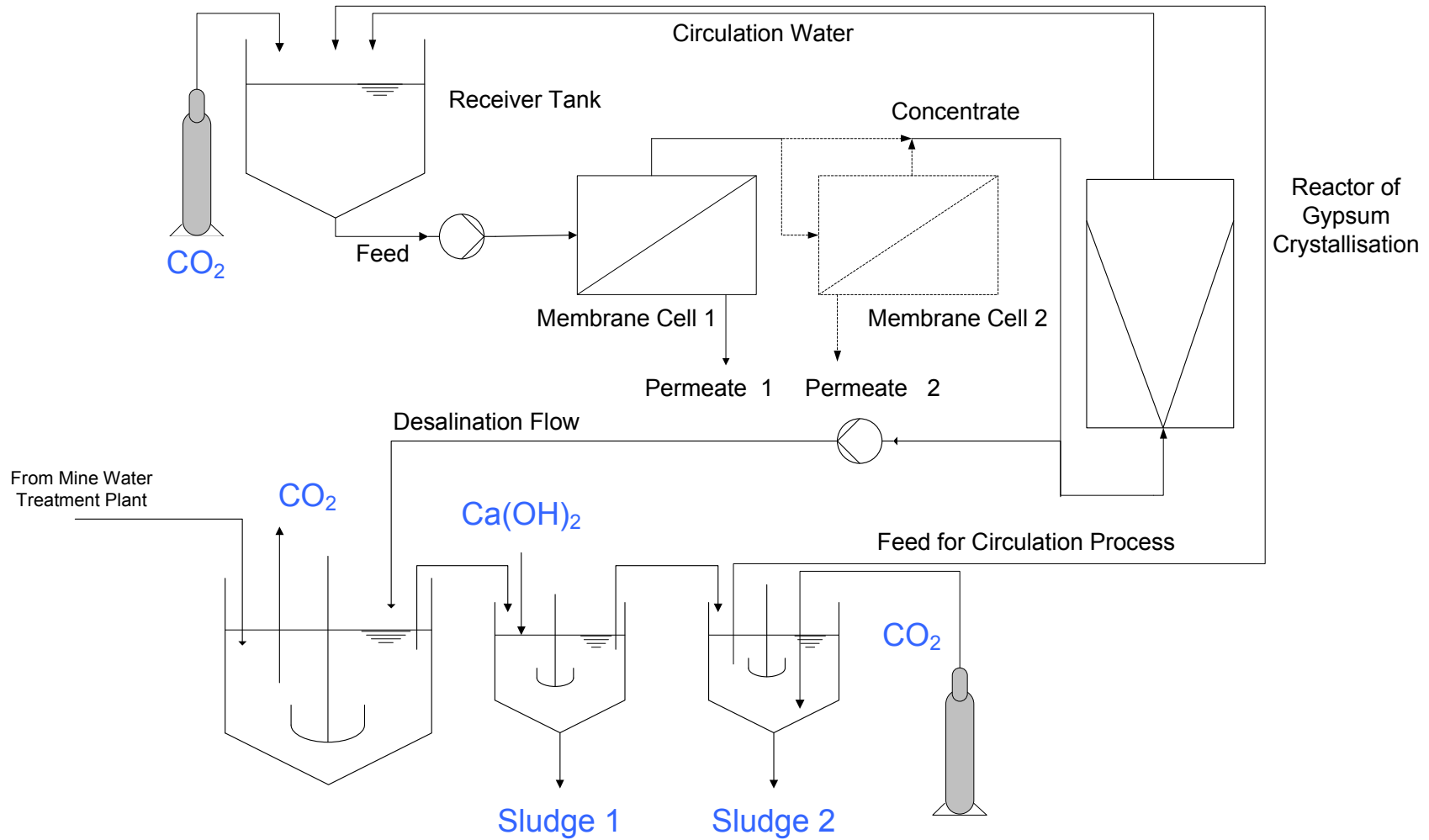
Advanced mine water treatment



Conventional mine water treatment

TREATMENT STEPS

Tests in pilot scale



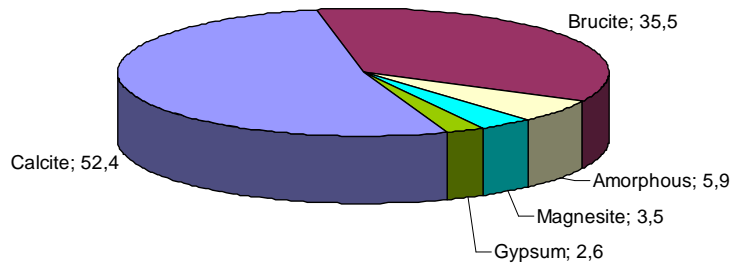
RESULTS

Clear Water and Residual Materials

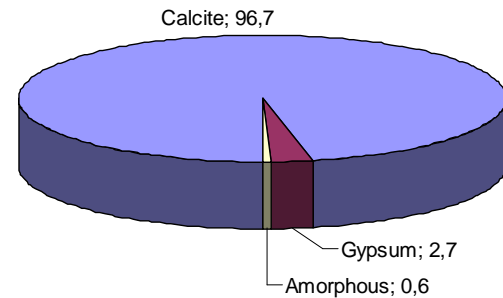
Parameter	Sample value	Parameter	Sample value
pH	6.80	Sodium, mg/l	29.5
Electrical conductivity, µS/cm	350	Potassium, mg/l	12.0
Temperature, °C	23.5	Magnesium, mg/l	13.0
Alkalinity, mmol/l	1.5	Calcium, mg/l	95.0
Silicate, mg/l	6.2	Iron, mg/l	<0.1
Chloride, mg/l	26.0	Manganese, mg/l	<0.05
Sulphate, mg/l	65	TOC, mg/l	6.1

- additional treatment of a side stream is sufficient
- process recovery is limited by water content of sludge

Sludge 1

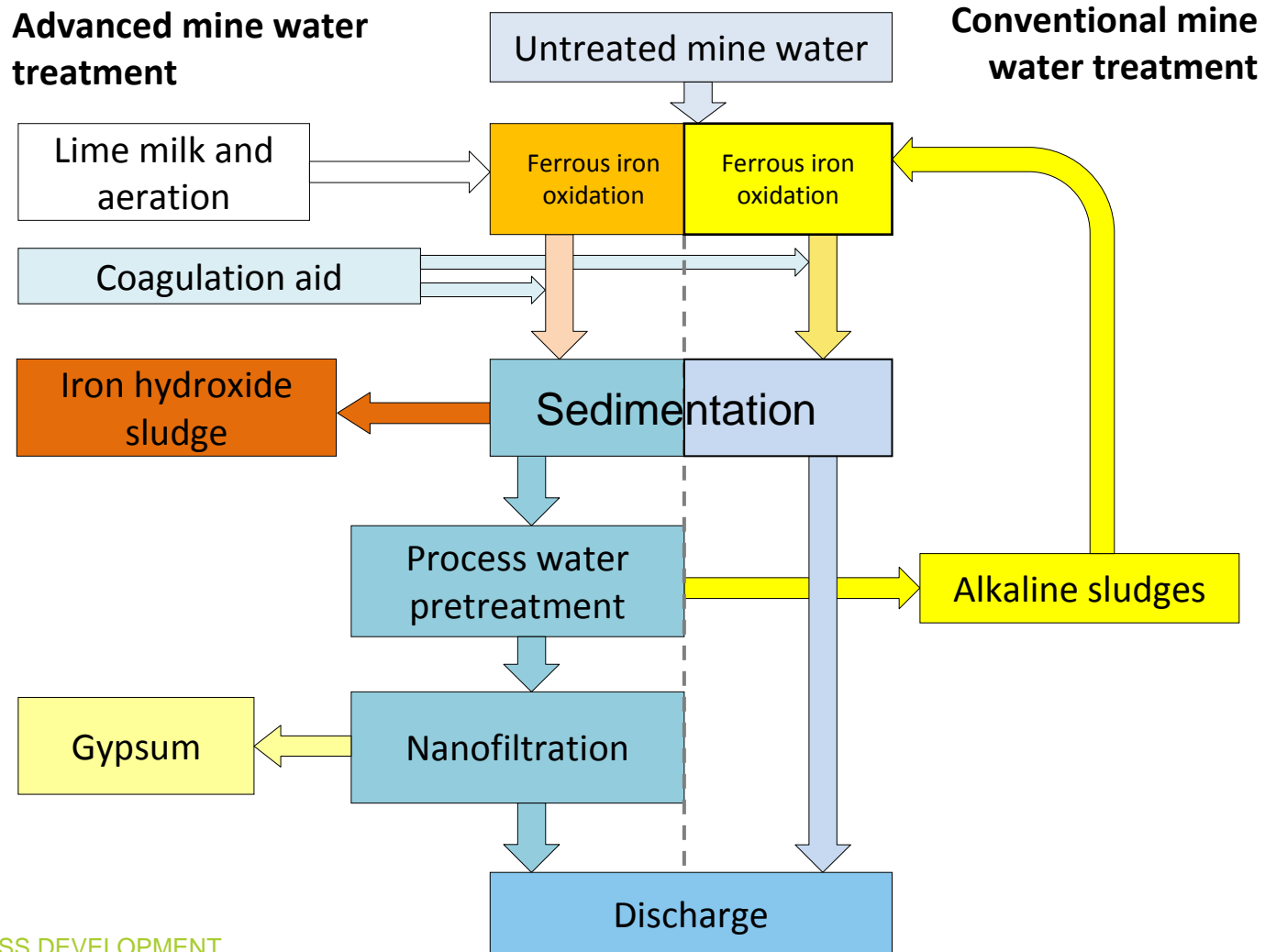


Sludge 2



RESULTS

Overall Process



RESULTS

Variation of NF portion

Rate of Nanofiltration	0 %	33 %	45 %	66 %	88 %	100 %
Description	no Nanofilt	1 lane Nanofilt.	optimal ratio	2 lanes Nanofil.	Drinking water limit	3 lanes Nanofilt.
Discharge: Sulphate [mg/l]	1800	1200	1000	650	250	< 50
Lime hydrate - Increasing Consumption	0 %	1,5 %	3 %	50 %	100 %	130 %
Alkaline excess sludge [t DW /d]	0	0	0	130	255	330

RESULTS

Variation of NF portion

Rate of Nanofiltration	0 %	33 %	45 %	66 %	88 %	100 %
Description	no Nanofilt	1 lane Nanofilt.	optimal ratio	2 lanes Nanofil.	Drinking water limit	3 lanes Nanofilt.
Discharge: Sulphate [mg/l]	1800	1200	1000	650	250	< 50
Gypsum [t DW /d]	0	65	90	140	185	215
Alkaline sludge [t DW /d]	0	110	150	220	290	330

THANKS FOR YOUR ATTENTION !