

Best available technology for chrome effluent treatment

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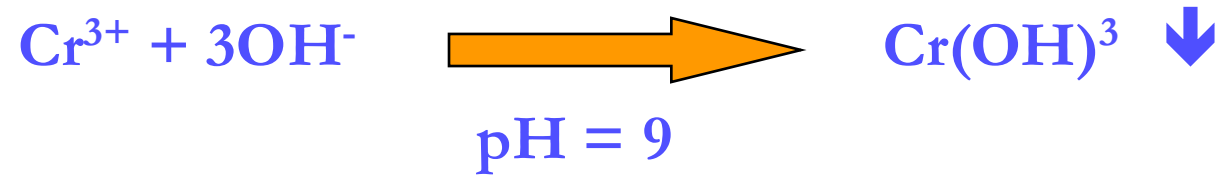
The Challenge of chrome in tannery effluent

- About 80% Chrome tannage worldwide
- Strict effluent discharge limits of 1mg/1 chrome
- Chrome precipitation and settlement does not achieve limit due to chrome masked fibers and fats
- Lime-milk and Ferric Chloride generates more sludge, high disposal costs of up to 250 € / ton
- Cross-contamination of biological sludges
- Chrome-free sludge can be used for biogas production

The Solution: DAF treatment of tannery effluents

Principals of chrome effluent treatment

- Screening of tanyard effluents
- Mixing and pH adjustment in a balancing tank
- Precipitation with NaOH at pH 9



chrome + alkali \longrightarrow insoluble chrome hydroxide

- Separation by settlement or flotation
- Collection and mixing in a sludge tank
- Sludge de-watering with screwpress, bandfilter or filterpress
- Chrome sludge recycling or disposal

Conventional chrome settlement versus Dissolved Air Flotation

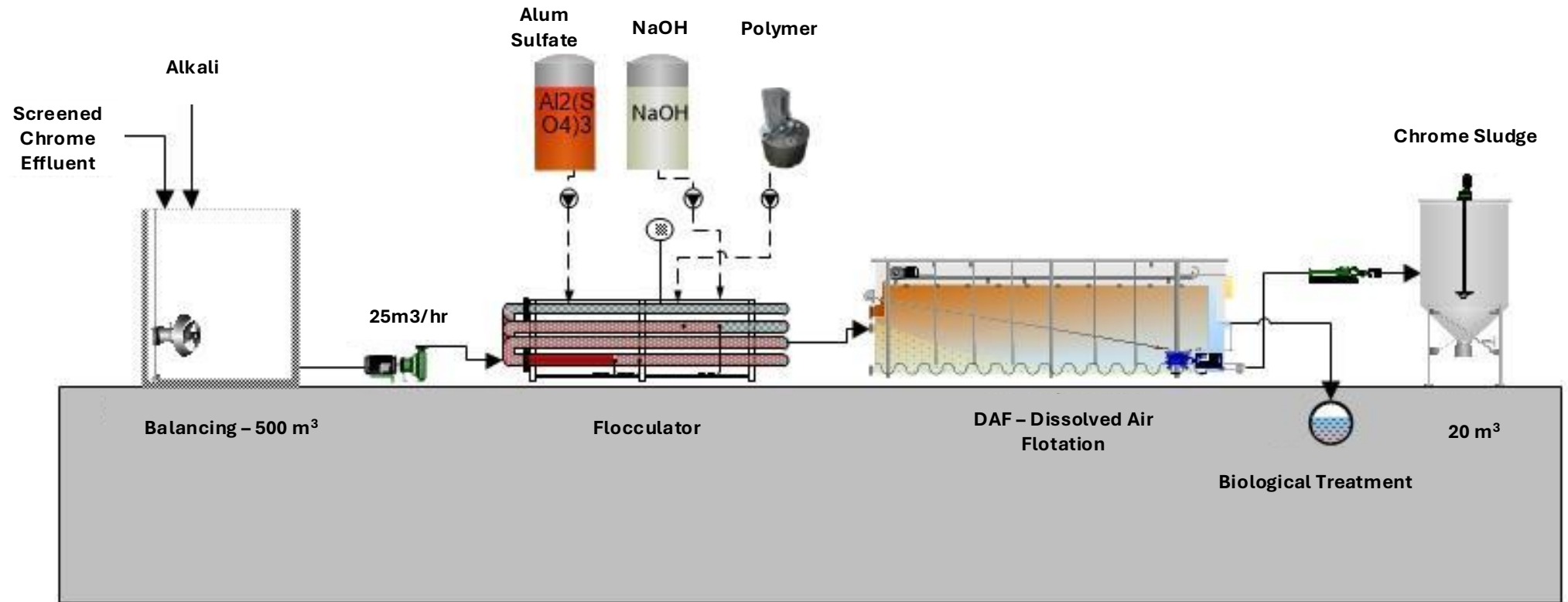
Chrome - Settlement

- Batch process high supervision
- 8-12 mg/l Cr^{3+} in Supernatant
- Cross-contamination of chrome free sludge
- Lime-milk - more sludge
- 3-5 % sludge dryness
- Doubles sludge de-watering
- High disposal costs of chrome sludge

Chrome - Dissolved Air Flotation

- Continues process low supervision
- 0.25 mg/l Cr^{3+} in effluent
- No cross contaminations of chrome free sludge
- Sodium Hydroxide - less sludge
- 8-10 % sludge dryness
- Reduced sludge de-watering
- Minimizing disposal costs of chrome sludge

Chrome effluent treatment with Dissolved Air Flotation



Automatic fine screening

Self-cleaning step-screen removes fibres > 1mm,
which never blocks due to mechanical cleaning
Installed in a channel with 50-100 cm depth



Pre-precipitation and mixing in the Balancing



- Automatic pH adjustment with Sodium Hydroxide to pH 9
- Chrome precipitation
- Balancing tank for tanyard effluents with 1 day retention time
- Mixing and aeration with jetox venturis to homogenize effluent
- Constant flow rate of 25m³/hr to DAF

Dissolved Air Flotation (DAF)

Physico-chemical process, which is used for the separation and removal of precipitated chrome from tanyard effluent.

The chrome effluent is precipitated at pH 9 with NaOH Caustic Soda and conditioned with a coagulant and a flocculant with automatic pH correction.

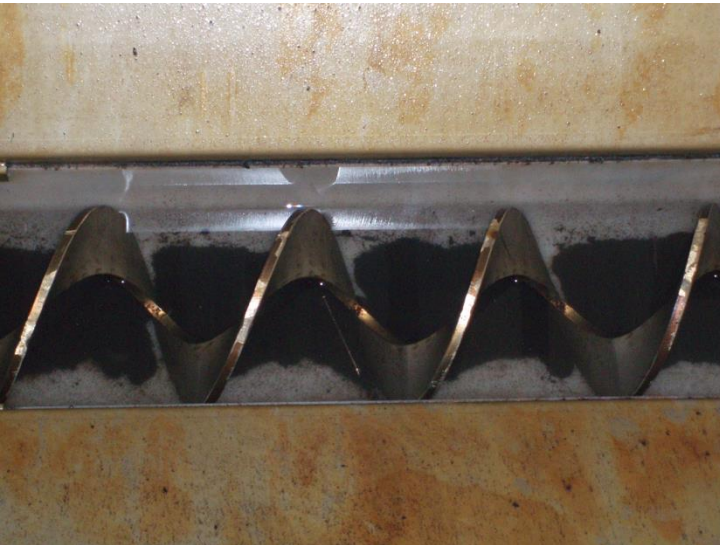
Then air is introduced at high pressure into the effluent to generate small air bubbles. Precipitated chrome rises to the surface where a sludge blanket is formed which is removed with a scraper.



Effluent, sediments and sludge (DAF)



- DAF Chrome sludge with 8-10 % DM
- Removal of heavier particles and sediments
- Chrome free effluent with $< 0.25 \text{ mg/l}$ chrome



DAF for chrome effluent treatment

Chrome free DAF effluent is drained to the biological treatment

Sludge tank and mixing to homogenize sludge for sludge de-watering



Results

The new chrome effluent treatment plant was started up in November 2024. The DAF treatment for tanyard effluents has improved the performance of biological treatment and has reduced the sludge disposal volumes and costs.

Parameters (mg/l)	Inflow	Outflow	(%) Reduction
Chrome (mg/l)	209	0,25	99,9
Suspended Solids (mg/l)	2337	69	96,3

The plant is fully automatic and requires the minimum of supervision.

Conclusions

The DAF reduces chrome to $< 0,25$ mg/l in the effluent. The biological sludge remains chrome free and can be used for biogas production.

Reduced chrome sludge generation, as Lime milk and Ferric Chloride have been replaced by Sodium Hydroxide and Aluminium Sulphate.

Improved sludge dryness reduces the sludge management and disposal costs.

High automation reduces chemicals to a minimum at optimum operation.

Nitrogen concentration of the effluent reduced by 61% which reduces air requirements for the following biological treatment.

The DAF treatment requires little space and can be well integrated into existing effluent treatment plants.

Thank you for your attention



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