

Excess activated sludge reduction in papermaking wastewater treatment: use of hydrogen peroxide

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Objective

Nowadays in Europe, the production of excess sludge from domestic and industrial wastewater treatment is exceeding 10 million tons of dry solids and forecasted to increase. The sludge management is estimated in average at about half of the total operating costs of a wastewater treatment plant.

Within the framework of sustainable development, reducing excess sludge production represents an alternative option to common sludge management. For over thirty years, H₂O₂ has been used in the pulp and paper industry as a brightening and bleaching agent. This study focused on the oxidation of the returned activated sludge by H₂O₂ used alone and at room temperature in order to minimize the costs of the implementation.

Current work

Introduction

This paper presents the results, in terms of excess sludge production reduction and of treatment efficiency, obtained at laboratory scale in sequencing batch reactor (SBR) fed with paper mill influent.

Experimental procedure & setup

- Two trials were performed in two SBRs: one reactor served as control while the second was oxidized after an acclimation period.

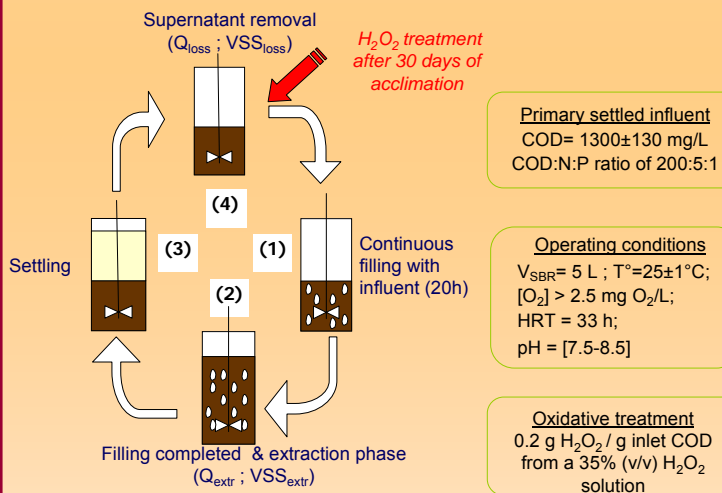


Figure 1: Experimental procedure - Lab-scale trials

Determination of daily sludge production

$$\text{Sludge production} = Q_{\text{extr}} \times VSS_{\text{extr}} + V_{\text{SBR}} \times \frac{\Delta VSS}{\Delta t} + Q_{\text{loss}} \times VSS_{\text{loss}}$$

	Trial #1	Trial #2
Duration (weeks)	8	18
Solid Residence Time (day)	30-40	20
H ₂ O ₂ dose (g/g/d)	0.6	0.78
Length of injection (min.)	9	7

Table 1: Summary of experimental setup

Results and discussion

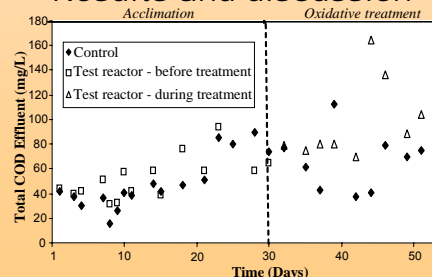


Figure 2: Trial #1 - Evolution of the total COD in the effluent

Table 2: Treatment efficiency of the test reactor - Trial #2

	Acclimation	Treatment phase
COD (mg/L)	250 ± 80	280 ± 50
N-NH ₄ (mg/L)	0.4 ± 0.3	1.6 ± 0.9
N-NO ₃ (mg/L)	4.3 ± 3	1.8 ± 0.7

- ✓ A 50% (Trial #1) and 10% (Trial #2) increase of total COD in the effluent, probably due to the release of organic compounds triggered by biomass disruption.
- ✓ Effect of H₂O₂ on nitrogen removal process, with a limitation of the nitrification step.

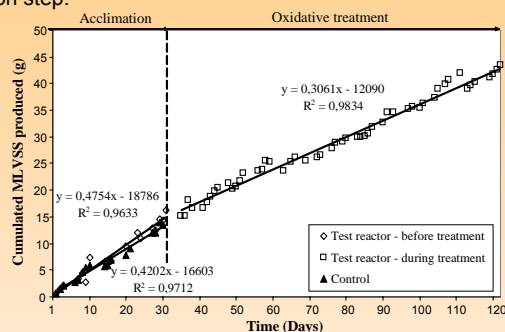


Figure 3: MLVSS cumulated production in the SBRs - Trial #2

- ✓ ~0.45 g MLVSS.day⁻¹ in both reactors during acclimation and 0.3 g MLVSS.day⁻¹ with oxidative treatment.

➡ **30% reduction of the sludge production**

Conclusion & Perspectives

- ➡ Despite a slight increase of the effluent's COD and an impact on nitrogen removal process, preliminary trials at laboratory scale showed a 30% reduction of the sludge production.
- ➡ Further experiments at larger (pilot plant) and smaller scale trials (beaker) interpreted with additional analytical methods (e.g.: ATPmetry, floc size and structure analysis) are ongoing to validate these results and better understand the influence of the oxidant on the sludge.

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