Research Institute:

PTS Munich
Hessstr. 134
80797 Munich

Internet: www.ptspaper.de

Head of the research institute:

Dr. P.W. Rizzi, Dr. A.-B. Kerkhoff

Project leader:

Dr. H.-J. ÖLLER
Tel: 089 / 12146-465
Fax: 089 / 12146-36
E-Mail: hans-juegen.oeller@ptspaper.de

Research area: General aims

Environmental technology // Water

Key words:

AOX, waste water, effluent treatment plant

Title:
Reducing the AOX concentration in the effluents of directly and indirectly discharging paper mills to comply with statutory AOX limits

Background/Problem area

The new minimum requirements for the discharge of paper mill effluents define much more stringent limits, especially concerning the parameter AOX. Compared to former regulations, the specific load limits were lowered by 90 % down to only 10 g/t for all paper grades.

The most important AOX sources in paper mill effluents are: certain biocides, chlorine, chlorine dioxide for fresh or circuit water treatment, fibrous raw materials, wet strength agents based on epichlorohydrin and odour reducing compounds splitting off halogens. Due to the developments in the past decade the as-is shares of the different AOX sources have to be investigated to define actual and future measures for further AOX reduction in the effluents. Furthermore many highly loaded biological stages (anaerobic systems, moving bed biofilm reactors) have been installed in the meantime. Their potential of AOX degradation has not been investigated yet. The conventional AOX reduction by flocculation/precipitation is no longer to date or enforceable, due to economical (treatment costs of up to 2 €/t paper) and ecological reasons (salinisation). Especially indirectly discharging paper mills are facing severe “AOX problems” in some cases due to the treatment of municipal effluents and are forced to minimise AOX already in their incoming flows.

Objectives/Research results

Updated measures for AOX reduction suitable for all relevant paper grades in Germany are to be developed to comply with current and future AOX limits. As the final result, a simulation model will be created which enables paper mills to forecast the impact of individual measures on the AOX load of their effluents.

In total 8 mills were investigated (s. table). A hook indicates the main source(s) of the AOX in the untreated effluents, a hook in brackets indicates AOX sources which contribute to a minor degree. If both, wet strength agents and fibres are responsible for the AOX (see mill A, B and F), there is no general rule which contributes the higher share. It depends on the current paper grade, e.g. in mill A wet strength agent amounts to a share between 16 and 98 %. Substitution of wet strength agents by products having lower AOX content or of ECF pulp by TCF pulp enable a AOX reduction up to 40 and up to 80 % respectively. But these positive results can only be realised if the retention of the wet strength agent remains stable in both cases. Recovered paper is the only AOX source in mill G and H and might also contribute to the AOX in the effluent of mill F. Depending on the recovered paper grade used, this fibre material can also adsorb the AOX in the stock preparation and therefore reduce the AOX in the effluent.

With an ozone dosage up to 100 g O_3/m^3 the AOX was reduced up to 67 % whilst COD was reduced only up to 12 %. A low content of filterable solids – preferable less than 20 mg/l - in the inlet to the ozone stage improves the efficiency of the ozone treatment. The ultrafiltration unit of the MBR stage does not improve the AOX reduction compared to conventional activated sludge process. A comparison of MBBR with an anaerobic stage referring their AOX reduction potential did not show a clear result which technology has to be preferred.

A simulation model to forecast the AOX in the effluent was successfully developed. The calculations and calibrations of the model demonstrated that the AOX desorption of the fibre raw materials determined under lab (standard) conditions is approximately 40 to 60 % less in technical scale. The accuracy of the model is sufficient to cover approximately 85 % of the analysed AOX values in the effluents.

Application/Economic benefits

SME can save only a small amount of between 0.25 and 0.80 €/t on their waste water tax because this tax amounts to max. 10 % of their overall fees. The greater benefit of the expected results is the resulting avoidance of conventional techniques for further AOX elimination. Those can cause costs of up to 2 €/t, at higher effluent amounts even up to 5 €/t. Above all, the integrated approach to reducing AOX in effluents shall help to avoid these additional expenses and to safely comply with actual as well as future AOX limits

Project period: 01.04.2005 – 31.03.2007

Remarks

The research project IGF 14372 was funded by the German Federal Ministry of Economics and Technology BMWi.