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**Research area: general aims**

Environmental technology // Water

**Keywords:**

Effluent and circuit water treatment, anaerobic treatment, biology

**Topic:****Chances and limitations of high-performance anaerobic reactors in the paper industry****Background/Problem area**

More than 90 % of all papermaking effluents are treated biologically today. Growing demands on the quality of treated effluents (which can lead to considerable outlay) underline the importance of stable, reliable and economical treatment methods. Anaerobic treatment offers decisive advantages owed to its favourable energy balance and significantly lower biosludge production as compared to aerobic treatment. By now, slightly more than one third of all papermaking effluents are subjected to anaerobic treatment (figure based on the production of 19.3m tons in 2003). The present knowledge about the chances and limitations of anaerobic reactors is rather sketchy, though, because the operating conditions of these systems can vary greatly and have not been systematically analysed or evaluated so far. Detailed and reliable information about these issues is necessary, though, to reliably plan and operate high-performance anaerobic reactors for new application areas (e.g. production of tissue, paperboard, newsprint) and the internal treatment of process waters.

**Objective/Research results**

The research projects aimed to identify the chances and limitations of high-performance anaerobic reactors in the paper industry. More specifically, design parameters such as COD volume load and hydraulic load (water and biogas) were to be determined as a function of effluent characteristics (biodegradability, sulphate, calcium, H<sub>2</sub>O<sub>2</sub> etc.) for the various product groups. Eight plant systems were investigated systematically (printing paper, packaging paper, tissue) to establish their operating conditions and the capacity limits of high-performance reactors for these applications. The results show that anaerobic degradation takes place without problems at average sulphate levels of up to 650 mg/l, and that excessive CaCO<sub>3</sub> precipitation will not occur in the reactor as long as the average Ca concentration does not exceed 550 mg/l. Pre-acidification is advisable, and including a pre clarifier is basically possible but should be looked at in detail in each specific case. Guide and limit values for the dimensioning and operation of high-performance UASB reactors have been determined, with the limits resulting from the hydraulic or COD loads. Process-technological measures required for the stable operation of the systems have been specified. The reactor capacity, expressed as the volume-specific degradation performance in kg COD per m<sup>3</sup> reactor volume, varies depending on product types, which can be explained by the specific effluent characteristics of the various applications.

**Application/Economic benefits**

The findings from this project will be valuable tools for the planning and operation of high-performance anaerobic reactors in biological effluent treatment plants of the paper industry. Plant operators can use the knowledge about the limitations and applicability of reactors when planning new treatment systems. If the mill intends to increase its production, capacity enlargements of the effluent treatment system can be planned reliably and well in advance. This will help avoid unstable operating conditions and higher discharge fees caused by the non-compliance with monitoring values. Trouble-free, stable plant operations can also save extra costs due to increased man-hour or material requirements, and help prevent production losses. Including an anaerobic stage reduces the operating costs of biological effluent treatment plants considerably (as compared to exclusively aerobic systems). For the anaerobic systems currently operated in the paper industry, the overall gain from cost savings (sludge disposal costs, aeration energy, nutrients) and biogas utilisation amounts to around 17m euros per year. Related to the production volume of paper mills with anaerobic treatment, savings amount to around 2,6 euros per ton of product, a figure which highlights the great importance of anaerobic effluent treatment in the paper industry.

**Project period: 30.04.2005 – 30.04.2006**

**Remarks**

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