

**Research Institute:**

PTS Munich  
Hessstr. 134  
80797 Munich

**Head of the research institute:**

Dr. Frank Miletzky

**Project leader:**

Dr.-Ing. Benjamin Simstich  
Tel: 089 / 12146-388  
Fax: 089 / 12146-36  
E-Mail: benjamin.simstich@ptspaper.de

Internet: [www.ptspaper.de](http://www.ptspaper.de)

**Research area: General aims**

Environmental technology // Water

**Key words:**

Anaerobic wastewater treatment, membrane, biogas

**TITLE:****Further development of anaerobic MBR technology for producing biogas from partial wastewater streams****Background/Problem area**

Wastewater from the paper industry includes chemical energy which can be utilized for the production of biogas in anaerobic treatment processes. However, only 20% of German paper mills use this technology. The state of the art in most mills is still aerobic wastewater treatment (e.g. activated sludge process) or indirect discharge to the municipal sewer system. Compared to aerobic treatment, the advantages of the anaerobic process are a much lower energy demand (only 10%) and a much reduced production of solid by-products (only 5%). And the most important difference in terms of sustainability and economic efficiency is the generation of biogas.

The main reason why only few mills use anaerobic water treatment technology is an excessively low COD concentration in the wastewater. Of course, anaerobic reactors could be integrated into the process to treat partial streams only, especially those with a higher COD concentration. However, this has not yet been put into practice because the unstable feedwater parameters negatively affect the performance of the anaerobic microbiological system.

The combination of an anaerobic reactor and a membrane (AMBR) is a promising new technology which is currently under development by some companies and researchers. With this combination, a substantially larger number of paper mills would be able to use and profit from the anaerobic treatment of their wastewater. Concerning applications in the paper sector, and also for breweries, PTS revealed some open research questions which are important for the further development of the AMBR.

**Objectives/Research results**

The main project objective was to expand the number of possible users in the paper industry who might profit from their wastewater as a biogas source. The research therefore focused on technical details which are important for the industrial branches of paper production and breweries that were studied. In concrete terms, the project should have led to findings on:

- the filterability of the sludge-water mix in the reactor when the system is operated under unstable conditions in terms of COD feed concentration or operated at low COD concentrations < 1000 mg/l.
- the filtration performance in a dynamic cross-flow membrane module.
- economically sound concepts for the process integrated use of these AMBR systems.

The main results achieved include:

- A weekly change of the inflow feedwater (different partial streams of a paper mill) led to a comparably small decrease in the COD degradation rate by 1-3 %. Some changes of the biocoenosis were observed by FISH Analysis, however, with no severe effects on overall reactor process performance.
- Treatment of feedwater with a COD < 1000 mg/l led to an increase in the lag phase resulting in the need for a prolonged hydraulic retention time of the reactor due to diffusion limitation. A change in the structure of sludge pellets could not be verified clearly.
- The use of a dynamic cross-flow ultrafiltration module showed good performance at high fluxes and stable operation.
- An Excel tool was developed to calculate quickly and easily the economic viability of AMBR installations depending on individual conditions like COD, volumes etc.

**Application/Economic benefits**

The project results provide Bavarian paper mills with an opportunity to glean knowledge and obtain information on this new AMBR technology and especially on how to reap its benefits in their own mill. Participating in the project are also several Bavarian companies from the environmental mechanics and plant construction sector (mainly SMEs) that stand to earn direct profits from the project results. The development aims to provide economically viable processes that are intended to offer economic benefits to end-users in the paper industry as well as in breweries.

**Period of time: 01.02.2012 – 31.01.2013**

**Remarks**

Research project [Bay-IGF-1112-0003](#) was funded by the Bavarian Ministry of Economics, Infrastructure, Transport and Technology.