

**Research Institute:**

PTS München  
Heßstr. 134  
80797 München

Internet: <http://www.ptspaper.de>  
<http://www.cornet-albaqua.eu>

**Heads of the research institute:**

Dr. F. Miletzky

**Project leader:**

Gabriele Weinberger  
Tel: 089 / 12146-463  
Fax: 089 / 12146-36  
E-Mail: [gabriele.weinberger@ptspaper.de](mailto:gabriele.weinberger@ptspaper.de)

**Research area: Process aims**

Environmental technology // Water

**Key words:**

Algae, mixed algae-bacteria biomass, biological effluent treatment, paper industry

**Title:****Combined algal and bacterial waste water treatment for high environmental quality effluents****Background/Problem area**

Biological purification is the conventional way of treating effluents in the paper industry. Biological wastewater treatment – meaning purification solely done by bacterial activity - is state of the art and highly sophisticated in the European industry. A lot of different treatment technologies, specialized for several treatment targets, are available on the market. However there are limits to classic biological treatment which could not be overcome by the sole use of bacteria so far. Priority, endocrine substances, residual COD, nutrients, inhibitory or refractory substances, for example, cannot be removed by bacterial activity alone.

Multiple technologies for advanced effluent treatment, e. g. evaporation, membrane filtration, oxidation processes, and precipitation..., have been the focus of research for some years. Unfortunately most of these technologies are quite expensive in investment and operating costs. Therefore the issue of algae is becoming increasingly important worldwide: Algae are seen to have great potential for effluent treatment and the production of energy and biofuels, as raw material or to reduce greenhouse gases – there are a multitude of possible applications.

Within the "ALBAQUA" project researchers from four European countries – Germany, Hungary, Belgium and Slovenia – are combining their experiences and capabilities to study the potential of algae for the paper industry and related industrial sectors by an initial exploratory research project. The initial focus will be on effluent treatment due to its operational availability, in order to collect information and gain experience with the use of algae in this field. On the basis of these leadoff results, the further use of algae containing biomass is to be investigated to evaluate follow-up beneficial issues for the paper industry. The aim is to establish which of the concepts currently available are suitable for this purpose and have enough potential to be cost-efficient for all grade groups.

**Objectives/Research results**

The approach taken in this project focuses on effluent treatment first, in order to collect information about and gain experience with the use of algae in this field. The aim is to assess if the use of algae of any kind is suitable for the purposes of the paper industry and its related sectors and has enough potential to be cost-efficient for all tasks planned. These are: cultivation of suitable algae species, testing of suitable kinds of fixation of algae in mixed algae-bacteria biomass, operation of single algae-bioreactor, design of pilot system, degradation performance, utilisation of excess mixed algae-bacteria biomass, pilot plant trial, evaluation of the benefits of effluent treatment by single algae bioreactor or mixed algae-bacteria bioreactor, evaluation of economics.

COD-degradation and settling of biomass are comparable to the sole activated sludge treatment most of the time in low load operation conditions. O<sub>2</sub>-production by algae is sufficient to supply bacterial O<sub>2</sub> demand in these trials. Improved COD-elimination has been experienced at medium load operation but lacks stability of biomass composition and system has to be aerated in this case.

Mixed algae-bacterial biomass offers a higher content of carbohydrates and sugars and provides a good potential for anaerobic digestion therefore.

**Application/Economic benefits**

The results of the project may lead to a paradigm shift regarding effluent treatment in the paper industry as well as in related industrial sectors in case the effluent treatment by means of algae proves successful. Entire industrial sectors would change their service and technology portfolios in favour of the new concepts for biological effluent treatment and reuse of excess biomass.

In anticipation of reduced operating costs for effluent treatment (reduced energy supply, lower water discharge costs, prospect of earning money by selling recyclable excess biomass) the outcome of this project will have an impact on SME as well as bigger companies of all industrial divisions related to the set objectives. It would bring new know-how for every SME partner and enable the exchange of experiences, ideas, knowledge, methods and transfer of know-how, all with the aim of efficient problem solutions. The set objectives will be implemented at existing locations and the results will be applied directly in practice. The target market is the entire area of the EU, including the Balkans.

**Project period: 01.09.2009 – 31.12.2011**

**Remarks**

The research project Cornet ALBAQUA IGF EN 23 is being funded by the German Federal Ministry of Economics and Technology BMWi and performed together with Technical University of Hamburg-Harburg, CELABOR, Pulp and Paper Institute Ljubljana, Federation of Hungarian Printers and Paper Makers and Paper Research Institute.