LeAF Letter

Number 2, December 2003

With this newsletter Lettinga Associates Foundation aims at informing the reader on her projects, courses and other activities performed in the field of implementation of environmental protection and resource conservation technologies

Inside this issue

Dear readers,

After launching the first LeAF letter we got many encouraging reactions from all over the world. From here, we would like to thank all of you for the kind words and remarks made. In the current issue, various project activities are highlighted as well as the announcement of the second Lettinga Award.

Insight in the anaerobic conversion mechanisms is of great importance not only to treat waste(waters) but also to understand unexpected phenomena in water-based industrial processes. An example is the occurrence of strange smells in factories, where water is in contact with organic matter or when process water loops are being closed, leading to higher concentrations of pollutants in the water flow. Another phenomenon where bad smells occurred in cast-iron industries is described within this issue. Since so far no attention was paid to microbes disturbing iron production, a link to natural decomposition processes was not immediately made. LeAF took the challenge to bring her microbial knowledge into the heavy metal industry. We hope you will enjoy reading.

Approaching the end of 2003, we would like to use the opportunity and wish everybody a **Merry X-mas** and a **very Happy and Peaceful New Year !!**

Jules van Lier
Director

IWATER going to the factory

LeAF's Industrial Water Treatment and Reuse (IWATER) group focuses on the development and application of biotechnological water treatment methods within industrial production processes. The group seeks to combine LeAF's core technology anaerobic treatment, and complimentary treatment technologies, with clean production methods, with the purpose to achieve a reduction of industrial water consumption and wastewater production. More specifically, techniques are applied to accomplish removal of hazardous contaminants, recovery of valuable materials and energy, and reuse of water.

One example is the application of the biological sulphur cycle to recover sulphur from waste streams. As successful integration of biotechnological water treatment processes in industrial production depends on a reliable operation of these processes. Techniques for instrumental measurement and control of treatment processes are considered to be imperative tools.

Currently, various projects are being carried out within the group's scope, including chemical and microbial contamination of process streams, on-line process monitoring, and water recycling in textile industry, agro-industry and car wash industry.

The group is investigating the possibility of setting up a forum with industrial partners with the purpose of promoting and developing water treatment methods for the reduction of industrial water consumption and wastewater production.

Contact Henri Spanjers for more information, henri.spanjers@wur.nl

Something is eating my coating

LeAF participated in the first phase of a NOVEM project on environmentally friendly and spoilage-free waterborne coatings in foundries. In iron foundries cast iron products are made by pouring liquid iron into moulds, which are coated to give them the right surface properties. Traditionally the coating solvent was based on isopropyl alcohol, but this is being replaced by water because of workers' health and environmental legislation. The change from isopropyl alcohol to water-based coatings is not without problems. One of the concerns is decay of water-based coatings. Spoiled coatings loose the properties needed for their use and have to be disposed of.

Also in the foundry that was investigated within this project decay of waterborne coatings was experienced, and it was believed that the decay had a microbiological origin. LeAF carried out research to shed more light on the problem. The results from the performed microbial activity tests and microscopic observations all indicated that bacteria are able to grow in the coatings, causing the decay.

Lettinga Associates Foundation
P.O. Box 500
NL-6700 AM Wageningen
The Netherlands
Tel. +31 (0) 317 482023
Fax +31 (0) 317 482108
Chamber of Commerce Arnhem 4103544
www.lettingaassociatesfoundation.com

Especially the microbial activity tests, as developed by LeAF for this specific material, proved very useful in assessing the microbiological contamination of the coatings.

Coatings contain biocides to prevent microbial decay during storage. This causes the coatings to be classified as chemical waste, making disposal difficult and costly. Coating manufacturers do not want or are not allowed to increase the use of biocides. When it is possible to determine to which level a coating has decayed a distinction can be made between the ones that have to be disposed of as (chemical) waste, and the ones that can still be used. In this way a significant waste reduction can be achieved.

Casting mould coating under microbial attack

Ultimately, new solutions have to be found to prevent the decay of waterborne coatings, either during manufacturing or during usage. Timely and accurate assessment of microbial contamination is a requisite for the development towards a significant reduction of biocide use in casting moulds manufacturing. If this turns out to be a success story, it can be applied to paints and coatings manufacturing in general. The less useful material has to be thrown away, the less valuable resources will have to be used.

Contact Henri Spanjers or Iemke Bisschops for more information, henri.spanjers@wur.nl or iemke.bisschops@wur.nl

Ganga Action Plan – a reaction

In April 2002 Suparna Sharma published a very critical evaluation on UASB technology application in India. In fact, he postulates that implementation was a big mistake since UASB does not remove TSS and chromium and the effluent cannot be used for agricultural purposes. The article is published on the www.cleanganga.com.
Below you can read Prof. Gatze Lettinga's comments to this article.

The critical comments made by Suparna Sharma on the application of the anaerobic pre-treatment of sewage in the Ganga region (Kanpur) by using the UASB-reactor concept deserve a serious reaction. For attaining a real sustainable and robust environmental protection in the public sanitation sector, the position of anaerobic water treatment should be well understood. Otherwise it would lead to expectations that not can be fulfilled, and apparently such a situation already seems to exist with respect to measures taken in the framework of the Ganga Action Plan.

What went wrong?
A major drawback in India is the application of centralised sanitation concepts where the large pool of domestic wastewater is mixed with (often small amounts) of industrial wastewaters, containing chromium and other hazardous materials. Reclamation of such wastewaters then becomes very difficult and expensive high-tech technologies are needed to comply with stringent effluent criteria. In contrast, treatment of industrial wastewater at the site will encourage industries to reclaim resources like chromium for the production process, reducing the costs for leather production while the environment is adequately protected. In addition, the appropriately treated domestic waters, which are free of industrial contaminants, will only then become of interest for agricultural reuse.

But even when considering the public sanitation sector alone, it is clear that the pathogenic organisms present in (particularly) the human excreta should remain concentrated, together with the rather well biodegradable organic constituents of the excreta. And in fact the same can be said with respect to the high concentration of urea (potential source for ammonia-N) in urine! In order to prevent serious pollution problems and to enable optimal valorisation of human and domestic residues, we virtually need waste separation at the source, combined with adequate treatment to produce the valuable by-products, viz. energy, fertilisers and organic soil conditioners.

How to proceed?
On many occasions, however, source separation is not (yet) implemented and municipalities are facing the ever-increasing volume of polluted waters. UASB technology, with all its benefits, can be considered an appropriate alternative to treat these wastewaters up to the secondary level. If further treatment is required other technologies should be applied which are preferentially also characterised by low operational costs and a high efficiency.

Anaerobic treatment, whatever reactor system is applied, practically never can be designated as a complete treatment system. Such statement only can come up in the mind of people who not really understand what is needed in sewage treatment and what can be accomplished with the various methods. The UASB-reactor concept, as it was introduced in the late eighties in India, comprises the first generation for sewage treatment. The system was open for improvement, i.e. by all users including those in India. And as a result of excellent PhD-work conducted in Jordan, Egypt, Palestine, Brazil, Argentine, and the Netherlands, various substantial improvements have been made the last decade. This resulted in for instance a quite satisfactory anaerobic pre-treatment of sewage at ambient temperatures in the range 10-15 ^{o}C. A country like India should take advantage of these developments (no patents) and contribute for the

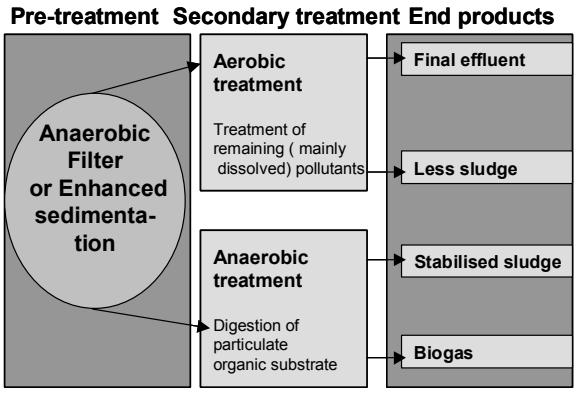
Lettinga Associates Foundation
P.O. Box 500
NL-6700 AM Wageningen
The Netherlands
Tel. +31 (0) 317 482023
Fax +31 (0) 317 482108
Chamber of Commerce Arnhem 4103544
www.lettingaassociatesfoundation.com

sake of the billions who presently suffer from the lack of any form of sanitation.

Reduction of wastewater sludge production by (anaerobic) pre-treatment

Excess sludge is an unavoidable by-product of (municipal) wastewater treatment. It is produced through the growth of micro-organisms that remove pollutants in wastewater. Because of strict regulations incineration or controlled land filling currently disposes off most excess sludge. Disposal of excess sludge is very costly, it represents 40-50 % of the total costs of municipal wastewater treatment in The Netherlands.

Reduction of excess sludge production is a major challenge at both national and European level. LeAF is participating in a EU funded research project named WIRES ('Ways of Innovation for the Reduction of Excess Sludge') that is aimed at the development of technological options for reduction of excess sludge production. The research is performed in close co-operation with universities and research institutes from Germany, France, UK and Spain.
The work of LeAF within the WIRES project is focused on pre-treatment of wastewater. The aim of pre-treatment is to separate the particulate organic material from water (figure). The separated particles are anaerobically digested resulting in a considerable reduction in mass and in the production of biogas. Due to the removal of particles in the first step of treatment, the secondary treatment will receive a lower organic loading and will produce less sludge. In addition, a longer solid retention time can be maintained which will enhance sludge minimisation. The research is focussed on two types of pre-treatment, the Anaerobic Filter reactor and improved sedimentation by addition of cationic organic polymers.



For more information contact Adriaan Mels, adriaan.mels@wur.nl or visit the website of the WIRES project at www.cirsee-eu-wires.com

Improved pre-treatment by adding polymers at wastewater treatment plants

In close co-operation with the Dutch consultancy firm Witteveen+Bos, LeAF is evaluating the practical application of organic flocculants at the wastewater treatment plants Kralingseveer, Assen, Alphen-Noord, Amstelveen and Venray in The Netherlands. The project is asked for by water boards involved and is financed by STOWA (the Dutch Foundation for Applied Water Research). The addition of cationic organic polymers to wastewater results in flocculation and may strongly enhance the efficiency of primary clarifiers. Adding organic flocculants will reduce the organic pollutant load to a secondary treatment like the activated sludge process and will reduce the energy requirement, excess sludge production and treatment capacity significantly. In addition, more biogas is produced because more primary sludge can be fed into an anaerobic digester. Scenario analyses have already shown that this could lead to 50-75% of energy savings at municipal wastewater treatment plants. At overloaded treatment plants approximately 10-20% more treatment capacity can be created while the nitrogen removal capacity is maintained.

Wastewater samples of the various wastewater treatment plants were collected. The flocculation efficiency of the samples was tested in jar tests by adding increasing amounts of organic polymer. The supernatant was sampled and tested for the removal of turbidity, biodegradable organic compounds and nutrients. The results were used for a model study with Activated Sludge Model 1 to calculate the potential for energy reduction and capacity extension of each treatment plant. The results show that the use of polymers is already very effective at low dosages (1 –2 mg/l).

Wastewater flocculation with organic polymers

For more information contact Adriaan Mels, adriaan.mels@wur.nl.

Biomethane and Biohydrogen – a new book *edited by J.H. Reith , R.H. Wijffels and H. Barten*

This book contains 4 essays on the status and perspectives of biological H_2 and CH_4 production and their integration in the energy infrastructure. The publication was realised with funding from the program NECSST (New Energy Conversion Systems and Technologies) and executed by NOVEM on behalf of the Ministry of Economic affairs. The book is a publication of the Dutch Biological Hydrogen Foundation and includes

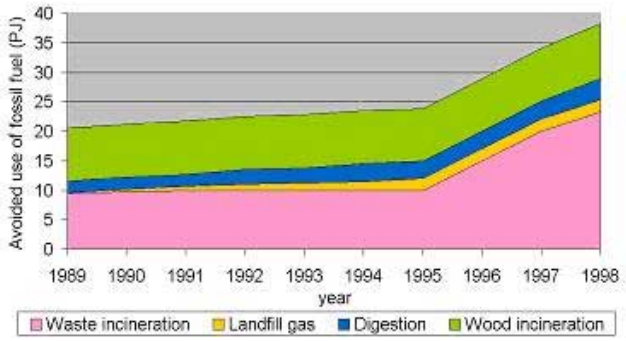
- Chapter 3 that addresses the background for the potential role of biomethane and biohydrogen in the energy economy as a function of

Lettinga Associates Foundation
P.O. Box 500
NL-6700 AM Wageningen
The Netherlands
Tel. +31 (0) 317 482023
Fax +31 (0) 317 482108
Chamber of Commerce Arnhem 4103544
www.lettingaassociatesfoundation.com

future energy end-use technology, infrastructure and energy policy. This chapter is written by Energy Research Centre of the Netherlands, ECN.

- Chapter 4 on biological methane production through anaerobic digestion. The chapter reviews the state of the art and perspectives of application of anaerobic digestion and treatment of wastewater, slurries and solid waste. Written by Lettinga Associates Foundation, **LeAF.**
- Chapter 5 on bio-hydrogen production via dark fermentation, written by researchers from the Agrotechnological Institute, ATO.
- Chapter 6 on photobiological hydrogen production, written by researchers from different institutes, viz. The New Delta, Wageningen University, University of Coimbra and The Energy Research Centre of the Netherlands, ECN.

The essays provide a thorough review of the field of bio-H_2 and -CH_4 production, from a technological and scientific perspective and give insight in the expertise available in the Netherlands. Moreover the most important areas for further development are identified. In 2020 10% of the energy demand in the Netherlands should be provided by renewable energy sources. The publication provides the potential of Bio-methane and Bio-hydrogen processes to cope with this objective.



Total amount of energy produced from biomass in the Netherlands over the years 1989-1998

For more information contact Grietje Zeeman, grietje.zeeman@wur.nl or visit our website.

Will your project win the second Lettinga Award ?

Do you have an innovative anaerobic thought but no money to realise it? Than use the opportunity that the second Lettinga Award offers you. The prize of 25.000 euro might help you to get a start with your project. What you need to do is to write a project proposal according to the guidelines as indicated on LeAF's website. The three main criteria that will be used to select the winning project are innovation, applicability and reality. Of course the project should be innovative, but it should also be focused on implementation in practice. Furthermore, the project and its execution must be realistic and cost-efficient.

We are looking for innovations in the field of anaerobic technology for wastewater treatment, sustainable development, or resource conservation. The project might be focussed on treatment concepts, public awareness, implementation, knowledge transfer, demonstration, etc.

Dates to be remembered:

April 1st, 2004	*Deadline submission of the project proposal*
July 1st, 2004	*All applicants are informed on judgement of their proposal*
September, 2004	*Announcement of the price winner during the Anaerobic Digestion congress 10, August 29th to September 2nd, 2004, Montreal Canada*

For more information contact Marjo Lexmond, marjo.lexmond@wur.nl or visit our website.

The International Short Course on Anaerobic Sewage Treatment

To be held:
Spring 2004, April 26 - 30,
Delft, The Netherlands.

Organized by
LeAF and UNESCO-IHE.

The International Short Course on Anaerobic Sewage Treatment presents practical information, ongoing developments and scientific backgrounds on the application of anaerobic digestion for the treatment of municipal sewage. Application of this environmental friendly technology fits in the growing interest in cost-effective waste management strategies that focus on sustainability and resource recycling.

For information or registration contact sjon.kortekaas@wur.nl or visit our website

Colophon

Lettinga Associates Foundation is a non-governmental, not for profit organisation that does not receive donor funding. The foundation earns its income from projects related to applied research, consultancy tasks, course organisations, etc.

Twice a year Lettinga Associates Foundation will distribute this LeAF Letter amongst its clients, relations, and others interested in environmental technologies for waste and wastewater treatment.

If you would like to receive this newsletter on a different e-mail account, or if you wish to subscribe someone else for this service, please send an e-mail to leaf@lettingaassociatesfoundation.com. If you wish to be removed from this mailing list, you can send an e-mail to the above mentioned address with the subject 'remove from LeAF Letter list'.

Lettinga Associates Foundation
P.O. Box 500
NL-6700 AM Wageningen
The Netherlands
Tel. +31 (0) 317 482023
Fax +31 (0) 317 482108
Chamber of Commerce Arnhem 4103544
www.lettingaassociatesfoundation.com