



# LeAF Letter

Number 8, December 2007

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

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## Dear Readers,

The start of 2007 was above all expectations. With our 10<sup>th</sup> anniversary to come, we received the news that Gatzke Lettinga, was awarded the 2007 Tyler Prize for Environmental Achievements. We celebrated this fact during our 10<sup>th</sup> year anniversary symposium, the revenues of which are donated to a project that aims at improving the water and sanitary infrastructure in a Kenyan youth prison (more information elsewhere in this LeAF Letter).

Via the Lettinga Foundation the third Lettinga Award has been awarded. *Paques Natural Solutions*, *Biothane Systems International* and *Royal Haskoning* initiated and finance this Award of €25.000 to stimulate innovations. This year Dr. Francisco Cervantes submitted the winning project. You can read more about this project and about the achievements of the previous Award winner Professor Madalena Alves elsewhere in this LeAF Letter.

LeAF consolidated its status as Knowledge Centre as described by the Dutch Innovation Voucher Regulation. More concrete this means that the Dutch Small and Medium sized Enterprises (in Dutch MKB) can use an innovation voucher to contract LeAF for research and innovations.

LeAF can look back at a year in which some very promising projects started in the area of sanitation, environmental capacity building and of course in the area of anaerobic treatment technology. We also showed our niche in the area of biological testing, especially now with the increased interest in renewable energy. At this point we would like to thank the Sub-department of Environmental Technology for its good cooperation that enables us to perform these tailor-made tests in the shared laboratories.

We would also like to thank Adrie Veecken for his enormous contribution to the increase in our activities on solid waste digestion. For after 18 years of Wageningen employment, Adrie is starting a new job at the Waste Management Department of SenterNovem in Utrecht on January 1<sup>st</sup> 2008. We wish Adrie all the best in the future! Adrie will remain involved in a few LeAF activities, like the ORBIT congress.

Gusta de Kaste, our former secretary, finished her educational training and is now considering her future career steps. We are looking for a new secretary and we expect to introduce her or him in our next LeAF Letter. In the meantime Ria Ruhe is taking care of our administration.

We welcomed David Castellano Fabrega, who combines a job at WASTE (in Gouda, the Netherlands) with his employment at LeAF for which he is working on the MobiSan® project. Also, Look Hulshoff Pol, an old friend, and Joost Jacobi have joined LeAF on a temporary project basis. Els Schuman is supporting us temporarily in the performance of the huge amounts of biological tests and in January Jana Bartackova will start assisting us with our experimental projects.

Herman Hegge accepted a position in our board. Together with the other board members Ronald Kalwij (chair), Paul van Helvert (secretary and treasurer), Ike van der Putte, and Michiel Groeneveld, Herman will stimulate us to develop LeAF into a sustainable organization.

For 2008, the International Year of Sanitation, we have great plans in increasing our contribution to the realization of the Millennium Development Goals. We hope you will join us!

On behalf of the LeAF staff and board I wish you a healthy and inspiring new year.

Marjo Lexmond  
Managing director

## Lettinga Foundation

The Lettinga Foundation (LeF) is an idealistic fund which is administered by LeAF. LeF has recently again been accepted by the Dutch Tax and Custom Administration as an organization that aims at scientific or general benefits (in Dutch: *Algemeen Nut Beogende Instelling - ANBI*). This means that donations to LeF are free of donation or inheritance taxes and therefore an interesting option for individuals, and companies that want to take corporate social responsibility, by contributing to the realization of our aims.



## AD11 and the 2007 Lettinga Award

*Lettinga Award 2007 winner receives his award during AD11 in Brisbane, Australia.*

In LeAF Letter no. 7 we proudly announced that the project of Dr. Francisco Cervantes of the Instituto Potosino de Investigación Científica y Tecnológica (IPICYT) in Mexico was the winner of the Lettinga Award 2007. The jury representative,



Dr. Jaap Vogelaar of Paques, The Netherlands handed the Award to Dr. Cervantes in a special session dedicated to the Lettinga Award

during the IWA Anaerobic Digestion World Conference Brisbane, Australia, September 23-27 (AD-11). Over 350 participants were present at AD-11 of which the majority attended the award session during the conference banquet.

The Lettinga Award session started off with Prof. dr. Jules van Lier explaining the mission of LeAF and the rationale behind the Lettinga Award. Thereafter, Dr. Jaap Vogelaar passed the judgment of the jury on the winning project proposal. This edition of the Lettinga Award had a special focus on anaerobic wastewater treatment in the chemical industry. According to the jury, the prize winner certainly meets this criterion as he addresses recalcitrant components like aromatics and halogenated solvents from chemical effluents. These effluents are persistent in conventional systems and on release there would be a severe impact on the environment. Dr. Cervantes suggests that immobilizing redox mediators on nano-structures could be a step towards economic application of these processes. Different researchers, among which Cervantes, showed that the introduction of these mediators has great potentials for reductive transformation of highly oxidized compounds into non-toxic substances in anaerobic systems. However, up to now, continuous addition of these dissolved mediators does not appear to be an operational cost effective option. More research is required to achieve this and the Lettinga Award jury felt that Francisco Cervantes wrote an excellent proposal dealing with fundamental screening of mediators and appropriate nano-structures with the aim to immobilize the mediators, combined with well designed lab scale experiments. The jury stated that he has the appropriate scientific basis to bring such a type of research work to a success. And by funding this research the committee hopes to contribute to a new line of research, which will give an outlook on effective treatment of persistent pollutants in the future.

Francisco Cervantes promised to complete his research on December 31, 2010. One of the obligations that comes along with winning the €25,000 prize is that he will present the results of

his project at the next IWA Anaerobic Digestion Congress (AD12).

We are looking forward to his presentation!

Elsewhere in this LeAF Letter you may find the report about the achievements of the Lettinga Award 2004 winner Prof. Dr. Madalena Alves of the University of Minho in Portugal.

## Sanitation Challenge, an international conference on new sanitation concepts and models of governance

The United Nations have declared 2008 the International Year of Sanitation. In 2008 the Environmental Policy Group and the sub-department of Environmental Technology of Wageningen University in cooperation with Wetsus and LeAF organize an IWA conference in Wageningen, The Netherlands. The aim of the conference is to scientifically discuss new sanitation concepts and techniques, models of governance and experiences from all over the World.

By organizing this conference WU, Wetsus and LeAF intend to create a dialogue between civil, process, agricultural and environmental engineers; urban planners, sociologists, economists, and political scientists who are involved in international sanitation research and implementation. Furthermore, this conference tries to bridge the gap between sanitation research and demonstration in the 'North' and in the 'South'.

Several themes will be addressed during the conference:

1. Innovation management in sanitation;
2. Socio-spatial embedding of innovative sanitation solutions;
3. Perspectives from the extreme ends of the chain: consumers and farmers;
4. New sanitation concepts;
5. Contemporary knowledge gaps.

The deadline for submission of abstracts was November 1, 2007, and the organization received 120 abstracts. Currently, the scientific committee is reviewing the abstracts and around the end of December 2007, authors will be informed whether their abstracts have been accepted for oral or poster presentation.

More information and news about the sanitation challenge can be found at [www.sanitation-challenge.wur.nl](http://www.sanitation-challenge.wur.nl) or via [leaf@wur.nl](mailto:leaf@wur.nl).

The Sanitation challenge is only one of the



activities that are organized within the framework of the International Year of Sanitation (IYS). Everybody in the Netherlands that organizes activities in the framework of the IYS may use the 'Wij doen mee!'



logo. In this way the Dutch contribution to the IYS becomes more visible. The logo and a list with a complete overview of activities may be downloaded via [www.nwp.nl/IYS2008](http://www.nwp.nl/IYS2008). The Netherlands Water Partnership is coordinating the activities around the IYS and Partners for Water is co-sponsoring the coordination.

## ORBIT 2008

LeAF is very active in biogas projects. Organic waste management is one of the sectors where production of biogas is a hot topic. Anaerobic digestion of complex and relatively wet organic waste streams is an attractive option to deal with these types of waste. Biogas, a renewable energy source and a valuable end product, is produced together with compost, which can substitute peat. Anaerobic digestion is one of the main topics in the bi-annually organized conference on Organic Recovery & Biological Treatment, ORBIT. Wageningen University and Research Centre will host ORBIT 2008 "Moving Organic Waste Recycling towards Resource Management and for the Biobased Economy" at October 13-15, 2008. LeAF will be organizing this conference on behalf of Wageningen UR and will also be functioning as the chair of the scientific part of ORBIT 2008.

ORBIT 2008 will deal intensively with organic residues including biowaste. The more traditional subjects of composting and anaerobic digestion will be presented together with various matters dealing with technology and product quality. New aspects like the complex issues of sustainable energy recovery from biomass, organics as feedstock for the bio-based economy, the carbon competition and the need for a strategy for the preservation of the humus content in soils worldwide will also be addressed.

While the scientific discussion and the presentation of the latest research findings are in the foreground of the ORBIT conference, the involvement of the ongoing European political context on waste, recycling, renewable energy and climate change will find its place in the course of the presentations and discussions. High technology on the one hand and the demand for affordable low-technology solutions on the other hand, the traditionally well-attended session "Technologies for Developing Countries" will again be included in the program.

More information can be found on the conference website [www.orbit2008.de](http://www.orbit2008.de) where also the flyer of the conference can be downloaded. Abstracts can be submitted until the end of February 2008.

## MobiSan® for informal settlements in Cape Town, South Africa

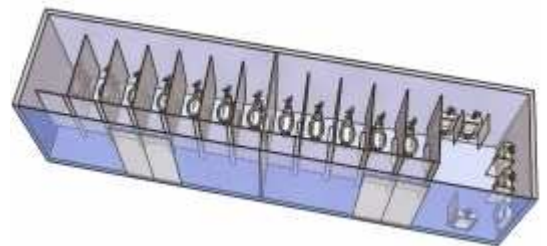
*LeAF is cooperating with Vitens-Evides International and Landustrie Sneek on the practical*

*demonstration of a mobile sanitation system (MobiSan®) for application in the informal settlements of Capetown. MobiSan® will provide a flexible, community-based sanitation solution that fits the characteristics of the settlements and the needs of Cape Town Water Services, the organization that is responsible for the provision of basic services to these settlements.*



Example of current (shared) container toilets in one of the settlements. Because of shared responsibility between families these toilets are often poorly maintained

The provision of water and sanitation services in informal settlements and slum areas is currently high on the international agenda. Many rapidly developing cities have such informal settlements. They are inhabited by rural dwellers that draw to the city in search for work and income. Informal settlements are often characterized by their temporary character and high population dynamics. They are often located on lands that are unsuitable for city development, because of e.g. steep slopes or frequent flooding. In many cases construction of water supply and sewer networks is impossible or very costly.



Artist impression of the MobiSan® unit that will include toilets, urinals and a treatment system

The city of Cape Town, South Africa, has seen a rapid growth in informal settlements around the city during the last ten years. The city has approximately 220 of these areas, inhabited by approximately 800,000 people at this moment. The municipality has committed itself to provide these people with basic water and sanitation services in order to safeguard public health. The responsible authority, Cape Town Water Services Department, is cooperating with Vitens-Evides International (VEI), in order to develop strategies and measures for this purpose.

VEI, in turn, has established cooperation with LeAF and Landustrie Sneek BV to develop and demonstrate a mobile sanitation system in one of the informal settlements in Cape Town. This mobile sanitation system will consist of a sea container equipped with toilets, urinals and treatment facilities. The system will have a caretaker and the potential for employment of



local entrepreneurs that earn their money (partly) with the sale of relevant articles (e.g. toilet paper, soap) and an entrance fee for the showers.

The funding for the project comes from Partners for Water. The ultimate aim is to develop a product that potentially has a very large market. Based on the demonstration the Water Services Department will decide whether more of these units will be purchased.

*For more information: contact Adriaan Mels (Adriaan.Mels@wur.nl)*

### **LeAF contributes to water and sanitary infrastructure improvements in Kenyan youth prison**

LeAF organized a lustrum symposium to celebrate its 10 year anniversary on June 8, 2007. Participants were asked for a voluntary donation as a birthday present to LeAF in order to fund a water and sanitation project in Mombassa, Kenya. A total of € 6,000 was raised, and this amount was doubled by the Aqua For All Foundation (A4A) to a total sum of € 12,000. This money will be used to improve the water and sanitary infrastructure in the Borstal Institution of the Shimo la Tewa prison in Kenya.

The Borstal Institution is a facility for juvenile delinquents who by virtue of their age cannot be integrated into the main prison system. The institution houses almost 300 inmates with a daily staff attendance of some 30 people. It is basically a training institution and as part of their reformatory process inmates have to follow a three year course of study. Some of the courses taught are masonry, carpentry, tailoring, painting and metalwork. At the end of the three years the students take the Kenya Trade Test Examinations.

The facility was first established as a naval base during the World War II and was built to house a maximum of 100 people. Currently the population of 300 inmates and 30 staff members is exerting a lot of pressure on the existing facilities. Also, the infrastructure is in poor state as a result of wear and tear over the years.

To address the problems with the current infrastructure A4A, UNEP and LeAF will finance a project to improve water and sanitation services in the Borstal Institution and to demonstrate a DESAR approach with separation and use of (waste) water flows at source.

Firstly, rain water will be harvested for further use. Furthermore, grey water will be detached from the other streams and treated separately. Three ecosan demonstration toilets will be constructed from where compost and urine will be generated for use in the prison's farm. A biogas digester for black water treatment will be constructed, which will be able to deal with the increase in population. The biogas will supply gas

that will be used for cooking and lighting and as such will save large amounts of fire wood. Effluent from the grey water stream combined with the black water stream will be led through a wetland system and thereafter it can be used for agriculture and aquaculture purposes.

### **Evaluation of co-digester performance**

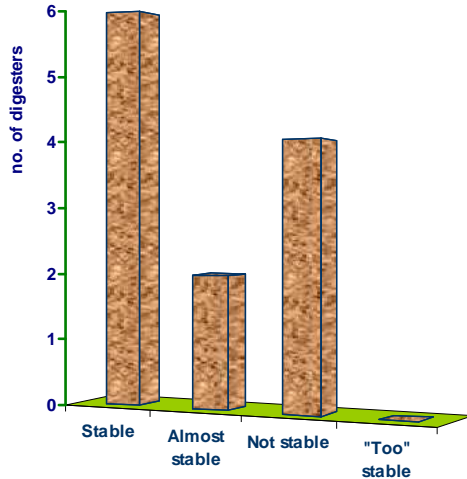
The centralised and decentralised (co-)digestion of animal manure for biogas production is popular in many countries, and the number of installations is increasing steadily. When looking at the large variety in used systems, from very high-tech to quite low tech, one is tempted to conclude that the technology and the processes behind it are rather straightforward. This is true up to a certain extent: it is easy to produce biogas from manure, either alone or in combination with other anaerobically degradable materials; this is a process that occurs spontaneously in many places in nature. The difficulties arise when the objective is to do this efficiently and with continuous stable production. In fact it is quite a challenge to achieve a continuous optimal biogas production from complex substrates, and more so when the digester loading and substrate composition are changing in time.



WUR-ASG digester in Sterksel

The retention time (RT) of a co-digester should be such that there is an optimal gas production from the mixture of manure and co-substrates (such as organic waste streams or energy crops), and that a stable digestate is produced. A stable digestate has a very low concentration of VFAs and produces little biogas during storage. At the same time a very long retention time calls for a large reactor volume, so there is an economic optimum somewhere. A digester should be designed for a specific mix of substrates, for which the biogas production was measured in a test that allowed choosing a good RT, and for a certain temperature. When the digester is running, there are some key parameters to consider in the evaluation of its performance: the remaining biogas production of the digestate, its concentration of short-chain volatile fatty acids (VFA) and the change of the latter throughout the digestate biogas production test. At our labs we can determine these parameters and we have done so with samples from different manure co-digestion plants.

In practice, digesters are built to run at a certain RT, but fed with a continuously changing substrate mix (driven by availability and thus by costs). Also, the manure quality and digester temperature often vary during the year. It is no surprise then that many of the digestate samples analysed at our labs turned out to be instable (i.e. the RT was too short), others were actually too stable (i.e. the RT could be shorter) and some appeared to be inhibited by extremely high VFA concentrations. Very few samples indicated a good operation of the digester they were taken from.



Unstable digestate (with non-inhibiting VFA concentrations) gives a large biogas production in the digestate storage, so only installations with a gas-proof storage can utilise this extra gas. In other installations the gas will simply escape to the atmosphere and contribute to global warming: CH<sub>4</sub> has a global warming potential that is 24 times larger than for CO<sub>2</sub>. We say "extra" gas because in fact most of it could be captured in the digester itself if the retention time was increased to better fit the optimal RT for the used substrate. When the retention time is too long, the biogas production of the system can be seen as suboptimal. The loss of biogas that could have been captured for energy production is the lesser of the problems that can arise from unstable digester performance. In some cases the system collapses completely, and then a new start-up needs to be performed. It can take months before a digester is performing normally again, which is a long time when taking into account that one month of low gas production can result in a year without profit.

*For more information please contact Grietje Zeeman (Grietje.Zeeman@wur.nl)*

*Tests we regularly perform with co-digester samples are:*

- maximum biogas potential (MBP) of substrates
- degradation rate of substrates
- anaerobic stability of digestate
- aerobic stability of digestate

## **Achievements with the Lettinga Award 2004!**

### **Going full circle in innovation....**

Professor Madalena Alves of the Institute for Biotechnology and Bioengineering of the University of Minho in Braga Portugal, received the Lettinga Award in 2004 at the IWA World Congress on Anaerobic Digestion (AD10) in Montreal, Canada. The money that comes along with winning the Lettinga Award was well spent as was shown in professor Alves' presentation at IWA AD11 in Brisbane, Australia this year.

Anaerobic treatment had a bad name in Portugal and the Lettinga Award initiated a cycle of anaerobic wastewater treatment innovation in Portugal that led to an international patent, the winning of two national innovation awards, lots of media coverage, new projects and funding, employment, and the start of a new company, AMBISYS. Furthermore, the image of anaerobic treatment in Portugal improved due to this cycle of events.

The work of the group of Professor Alves focuses on the anaerobic treatment of fat containing water. The Lettinga award was assigned to her group to build a 1 m<sup>3</sup> pilot sequencing batch reactor for the anaerobic treatment of dairy wastewater that contains long chain fatty acids (LCFAs) with the aim to convert the LCFAs to methane. From that moment onwards the cycle began (see figure below) and the results had an enormous influence on the acceptance of anaerobic technology in Portugal.



The winning team of the Lettinga Award and Gatzke Lettinga in 2004 (courtesy Madalena Alves)



## AD 2004, Lettinga Award A New Anaerobic Treatment for Efficient Mineralization of Lipids/LCFA

### Novel reactor design for the anaerobic treatment of fat containing wastewater

- International patent application (2005)
- Portuguese national innovation prizes
  - BES Innovation Award (2005)
  - National Environmental Innovation Award (2006)

- #### Jobs
- PhD position
  - 3 jobs within start-up company

#### Company start-up (2007)

- Specialized in wastewater treatment systems
- Marketing of the novel reactor in development
- Further innovation within the field of wastewater treatment

#### Media coverage (2006)

- Anaerobic treatment in the Portuguese spotlight after past negative experiences
- Approach by companies with wastewater problems

#### New projects & funds

- Development & hydrodynamic characterization of the novel reactor
- Mobile pilot plant construction for on-site testing
- Wastewater treatment consultancy

Figure courtesy Merijn Picavet

## Upcoming events

### Spring 2008

E-course on Wastewater Reclamation for Agricultural Reuse

If you are interested to participate in this course, please send an e-mail to [info@leaf-water.org](mailto:info@leaf-water.org) and we will provide you with a registration form and course details.

### May 19-21, 2008, Wageningen, The Netherlands

Sanitation Challenge

*An international conference on new sanitation concepts and models of governance*

More information: [www.sanitation-challenge.wur.nl](http://www.sanitation-challenge.wur.nl) or contact the congress secretariat at [leaf@wur.nl](mailto:leaf@wur.nl)

### October 13-15, 2008, Wageningen, The Netherlands

Orbit 2008

Moving organic waste recycling towards resource management and for the biobased economy

More information: [www.orbit2008.de](http://www.orbit2008.de)

## Colophon

LeAF (Lettinga Associates Foundation) is an independent knowledge centre working on the development and implementation of sustainable environmental protection technologies with the aim of (re-)utilisation of valuable compounds in waste and wastewater and the improvement of the quality of life of people living in countries in transition. LeAF has close ties with Wageningen University and one of its aims is to bridge the gap between research and practical application. LeAF does not receive donor funding and earns its income from projects related to applied research, consultancy tasks, organisation of courses, biological tests, etc.

Twice a year LeAF 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@leaf-water.org](mailto:leaf@leaf-water.org). 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'.



## Appendix – LeAF publication list 2007

In 2007 LeAF co-workers have published a number of articles on a variety of subjects. This list can also be found on our website, <http://www.leaf-water.org>

### Articles

Mels A., Telkamp P., Koetse E., Braadbaart O. (2007) Praktijkervaringen met zwart- en grijswatersystemen in Noorwegen en Duitsland, H2O / 10, 25-28

Mels A., Jacobi J., Seghezzo L., Bijlmakers L., de Hoog J., Anten M. (2007) Nederlandse hulp voor waterproblemen in Matagalpa, H2O / 16, 26-17

Van Lier J.B. (2007) Agrarisch hergebruik van gezuiverde effluenten. SPIL 239-240: 25-28.

Van Lier J.B. (2007) Water en grondstoffen terugwinnen met anaerobe zuivering; is de historische veronachtzaming volledig achterhaald? SPIL 237-238: 23-26.

Van Lier J.B. (2007) Duurzaam omgaan met een essentiële 'grondstof in overvloed'; meervoudig watergebruik op de waterplaneet. SPIL 233-234: 9-14.

### Conference contributions

Nielsen A.M., Spanjers H. and Volcke E.I.P. (2007) Calculating pH in pig manure taking into account ionic strength. Presented at 11th World Congress on Anaerobic Digestion, 23-27 September 2007.

Spanjers H. (2007) Anaerobic digestion: industrial wastewater treatment technique or resource conversion technology? Global Water Management Congress, Dubai, 19-20 November 2007

Veeken A., Blok W., Mels A., Moolenaar S., van Ewijk H. (2007) Present and Future Strategies for Biowaste Management. 2nd BOKU Waste Conference, April 16 - 19, 2007, Vienna, Austria. <http://waste-conference.boku.ac.at/>

Veeken A., Blok W., Moolenaar S., Grigatti M. (2007) Standardized determination and classification of compost organic matter stability. 2nd BOKU Waste Conference, April 16 - 19, 2007, Vienna, Austria. <http://waste-conference.boku.ac.at/>

Van Lier J.B. (2007) Current and future trends in anaerobic digestion: diversifying from waste(water) treatment to resource oriented conversion techniques. In: Proc. of the 11th IWA-International Conference on Anaerobic Digestion, Brisbane, Australia, 23-27 September, 2007. Invited key-note speaker

### Other publication types

Project internet site "Agua para Todos - Agua para Siempre", launched in November 2007: <http://www.aguaparatodos.nl>