



LeAF Letter

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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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and Colson contributed via the Lettinga Award to the development and implementation of anaerobic processes. Details on the winning project can be read below.

Whatever the future may bring us, it certainly includes a new location for LeAF. Early 2011 we will move to another building of Wageningen University and Research Centre, together with the sub-department of Environmental Technology. P.O. Box and e-mail addresses remain the same. Although we aim to minimize the changes, some telephone numbers may be subject to change. The relocation also means that our laboratory will be closed for a couple of weeks. We will keep you informed via our website.

For now I wish you all some beautiful and inspiring moments during the weeks to come.

Marjo Lexmond
Managing director

Dear Readers,

The world economic crisis is more severe than many experts may have imagined and as a result the Dutch Government is reducing the budget of many governmental and funding organisations. Although we notice that for others these developments already have serious impact, the effects for LeAF are not (yet) significant. As we have many different types of clients and do not receive structural funding, our financial risks are minimized. In addition, in the field of water, energy and sanitation there is a lot going on. Many challenges lie ahead of us and some of them are presented as recently started projects in this LeAF Letter. A frequently met challenge is the proper implementation and long term operation of (anaerobic) treatment systems in countries or areas where things are organised in a different way than in our own country. Then, it is not simply a matter of applying the most suitable technology. Social factors and structures are (at least) as important as technological aspects.

That is why one of our aims is to train people from all over the world so that they can apply their knowledge in the region they know best. And that is why LeAF will offer a course on Anaerobic Wastewater Treatment by the end of March 2011 in Wageningen.

I would also like to draw your attention to the fourth Lettinga Award, funded by *Biothane Systems International*, *Colson b.v.* and the *Lettinga Foundation*. We are very pleased that Biothane

Winner Lettinga Award 2010

Every three years LeAF and some Dutch companies active in the field of sustainable anaerobic technologies organize the Lettinga Award, a prize of 25,000 Euros, for the most promising project proposal. *Biothane Systems International* was the main sponsor of the Lettinga Award 2010 and in addition funding was provided by *Colsen bv.* and the *Lettinga Foundation*. The focus of this year's Lettinga Award was enhancing the efficiency of anaerobic treatment.

The winner of the Lettinga Award 2010 has recently been announced during the 12th World Congress on Anaerobic Digestion (AD12) in Mexico. It is the proposal of Shelley Brown-Malker, Rene Rozendal, Damien Batstone, Paul Jensen, Cristian Picioreanu, Korneel Rabaey and Jurg Keller from Advanced Water Management Centre (AWMC), University of Queensland in Brisbane, Australia.

A number of high quality proposals were submitted for Lettinga Award 2010 and the judging committee, consisting of Prof. Fons Stams and Prof. Huub Rijnaarts from Wageningen University, Mr. Bram Versprille from Biothane Systems International and Mr. Joop Colsen from Colsen b.v., had a difficult task to select a winner. There was a competition for the third place between proposals of Prof. Han-Qing Yu from the University of Science and Technology of China in Hefei

and Dr. Robbert Kleerebezem from Delft University of Technology. On the second place ended the proposal of Dr. David Jeison from the Universidad de La Frontera in Temuco, Chile. However, the clear winner was the proposal of Dr. Shelley Brown-Malker and her colleagues entitled "Bio-Electrochemically upgrading the CO₂ and H₂S fractions of biogas: increasing the efficiency and adding value to Anaerobic Digestion technology". This proposal was rated highest for its scope, quality and innovative approach. On behalf of the judging committee and LeAF, Mr. Jeroen van der Lubbe handed over the Lettinga Award to Prof. Jürg Keller, director of AWMC, during the AD12 in Mexico, beginning of November 2010.



Prof. Jürg Keller presenting ideas behind the winning proposal at AD12, Mexico

The winning proposal addresses the issue of increasing volumes of biosolids from WWTPs in Australia. Biosolids often undergo a pre-treatment step followed by anaerobic digestion. During the digestion a biogas is formed as a mixture of methane (~50%), CO₂ (~50%) and residual H₂S. The research proposal is building on previous promising results, obtained by the same group at AWMC which used solubilised biosolids as an influent to a BioElectrochemical System (BES). The proposal includes placement of two BESs in series after biosolids undergo pre-treatment and anaerobic digestion, aiming at: removal of the residual organic fraction from the digestate; conversion of the CO₂ biogas fraction to CH₄; removal of H₂S and production of H₂O₂ for on-site usage or down-stream combination with methane for bio-methanol production.

The judging committee was impressed by the quality of the winning proposal. They believe that the team has the appropriate scientific basis to bring the proposed work to a success. The winning team consists of two groups from AWMC (BioElectrochemical Systems and Anaerobic Biotechnology group) and the Environmental Biotechnology group of TU Delft.

For more information about the Lettinga Award please check the LeAF website www.leaf-water.org

Announcement for the course 'Principles of Anaerobic Wastewater Treatment' – March 2011

LeAF is offering a three-day course entitled 'Principles of Anaerobic Wastewater Treatment'. The course will provide the basic concepts on anaerobic treatment of municipal and industrial wastewaters, with a special focus on UASB (Upflow Anaerobic Sludge Blanket) technology. Some of the topics that will be addressed are:

- Evaluation of wastewater characterization,
- Microbiological and biochemical aspects of anaerobic treatment,
- Design considerations and design exercise,
- Operation and maintenance of UASB reactors, laboratory studies / tests.

The course will be organized in Wageningen, the Netherlands on March 23-25, 2011. The standard registration fee is € 985,- per participant, and € 500,- for participants from low income countries and/or PhD students.

If you are interested or like to have more information, please check the website www.leaf-water.org for the preliminary programme and registration or contact Darja Kragić Kok (darja.kragic@wur.nl).

First UASB to treat municipal wastewater in Morocco

LeAF is participating in a consortium for the construction of an anaerobic wastewater treatment plant for the city of Kasba Tadla in the centre of Morocco. The consortium further consists of the joint venture Mabsout Colsen Environment and Energy s.a.r.l. and the municipality of Kasba Tadla. This project will deliver the first municipal wastewater treatment plant of the UASB type in the country treating municipal wastewater.

The lack of sufficient water resources is endangering the main economic pillars agriculture and tourism and thus the country's economic growth aspiration. Wastewater treatment technologies are expensive due to high investment cost, and operational and maintenance costs. The Moroccan government has therefore raised the priority of proper water management in order to safeguard a sustainable development of the country's economy and ecology. Awareness on local level is also rising, hence the interest from the municipality of Kasba Tadla and their associated partners to implement the first water sanitation plant based on UASB Technology in Morocco.



Oum Er Rbia river



This decision is considered to be an effective solution for the city's environmental problems caused by the discharge of untreated domestic and industrial wastewater into the river Oum Er Rbia.

The project is supported by AgentschapNL through the Private Sector Investment (PSI) Programme of the Dutch government. The programme provides financial support for innovative investment projects in emerging markets in Africa, Asia, Central and Eastern Europe and Latin America. This particular PSI project distinguishes itself in such a way that both the Dutch and Moroccan partners transfer knowledge and technology into the Moroccan society in order to sustain the business co-operation. The municipality of Kasba Tadla made the necessary funds and land available for the construction of the plant.

The treatment plant is designed to treat the sewage from 28 000 inhabitants thereby producing energy in the form of biogas and an effluent that is suitable for irrigation.

This pilot project will not only be a show case for Kasba Tadla, but also for other municipalities facing similar wastewater problems. There are numerous (smaller) cities in the region that have no or poorly operating treatment plants. The success of this project should lead to the establishment of treatment plants based on the same concept throughout Morocco and in other (North-African) countries, where climatic conditions are comparable.

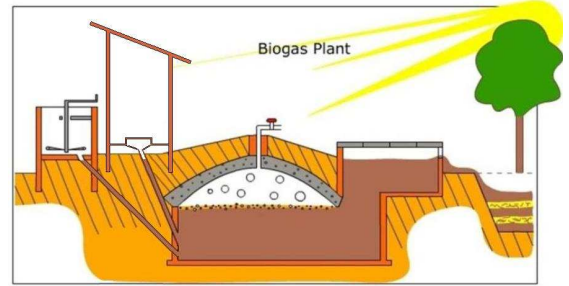
For more information contact Henri Spanjers (henri.spanjers@wur.nl).

Domestic anaerobic digesters in developing countries: how to improve practices?

During the workshop Anaerobic Digestion in Developing Countries, held as part of the 12th World Congress on Anaerobic Digestion (AD12) in Guadalajara, Mexico, October 31st – November 4th, LeAF, in collaboration with the Netherlands Development Organization SNV, has proposed to establish a working group on the improvement of practices in the operation of domestic anaerobic digesters.

Small scale domestic biogas plants are a very successful application of anaerobic technology worldwide. These plants, that are usually fed with dung and human excreta, contribute significantly to good family health, safe sanitation, agricultural production, decentralized energy supply, local employment and protection of the environment. In Asia about 40 million of these plants, with a typical biogas production of 1-4 m³/d, have been installed. However, the total technical potential for Asia, Africa and Latin America is estimated at 155 million plants.

Although domestic biogas plants are relatively robust and reliable, and their operation is rather straightforward, it is expected that significant improvement of their performance can be achieved in terms of biogas yield and production of stabilized digestate.



Scheme of a domestic biogas plant

LeAF is currently investigating the constitution of an international working group that could contribute to the advancement of operational practice of domestic biogas plants in order to increase biogas yield and digestate quality. During the workshop a number of expert scientists and practitioners from around the world have been identified to form the working group and to define framework and goals of the group.

For more information contact Henri Spanjers (henri.spanjers@wur.nl).

Bio-energy project in Kenya

1300 million cubic meters of methane could annually be produced from agriculture waste in Kenya. A third of such agriculture residue could be fermented directly. Kenya would have enough to replace the fossil fuels which it now imports. This conclusion is drawn by a team consisting of LeAF, the University of Ghent in Belgium and the Moi University in Eldoret, Kenya, and presented in a recent article in Renewable Energy.

First, the volume of waste products in the cultivation of maize, cotton and barley was calculated. Anaerobic biodegradability tests carried out in the laboratory of LeAF have shown that a ton of maize residue can produce 363 m³ of methane, a ton of cotton residue gives 365 m³ of methane, and from barley comes 271 m³ of methane. Fermentation of all the waste products of these crops would yield 1300 million m³ of methane. This could be converted into 3900 Gigawatt hours of electricity, which form three quarters of the current energy production in Kenya.



Biogas stove in Kenya

For more information contact Henri Spanjers (henri.spanjers@wur.nl) or visit http://resource.wur.nl/en/wetenschap/detail/bio-energy_can_replace_petroleum_in_kenya/



TORIPO project for energy production from biomass takes off

LeAF participates in the TORIPO project (TORwash Rioolwaterzuivering Pilot Ontwerp – Torwash wastewater treatment system pilot design). The project kick-off meeting took place in September 2010. In the coming 3 years a consortium consisting of ECN (Energie-Onderzoek Centrum Nederland), Hoogheemraadschap Hollands Noorderkwartier, LeAF, VISNO Machinefabriek (recycling machines), and Triqua will develop a pilot plant installation for the TORWASH process including the wastewater treatment. The main task of LeAF in this project will be to investigate the anaerobic and aerobic treatability of the water that is produced during the TORWASH process and to study the possibilities for the recovery of nutrients (N,P,K) from this wastewater.



Fuel pellets produced from grass, produced on a laboratory scale TORWASH by ECN

In the TORWASH process, 99% of the salt in relatively wet and salt biomass (reed, grass, leaves and digested manure) is removed while the caloric value of the biomass fuel is increased. The biomass treated in TORWASH is already digested or difficult to digest without pretreatment. Pre-drying of the biomass is not necessary, so wet and fibrous biomass, which otherwise are not suitable for simple water extrusion, because the biomass contains chemically bound water, can also be handled.

The principle of the TORWASH process is that biomass is treated thermally under pressure in the presence of water. One of the advantages of the TORWASH process, when comparing the technology with other similar processes, is the fact that the dewatering of biomass is increased to such an extent that the input of a small amount of thermal energy after the process is enough to yield a dry product. The product is a compressed pellet, which can be used directly in a regular combustion facility without the negative effect (corrosion) of the presence of salts. ECN has carried out the proof-of-principle of this concept on a laboratory scale.

For more information contact Miriam van Eekert (miriam.vaneekert@wur.nl)

LeAF part of consortium that wins Vernufteling 2010

A consortium headed by consultant DHV has been awarded this years "Vernufteling", which is an award for the most innovative project/idea presented by a Dutch consulting agency. LeAF is part of the consortium consisting of DHV, the

Waterboard of Hunze en Aa's, STOWA, Delft Technical University, HITC, the Waterboard of Noorderzijvest and Nedmag. Both the public and an independent professional jury honoured the project a first place out of in total 50 submissions.

Existing wastewater treatment plants use an excess of energy to remove nitrogen and phosphorous from water without recovery of the nutrients. The new concept that will be tested at pilot plant scale in the next year aims to recover the nutrients at lower costs and with a lower energy demand from e.g. urine and domestic wastewater. To achieve these goals nitrogen is removed as gaseous ammonia and subsequently used in a special fuel cell to generate electricity and heat. In addition phosphorous is recovered as a high quality starting material for the production of fertilizers

For more information contact Jan Weijma (jan.weijma@wur.nl).

Anaerobic course held in Lima, Peru

Currently, steps are being taken in Peru to improve the situation with regard to domestic and industrial wastewater treatment. Recently new laws and discharge limits were introduced for this purpose. Anaerobic treatment is one of the technologies that could be successfully implemented in several areas in Peru as a key tool for wastewater management, which is why Rosa Elena Yaya Beas (MSc Wageningen University) took the initiative in organising a five-day international course on the anaerobic treatment of domestic and industrial wastewaters in Lima, Peru, from May 31st to June 4th 2010.

In 2008 she also organised a course on anaerobic wastewater treatment in Lima, involving Jules van Lier as main lecturer. That course was a great success and people were interested in a follow-up. Another example of the growing interest in the topic is the recent visit of Lucas Seghezzo to Arequipa, Peru's second largest city, for knowledge transfer on anaerobic treatment of domestic wastewater and evaluation of the design of a UASB for the cities' sewage.



Participants in the course in Lima, Peru



Different groups were involved in setting up the course. It was organised by Rosa Elena Yaya Beas together with the Colegio de Ingenieros del Perú (CIP) in Lima and by LeAF. Sponsoring was provided by the Lettinga Foundation, GTZ Peru and UNITRAR. Also the Peruvian Ministry of Housing, Construction and Sanitation was involved. Different prominent people from institutions involved in the topic, for example from the recently created Ministry of Environment, were invited as guests of honour to mark the importance of knowledge transfer on anaerobic technology in Peru.

The course was split in two main parts. Day two to five were meant to be attended by people with a technological background. Module one, the first day, was accessible for policy makers as well. The large hall at the main office of the CIP in Lima served as the main course venue, whereas a second group of participants was involved through a two-way video link with the CIP office in Arequipa, allowing the interaction of both groups. In total there were 57 participants, of which 13 attended the course from Arequipa. The course was held in Spanish, with Rosa Elena Yaya Beas, Lucas Seghezso and Iemke Bisschops as instructors.



Participants and instructors of the course in Lima

On the first day, Eng. Guillermo León Suematsu was invited to give lectures on the local situation with regard to wastewater management and legislation. During the technical part of the course, all main topics of anaerobic wastewater treatment were discussed, ranging from the biochemical and microbial backgrounds to details on reactor technology. Reactor design principles received special attention, and a practical design exercise was included as the course evaluation. Sustainability issues and multi-criteria analysis to assist in technology selection were included as well. An optional field visit to the UNITRAR treatment plant at Lima's National Engineering University was offered the day after the course.

For more information, please contact Iemke Bisschops (iemke.bisschops@wur.nl).

Workshop on anaerobic biomass digestion held in Wageningen

On June 30th, the workshop "Design and modelling of anaerobic biomass digestion: manure, WWTP-sludge and co-substrates" was held in Wageningen. This anaerobic workshop was organised by LeAF and the Sub-department of Environmental Technology of Wageningen Uni-

versity (WU-ETE). It was part of the project "Maximising the bio-energy potential of lignocellulose biomass: Mitigating the effect of humic and fulvic acids" funded by AgentschapNL. A special focus was given to the co-digestion of manure and sludge from municipal wastewater treatment systems with other substrates, as maize and fat waste respectively.

Presentations were given by Tânia V. Fernandes (WU-ETE) on co-digestion of manure, Ad de Man (WBL, Waterschapsbedrijf Limburg) on digestion of municipal WWTP-sludge and Henri Spanjers (LeAF) on modelling of anaerobic digestion, during the first part of the day. The second part included a hands-on practical in which the participants investigated the effects of co-digestion of several substrates and temperature on biogas production by computer simulations using software programme BioWin.

For more information contact Henri Spanjers (henri.spanjers@wur.nl)

MobiSan website launched by Consul General David de Waal

At the WISA conference in East London, November 29th, Consul General of the Netherlands Consulate, David de Waal, launched the website of the MobiSan project, Mobile Sanitation for the Informal Settlements in Cape Town, South Africa. The MobiSan project, sponsored by Partners for Water programme of the Dutch government, aims at improving the sanitation in informal settlements applying a user-friendly mobile sanitation unit. The MobiSan unit, developed by the consortium Landustrie, Vitens-Evides International and LeAF, consists of a series of toilets and urinals, hand washing facilities and a room for the care-taker. Faecal matter and urine are processed in the unit itself and no water supply, sewerage and electricity is required. The MobiSan was successfully introduced in May 2009 in the informal settlement Pook se Bos of Cape Town with a high user satisfaction. A monitoring program by Cape Town Water Services Department revealed the following factors contributing to this success: the community-based approach of the system, the presence of a caretaker crew for maintenance on the system, and the diversion of urine and faecal matter including the subsequent drying of the faeces, reducing the amount of emptying the system significantly. The consortium is currently working on upscaling of the MobiSan approach in Cape Town and other cities in South Africa.

For more information contact Jan Weijma (jan.weijma@wur.nl) or visit <http://www.waternetwork.co.za/projects/mobisan-project.html>



LeAF publication list 2010

Articles

Kragić-Kok, D., Spanjers, H. and Starkl, M., 2010, Global knowledge based technologies for water supply and sanitation in rural and peri-urban areas – an integrated approach for various stakeholders and decision makers, presented at the Project Antinomos final conference on “Dilemmas in Water Supply and Sanitation Sustainable Technology”, November 22-24, 2010, Bari, Italy.

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Nzila, C., Dewulf, J., Spanjers, H., Kiriamiti, H., van Langenhove, H. 2010, Biowaste energy potential in Kenya, *Renewable Energy* 35:2698-2794

Taş, N., Heilig, H. G. H. J., van Eekert, M. H. A., Schraa, G., De Vos, W. M. and Smidt, H., 2010, Concurrent hexachlorobenzene and chloroethene transformation by endogenous dechlorinating microorganisms in the Ebro River sediment, *FEMS Microbiology Ecology* 74:682-692.

Taş, N., van Eekert, M. H. A., de Vos, W. M. and Smidt, H., 2010, The little bacteria that can – Diversity, genomics and ecophysiology of 'Dehalococcoides' spp. in contaminated environments. *Microbial Biotechnology* 3:389-402.

Weelink, S. A. B., van Eekert, M. H. A. and Stams, A. J. M., 2010, Degradation of BTEX by anaerobic bacteria: Physiology and application. *Reviews in Environmental Science and Biotechnology* 9:359-385.

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Bisschops, I., van Eekert, M., Rossum, F., Wilschut, M., van der Spoel, H., 2010, Betuwse Kunstmest. Winning van stikstof en fosfaat uit urine. STOWA rapport 2010-30.

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Conference presentations

Schram, E., Swinkels, W., van Eekert, M., Schuman, E., Schneider, O., and Verreth, J., 2010, How to prevent off-flavour in farmed fish? Poster presented at Aquaculture Europe, October 5-8, 2010, Porto, Portugal.

Mariska Ronteltap and Miriam van Eekert, 2010, P-recovery from source separated urine. Presented at Trend in Environmental Biotechnology: “Phosphorus: from excess to shortage. Can technology solve the problem?”, November 18, Delft, The Netherlands

Miriam van Eekert, 2010, Nieuwe sanitatie. Verwerking van urine: terugwinning van N en P. Opening van Saniphos, Zutphen 13 oktober 2010 (<http://www.saniphos.eu/>)

Book (chapter)

Miriam H.A. van Eekert, Hendrik Jan van Dooren, Marjo Lexmond, and Grietje Zeeman, 2010, Methane from wastewater and manure. In: “Methane and Climate Change” Earthscan Publishers, 261 pp.

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 all around the world. 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.

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