

March 2005

Content

This NewsLetter is dedicated odour measurement and reduction technologies, which are very hot topics in regards to the new action plan for the aquatic environment 2005-2015.

Odour nuisance can besides industrial production also originate from all types of livestock productions, but primarily from concentrated swine productions because of their predominance in Danish agriculture. The structure development in the agricultural sector tending towards fewer and larger production facilities indicates that it won't be less of a problem in the future. The odour nuisance comes from animal manure – whether it is handled as slurry or solid manure. The odour originates from livestock buildings and manure storage as well as from handling and application of manure.

Odour

An odour is perceived when odorants interact with the sensory receptors in our noses. There are more than a 1000 different receptors, each reacting on a specific group of odorous compounds. Different combinations of interactions between several receptors at the same time do that the human brain can differentiate between more than a 10.000 odours. There are individual differences in the human perception of odour. Perception is not only biologically determined but also cultural influenced and depending on the circumstances. The human sensitivity towards the perception of an odorous compound can differentiate up to a factor 1000. For further information take a look at the following internet references: <http://www.odournet.com/> and <http://www.odour-network.org/>.

Odour measurement technologies

Odour concentration is one parameter describing odour. Odour concentration can be measured in Odour Units [OU_E] after DS/EN standard 13725. 1 OU_E corresponds to the amount of odorous compounds evaporated in 1 m³ air which gives a response (50% criteria, see further in the following paragraph) from a human sensory panel corresponding to 123 µg n-Butanol (European Reference Odour Mass = EROM).

The classical method of measuring odour is through the use of olfactometry, which is the name for the use of humans' sensitive olfactory sense for the measurement of odour. For that purpose an instrument called an olfactometer is often used. It produces a series of dynamical dilutions of an odorous sample, which are presented for a sensory panel. The panel consists of trained people with an olfactory sense in the normal sense range. The panel estimates a given dilution of an odour sample up against a clean air sample as reference point. They start with the most diluted samples, where a difference between sample and clean air isn't possible to detect. The sample is diluted less and less, and gradually an increasing number of the panel members are able to point out the odorous

sample. The dilution step where 50 % of the panel are able to point out the odorous sample is called the odour concentration and is measured in OU_E .

Gas chromatography is an instrument for separating a sample in individual components. It is an expensive method due to the cost of the instrument and it takes skilled personnel for optimization and use. And even though it is a sensitive method the olfactory sense is still even more sensitive!

A sensor is an instrument used for measuring. In connection to odour it is sensors capable of intercepting and measuring odorous compounds. Sensors can be classified in optical, thermal, chemical/biochemical, magnetic and mechanical sensors. The principle in a chemical sensor is based on the interaction between samples (e.g. odours compounds) and the chemically sensitive coating material on the sensory surface. An electronic nose (E-nose) is a system, comprising an array of essentially non-selective sensors and an appropriate pattern recognition. By means of electronic noses it will be possible to do routine sampling of odour in a simple, cheap and fast way. Work is done several places in the world today in E-noses. A network in E-noses with the aim to stimulate information exchange is found at <http://www.nose-network.org/> where key publications, events and an overview of research and products are some of the main features.

LugtTek A/S is a Danish company that has specialized in measurement and reduction of odour. They have developed a method called IQO (Identification and Quantification of Odorants) that by means of GC-MS can decide the type and quantities of odorants in the air. For more information look at <http://www.lugttek.dk>

At DIAS, Department of Agricultural Engineering, an IT-Based Automatic Sampler (ITBAS) is being developed, and a prototype will be ready ultimo 2005. ITBAS consist of a STD-unit (Sensor and Thermal Desorption), a sensor unit, a weather station and a base station. The focus is on a number of odour compounds from the air of livestock buildings, but it could be developed to other odorous compounds as well. The aim is to collect and map odorous nuisances from agriculture under different conditions. For more information look at project description and reports at the Ministry of Food, Agriculture and Fisheries under the homepage for the new action plan for the aquatic environment: <http://www.vmp3.dk/Default.asp?ID=53>.

Odour reduction technologies – 2 examples

Reduction of odour from among others livestock buildings can be approached from different perspectives. Firstly it can be approached by a reduction of the odour source, by preventing odour formation or by a dilution of the odour. Secondly a reduction of the odour can be achieved with biological, chemical and physical processes, two of which are introduced in the following.

Biofilters are based on organic material that uses the activity of microorganisms to help clean the air from odorous compounds. The normal efficiency is 70 – 90 %. Biofilters

can be made of among other things straw, compost, peat, hemp, paper and other fibrous, porous materials. The choice of matrix is extremely important for the efficiency and running costs, and there is still further research in this field by among others The National Danish Committee for Pig Production.

Another way to reduce the odour nuisance from livestock buildings is to use a wet scrubber for absorption of odour, ammonia and dust from livestock buildings in water droplets. Danish Institute of Agricultural Sciences (Department of Agricultural Engineering) has in collaboration with Aalborg University (Department of Energy Technology), University of Southern Denmark (Department of Biochemistry and Molecular Biology), The National Committee for Pig Production, Turbovent and Solum developed a scrubber for mechanically ventilated livestock facilities (Farm Wet Scrubber). The project will during 2005 establish a full-scale pilot project where the effect of the scrubber is tested. For more information on the project look at: <http://www.danet.dk/danet/danet3f.html>

Topics of coming newsletters

Biosensors

Automatic and manual technology for early identification of production diseases

Robotics in agriculture