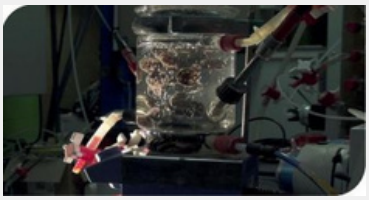
ENVIRONMENTALLY EFFICIENT TREATMENT OF PHARMACEUTICAL POLLUTANTS IN WASTEWATER - MERMISS PROJECT

CASE STUDY - Pharma

| The client's needs

Drug residues in wastewater from hospital, domestic areas and pharmaceutical industry, are not removed by most municipal wastewater treatment plants and they therefore enter the environment. An effort is being made in Denmark to develop a technology that may be used to treat wastewaters containing pharmaceuticals in an efficient and environmentally acceptable manner. The research project known as MERMISS was first executed at Skejby Hospital in Aarhus and has since been extended to the municipal WWTPs Viby in Aarhus and to Herning. Krüger A/S, subsidiary of Veolia Water Technologies in Denmark, is one of the partners contributing to the project.



| The solution

Activated sludge is commonly used to treat wastewaters. It is an effective method for removing readily degradable pollutants and nitrogen compounds, but is ineffective on moderately or hardly degradable drugs. The MERMISS project focused on biofilm based technology for the removal of these difficult-to-degrade pharma- ceutical residues from hospital wastewaters as well as from municipal wastewater treatment plants.

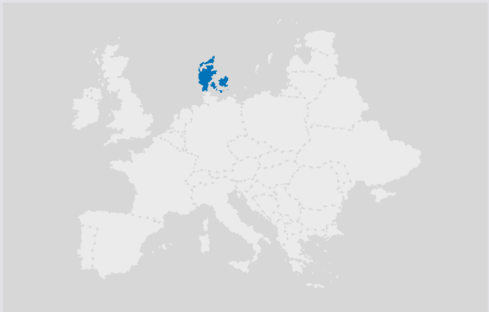
Veolia's MBBR solution at the centre of the project

The biofilm technology applied was the Moving Bed Biofilm Reactor (MBBR) principle, where biofilm is formed on plastic carriers, a process promoting slow growing microorganisms which can target difficult degradable compounds. Both stand-alone MBBR and HYBASTM - an integrated fixed film and activated sludge technology developed by Krüger A/S - were studied.

The concept was seen as a cost-effective treatment line compared with other approaches.

| Process description

It was initially tested in laboratory scale on wastewater from an oncology department, and later in medium capacity pilot scale on wastewater from a hospital and wastewater from Herning Water, and finally effluent from the municipal WWTP in Viby.



Denmark

| The client

The Technical University of Denmark, The Danish Technological Institute, Aarhus University, the New University Hospital in Aarhus, Krüger A/S, Herning Water, Aarhus Water, and Air Liquide have been involved in the development project "Environmental Effective Purification of High Potential Drugs in Hospital Waste Water", also known as the MERMISS project.

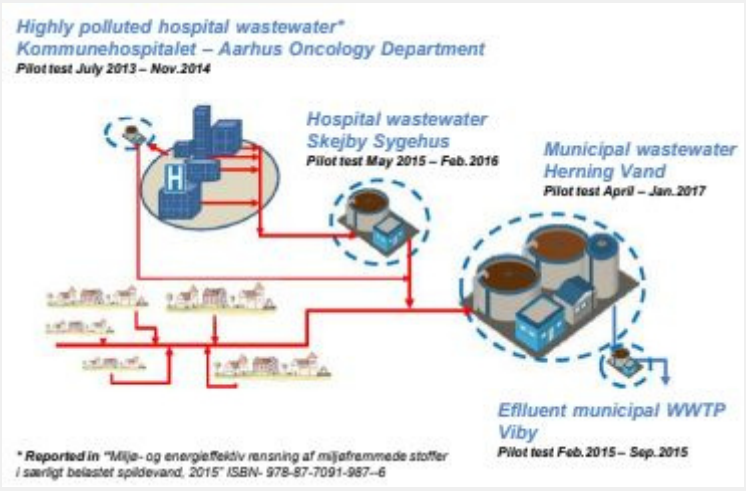
Mermiss has been partly funded by the Danish Ministry of Environment.

It is worth noting that a study by the University Hospital in Aarhus showed that over 96% of the total consumption of drugs takes place in the patients' homes and the main environment load therefore comes from households.

The research conducted to date has demonstrated that the biofilm-based technology is far more effective than the conventional active sludge treatment at removing moderately or hardly degradable pharmaceuticals from all types of wastewaters tested. Degradation of 50 - 100% was obtained for most of the more than 30 compounds studied and at unprecedented reaction rates.

"It has been important to show that the purification technology can be used not only for treatment of hospital wastewater but also as an effective method to upgrade the effluent from the municipal wastewater treatment plants as it is here that the vast amounts of the drugs are to be found", Cristina Sund, Krüger A/S.

The figure below provides an overview of bench scale (litre scale) and pilot scale experiments (m3) conducted on site for the different tests. Bench scale and pilot scale test sites were operated between 6-11 months on site as illustrated below.



An economical and sustainable solution

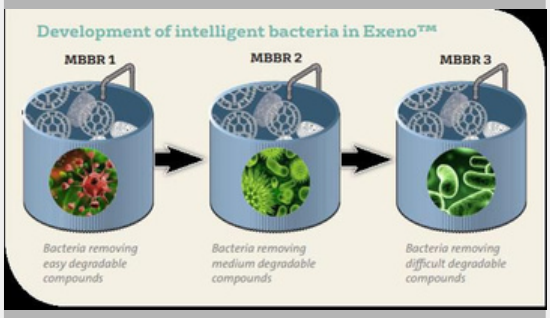
The cheapest and most environmentally friendly method to remove organic compounds from wastewater is biological treatment. However biological treatment cannot ensure PNEC for all target pharmaceuticals. Yet, the more effective the biological treatment, the less ozone and/or activated carbon need to be added. This makes the Veolia's concept much more economical than activated sludge systems, and it also consumes less energy than pure chemical treatment.

From concept to technology. The Veolia solution for drug residues in water

A technology based on AnoxKaldnesTM MBBR (Moving Bed Bio Reactor) for biological removal of drug residues in wastewater. ExenoTM is extremely effective, economic and environmental friendly.

The MBBR technology relies on microorganisms, or bacteria, growing on plastic carriers. MBBR technology involves multiple reactors in series where the microorganisms can be specialised to target the difficult biodegradable pollutants. In contrast to conventional activated sludge systems, MBBR allows for the development of slow growing bacteria essential for degradation of complex compounds. These bacteria are prioritised by creating 'starving conditions' to encourage growth of micro-organisms capable of degrading difficult biodegradable drugs.

For complete treatment of, for example wastewater from pharmaceutical industry, the system will be designed with multiple reactors in series (i.e. three to six MBBR reactors). For post-treatment after existing activated sludge plants normally three reactors working in a cyclic mode and with short retention time is sufficient.



Moving forward

The results of the project are so promising that a new development project, MerEff, has been launched in order to optimise the technology to post-treat municipal WWTPs effluent for pharmaceuticals. Also this project receives financial support from the Ministry of Environment.

> ***With the MBBR process, you achieve a highly efficient biological treatment for drug substances and the overall plant and operating costs are significantly lower than with alternative processes***
>
> ***Cristina Sund, Krüger A/S***

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