

# MistraPharma

## News June 2010

MistraPharma is a Swedish research programme funded by the Foundation for Strategic Environmental Research (Mistra)

In this newsletter some of our most important stakeholders give you good examples of their work towards a sustainable society in regard to pharmaceuticals. You can also read about the latest news from the research in MistraPharma.

### Therapeutic levels of levonogestrel detected in blood plasma of fish

A study, just published in Environmental Science and Technology by the MistraPharma scientist in Umeå and Gothenburg, shows that fish exposed to treated effluent from Swedish sewage treatment plants bioconcentrate a range of pharmaceuticals into their blood. One of these drugs are levonorgestrel, a synthetic progestin in many contraceptives, that bioconcentrates into the blood of fish to levels that exceed the blood levels of women taking the pill.

The concentrations of levonorgestrel found in the treated effluent at one of the three investigated treatment plants (1 ng/L) is sufficient to reduce egg production in fish, as shown by a recent German study. Together these results show that there are environmental risks associated not only with estrogen in contraceptives, but also the progestin component. The new data also add confidence to the MistraPharma approach of using blood plasma levels in fish to assist the prioritization of pharmaceuticals for in depth

studies on effects as well as ways to reduce their concentrations in sewage effluents.



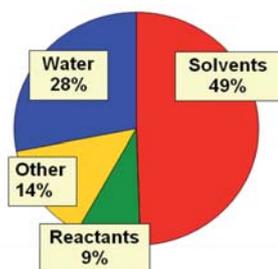
**Dr Jerker Fick,**  
Assistant Professor,  
Umeå University



**Dr Joakim Larsson,**  
Associate Professor,  
University of Gothenburg

### Striving towards greener production at AstraZeneca

The chemical waste from production of active pharmaceutical substance in the pharmaceutical industry is large. A commonly used number is 25-100 kg waste/kg product, but the amount varies depending on the complexity of the molecules. Generally, about half of the waste is solvents, one third is contaminated water and the rest is reactants, by-products and other chemicals.

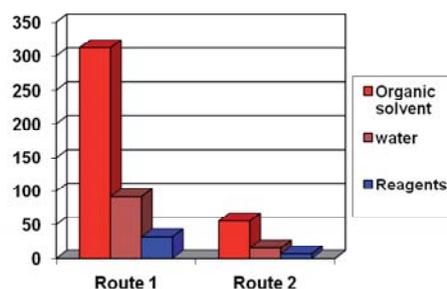


AstraZeneca's code of conduct emphasizes that the company should integrate environmental considerations into our processes. Our reputation is built on the trust and confidence of all stakeholders and is regarded as one of AstraZeneca's most valuable assets.

We have invested a lot of efforts during the last decade to implement a greener working model for the development of production methods for new pharmaceuticals. A "Green Chemistry Network" links environmental specialists with chemists and engineers and promotes the application of Green Chemistry and Engineering principles within the company. One of the major tasks for the network

is to influence the chemist's choice of chemicals in the design of chemical reactions. The chemists should have the green aspects in their mind while choosing between the different chemicals on the shelf.

The efforts have been focused on education on environmental considerations and tools on Solvent selection, Acid and bases, Alkylating agents and "Substance avoidance database" - tools that the Network has devised. The progress of the "green" process development is continuously discussed, e.g. the number of kg/kg product and the "greenness" of the chemicals and techniques used. A typical example of the amount of kg waste/kg product in the beginning of the process (route 1) development and after a few years of green considerations (route 2) is shown in below.



**Eva Jakobsson**  
Process chemist, AstraZeneca

## The County Council's network for pharmaceuticals and the environment

All County Councils in Sweden are taking action to reduce the environmental impact of pharmaceuticals. However, it is not an easy task to ensure prescription that minimizes the environmental impact without affecting the benefit of the patients, and the complexity of the issue requires that several professions work together. Therefore a national network of pharmacists, environmental officers and other specialists from the health care sector was created in 2009. In this way all the professions within the County Councils that are involved in this issue can exchange experiences, good examples and ideas and new, joint goals can be identified.

At an early stage four focus areas were established and working groups were formed, focusing on information, education, procurement and goal-setting. In all these fields, previous local strategies are unified and developed into common objectives. For example, in the field of procurement the working group contributes to the national criteria for green public procurement of pharmaceuticals used for inpatient care. This way the public sector can demand

better environmental performance of e.g. the production of pharmaceuticals.

Also, the group can give input to the MistraPharma projects via the members that are represented in the reference group, and the results of the research can easily be communicated to the majority of the Swedish health care organisations. In the future, the results from MistraPharma will provide even more possibilities for the network to find ways to incorporate environmental aspects into the prescription and use of pharmaceuticals, and as the substances of highest concern are identified, the network with its wide variety of competence will hopefully contribute to a successful risk management strategy.



**Theres Olsen**  
Project manager  
Uppsala County Council

## Pharmaceuticals in wastewater

Stockholm Water Company has recently finalized a research project on pharmaceuticals in wastewater, financed by the City of Stockholm, "Miljömiljarden". One of the objectives was to identify measures to reduce the discharge of pharmaceuticals into the sewers; another was to map the present levels of pharmaceuticals in effluents from the wastewater treatment plants (WWTPs) and in the receiving waters.

Because the operating WWTPs do not remove all pharmaceuticals from the wastewater an important sub-project tested supplementary treatment techniques in order to see if it is possible to further reduce the levels of pharmaceuticals in wastewater. Among the studied methods were some oxidative techniques (ozonation and treatment with UV-light in combination with hydrogen peroxide) and some separating methods (nanofiltration, reversed osmosis and activated carbon). Furthermore, a couple of biological processes were evaluated. Several of the methods proved to work well.

To ensure that additional toxicity would not be introduced, an extensive ecotoxicological testing was performed of waste water treated by the different techniques. Most of the tests were done by researchers later connected to MistraPharma. A balanced assessment was made by the researchers showing that the best techniques from an environmental point of view were activated carbon or ozonation, using a low dose of ozone.

The introduction at WWTPs of additional treatment and the possible positive environmental effects from this, must, however, be balanced against an increased consumption of energy and resources.

The important issue is therefore to better understand the effects of pharmaceuticals in the aquatic environment and thus we are eagerly awaiting the results from the MistraPharma programme.



Figure. Ozonation treatment

**Cajsa Wahlberg**, Environmental Engineer  
**Berndt Björleinius**, Research Engineer  
Stockholm Vatten

**We wish you all a relaxing and wonderful summer!**

**Christina Rudén, Karin Liljelund and, Helene Hagerman**

**If you have any questions you are welcome to contact us!**

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