



WHITE PAPER - REDUCTION OF MICRO POLLUTANTS

Micro pollutants in the water cycle

Micro pollutants in the water cycle provide a long-term hazard to the ecosystem. The effects of these contaminants has been investigated in many large-scale studies over a long period of time, and the results are worrisome. Today's waste water treatment plants are not built to remove these pollutants. But there are solutions available.

Micro pollutants are contaminants that are persistent and bio-active. This means that they are not completely biodegradable and cannot be removed with conventional water treatment technologies. The continued release of micro pollutants with waste water effluent is believed to cause long-term hazards as the contaminants are bio-accumulating and even forming new mixtures in our waters. The exact effects are not fully known.

The ecological impact of endocrine disrupters (EDCs) is more known. It can interfere with the endocrine i.e. hormone system of humans and animals. Studies on different species of fish have shown a negative effect on the reproductive system (for example feminization of male fish) and alteration of behavior that may ultimately change the natural evolution of these species.

Pathways to the water

Micro pollutants enters the water cycle via waste waster treatment plants and surface run-off from agricultural areas or cities. 70% of the pharmaceutical residue found in waste water comes from human consumption and 20% from livestock farming.

Available water treatment technologies

Conventional biological as well as mechanical water treatment methods are not sufficient for reduction of micro pollutants.

There are a couple of available technologies that has been proven to work. Large scale studies in Switzerland, Germany and Sweden, show that ozone and activated carbon are the most viable solutions available. These studies also conclude that ozone is the most environmentally friendly and economically sound solution.

Ozone for reduction of micro pollutants

Ozone has a very high oxidation potential which makes it very efficient. Ozone is also a selective oxidant and primarily attacks electron rich structures in molecules, such as double bonds, and is therefore efficient in breaking down pharmaceuticals and other micro pollutants.

The success of the reduction of micro pollutants is dependent on the design of the ozone solution, the ozone dose, the dissolution system etc but also the individual process conditions at the treatment plant where the ozone system is installed.



MICRO POLLUTANTS

Micro pollutants are persistent and bioactive and thus not completely removed by conventional water treatment methods. The bioaccumulation of these contaminants in our waters is of great concern.

EXAMPLES OF MICRO POLLUTANTS:

- **Pharmaceutical and personal care products (PPCP's);**
 - Pharmaceuticals (prescriptions, OTC-drugs, veterinary drugs)
 - Personal care products (fragrances, cosmetics, sun-screens)
- **Radioactive and/or biologically harmful metals (Pb, Hg, As)**
- **Pesticides**
- **Hydrocarbons**
- **Solvents**
- **Endocrine disrupters (EDCs)**

There are currently 100 000 commercially registered compounds in Europe and residue from the majority of these will eventually end up in the water cycle.



A REDEFINING PRIMOZONE® OZONE SOLUTION

Pilot scale installations for reduction of pharmaceutical residue

In 2014 Primozone built a mobile pilot scale ozone system designed especially for reduction of pharmaceutical residue.

The mobile ozone system was then installed at more than 10 different waste water treatment plants in the south of Sweden.

The aim of these installations was to be able to prove the concept on existing waste water treatment plants and to test and confirm the system design on different water flows and different environmental and process conditions.

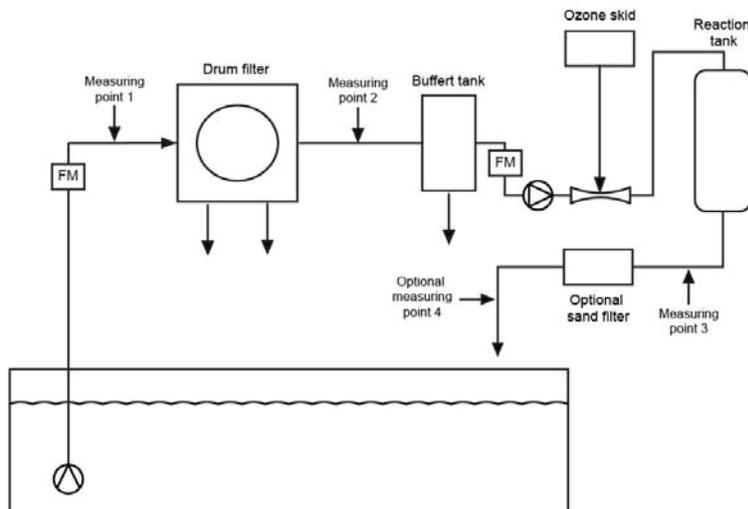
The benefit for each individual water treatment plant is the opportunity to get results that are specific for their plant size, treatment method, process technology and population structure.

Project implementation

Together with the waste water treatment plant it was decided where in the process to implement the ozone system.

Design of Primozone® ozone solution for reduction of pharmaceutical residue

The complete system is mobile and fits in a 20 foot container



The installation of the pilot plant only takes a couple of hours and after the system has been up and running for a couple of days it is possible to take samples for analysis.

The samples are taken before pre-filtration, after pre-filtration and after ozone treatment. If an additional sand filter has been used, samples are also taken after that.

Results

The results from these pilot installations show that with a dose of 5 g O₃/m³ a reduction of up to 95% can be achieved.

These installations also confirmed that the design of the ozone solution is important and that the cost of using ozone is low. In fact much lower than comparative techniques.



EXAMPLE OF SEEN RESULTS

The results depend on various parameters such as DOC (dissolved organic compounds), as well as pH and alkalinity. Other parameters unique to an individual WWTP may also matter.

Below is an example of the results found in the Primozone pilot study.

Reduction of pharmaceutical residue with ozone

- Dose - 5 g ozone/m³
- Result - 95% overall reduction
- Cost - approx. 0.015 Euro/m³

Disinfection is a valuable bonus when treating waste water with ozone

- Dose - 5 g ozone/m³
- Result (reduction in %)
 - Coliform bacteria - 99,9%
 - E-coli bacteria - 99,8%
- No extra cost

Primozone®
Clean water. The natural way.™

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