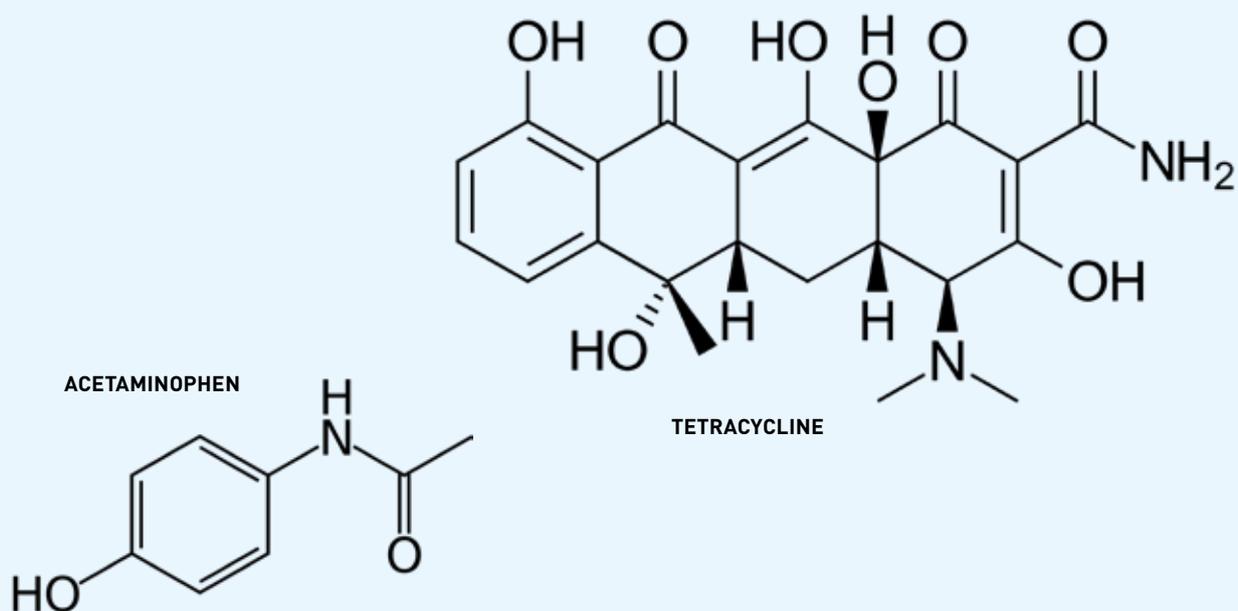
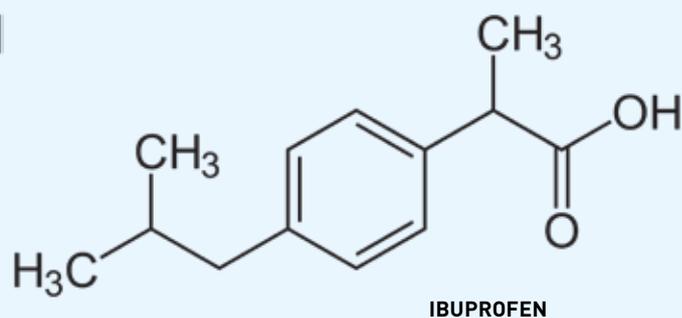
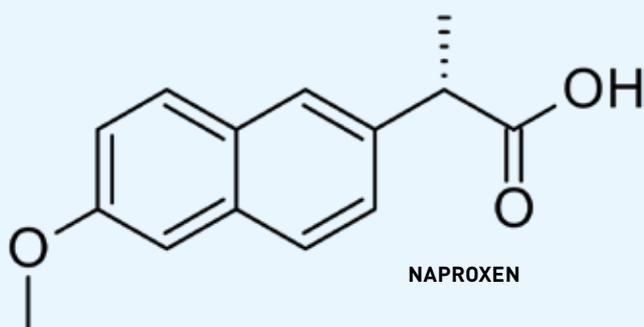
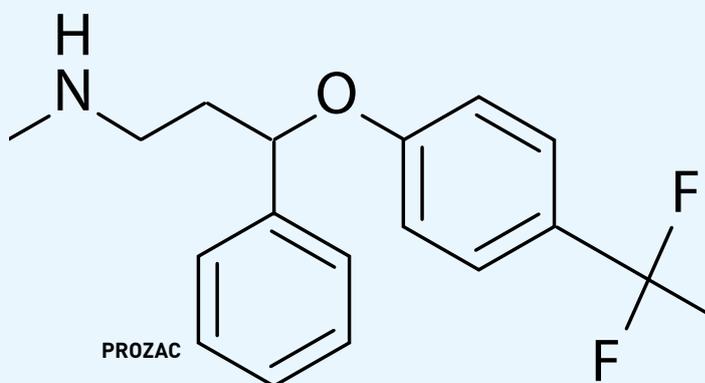
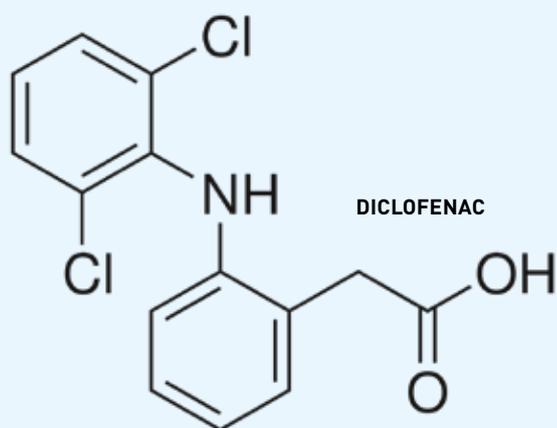


# Pharmaceutical residues in wastewater

A HEALTH RISK THAT CAN BE ELIMINATED

**ozonetech.**

# CAN PHARMACEUTICAL RESIDUES BE REMOVED EFFECTIVELY AND SUSTAINABLY?



# YES, THEY CAN.

Medicines such as antibiotics, pain killers, and antiseptics used to sustain health also have detrimental, environmental side effects.

A large portion of consumed drugs has inevitably affected our environment for a long period of time.

It is now possible to end the accumulation of micropollutants through effective removal of active pharmaceutical ingredients (API).

In parallel worldwide private and public initiatives are taking action to encourage the current development in neutralizing harmful micropollutant emissions.

Ozonetech is a global engineering company, specializing in implementing the most efficient treatment methods for API removal for municipal wastewater treatment plants and the pharmaceutical industry.

We present our technology, engineering expertise, and consulting services required in order to deliver the world's most cost-effective and energy efficient solution.

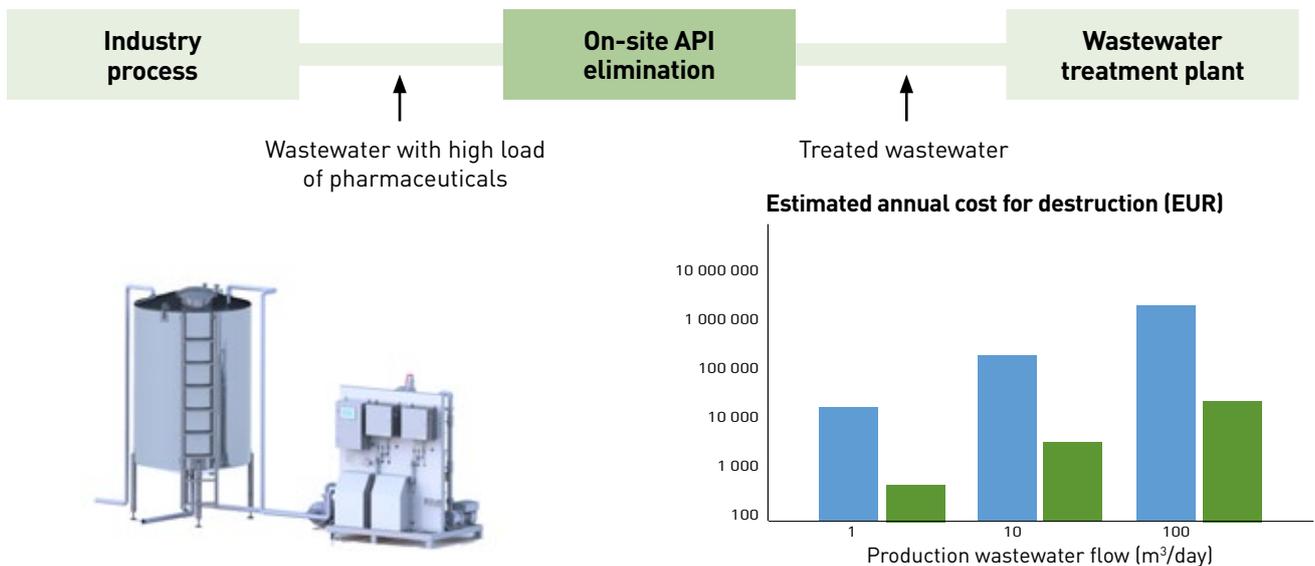
*Only a fraction of active pharmaceutical ingredients (API) can be removed with traditional technologies, leading to harmful effects on flora, fauna and ultimately human beings.*



# TREAT AT THE SOURCE

Large quantities of micropollutants are released directly from hospitals and pharmaceutical production plants in high concentrations. Still the majority of all API residues can be traced to municipal wastewater treatment plants.

## At pharmaceutical production facilities



Pharmaceutical residues can be treated directly at the source in a containerized solution or turnkey system, depending on the client need.

On-site treatment of pharmaceutical residues (green) eliminates the need for high-cost transportation and off-site destruction (blue).

## At hospitals and healthcare facilities



Treating micropollutants at the source alleviates the API load at the municipal wastewater treatment plant.

## At municipal wastewater treatment plants



A fourth treatment stage removing pharmaceutical residues can easily be retrofitted into an existing wastewater treatment facility.

Pharmaceutical residues removal system

# CHOOSE PROPER SERVICE, SCOPE AND CAPACITY

A successful full scale advanced treatment system involves proper analysis, technology and services from start to finish. Ozonetech is an ozone based supplier of oxidation technologies and separation systems dedicated to finding the suitable combination of technologies tailored to each facility.

## In-house engineering services

Each and every system leaving our production facility has gone through the same design steps. All steps are carried out by our in-house experts.

**Pilot projects.** This unique service enables complete customization based on the specific water quality.

**CFD.** We use computational fluid dynamics to ensure the maximum treatment capacity of oxidation technology.

**System design.** We customize the complete solution using a number of technologies such as ozone, carbon filtration and advanced oxidation processes (AOP), fine-tuned with CAD.

## Manufacturing and quality control.

The designed system is constructed and assembled by Ozonetech. As an original equipment manufacturer, we validate performance and operation before shipping.

**Installation.** We offer complete installation services when needed and full assistance throughout the process.

**Commissioning.** As the system has been delivered and installed, we optimize the operation based on local site conditions for a smooth operator experience in order to reach maximum efficiency and lowest possible operating costs.

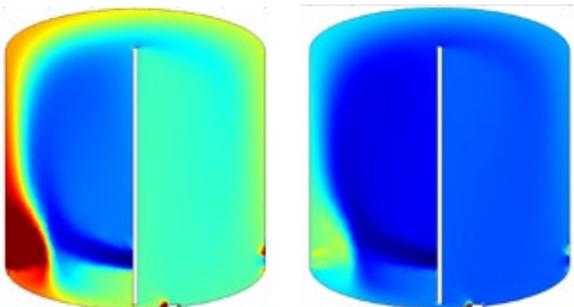
## Pitfalls. Be aware of design flaws. Here is a quick guide how to avoid them.

Perform a proper analysis of API concentrations and water quality to determine the dissolved ozone concentration and type of system.

Make a careful choice of suitable pre-treatment and post-oxidation treatment methods to avoid inadequate results or excessive maintenance.

Choose the proper combination technology to avoid high investment and operating costs.

Choose a turnkey solution from a supplier with extensive engineering and supply expertise.



Example of Computational Fluid Dynamics (CFD) for ensuring maximum reaction rates. Our CFD services are one of many key aspects to efficiently designing an API removal system.

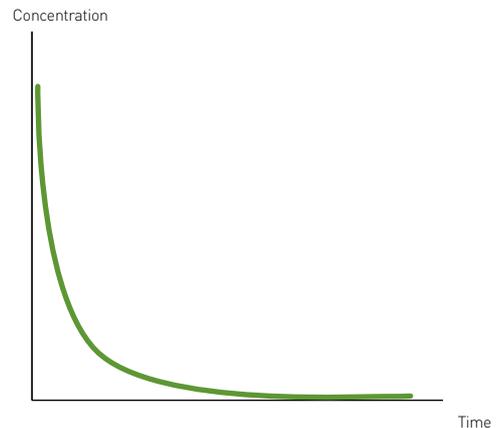


Actual containerized expansion system for on-site treatment of micropollutants.

# SUPERIOR CORONA DISCHARGE OZONE SYSTEMS

We base each micropollutant removal solution on tailored design and engineering, combining ozone with suitable pre-treatment and polishing steps. Depending on the requirements, we design our systems with up to 100% removal of pharmaceutical residues.

All RENA systems are designed with utmost attention to detail and performance, specifically low energy consumption and low maintenance need. Pharmaceutical residues are typically present at nanogram and microgram levels depending on the source. Our most common designs cover ozone treatment, which degrade micropollutants at a very high rate, followed by carbon filter polishing, or extended ozonation. Our designs allow for treatment costs of less than €0.0065/m<sup>3</sup>.



*APIs can be neutralized at rapid rates, which accommodates smaller overall system footprints.*



*A RENA turn-key ozone system can treat over 1,000 m<sup>3</sup>/h of water with a footprint less than 7 m<sup>2</sup>, suitable for containerized design depending on local conditions.*

**RENA**

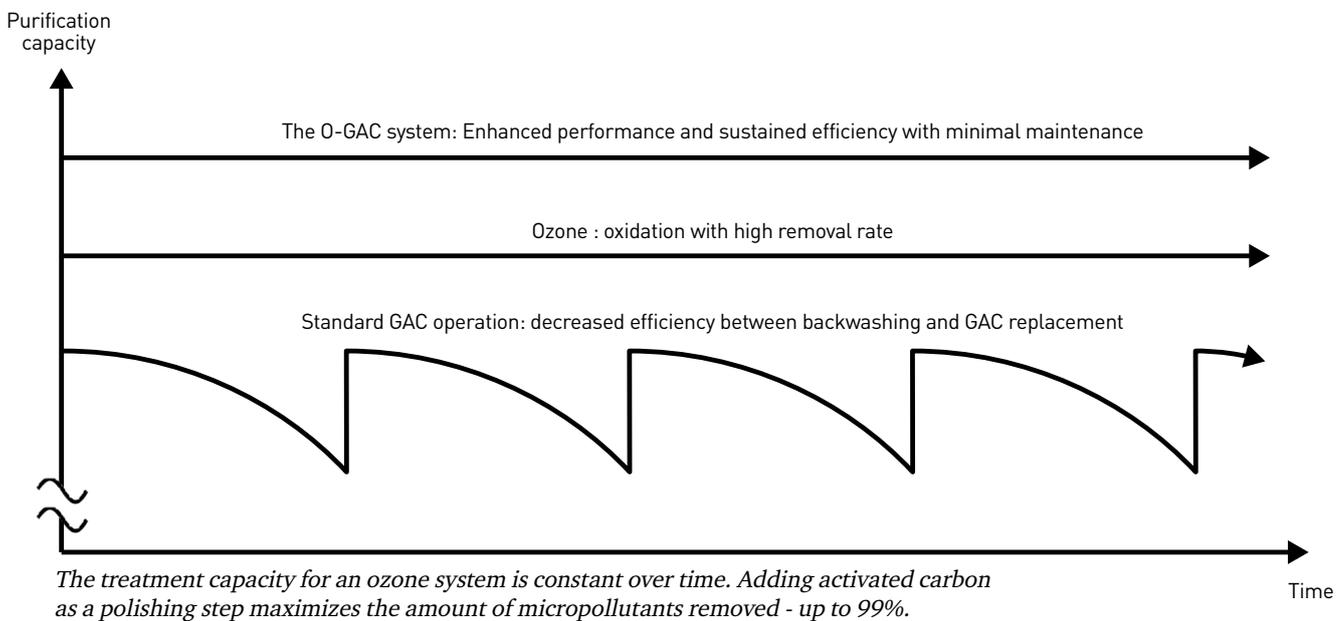
# IN-HOUSE DESIGNED FINAL POLISHING

All water treatment solutions combining a RENA system and a final polishing step are sized and configured for each specific client and task. With the introduction of O-GAC™, time and cost of replacing the activated carbon is highly reduced.

## Ozone and activated carbon - a perfect match

Granular Activated Carbon (GAC) units are good alternatives to oxidation based API removal systems, although frequent maintenance must be considered. We have developed a unique combined oxidation- GAC system which significantly

reduces the GAC replacement and backwashing requirements. Each GAC unit is in-house designed to achieve the most optimal combination with regard to power consumption, removal rate and footprint.



*Our deliveries include all equipment, parts and components - integrated and tested - to supply a fully functioning solution.*



*Granular Activated Carbon (GAC) with the most effective API adsorption rate is always utilized in Ozonetech's O-GAC solutions.*

## About Ozonetech

Ozonetech is an award-winning cleantech company that has offered premium products for air and water treatment since 1993.

Our unique technology and extensive expertise has made us a rapidly growing global company with installations on six continents. All development and manufacturing is located in Sweden. In addition, we have in-house specialists for consultation, planning, installation and service.

As a Center of Excellence within air and water treatment, we also collaborate in international efforts to develop global standards for purification solutions.

At Ozonetech, we have a strong incentive to reduce energy consumption, health risks and the impact on the environment. Our current solutions provide a multitude of benefits in the processing and food industry, real estate, commercial kitchens as well as in the retail market.

For additional information, visit our website at [www.ozonetech.com](http://www.ozonetech.com)

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