

## ADVANCED OXIDATION PROCESS (AOP) WITH IONIZED AIR

### C-ION™ NTP-OXIDATION

**C-ION™** is an innovative and pioneering technology for advanced oxidation based on ionized air – a so-called **non-thermal plasma (NTP)**. It is used in numerous areas of **wastewater and drinking water treatment** as well as **water reuse**. **C-ION™** sets new standards in modern water treatment thanks to its high efficiency, simple integration and broad effectiveness against a wide range of pollutants.

The technology is based on the generation of **reactive oxygen species (ROS)** by means of a dielectric barrier discharge (DBD) in pure ambient air, without any prior supply airtreatment. These ROS are characterized by an extremely high oxidation potential and enable the effective degradation of both organic and inorganic pollutants. These include substances that are difficult to treat, such as **drug residues, hormones, pesticides, herbicides and heavy metals**. The process also has a disinfecting effect and makes a lasting contribution to improving microbiological water quality.

The non-thermal plasma is introduced into the water to be treated either via an immersed turbine or via external blowers and a floor-mounted aeration system. The modular design of the system enables easy retrofitting and integration into existing infrastructures – regardless of the size of the plant.

### IRON, MANGANESE AND ARSENIC REMOVAL

The removal of iron, manganese and arsenic is a key area of application for our process. These elements occur naturally in groundwater, cause deposits and pose a health risk in high concentrations.

Our **C-ION™ oxidation technology** uses non-thermal plasma from ambient air with a high oxidation potential. This converts iron, manganese and arsenic into reactive forms and precipitates or flocculates them as iron complexes. The solids are then reliably removed – e.g. by **C-MEM™ ultrafiltration**. This enables a reduction of these substances by over 99%.

The combination of oxidative pre-treatment and ultrafiltration delivers a particularly high effluent quality with turbidity values below 1 NTU – without the continuous addition of (potentially toxic) oxidation chemicals. Potassium permanganate is not used; iron salt dosing is only necessary in absolutely special cases. No other process chemicals are used in normal operation. A pH adjustment is not necessary, nor is the replacement of adsorbers or filter materials.

The system is modular in design, flexibly scalable and immediately ready for operation – without any run-in time. Even with raw water containing bromide, bromate formation does not occur. Operation requires only electrical energy with an extremely low consumption of less than 0.5 kWh/m<sup>3</sup> and occasional citric acid to maintain the filter membrane.

### REMOVAL OF ANTHROPOGENIC TRACE SUBSTANCES (4<sup>TH</sup> PURIFICATION STAGE)

Anthropogenic trace substances – chemical micro-substances introduced by humans – enter municipal wastewater treatment plants via domestic wastewater, where they are usually only removed inadequately. As a result, they reach surface waters and potentially also ground water and drinking water resources. Even in the lowest concentrations – such as X-ray contrast agents, industrial chemicals, detergent residues or pesticides – they can pollute the environment and human health.

**C-ION™** offers an effective solution here: as a fourth purification stage, the technology can be integrated into existing biological wastewater treatment plants in order to specifically oxidize and eliminate these poorly degradable trace substances. The high oxidizing power of the non-thermal plasma converts harmful compounds at a molecular level. Thanks to its modular design, **C-ION™** is suitable for new construction and retrofitting of wastewater treatment plants of any size and can be flexibly combined with other processes such as **C-MEM™ ultrafiltration, fiber disc or activated carbon filters** – for tailor-made effluent qualities.

### OPTIMIZATION OF THE ACTIVATED SLUDGE PROCESS

The integration of **C-ION™ oxidation technology** in activated sludge bioreactors offers effective control of filamentous microorganisms such as *Microthrix parvicella* and *Nocardia*, which cause bulking sludge and significantly worsen the settling behavior of the sludge.

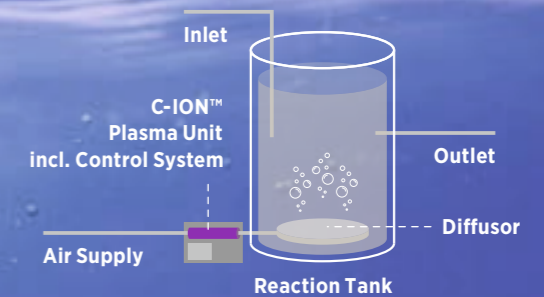
By selectively generating reactive oxygen species (ROS) and injecting them into the aeration tank in a controlled manner, **C-ION™** selectively destroys these filaments without affecting the structure or performance of the sludge flocs. The result is significantly improved settleability in the secondary clarifier.

Another advantage: the use of floc-forming chemicals can be significantly reduced or avoided altogether – which saves costs and protects the environment. **C-ION™** thus enables efficient, selective and low-chemical stabilization of the sludge structure and sustainably improves the effluent quality of municipal and industrial wastewater treatment plants.

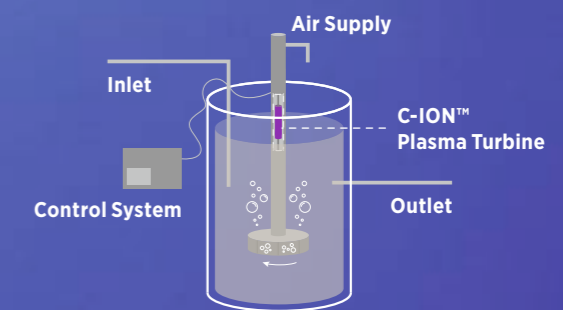


PlasmaConnect™ 5

### 4<sup>TH</sup> PURIFICATION STAGE / DRINKING WATER



### BULKING SLUDGE



### PROCESS ADVANTAGES

- ❑ **Lower energy requirement** compared to ozone or classic AOP processes
- ❑ **No supply air treatment** or external cooling required
- ❑ **Robust, simple system** without precision mechanical components
- ❑ **Compact design**, low space requirement
- ❑ **Simple installation**, flexible and modularly expandable
- ❑ **Start/stop operation** possible at any time – no run-up time required
- ❑ **Durable system components**, cost-effective replacement
- ❑ **No additional chemicals** or consumables required

### APPLICATIONS

- ❑ Removal of anthropogenic trace substances as a fourth purification stage
- ❑ Iron, manganese and arsenic removal from raw water or groundwater
- ❑ Color removal, e.g. for water contaminated with humic substances
- ❑ Suppression of bulking sludge in biological treatment stages