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Drinking water treatment with oxygen

Oxygen improves the quality of drinking water economically and efficiently.



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Oxygen – important factor for water quality



Oxygen can be used in drinking water treatment for various purification processes based on oxidation. The removal of iron and manganese is the most common application where oxygen can be used. Waterworks that treat groundwater must use this method in most cases to remove unwanted precipitates in the pipelines.

Since groundwater is low in oxygen, it contains iron and manganese in a reduced, soluble form. After oxygen enrichment of the water, the iron oxidizes to iron oxide particles, which remain in the filters. Manganese reacts with oxygen to form waterinsoluble manganese(IV) oxide, which is also retained in the filters.

Higher efficiency with pure oxygen

From a stoichiometric point of view, the oxidation of iron and manganese requires only small amounts of oxygen and could therefore also be carried out with atmospheric oxygen. Pure oxygen injection is more economical and offers further advantages over aeration:

- The use of oxygen instead of air significantly increases the filter throughput between two backwashing cycles. This means fewer backwashing cycles and thus less rinsing water consumption as well as lower costs for treatment and disposal.
- When pressurized with ambient air, the water is supersaturated with nitrogen. The pressure drop in the filter causes the nitrogen to outgas. Gas bubbles accumulate in the filter bed and block the filter, which re-

quires premature backflushing. In contrast, operation with pure oxygen is not disturbed by nitrogen.

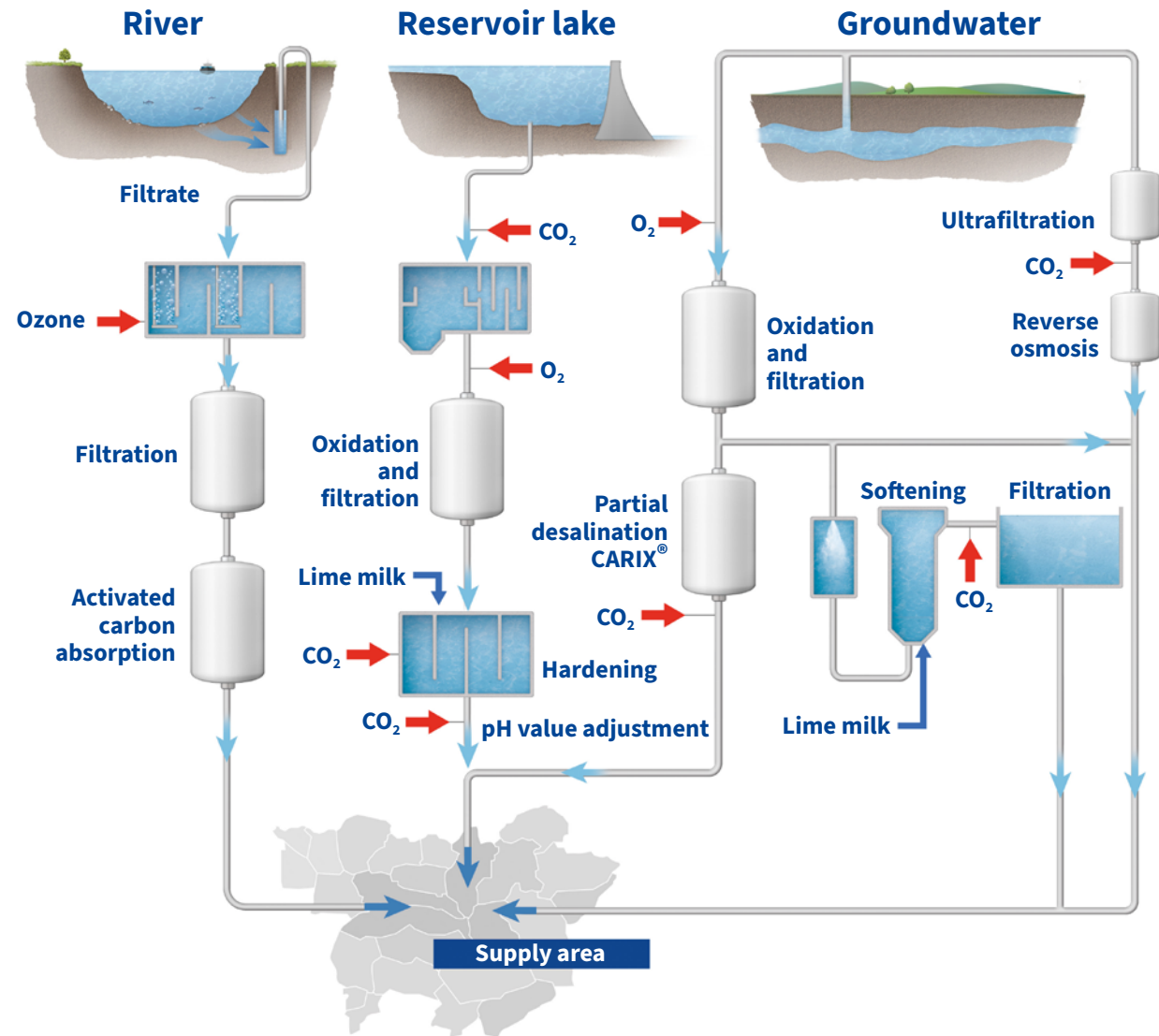
- Oxygen avoids „white“ water. This occurs during pressurized aeration with atmospheric air, as the nitrogen vapor also degasses at the tap, resulting in milky, cloudy water.
- With pure oxygen, a high oxygen enrichment of 20 mg/l and more can easily be achieved. This is important if the raw groundwater contains ammonium, methane or hydrogen sulfide in addition to iron and manganese. For their degradation, a relatively large amount of oxygen is required.
- Oxygen is clean and odourless, while ambient air, especially in the vicinity of agricultural or industrial facilities,

can cause hygiene or odour problems.

- CO₂ losses from soft water are prevented, since only the exact amount of oxygen required is injected and stripping of other gases by large amounts of air cannot take place. The existing CO₂ can therefore be used for subsequent hardening.
- Low investment and operating costs as well as the elimination or significant reduction of maintenance and cleaning work on compressors and air vents.

Due to these advantages, the use of pure oxygen represents the current state of the art.

Oxygen is used for a variety of processes in drinking water treatment



Ozone - the „multi-talent“ for drinking water treatment



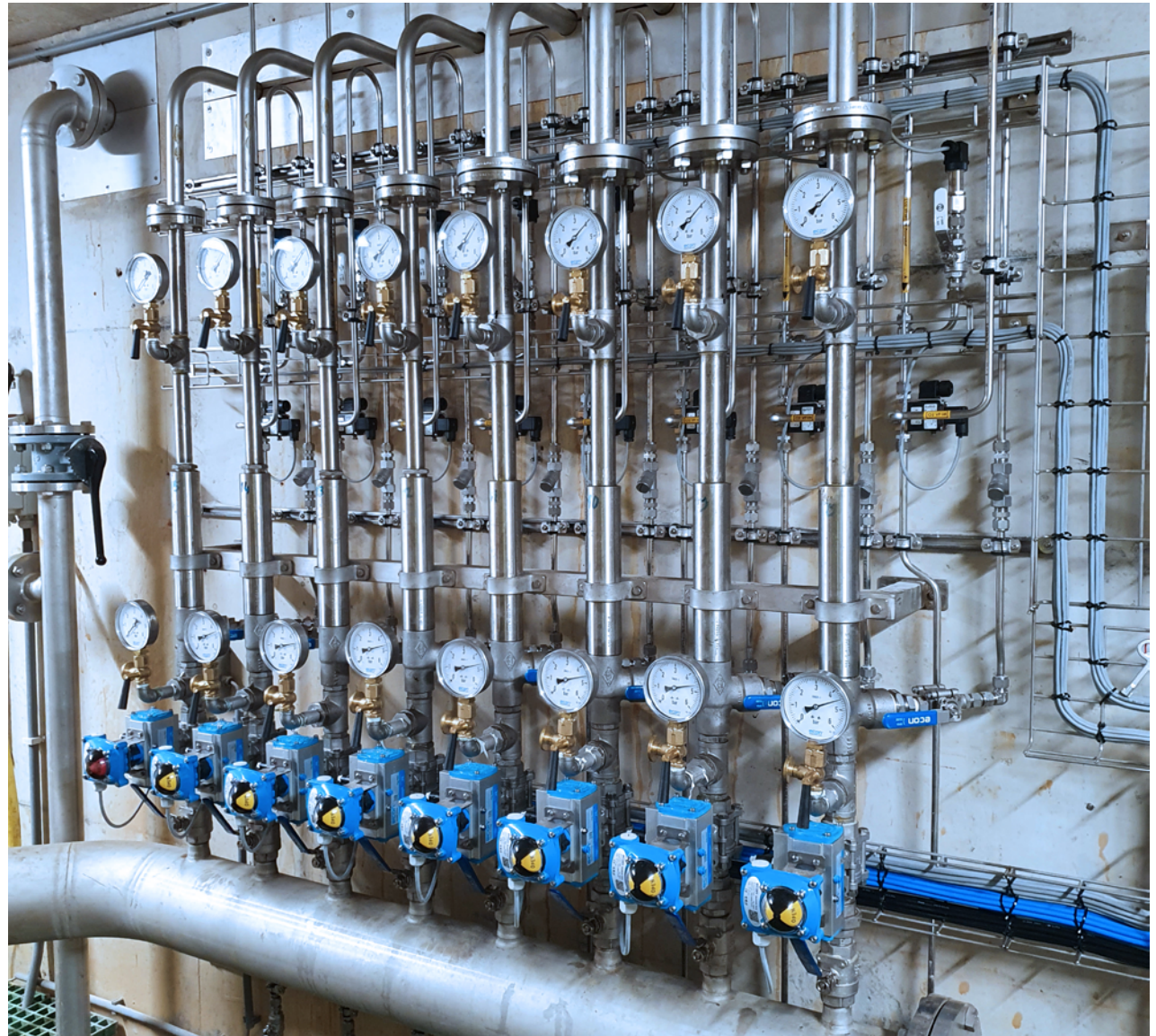
Modern ozone generators, such as this system with a production capacity of 3kg/h, use pure oxygen as the feed gas.

When conventional cleaning methods such as flocculation, filtration and chlorination are not sufficient, the strong oxidant ozone (O_3) is a universal and environmentally friendly solution. Ozone reacts to form oxygen and harmless oxidation products. Unwanted by-products or changes in taste do not occur. Other advantages of using ozone:

- Ozone oxidizes non-biodegradable organic products, improving the color, clarity, odor and taste of water. It is often used in conjunction with granular activated carbon to remove pesticides. Ozone also „cracks“ precursors of trihalomethanes. This is important when chlorination occurs during subsequent entry into the plumbing system.

- Ozone improves the flocculation.
- Ozone is used in the oxidation of iron and manganese when these are present in humic acid complexes and can therefore no longer be oxidized by acid sulfate.


Since ozone, the triatomic form of oxygen, is unstable, and the gas must be generated on site. Oxygen as a feedstock is more economical than air, especially for medium and large plants, because it does not require capital-intensive processing equipment to dry and purify the air. In addition, a much higher ozone concentration in the product can be achieved by using oxygen (10 - 15 wt.%). Corresponding ozone generators and injectors are more compact and consume less energy, which also makes them more cost-effective. For this reason, modern ozone generators always operate with pure oxygen. Many older air-driven generators have also been converted to pure oxygen in order to save high costs for air preparation and monitoring.




Oxygen injection system for iron and manganese removal and ammonium oxidation

About Messer



 Messer is the world's largest privately owned specialist for industrial, medical and specialty gases. Under the brand, **Messer - Gases for Life**, the company offers gases and services in Asia, Europe and America. The cooperation between the more than 11,500 highly qualified international employees is based on mutual respect. Messer pays particular attention to diversity and inclusion.

 Messer's 'Gases for Life' are used in industry, environmental protection, medicine, the food industry, the electronics industry, welding and cutting technology, 3D printing, construction, research and science. Messer offers one of the largest product portfolios on the market and develops application technologies for gases in state-of-the-art competence centers. 'Gases for


Life' are as important as water and electricity in most industrial processes and can play a significant role in their decarbonization, for example through the use of green hydrogen, CCUS or oxyfuel technology. In its customers' processes, Messer's customized gas solutions ensure greater safety, efficiency, quality, capacity and environmental compatibility and/or reduce the associated emissions and costs.

As a pharmaceutical company, Messer is also a provider of medical and pharmaceutical gases and complete solutions and has proven itself to be a reliable supplier of vital products.

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The company was founded in 1898 and is majority-owned by the Messer family.

Service and Advice

 Depending on the initial quality of the raw water, oxygen or ozone are used for oxidation processes throughout the entire treatment chain - from the well to the tap. Take advantage of the know-how of our application experts. We have extensive experience with the processes presented and will be happy to show you how gases and hardware can be successfully used in your drinking water treatment. In recent years, more than 200 plant projects have been implemented in waterworks throughout Europe using know-how and gases from Messer.

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