

Clean Water:

XYLEM, HPNow AND EVONIK MAKE ON-SITE TRACE SUBSTANCE DEGRADATION POSSIBLE WITH THE HELP OF HYDROGEN PEROXIDE!

One of the biggest challenges in the water cycle today are pharmaceutical residues and other highly active organic micro-pollutants. They contaminate wastewater and can even be detected in our drinking water. This is because only some of them can be removed in wastewater treatment plants. Experts agree that retrofitting is required here: A fourth purification stage has proven effective, as a recent study by Xylem, HPNow and Evonik shows.

SYSTEM:

Xylem UV-Reactor (Spektron), HPGen A1000

RESULT:

Substance	Reduction with UVC plus 10 mg/l H ₂ O ₂
Ibuprofen	> 99,4%
Caffeine	> 98,4%
Dichlorobenzamide	> 95,2%
1,4-dioxane	> 92%

1 The challenge

Rapid population growth, contamination from industrial and municipal use and severe regional droughts pose major challenges to global water resources and therefore to water purification systems. To solve the problem regardless of location, Xylem, HPNow and Evonik have launched a unique research project that focuses on the removal of four emerging contaminants using hydrogen peroxide and UVC rays.

The innovative approach of this project is to generate the hydrogen peroxide directly at the point of use, contrary to established practice, and to apply it in a UV-Advanced Oxidation Process (UV-AOP). AOP is the term used to describe efficient oxidation processes that safely and highly effectively remove micro-pollutants from water. UV-AOPs are already successfully used worldwide in drinking water and wastewater treatment, but the on-site production of hydrogen peroxide has not been possible until now.

2 The solution

Evonik, the world's leading specialty chemicals company, installed a so-called "HPGen UV-AOP" at its Hanau-Wolfgang industrial park in April 2021. The main components of the plant were a Xylem UV reactor from the Spektron series and the "HPGen A1000" model from the Danish company HPNow.

The UV reactor from Xylem emits high-energy UVC light, which activates the hydrogen peroxide to form the desired hydroxyl radicals - a kind of chemical detergent. With the simultaneous intensive UV irradiation, a 99.9999% reduction of pathogens is achieved in addition to the degradation of micro-pollutants. Due to the very high reactivity of the OH radicals with the micro-pollutants and other water constituents, the substances are oxidised in a split second and no OH radicals remain in the water.

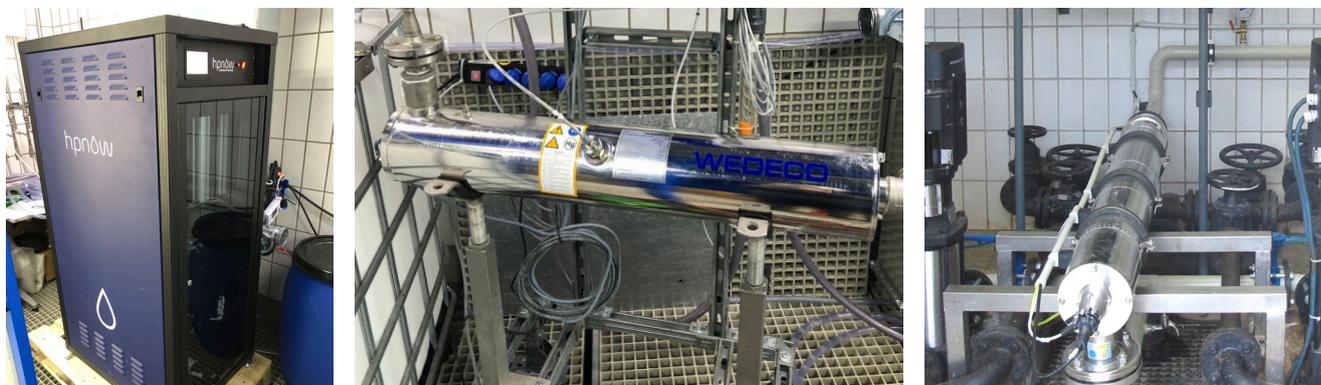
In the study, ibuprofen (anti-inflammatory and painkiller), caffeine (stimulant), dichlorobenzamide (herbicide degradation product) and 1,4-dioxane (industrial solvent) were added to the process water as target pollutants and the degradation behaviour in the UV-AOP with the low-concentration and environmentally friendly oxidant hydrogen peroxide (H_2O_2) was investigated. The HPGen H_2O_2 generator from HPNow requires only tap water, electricity, and oxygen for hydrogen peroxide production. The oxygen is obtained by the system from the ambient air. Purified water of drinking quality can be used as the source for the required water.

On-site generation of hydrogen peroxide offers great advantages in terms of logistical, safety and regulatory challenges and can complement today's established hydrogen peroxide production and supply chain. HPNow has developed and launched a technology solution for this purpose, known as HPGen. HPGen uses a proprietary direct electrochemical synthesis and produces H_2O_2 at the point of use in a safe and sustainable manner.

3 Conclusion

All test runs showed good to very good degradation results of the target substances at different levels of UV irradiation and hydrogen peroxide doses. Ibuprofen could be reduced most efficiently with a reduction of more than 99.4%, followed by caffeine, dichlorobenzamide and 1,4-dioxane (>92%).

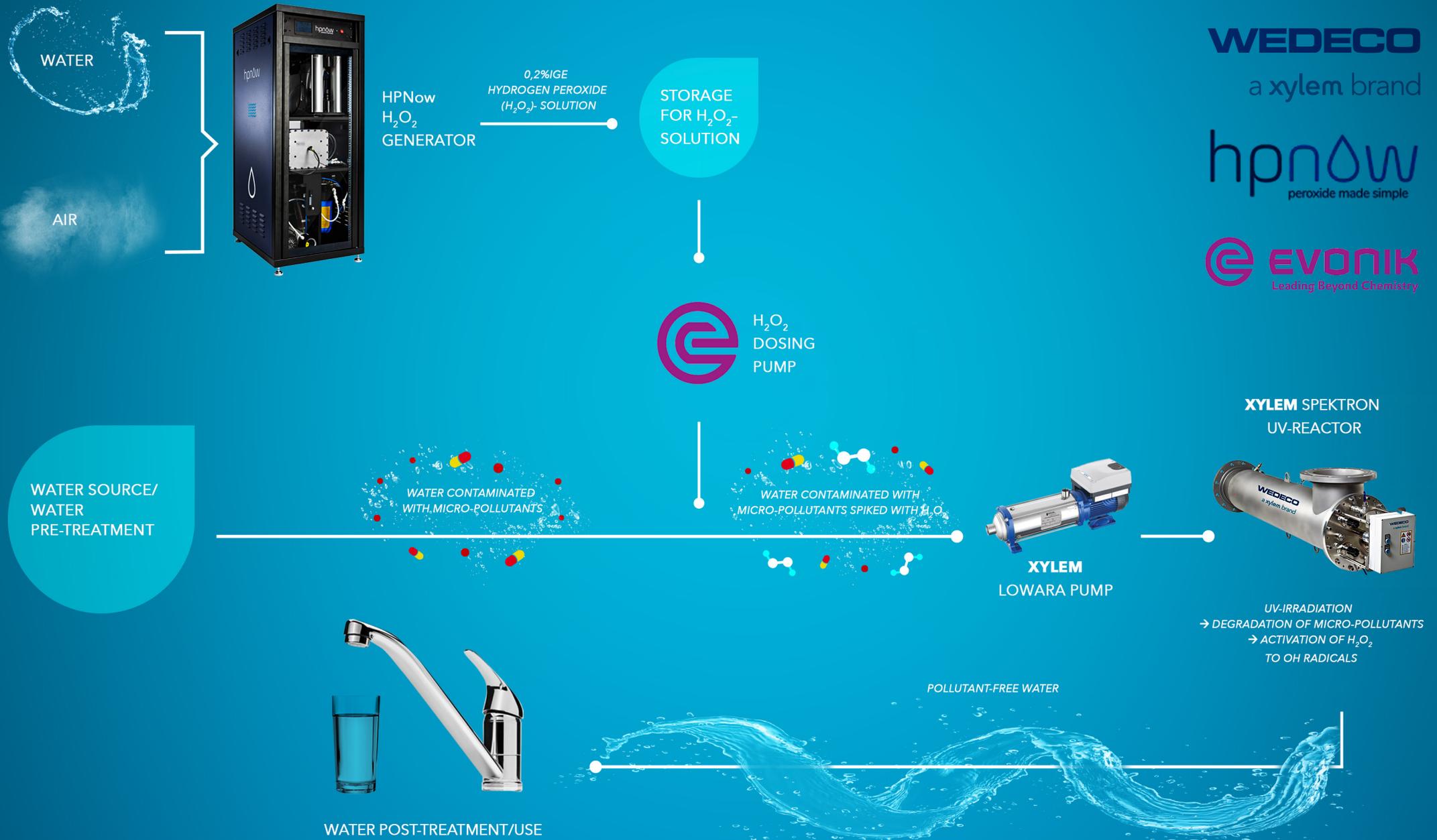
HPGen H_2O_2 generator from HPNow and Spektron 6 UV reactor from Xylem-Wedeco



By combining Xylem's globally established AOP solutions with HPNow's HPGen decentralised hydrogen peroxide generators, this advanced and environmentally friendly technology can be used in regions where hydrogen peroxide supply is difficult to obtain. Another advantage is the low H_2O_2 concentration, which eliminates the need for on-site storage of highly concentrated hydrogen peroxide. Equally important are the positive effects on sustainability. The combination of highly efficient direct electrochemical generation with no need for transportation significantly reduces the carbon footprint. By using green electricity, a CO₂-neutral operation of the UV-AOP with HPGen is possible.

This project has successfully demonstrated how the combination of expertise, products, and technologies from Xylem, HPNow and Evonik can make for sustainable solutions in wastewater recycling and provide people with healthy drinking water - even in remote locations that cannot be supplied with conventionally produced hydrogen peroxide on site.

PROCESS DIAGRAMM UV-AOP WITH HPNow



Partner

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Info:

Xylem Inc. (Xylem) is committed to this challenging technology as an international water treatment company and has many years of experience with ozone and UV light-based AOPs. With thousands of UV, ozone and AOP installations worldwide, Xylem, along with its other water treatment, transport, and analytical technologies, is making an important contribution to safe water supply and wastewater treatment.

HPNow meets the growing global clean water and sanitation challenges with its range of autonomous, safe, and sustainable on-site hydrogen peroxide generation solutions. Based in Copenhagen, with offices in Europe, the Americas and Asia, HPNow addresses water treatment needs in market segments ranging from agriculture and aquaculture to industrial and drinking water treatment. HPNow is a technology and market leader in on-site generation of hydrogen peroxide and is constantly striving to develop its technology and products to meet growing market demands and increasing global demand.

Evonik is a leading global specialty chemicals company based in Essen, Germany. Evonik offers attractive businesses and innovative strength and is committed to developing products that provide maximum benefit for customers and society. Customer proximity and solution partnerships are Evonik's key to success.

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