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Challenge of “forever chemicals” in drinking water

Effective against PFAS: terraplasma successfully tests its own cold plasma technology for water treatment

Garching near Munich, April 25, 2024 - Successful initial attempts to treat drinking water contaminated with PFAS: this is how terraplasma, the innovation leader in the area of development and implementation of applications with cold atmospheric plasma (in short: cold plasma or cold plasma), succeeded Using the self-developed energy-saving cold plasma technology for water treatment, in addition to other substances such as microorganisms, PFAS can also be significantly measurably reduced. In a first, larger series of tests with real water samples from a southern Bavarian PFAS hotspot, some of the so-called “forever chemicals” were reduced by up to almost 30%. Reason enough for the company to further optimize its technology and, together with potential partners, develop it into a commercial solution for water treatment.

Durable, but unfortunately (almost) indestructible

PFAS (**per- and polyfluoroalkyl substances**) do not occur in nature, but are industrially produced chemicals and are used specifically in production, but also in private households due to their water- and grease-repellent properties as well as their extreme stability and durability (hence the term "forever chemicals").

In industry, PFAS are used in a number of special applications, such as the production of durable plastics, chrome plating, the production of semiconductors or photographic processes.

But they are also used at home in a range of consumer goods, such as paints, leather and textile coatings, (outdoor) clothing, shoes, carpets, packaging, ski wax, floor and car care products, as well as for the production of papers with dirt, grease and water repellent properties and as components of impregnating and lubricants.

Many PFAS are toxic and accumulate through the food chain. The following applies to all PFAS: once they have been released into the environment, they are hardly removable and enter the soil via the air or wastewater and then into drinking water and thus enter the bodies of humans and animals. As a result, they represent one of the greatest challenges for drinking water protection and environmental protection.

Test treatment with water contaminated by PFAS production

For many decades (although some manufacturers had known about their toxic effects since the early 1970s), PFAS were the epitome of modern and problem-solving chemistry. Founded in 1964, the Gendorf Chemical Park (part of the municipality of Burgkirchen an der Alz in the district of Altötting/Upper Bavaria) soon began the industrial production of a wide variety of PFAS. It was not until the end of the 1990s that production began to be designed in such a way that only a few PFAS were released into the environment. Nevertheless, due to decades of industrial production, PFAS are found in clearly detectable quantities in the soils and thus also in the low-lying drinking water sources. This water is therefore a suitable test basis to check the effectiveness of cold plasma treatment.

Cold plasma for water treatment successfully passes the first test

Currently, the PFAS problem in Burgkirchen (one of a total of about 1500 hotspots nationwide) is currently being solved with an elaborate drinking water purification plant that uses various purification and treatment technologies – including UV, activated carbon and oxygen/carbon dioxide – to convert the contaminated water back into legally compliant drinking water over several processing stages. However, removing PFAS – specifically PFOA – with activated carbon has the disadvantage that PFAS can only be filtered out (and not broken down into more harmless substances). Due to their increasing degree of saturation, the silo-sized activated carbon filters also have to be replaced annually at the latest – the costs for operation and the activated carbon are therefore around 500,000 euros per year.

With the treatment of the contaminated water using terraplasma's cold plasma technology, a first extensive test showed a partly clearly measurable reduction in PFOA in particular: up to 30% less could be measured after treatment. This first test was carried out in an experimental set-up that was not specially optimised, in which the cold plasma obtained from the ambient air was blown into the contaminated water via a special Venturi nozzle. In addition to the reduction, the low energy consumption of the technology used is also remarkable: the plasma sources are operated with approx. 4W – this corresponds to an extrapolated energy requirement of 0.015 kWh/cubic meter of water.

Looking for partners for meaningful tasks with good future prospects

With this improvised test use of cold plasma for the degradation of PFAS, in addition to proof of efficacy, a positive trend in cost-effectiveness in possible real operation has also been determined: for example, water treatment requires only a small amount of electrical energy to achieve measurable effectiveness.

These first promising results motivate the terraplasma team to continue testing and developing this important topic – preferably with a partner company, ideally from the field of water treatment, because the development of scaled systems for real-world use is time-consuming and cold plasma technology will not replace these established treatment processes, but ideally complement them in the long term.

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About terraplasma

Founded in 2011 as a spin-off of the Max Planck Society, terraplasma GmbH (https:// www.terraplasma.com) based in Garching near Munich offers innovative solutions and technologies for the development of cold plasma products in areas where bacteria, fungi, viruses, spores, allergens and odor molecules need to be inactivated efficiently and sustainably or where harmful molecules cause problems. Cold plasmas are partially ionized gases that can replace conventional chemicals or other technologies such as UV, heat or radiation in an increasing number of applications due to their high efficacy.

With its tried-and-tested basic technologies, terraplasma cooperates with well-known companies in the fields of medical technology, hygiene, water treatment, odor management, air purification, cosmetics and surface modification, among others. It is terraplasma's goal to work with these industrial partners to further develop and market its environmentally friendly cold plasma solutions in line with demand. A young team that works with a lot of creativity and sophistication, extensive know-how in the fields of cold plasma research and technology as well as numerous patents support the GreenTech company on its path to success.

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Press picture 2 - PFAS and Cold Plasma
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