Goal: disinfect with cold atmospheric plasma without chemicals

Start of research project on surface disinfection

Garching near Munich, April 25, 2023 - Clean start at terraplasma, the innovation leader in the field of development and implementation of applications with cold atmospheric plasma (Cold Plasma for short). Representatives of the Chair for Medical Technology Materials and Implants at the Technical University of Munich and terraplasma met on the joint research project "Plasma-activated mist for disinfecting surfaces" that started on April 17th at the company's premises in Garching near Munich. The first personal kick-off meeting took place under the motto "plasmaTOP – disinfect surfaces without chemicals or heat".

They are not visible to the naked eye and yet they "sit" almost everywhere: microorganisms, i.e. viruses, bacteria and fungi, are found on almost all freely accessible surfaces - because under normal conditions nowhere is "really clean" (i.e. germ-free). The good news: most microorganisms are not dangerous for a healthy person. But germ-contaminated surfaces can become a health risk - especially for people with previous illnesses and a weak immune system. Appropriate disinfection kills the microorganisms on the surface and prevents them from being carried over. Microorganisms can survive and remain infectious on different surfaces for different lengths of time - this depends on the characteristic properties of the microorganisms. The nature of the surface on which the microorganisms are located, and the environmental conditions (temperature and humidity) also have an influence.

Chemistry, heat and radiation were yesterday

Disinfection is an essential part of antiseptic (germ-free) work and means "putting dead or living material in a condition that it can no longer infect". Various methods can be used for disinfection, with "classic" chemical disinfectants such as hydrogen peroxide, chlorine, ozone, aldehydes, alcohols or iodine playing a major role to date, as well as disinfection by heat or radiation.

However, chemical disinfectants have many disadvantages - they are not only toxic to humans or even carcinogenic, but also generate resistance if used improperly, especially if the concentration of active ingredient and exposure time and thus the germ reduction factor are too low. Chemical disinfectants also cause permanent damage to human skin and some substances can also irritate human mucous membranes. Some chemicals also attack surfaces made of metal, plastic or natural materials and therefore cannot be used to disinfect these surfaces.

The many negative effects on the environment caused by chemical disinfection should also not be neglected: First, the chemicals must be produced, stored and finally transported to the place of use, which is energy intensive. If they are not used properly or disposed of properly, they get into rivers or sewage treatment plants and disturb the important interaction of many bacterial species there, which e.g., reduces the cleaning effect (in clarification tanks or water bodies). In addition, many disinfectants also have an ecotoxic effect on water bodies.

Most microorganisms can also be killed by heating at sufficiently high temperatures. However, this method is not very suitable for freely accessible surfaces, as it is difficult to direct the heat precisely and evenly onto a surface without leaving permanent damage. In the case of disinfection by irradiation (UVC light or gamma rays), the treatment of surfaces is also difficult,

since "open" disinfection sources would have to be used here, which are also harmful to people's health if used improperly.

Cold plasma is the future of disinfection

The use of cold plasma (or low-temperature plasma) is a new type of disinfection technology that can kill even antibiotic-resistant microorganisms not only on surfaces but even through clothing at room temperature in a time-saving manner. This makes cold plasma suitable for disinfecting air, surfaces, objects, hand disinfection, but also for treating poorly healing chronic wounds.

The solution approach in this research project is the development of a sustainable, environmentally friendly, and scalable technology that allows the simple and targeted generation of disinfecting plasma mist that is suitable for the highly effective reduction of germs on openly accessible surfaces. The first preliminary tests were so successful that the team from the Chair for Medical Materials and Implants (MMI) and terraplasma is optimistic that they will achieve or even exceed the individual sub-goals. This includes the development of an improved plasma source that also ignites in a humid environment, the optimization of the nebulization and the energy supply of the plasma system, the development of a functional prototype and the detailed investigation of the disinfecting effect of the generated plasma mist on various microorganisms as well as research into possible side effects of the Plasma mist treatment on various materials.

The research project called "Plasma-activated fog for the disinfection of surfaces" is funded by the German Federal Foundation for the Environment (DBU) and was approved on March 20, 2023. The operational start took place on April 17, 2023, with a term of almost 14 months and a total volume of around €300,000. The project is being carried out between MMI and terraplasma GmbH.

About the Technical University of Munich

With more than 600 professors, 50,000 students and 11,000 employees, the Technical University of Munich (TUM) is one of the most research-intensive technical universities in Europe. Her focus is on engineering, natural sciences, life sciences and medicine, combined with economics and social sciences. TUM acts as an entrepreneurial university that promotes talent and creates added value for society. It benefits from strong partners in science and business. It is represented worldwide with the TUM Asia campus in Singapore and liaison offices in Brussels, Mumbai, Beijing, San Francisco and São Paulo. Nobel Prize winners and inventors such as Rudolf Diesel, Carl von Linde and Rudolf Mößbauer have done research at TUM. In 2006, 2012 and 2019 it was recognized as a university of excellence. In international rankings, it is regularly among the best universities in Germany. More information at www.tum.de

More information at www.tum.deAbout terraplasma

Founded in 2011 as a spin-off of the Max Plank Society, terraplasma GmbH (https://www.terraplasma.com), based in Garching near Munich, offers innovative solutions for the development of cold plasma products in areas where germs, undesirable odors or harmful molecules cause problems. Cold plasmas are partially ionized gases that very efficiently inactivate bacteria, fungi, viruses, spores and odor molecules. With different basic technologies, terraplasma works together with well-known companies in the fields of medical technology, hygiene, water treatment, odor management, air purification and surface modification. As a partner to industry, terraplasma's goal is to work with its partners to develop and market cold plasma solutions as needed. A young team that works with a lot of creativity and sophistication, many years of extensive know-how in the field of cold plasma technology and numerous protective patents from a wide variety of areas support the company on its successful course.

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Press Pictures

The kick-off team of the plasmaTOP research project "Plasma-activated mist for disinfecting surfaces"