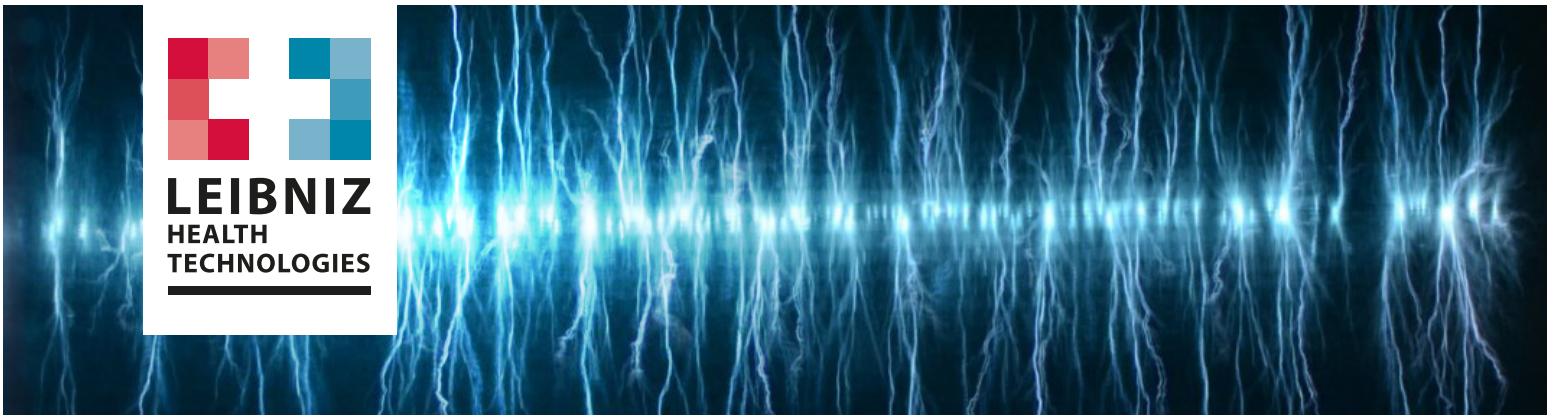
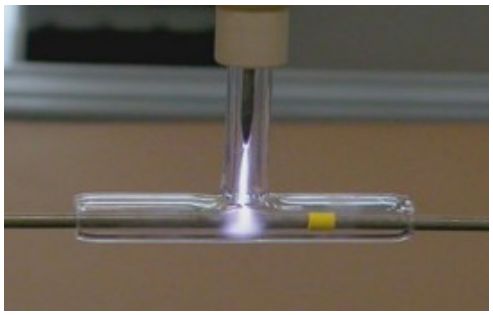


LEIBNIZ HEALTH TECHNOLOGIES

DEGRADATION OF BIOLOGICAL AND CHEMICAL CONTAMINANTS WITH COLD PLASMA

COMPETENCE AREA: PLASMA MEDICINE

Microorganisms can be effectivly inactivated or eliminated by plasma-based procedures. In addition, these procedures are suitable for the degradation of poorly degradable organic compounds on surfaces, in gases, gas mixtures and in liquids, e.g. pharmaceutical residues, pesticides or even odorous substances. Surfaces are decontaminated without damaging the wearer. Plasmas are therefore particularly useful when disinfecting thermolabile surfaces like e.g. instruments, textiles and agricultural products.



Plasma treatment of a catheter (Photo: Leibniz-INP)

The methods can be applied for effective hygiene procedures at medical facilities, in the food industry, for conservation of seeds and harvest products, for wastewater and drinking water treatment and air purification. Different processes with targeted mechanisms are used.

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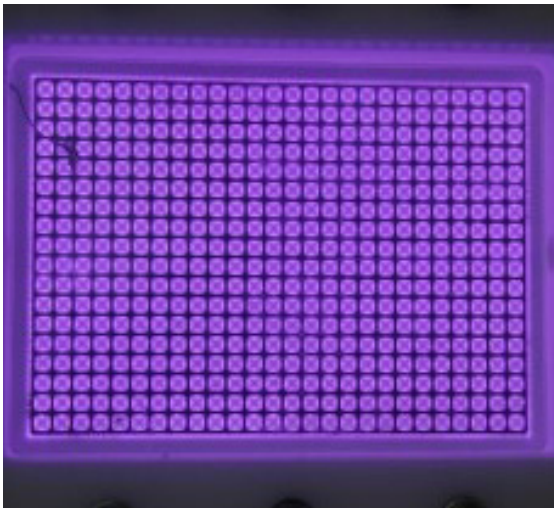
BENEFITS

- Pathogens are effectively killed
- No known microbial resistance
- Degradation of poorly degradable organic compounds, e.g. pharmaceutical residues /pesticides in water
- Degradation of harmful gases and odorous substances in exhaust air
- No chemicals and catalysts necessary
- No harmful residues
- Carried out at normal pressure and moderate temperatures
- Targeted treatment – controlled via provided energy



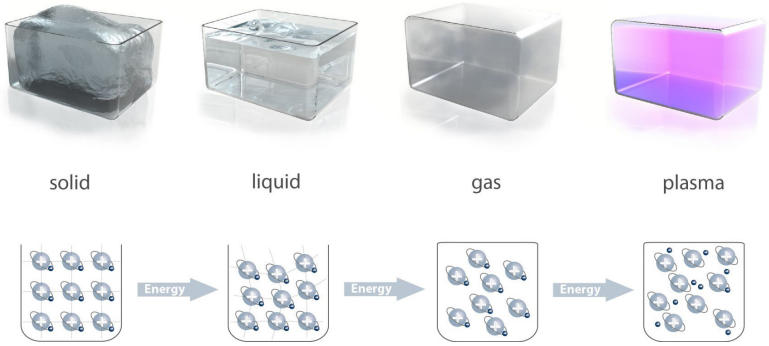
Single element of a plasma module for air decontamination (Photo: Leibniz-INP)

DECONTAMINATION. TOXIN REMOVAL. HYGIENE.

WHAT IS PLASMA?

Physical plasma is the fourth state of matter after solid, liquid and gas. By adding energy, a solid is transformed into a liquid and further into a gas, whereby the atoms and molecules that form the substance increase in mobility until they move freely in the gaseous state. If energy is added to a gas, for example by means of strong electric fields, partial or complete ionisation of the particles takes place.

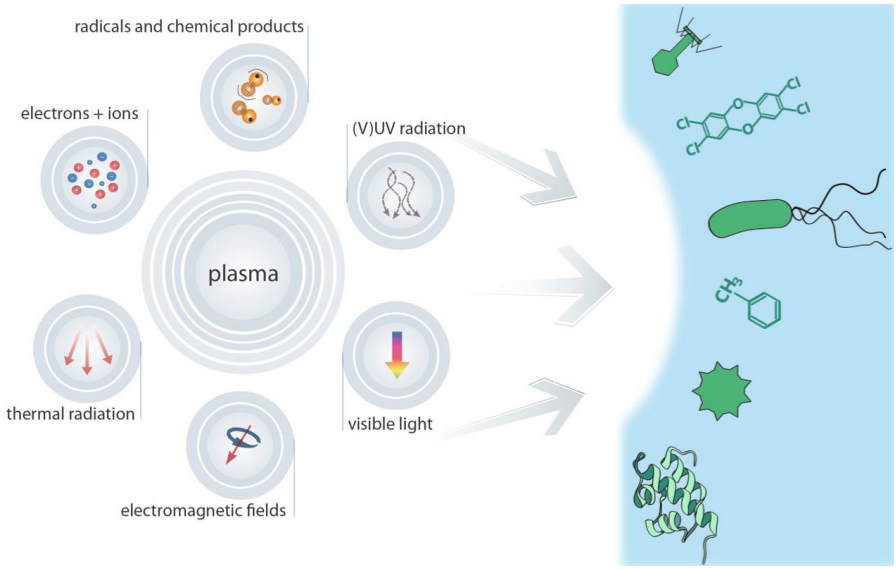
This state of an excited, electrically conductive gas is called plasma. In addition to freely moving electrons and ions, plasmas contain low-molecular chemically reactive species and emit electric fields, visible light, UV and thermal radiation. A rough distinction can be made between hot (thermal) and cold (low-temperature) plasmas as well as between high-pressure, atmospheric-pressure and low-pressure plasmas. Cold atmospheric pressure plasmas are of particular interest for applications in the field of decontamination.



MECHANISM

Depending on the medium and the target, various methods (including pulsed electrical discharges) are used. Depending on the composition of the medium, short- and long-lived species (e.g. hydroxyl radicals, ozone, nitrogen oxides), charged particles (e.g. electrons), electric fields and ultraviolet radiation are generated.

For the decontamination of water and air, the plasma can be generated directly in the medium in each case. Plasma-treated gases or water can also be used to decontaminate sensitive surfaces.



PUBLICATIONS

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Schnabel, U., Handorf, O., Yarova, K., Zessin, B., Zechlin, S., Sydow, D., Zellmer, E., Stachowiak, J., Andrasch, M., Below, H., & Ehlbeck, J. (2019). **Plasma-Treated Air and Water-Assessment of Synergistic Antimicrobial Effects for Sanitation of Food Processing Surfaces and Environment.** Foods (Basel, Switzerland), 8(2), 55. DOI: 10.3390/foods8020055

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INP FROM IDEA TO PROTOTYPE

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