

13.56 MHz Inductively Coupled Plasma Source ICP-P 200



Fig. 1: ICP-P 200

Plasma sterilisation:

Sterilisation is defined as the use of physical and/or chemical procedures to completely eliminate or destroy all forms of microbial life (including resistant bacterial spores).

Conventional methods for the sterilization of medical products and packaging materials for the food and beverage industry are steam autoclaving, dry heat, β - and γ - rays and ethylene oxide (EO). As an alternative, especially for heat sensitive polymer based materials, the low pressure plasma sterilization has been investigated during the last years. The sterilizing good is placed in a vacuum chamber, in some cases pretreated with a gas in a so called diffusion

phase, and exposed to a low pressure radio frequency or microwave plasma. The advantages of this technique are: relatively low process temperatures ($\leq 60^\circ\text{C}$), short sterilization cycle (≤ 1 hour), safe both for the operator and the patient, since there are no toxic residues like in the case of EO. A commercially available example is the so called Sterrad[®] technique, which uses hydrogen peroxide vapor and plasma. In principle, three phases can be distinguished: evacuation, H_2O_2 injection and diffusion, plasma.

From the microbiological point of view, the most resistant species are viruses and bacteriological spores. The following plasma properties should have a spore mortal effect: vacuum, UV and VUV radiation, ion bombardment, and the production of chemical radicals (e.g. O , O^- , OH , H)., Therefore, The combination of UV light and reactive radicals is necessary for a fast sterilisation processes. The DNA of most of the bacteria can be broken by high energy radiation with wavelengths below 280 nm.

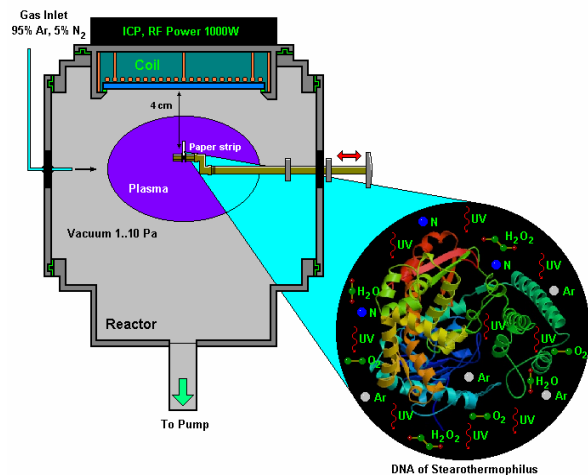


Fig. 2: Mechanism of plasma sterilization

Experimental results:

Plasma sterilisation experiments have been performed using the ICP-P 200 inductively coupled plasma source, mounted on top of a vacuum chamber. Bacterial spores (*Bac. stearothermophilus*, initial number $\sim 10^6$ on paper strip, 4 cm below quartz plate) were exposed to the plasma generated by the ICP (pressure 10 Pa, rf power 1000 W).

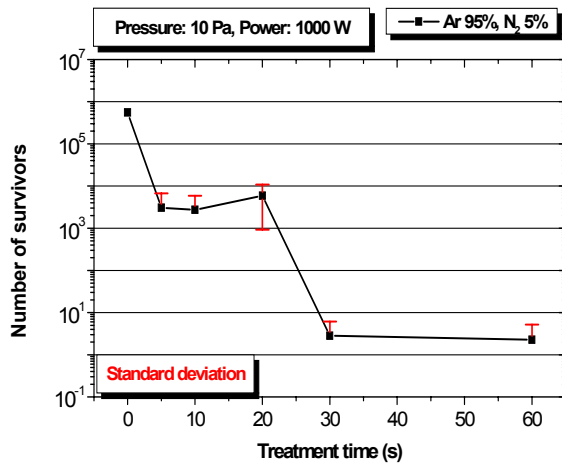


Fig. 3: Number of survivors as a function of treatment time for the gas mixture Ar:N₂ (95:5%) at a pressure of 10 Pa

After five seconds, the initial amount of bacterial spores was already reduced by a factor of more than 10^2 and after 30 seconds of treatment the paper strips were completely sterilized.

For further information please contact:



JE PlasmaConsult GmbH
Rainer-Gruenter-Str. 21, Geb. FN
42119 Wuppertal
Germany

Tel. ++49-202-28397-0
 Fax ++49-202-28397-123

contact@plasmaconsult.de
 www.plasmaconsult.com