

Analysis of the long-time lethal Effects of Plasma treated Sodium Chloride Solutions

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Nowadays used sterilization techniques such as heat and radiation as well as sterilization through chemicals are limited by high temperature, harmful radiation or cytotoxic effects, respectively. Consequently, it is not possible to use heat sterilization for heat-sensible materials and radiation sterilization for living tissues. Also, chemicals such as ethylene dioxide show often toxic effects in human cells. An alternative method for decontamination of heat-sensible drug containing solutions is the sterile filtration but it is also limited by the diameter of the pores. These limiting features and increasingly resistances of bacteria against common used antiseptics or antibiotics lead to the research for alternative methods for decontamination and sterilization. Over the past few years, it has been crystallised that non-thermal atmospheric pressure plasma can be used effectively for sterilization and decontamination processes especially for heat-sensitive materials and substances. [1] Recent investigations have been done to investigate the plasma liquid interaction with a special focus on decontamination processes. These investigations have shown that plasma treated 0.85 % sodium chloride solution has germicidal effects. [2] It is assumed, that the inactivation of bacteria is depending on acidic pH and the formation of low-molecular chemical species such as nitrate, nitrite, and hydrogen peroxide.

The aim of this work was to investigate the long-term antimicrobiological effects of plasma treated physiological sodium chloride solution with respect to the stability of reactive species, which are generated by plasma treatment. Plasma exposure to a 0.85 % sodium chloride solution with a ceramic surface dielectric barrier discharge results in acidification of the liquid as well as in formation of nitrate, nitrite, and hydrogen peroxide. The plasma induced generation of reactive species were determined by wet chemical reactions following by measurements of the absorption to quantify the amount. Germicidal effects have been investigated with a suspension of *Escherichia coli*, exposed to plasma treated sodium chloride solution. To characterize the biological effects as well as the stability of the generated reactive species the application and incubation time was systematically varied. Delay in application time brought a reduction in bactericidal efficacy which could be compensated by longer incubation times. Analytical investigations have shown a decrease in the concentration of hydrogen peroxide as well as nitrite within 24 h; pH value and the concentration of nitrate were stable over 24 h.

References

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