

Inactivation of Bacteria in Solution by Atmospheric Pressure Plasma: Density Effects

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Bactericidal, fungicidal, virucidal and sporicidal effects of cold atmosphere pressure plasmas were under intensive investigation in the past few years. Reactive species (besides charged particles) produced by the plasma are believed to play a crucial role in this [1, 2]. Most of the recent studies focused on occurring reactive oxygen species (ROS) during the plasma application and on oxidative stress on microorganisms. The generation of ROS and the resulting lipid peroxidation is believed to cause a loss in membrane integrity [3]. The purpose of this study is to take into account not only the involvement of ROS but also reactive nitrogen species (RNS). Additionally influences of initial cell densities and different plasma treatment times were taken into consideration. E.coli were treated in solution for up to 8 minutes with initial cell densities between 10² and 10⁸ cells per 20 µl with a plasma device, which uses the Surface Micro Discharge (SMD) technology and the surrounding air for plasma production [2]. The products of a few chemical reactions between the reactive species produced by the plasma and the liquid (with and without bacteria) were examined and analyzed. During the first 2 minutes of plasma application hydrogen peroxide and reaction products of NO rapidly occurred. The evidence of NO uptake by bacteria and further reference experiments with hydrogen peroxide clearly showed that the bactericidal properties of plasmas are a combination of oxidative and nitrosative effects.

References

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