Diagnostic and Design of Plasma Generated Reactive Species in Liquids to Investigate Cellular Effects of Plasma Treatment

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Only with the recent development of cold atmospheric pressure plasma sources plasmas are broadly studied for application in therapeutic medicine. These plasma sources generate highly reactive plasma components in ambient conditions and their gas temperature is below the destruction threshold of extremely sensitive surfaces such as biomaterials \cite{1}. For an understanding of fundamental processes in plasma surface interaction, a control and detailed diagnostic of the reactive plasma components is vital.

In this work we present optical diagnostics on atmospheric pressure plasma jets combined with modeling yielding an understanding of fundamental processes such as air species diffusion into the jet effluent. Especially in treatment of physiological liquids in ambient air, atmospheric species play a key role in plasma liquid interaction (see Fig. 1). To gain control over the reactive components, their generation processes need to be controlled \cite{2,3}. The plasma jet is characterized by laser induced fluorescence spectroscopy, by absorption and emission spectroscopy and by flow simulations \cite{4}.

![Fig 1: Flow Simulation of ambient species densities in plasma jet treatment in a petri dish](image)

With the gained knowledge, it is possible to tailor the reactive components and to influence plasma jet-liquid interaction. We show that reactive species generation within plasma treated liquid can be controlled and apply the findings to cells to investigate the effect of reactive oxygen and nitrogen species (RONS). The effects of plasma generated reactive oxygen species are compared to a combined reactive oxygen and nitrogen species composition.

References