Study of the Disinfection Abilities of Water Treated by Atmospheric Pressure Cold Plasma

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A direct current atmospheric pressure cold plasma mcriojet (PMJ) was used to treat water for 5 minutes and 20 minutes, respectively. Argon with 2% oxygen and argon with 2% oxygen and 10% nitrogen were used as the operating gases. The plasma activated water (PAW) was subsequently applied to *Staphylococcus aureus (S. aureus)* suspensions for various time periods over a time span of 2 hours. The inactivation efficacies of the PAW generated by PMJ with the two gases are in the following order: $Ar/O_2(2\%) > Ar/O_2(2\%)/N_2(10\%)$. It was also observed that the antibacterial ability of the PAW increase with the plasma treatment time. PAW with 20 min plasma exposure is still bactericidal after 2 h with a reduced inactivation efficacy. In a separate series of experiments, we compared the PAW generated with the PMJ (1) suspended above the water surface and (2) submerged in water, where a better inactivation efficacy was found for the latter.

A scanning electron microscope (SEM) was used to evaluate the bacterial morphology before and after the PMJ treatment. Optical emission spectroscopy (OES), high performance liquid chromatography (HPLC), and atomic absorption spectrophotometry (AAS) were employed to identify and monitor the reactive species in the plasma-liquid system, such as H_2O_2, O_3, and NO_3^-/NO_2^- as well as Cu (Cu^+/Cu^{2+}). Possible disinfection pathways will be discussed at the conference.