

Influence of impurity gas on the generation of reactive oxygen and nitrogen species (RONS) in water

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The application of plasma-activated liquid (PAL) e.g. plasma treated water (PTW or plasma-activated water, PAW) and plasma-activated medium (PAM) in life sciences is getting importance. [1,2] The biological response induced by plasma is often thought to arise due to the neutral reactive species such as a PAW with non-contact plasma treatment. [3,4] Number of studies reported that the neutral reactive species are strongly link to the biological and medical effects e.g. killing bacteria and cancer treatment etc. [1,2,5]

In recent of our studies related UV absorption spectroscopy, trace of NO_x was surprisingly found in radical activated water (RAW) with oxygen buffered in Ar at Meijo University as shown in figure 1 and an unidentified absorption in plasma-activated water (PAW) with He enveloped in guide gas at Kochi University of Technology, respectively. For a long time, however, we did not understand why the NO_x in RAW with oxygen radical irradiation even H₂O₂ and why the unidentified absorption in PAW with He were measured. Now, we speculate those unexpected absorption spectra possibly due to the impurity gas(es) in a high purity gas cylinder and we cannot disregard in an atmospheric-pressure plasma processing. For an example, an impurity gas in a high purity gas (99.9999%) cylinder is 1 ppm which is the same order of typical atmospheric-pressure plasma density $\sim 10^{13}$ cm⁻³. In this view point, further investigation is necessary, especially, in the calculation regarding secondary reactions. We believe the results can give us more detail of the chemistry of PAL.

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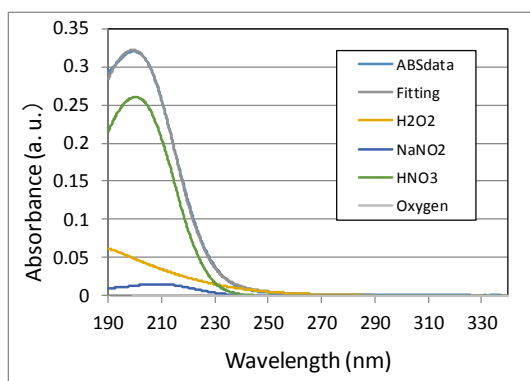


Fig. 1 Curve fitting results of UV absorption spectrum of RAW at a fixed exposure time of 5 min. The concentrations of H₂O₂, NO₂⁻, and NO₃⁻ were 7.67 mg/L, 0.21, and 1.24, respectively.

References

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