3P91

# 真空紫外吸収分光法を用いたプラズマ活性水の開発
# Investigation of Plasma-Activated Water using VUV Absorption Spectroscopy


呉　準席[1]，八田　章光[2]，伊藤　昌文[3]
Jun-Seok Oh[1], Akimitsu Hatta[2], Masafumi Ito[3]

[1]大阪市立大学大学院工学研究科電子情報系専攻
[2]高知工科大学大学院電子・光システム工学科
[3]名城大学理工学研究科電気電子工学専攻

[1]Dept. Physical Electronics and Informatics, Graduate School of Engineering, Osaka City Univ.
[2]Dept. Electronic and Photonic Systems Engineering, Kochi University of Technology
[3]Dept. Electrical and Electronic Engineering, Faculty of Science and Engineering, Meijo Univ.


## 1. Introduction

Plasma activated water is getting importance in importance with the increasing concerns over the emergence of antibiotic-resistant bacterial strains in the healthcare and food industries. PAW is being investigated for the treatment of bacterial contamination on food products and for medical applications.

It is without question that the bacteriostatic activity of PAW and other aqueous plasma-treated solutions is predominantly governed by reactive oxygen and nitrogen species (RONS). Within bacteria, RONS can destroy the cell through increased oxidative stress or DNA damage. The main RONS in PAW that are thought to be responsible for its antimicrobial action are hydrogen peroxide ($H_2O_2$), nitrite ($NO_2^-$), and nitrate ($NO_3^-$). However, the plasma–liquid chemistry is much more complex than this, particularly at the plasma-liquid interface where many other highly reactive RONS are generated. The initial liquid chemistry generated by plasma treatment may strongly affect the longer-term chemistry and antimicrobial property of PAW. Therefore, it is important to monitor and control the plasma and liquid chemistries of PAW in order to achieve desired processing outcomes for specific biological or medical applications.

In this study, we introduce a detailed study of UV–vis spectroscopy (UV-vis) for analyzing the concentrations of longer-lived RONS ($H_2O_2$, $NO_3^-$, and $NO_2^-$) and molecular oxygen ($O_2$) in PAW, and a recent development of UV-vis in far UV range.

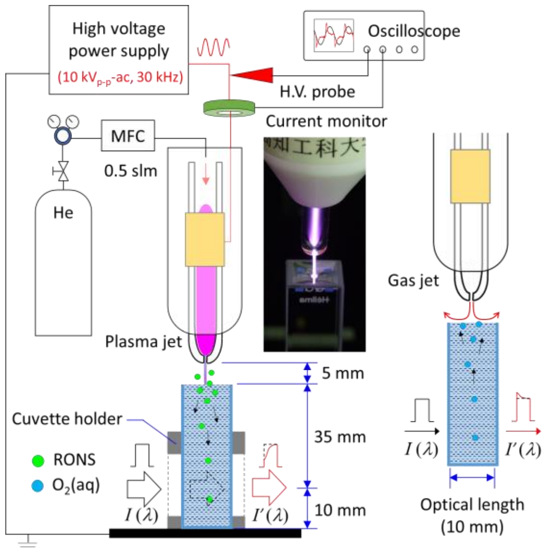


**Fig.1** *In-situ* UV-vis for analyzing long-lived RONS and $O_2$ concentrations.

## 2. UV-vis

UV-vis spectrophotometry is one of powerful methods to measure chemically stable species in liquid. Using UV-vis, we revealed how the dissolved oxygen [$O_2$(aq)] effect on the cell viability and how effect on the generation of ozone in water. In both cases, observing shorter wavelength range down to 190 nm was very important. Fig. 1 shows a schematic diagram of a set-up of *in-situ* UV-vis spectroscopy previously we used. Now, we investigating UV-vis using a modified system purging optical path with $N_2$. With this new UV-vis system, so far, we available much shorter wavelength down to 165 nm including unavailable wavelength around 178 nm due to a very strong absorption by water molecule. We will discuss further details onsite.


**Acknowledgements**

This work was partly supported by the MEXT-Supported Program for the Strategic Research Foundation at Private Universities (S1511021) and KAKENHI Grant Number JP17K05099.