

Time evolution of reactive oxygen nitrogen species in plasma-activated liquids

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Atmospheric-pressure plasmas (APP) have been frequently investigated for bactericidal effects and cytotoxicity against cancer cells using *in vitro* cell cultures [1]. The plasma treatment of essential media generates plasma-activated media (PAM) that then interacts with the cells under test. Thus, controlling the PAM generation process would facilitate researchers in clarifying the role of reactive species in plasma medicine. To this end, we present time-resolved measurements of reactive oxygen and nitrogen species (RONS) within plasma-activated water and PAM by a single-pass UV absorption system.

Concentrations were measured for plasma-activated water and diluted Dulbecco's Modified Eagle's Medium treated by an argon-fed, non-equilibrium APP. The APP nozzle was placed 13 mm from the liquid surface and was operated using a 60-Hz AC high voltage supply while varying applied voltage and gas flow rate. Liquids were treated in a 3.5-mL SiO₂ cuvette, allowing real-time measurements by UV absorption spectroscopy.

The time-evolution of RONS such as H₂O₂, NO₂, NO₃ and HNO₂ were investigated and evaluated against known solutions and previous studies using chemical indicators [2]. Of interest is the suggested presence of HNO₂, an unstable acid that may contribute to sustained levels of NO, NO₃⁻, and H⁺ well after plasma exposure. Figure 1 shows the time-resolved changes in total absorbance for PAM over 195-245 nm.

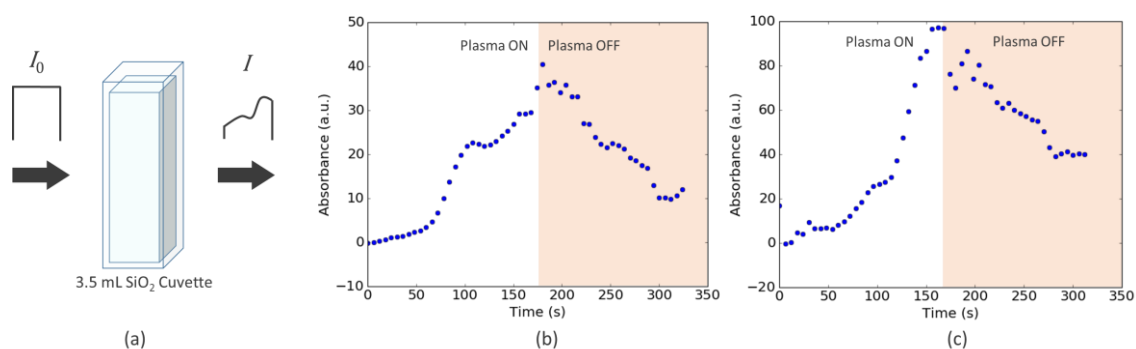


Figure 1: (a) Experimental setup for real-time UV absorption spectroscopy measurements, and (b) the total integrated absorbance of plasma-activated water and (c) plasma-activated DMEM solution.

References

- [1] H. Tanaka *et al.*: Clin. Plasma Med. **3** (2), 73-76 (2015).
- [2] N. Kurake *et al.*: Arch. Biochem. Biophys. **605**, 102-108 (2016).