一般セッション(口頭講演) | 8 プラズマエレクトロニクス：8.7 プラズマエレクトロニクス分科内招待講演

2023年9月21日(木) 16:00 ~ 17:00 | A302 (熊本城ホール)

[21p-A302-10~11] 8.7 プラズマエレクトロニクス分科内招待講演

伊藤 昌文(名城大)

英語発表

16:00 ~ 16:30

[21p-A302-10] [INVITED] Air Plasma-activated Bio-medical Media for Cancer Therapy: Effective dose to LRI

〇Dheerawan Boonyawan[1], Pipath Poramapijitwat[1] (1.Chiang Mai Univ.)

英語発表

16:30 ~ 17:00

[21p-A302-11] [INVITED] Spectroscopy diagnostics and modelling of electron kinetics in non-equilibrium plasmas at atmospheric pressure

〇Mohammed Yousfi[1] (1.University of Toulouse, CNRS)

Air Plasma-activated Bio-medical Media for Cancer Therapy: Effective dose to LRI

Pipath Poramapijitwat, and Dheerawan Boonyawan*

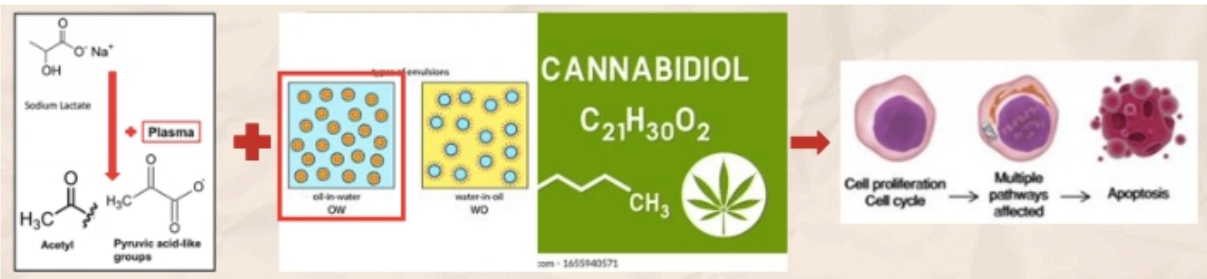
Plasma and Beam Physics Research Facility, Department of Physics and Materials Science,

Faculty of Science, Chiang Mai University, Chiang Mai 50200, Thailand

E-mail: pipath_p@cmu.ac.th, dheerawan.b@cmu.ac.th

Atmospheric pressure (atm) cold plasmas could be utilized in various bio-medical applications due to their unique properties, such as their ability to directly generate reactive oxygen and nitrogen species (RONS). Nightingale® is an IEC-standard and CE-certified air-plasma device intended for medical use. For air-plasma-activated LRI (PA-LRI), pH changes, concentrations of H_2O_2, NO_3^-, and NO_2^-, as well as the stability of H_2O_2 and NO_2^-, were investigated. Two-hour treatment of PA-LRI on A549 and H1299 cells resulted in morphological irregularity and cell death of 91.7 % and 70.0 %, respectively, while the non-cancerous cell line, human lung fibroblast (HLF), was not affected neither morphologically nor in terms of cell death. To elucidate the mechanisms of cell death induced by PA-LRI, common active species generated in PA-LRI (H_2O_2, NO_2^-, NO_3^-) were tested. Results showed that H_2O_2 alone can induce 72% of cell death, compared to PA-LRI, with 19% for NO_2^- and 2% for NO_3^-. The addition of catalase, which degrades H_2O_2, reduced cell death induced by PA-LRI and H_2O_2 to 9.2% and 6.4%, respectively. These results suggest that H_2O_2 is the most important player in PA-LRI-induced lung cancer cell death *in vitro*.

To the best of our knowledge, this study is the first to investigate the shelf life of PA-LRI at room temperature for medical purposes, as well as the application of air-plasma activated-LRI on the *in vitro* inactivation of human lung cancer cells. Furthermore, cannabidiol-nanoemulsion (CBD-NE) was accumulated in the plasma-activated LRI to perform activity enhancement. The results will be presented for extensive discussion.



Spectroscopy diagnostics and modelling of electron kinetics in non-equilibrium plasmas at atmospheric pressure

Mohammed Yousfi

University of Toulouse, CNRS, Laplace, France. E-mail: yousfi@laplace.univ-tlse.fr

Non-equilibrium plasmas at atmospheric pressure can be generated by various types of devices, such as corona discharges, dielectric barrier discharges, or microwave plasmas. These plasmas involve numerous reactive species, including reactive oxygen and nitrogen species (RONS) as well as energetic charged particles (electrons and ions) with also energetic photons and space charge electric fields. The density and temperature of these species depend on injected energy and the background gases used in each plasma device, such as air or specific mixtures of molecules and rare gases. These non-equilibrium plasmas find numerous applications in various fields, including medicine (1), agriculture (2), air pollution control (3), and thin film deposition for microelectronics (4), among others. To effectively control and adapt such non-equilibrium plasmas for specific applications, it is crucial to employ validated methods for characterizing the density of reactive species and their temperatures. It is worth noting that the generation of these non-equilibrium plasmas is primarily initiated by electron impacts, which result in the formation of primary dissociated, excited, and ionized reactive heavy species. These species, in turn, initiate a series of plasma chemical reactions leading to the formation of radical and long-lived reactive species relevant to various applications. Hence, obtaining accurate information about the electron kinetics, particularly the electron density and energy (or temperature), is of utmost importance. Within the scope of this lecture, I would like to emphasize a specific technique for determining the electron temperature in non-equilibrium atmospheric pressure plasmas. This technique involves the analysis of emission spectra from specific molecules and utilizes a simplified reaction kinetics model. Additionally, the classical method of determining electron density using atomic spectra broadening will be briefly discussed.

References

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