Enhancing Microgreen Cultivation with Innovative Multiple-Point Corona Discharge Plasma Technology

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Abstract

Atmospheric non-thermal plasma has emerged as a sustainable and eco-friendly technology with significant potential to enhance plant growth and seed germination through the generation of reactive nitrogen and oxygen species. These reactive species play a dual role by inactivating pathogenic fungi and stimulating plant metabolic processes, thereby acting as both protective agents and nutrient-rich biofertilizers. Various experimental findings indicate that plasma treatment substantially increases the production of essential bioactive compounds, including antioxidants, vitamins, and minerals, thereby improving the nutritional profile of microgreens. Despite these promising outcomes, the large-scale application of plasma technology in agriculture presents challenges related to maintaining power efficiency and ensuring consistent plasma stability across extensive cultivation areas.

The objective of this talk is to provide an overview of the application of corona discharge, a widely recognized atmospheric plasma technique, for the cultivation of microgreens. The implementation of multiple-pin electrode configurations offers a practical solution for achieving large-scale plasma treatment while maintaining operational simplicity. By integrating advanced plasma technology with sustainable agricultural practices, this technique presents a novel, environmentally friendly method to enhance crop quality, promote human nutrition, and contribute to sustainable farming solutions.

Keywords: Atmospheric non-thermal plasma, Corona discharge, Seeds

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Education History

[Doctorate]	2013	Electronics and Photonics Systems Engineering, Kochi University of Technology, Japan
[Master]	2009	Department of Electrical Engineering, Khon Kaen University, Thailand
[Bachelor]	2007	Department of Electrical Engineering, Khon Kaen University, Thailand

Professional Background

2013-Present	Associate Professor in the Department of Electrical Engineering, Faculty of Engineering, Srinakharinwirot University

Selected Awards and Honors

1. 2025 Honorary Award from the National Research Council of Thailand (NRCT)
   Received the National Researcher Award for Invention and Innovation for the Fiscal Year 2025 for the project titled "Atmospheric Pressure Non-Thermal Multi-Pin Corona Plasma Generator for Seed Enhancement."
   2024 First Runner-Up Award for Innovative Invention
2. Awarded for the invention “PEEP (Plasma-Enhanced Electrostatic Precipitator) for Magic Air,” by the “Magic Air Club” under the Warm Hearts Projects, organized by the Medical Association under Royal Patronage.
3. 2023 Awards from the Institute of Intellectual and Research Strategies, Srinakharinwirot University (Academic Year 2023)
   1. Third Place Award for the Researcher with the Highest Number of Registered Patents and Utility Models
   2. Award for Achieving Registered Utility Model Certification from the Department of Intellectual Property.
4. 2020 Outstanding Research Award
   Awarded at the Faculty of Engineering Anniversary Ceremony, Srinakharinwirot University, 2020.
5. 2019 Outstanding Thesis Advisor Award
   For the Academic Year 2019, Awarded by the Graduate School, Srinakharinwirot University.

Selected Publications

1. Samee, W., **Matra, K***., Lakkham, N., Dongkaew, B., Sumkhum, P., Sangwang, W., Nupangtha, W., & Promping, J. (2024). Electrical breakdown in liquid-phase processing on an enhancement of 7-hydroxymitragynine conversion from mitragynine in Mitragyna speciose (Kratom). *Heliyon*, *10*(17), e36676. Retrieved from https://doi.org/10.1016/j.heliyon.2024.e36676
2. Theepharaksapan, S., **Matra, K.***, Thana, P., Traiporm, T., Aryuwong, W., Tanakaran, Y., ... Ittisupornrat, S. (2024). The Potential of Plasma-Activated Water as a Liquid Nitrogen Fertilizer for Microalgae Cultivation. IEEE Transactions on Plasma Science, 1–11. Retrieved from https://doi.org/10.1109/TPS.2024.3362629
3. **Matra, K.*,** Aryuwong, W., Meetang, W., Ruthairat, S., Dechthummarong, C., Sangwang, W., & Luang-In, V. (2023). Application of Electrical Breakdown in Liquid Process on Inulin Structural Transformations. IEEE Access, 11(June), 114777–114789. Retrieved from https://doi.org/10.1109/ACCESS.2023.3321339
4. Luang-In, V., Saengha, W., Karirat, T., Buranrat, B., **Matra, K.**, Deeseenthum, S., & Katisart, T. (2021). Effect of cold plasma and elicitors on bioactive contents, antioxidant activity and cytotoxicity of Thai rat-tailed radish microgreens. Journal of the Science of Food and Agriculture, 101(4), 1685–1698. https://doi.org/10.1002/jsfa.10985 Q1
5. Tanakaran, Y., & **Matra, K.*** (2021). The Influence of Atmospheric Non-thermal Plasma on Jasmine Rice Seed Enhancements. Journal of Plant Growth Regulation. https://doi.org/10.1007/s00344-020-10275-1