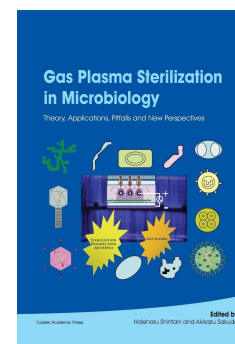


Gas Plasma Sterilization in Microbiology

Theory, Applications, Pitfalls and New Perspectives



Edited by: Hideharu Shintani and Akikazu Sakudo

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Gas plasma is the fourth state of matter, alongside solid, liquid, and gas. There are many naturally occurring events and man-made products related to gas plasma including: aurora, thunderstorms, high-intensity discharge headlamp bulbs, oxonizers, semiconductors, and solar battery panels. A gas plasma is generated by removing electrons from a gas, e.g. N(2), to produce a highly excited mixture of charged nuclei and free electrons. It has enormous potential as a broad spectrum antimicrobial sterilization procedure with applications in medical, industrial and agricultural settings (e.g. decontamination of medical instruments). A major advantage is the shallow penetration of gas plasmas: only ~10-20 nm from the surface thereby minimising damage to the material being sterilized. An important obstacle to overcome is the 'understanding-gap' between the engineering researchers who are developing the gas plasma sterilization technology and the microbiologists who aim to fine tune it for their needs. This timely volume aims to bridge that gap, permitting engineers and microbiologists to develop more coherent multidisciplinary strategies.

The book opens with introductory chapters that explain the background and principles of gas plasma sterilization and outline the possible mechanisms of action. Requirements for achieving the 'gold-standard' sterilization level i.e. a sterility assurance level (SAL) of 10⁻⁶, is also covered. The next eight chapters cover applications of this technology: these range from the inactivation of spores and endotoxins to inactivation of viruses and seed-borne plant pathogens. The final chapters tackle sterilization validation (from several ISO documents), common data-interpretation errors and speculate about future trends.

This book is an indispensable reference for students, microbiologists, engineers, and laboratory scientists interested in sterilization and decontamination.

Chapter 1. Introduction (*Hideharu Shintani*)

Chapter 2. Theoretical Background and Mode of Action of Gas Plasma Sterilization (*Hideharu Shintani*)

Chapter 3. Concomitant Achievement of a Sterility Assurance Level of 10⁻⁶ with Material and Functional Compatibility by Gas Plasma Sterilization (*Hideharu Shintani*)

Chapter 4. Current Progress in Advanced Technology of Nitrogen Gas Plasma for Remote Sterilization and Clarification of Sterilization (*Hideharu Shintani, Naohiro Shimizu, Yuichiro Imanishi, Akikazu Sakudo, Takuya Uyama and Eiki Hotta*)

Chapter 5. Current Progress in the Inactivation of Endotoxin and Lipid A by Exposure to Nitrogen Gas Plasma (*Hideharu Shintani*)

Chapter 6. Current Progress in Advanced Research into Tetrodotoxin Inactivation by Gas Plasmas (*Toshihiro Takamatsu, Hidekazu Miyahara, Takeshi Azuma and Akitoshi Okino*)

Chapter 7. Current Progress in Advanced Research into Fungal and Mycotoxin Inactivation by Cold Plasma Sterilization (*Pervin Başaran Akocak*)

Chapter 8. Current Progress in the Sterilization of Spores and Vegetative Cells by Exposure to Gas Plasma: Sterilization, Disinfection and Antimicrobial Activity (*Hideharu Shintani*)

Chapter 9. Current Progress in Advanced Research into the Inactivation of Fungi and Yeasts by Gas Plasma (*Gyungsoon Park*)

Chapter 10. Current Progress in Advanced Research into the Inactivation of Viruses by Gas Plasma: Influenza Virus Inactivation by Nitrogen Gas Plasma (*Akikazu Sakudo*)

Chapter 11. Current Technology and Applications of Gas Plasma for Disinfection of Agricultural Products: Disinfection of Fungal Spores on Citrus unshiu by Atmospheric Pressure Dielectric Barrier Discharge (*Yoshihito Yagyū and Akikazu Sakudo*)

Chapter 12. Current Progress in Seed Disinfection by Gas Plasma: Disinfection of Seed-borne Fungi and Bacteria by Plasma with Alternating Current High Voltage Discharge (*Terumi Nishioka, Tomoko Mishima, Yoichi Toyokawa, Tatsuya Misawa and Akikazu Sakudo*)

Chapter 13. Validation of Gas Plasma Sterilization (Importance of ISO documents, ISO TC 198 and 194). (*Hideharu Shintani*)

Chapter 14. Misinterpretation of Microbiological Data on Gas Plasma Sterilization: Avoiding the Pitfalls. (*Hideharu Shintani*)

Chapter 15. Future Perspectives and Trends in Gas Plasma Sterilization (*Hideharu Shintani*)

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