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EDITORIAL

PLASMA PROCESSES AND POLYMERS

Special issue: Plasma Medicine - part I

This special issue of Plasma Processes and Polymers focuses on the diverse range of applications and advancements in the field of plasma medicine, as showcased by the scientific papers featured in this Part I of the special issue. Plasma - also referred to plasma gas, cold plasma, cold atmospheric plasma - as well as plasma-treated liquids have gained significant attention for their potential in various medical settings, including microbial decontamination, wound healing, cancer treatment, and drug delivery. The papers presented in this special issue highlight the significant contributions of plasma technology in advancing healthcare practices. Framed within the activities of the PlasTHER COST Action CA20114, titled "Therapeutical Applications of Cold Plasmas",[1] this special issue, encompassing Parts I and II, provides excellent examples of ideas and applications where plasma could potentially be employed to revolutionize healthcare.

This first part of the special issue includes a scientific perspective, a review article and seven research articles that showcase and highlight the potential and advancements of this technology in the medical field. By discussing these research findings and their implications, the authors aim to provide insights into the future prospects and challenges associated with the utilization of plasma in medical applications. This compilation of cutting-edge research points out the expanding frontiers of plasma medicine and its potential in healthcare.

One of the key topics explored in the present special issue is the chemical aspects of plasma-treated liquids in medical applications. The scientific perspective from Tampieri et al.[2] emphasizes the importance of understanding the underlying mechanisms and chemical processes involved in plasma-generated liquids, enabling researchers to harness their full potential in medical treatments. Drawing insights from oral specialists, the review paper from Dubuc et al. discusses the role of plasma technology in the context of 3D printing for customized oral healthcare.[3] The opinions presented shed light on the potential synergies between plasma technology and additive manufacturing in dental applications, offering new possibilities for personalized treatments.

Opening the research works of the special issue, the article from Muro-Fraguas et al. explores the application of atmospheric-pressure plasma-polymerization technology for the development of low-friction coatings on medical needles.[4] The study highlights how plasma-based surface modifications can enhance the functionality and efficiency of medical devices, thereby contributing to improved patient experiences.

In this special issue, two articles are devoted to the antimicrobial properties of cold plasmas and plasma-treated media. Related to the previous paper, Seri et al. address the sterilization challenges associated with packaging materials and validate an indirect non-thermal plasma sterilization process for disposable medical devices.[5] This study emphasizes the importance of developing safe and effective sterilization methods to maintain the integrity of medical products. Meanwhile, Guo et al. examine the effects of plasma-activated air on pathogenic bacteria,[6] particularly focusing on the inactivation of Pseudomonas aeruginosa in a simulated respiratory tract. This research demonstrates the potential of plasma technology in combating respiratory infections. Interestingly, the article by Gromova et al. also studies the interaction of plasma-treated liquid with microorganisms.[7] However, their approach differs from the previous two articles. Instead of focusing on the antimicrobial aspects, the authors explore the potential of plasma-treated liquids in mitigating inflammatory bowel disease using an in vivo model. By shedding light on the anti-inflammatory properties of plasma-treated water, this work opens up exciting possibilities for its application as a therapeutic intervention for gastrointestinal disorders.

Another popular application of cold plasmas and plasma-treated media is in the field of oncology as an anticancer treatment strategy, as shown in the paper by Saadawy et al.[8] This paper presents a novel approach for the treatment of hepatocellular carcinoma using plasma-treated air-driven water mist. The findings highlight plasma-generated reactive species to induce selective cancer cell death, providing a promising avenue for noninvasive cancer therapies.

The last two articles of the special issue deal with combinatorial approaches. Xu et al. explore the synergistic effect of plasma-activated saline and chemotherapy drugs on cancer cells.[9] Their study offers insights into the potential of plasma to enhance the efficacy of

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conventional cancer treatments. The findings highlight the prospect of plasma as an adjuvant therapy for improved drug sensitization. Finally, Tian et al. investigate the efficiency and safety of touchable plasma jets for transdermal drug delivery, assessing their impact on skin tissue.[10] This research provides valuable insights into the development of plasma-based delivery systems and their potential as noninvasive alternatives for drug administration.

CONCLUSIONS

The present special issue of Plasma Processes and Polymers underscore the significant advancements and potential of plasma technology in various medical applications. The diverse range of topics covered, including surface modification, microbial inactivation, cancer treatment, and drug delivery, highlights the expanding frontiers of plasma medicine. As researchers continue to explore and refine plasma-based technologies, it is expected that the integration of plasma into medical practices will offer innovative solutions to address healthcare challenges and improve patient outcomes.

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