

Plasma Pharmacy: The Use of Plasma-treated Products for therapeutic Purposes

Thomas von Woedtke, Katrin Oehmigen, Mareike A. Ch. Hänsch, Klaus-Dieter Weltmann

*Leibniz Institute for Plasma Science and Technology (INP Greifswald),
Felix-Hausdorff-Str. 2, 17489 Greifswald, Germany*

E-mail: woedtke@inp-greifswald.de

During the last years, a multitude of findings about plasma-cell and plasma-tissue interactions and its possible use in medical therapy have been provided. One of the key findings is that several biological effects are not result of direct plasma-cell or plasma-tissue interaction but mediated by liquids. It was demonstrated that simple liquids like water or physiological saline, after treatment by atmospheric pressure plasma are antimicrobial active and that these effects are attributable to the generation of different low-molecular reactive species [1] [2]. Plasma treatment of more complex liquids like cell cultivation media result in changes of organic components which could induce various effects on living cells and their components [3] [4]. This focuses attention on a new and innovative field of medical plasma application where the plasma is no applied directly on living structures but is used to generate, optimize and/or stabilize products which contain active agents, above all liquids. In contrast to plasma medicine, what means the direct use of plasmas on or in the living organism for therapeutic purposes, this field – as a specific field of medical plasma application – should be called “plasma pharmacy”. Pharmacy is a branch of health sciences dealing with preparation, dispensing, and proper utilization of drugs whereas drugs in this sense are substance used in the prevention, cure, or alleviation of diseases.

Based on the present state of knowledge, application fields of plasma pharmacy might be: preparation of antimicrobial active liquids for disinfection and antiseptics [1]; modification of complex liquid components to influence cell and tissue behavior, e.g. stimulation of cell proliferation [3]; solubilization and stabilization of poorly soluble or non-soluble substances [5]. Another conceivable possibility is the activation of drugs before application. Finally it might be considered that plasma use for decontamination/sterilization of pharmaceuticals and pharmaceutical packaging materials is also a field of pharmacy.

A main advantage of plasma pharmacy is that direct contact of plasma with living tissue is avoided and, consequently, some possible side effects (e.g. caused by UV radiation) can be excluded. On the other hand, most of such plasma pharmaceutical products have the character of drugs and have to be licensed according to specific regulatory requirements.

Acknowledgement: Parts of this work were realized within the joint research project “Campus PlasmaMed” supported by the German Federal Ministry of Education and Research (grant no. 13N9779 and 13N11188).

References

- [1] Oehmigen K. et al., *Plasma Processes and Polymers* (2011), **8**, 904-913.
- [2] von Woedtke Th. et al., in: Machala Z. et al. (eds.), *Plasma for Bio-decontamination, Medicine and Food Security*, Springer 2012, 67-78.
- [3] Kalghatgi S. et al., *Annals of Biomedical Engineering* (2010), **38**, 748-757.
- [4] Kalghatgi S. et al., *PloS ONE* (2011), **6**, e16270.
- [5] Dwars T. et al., *Surface and Coatings Technology* (2003), **174-175**, 597-600.