PO4020

CAP can induce oxygenation of amino acids

Anna Scheglov[1], Leander Loewenthal[2], Andreas Helmke[3], Wolfgang Vioel[3]

[1]University of appl. Sci. and Arts HAWK, Goettingen, Germany [2]University of Applied Sciences and Arts HAWK, Faculty of Natural Sciences and Technology, Goettingen, Germany [3]Fraunhofer Institute for Surface Engineering and Thin Films IST, Application Center for Plasma and Photonics APP, Goettingen, Germany

anna.scheglov@hawk-hhg.de

The biomedical usage of cold atmospheric plasma (CAP) is a constantly growing field with various applications in dermatology, surgery and disinfection. Much research effort is made to develop therapies using the health promoting effects of plasma in wound healing, fighting infections caused by bacteria and fungi as well as raising the biocompatibility of artificially engineered substances applied on skin or wounds. These therapies can benefit from a more detailed understanding of the interactions between plasma and the biological systems. Therefore it is not only essential to understand how plasma affects living cells but also biopolymers of the extracellular matrix. One of the most abundant biopolymers is collagen. Type I collagen as a major component of the dermis consists of the major amino acids glycine, L-proline and trans-4-hydroxy-L-proline.
In our study, these amino acids in the state of zwitterionic molecules were exposed to CAP generated by a dielectric barrier discharge in ambient air and analysed by X-ray photoelectron spectroscopy (XPS).
For all amino acids the well-known effect of plasma cleaning by oxidizing organic contaminations deriving from the ambient atmosphere was observed. Further oxidation processes were most pronounced in proline: a significant increase of the O/C ratio was examined. At the same time the amount of oxygen bound to carbon in the carboxyl group decreases which, together with the decrease of carbon in the same group, is an indicator for decarboxylation. Furthermore, CAP exposure resulted in chemical modifications of the nitrogen content of all amino acids alongside with the dose dependent formation of a new nitrogen bond. Again, this effect was most pronounced for proline.

Keywords
cold atmospheric plasma
DBD
amino acid
XPS