



PLATHINIUM
PLASMA THIN FILM INTERNATIONAL UNION MEETING

13-17 September 2021
Antibes, French Riviera
WWW.PLATHINIUM.COM

100%
VIRTUAL

A cocktail of active ingredients - benefits and challenges for plasma medicine

Katharina Stapelmann, North Carolina State University

Low-temperature plasma discharges in or in contact with air produce a variety of reactive oxygen and nitrogen species (RONS). The reactive species produced by plasmas are the same molecules that the human body generates for signaling or antimicrobial effects. Plasma treatment of eukaryotic cells can thus cause a similar effect as an innate immune system oxidative burst and plasma at low doses can mimic an immune response to tissue damage, wounds or infection which could initiate a natural healing response. Utilizing plasma-generated RONS for plasma-aided wound healing or plasma oncology is therefore a promising alternative to conventional treatments and the effectiveness of plasma for wound healing and cancer treatment has been shown in vitro and in vivo. Yet, the mechanisms of action and the delivery of RONS to the target are currently still under investigation.

In this contribution we will explore the cocktail of active ingredients; the generation and transport of the reactive species O and OH from the gas phase through a liquid to a biological sample and investigate the role that the biological sample plays as part of the reaction pathway. Using the model biological sample cysteine, which is often found in proteins that play a key role in signaling, the differences between a more OH/H₂O₂-dominated chemistry and a more O-dominated chemistry is explored. The results indicate that the modifications caused by a OH/H₂O₂-dominated chemistry are similar to those that can be found in context of redox biology, whereas modifications caused by O-dominated chemistry differ significantly. Atomic oxygen is unknown in nature whereas OH and H₂O₂ are well known and produced by organisms. The cocktail of active ingredients in a plasma and the variety of different plasma sources available makes it thus difficult to assess and generalize the impact of plasma on cells. On the other hand, the tunability of plasma and the possibility to tailor RONS production to certain outcomes provides a promising and powerful tool to aid the healing of chronic wounds or to develop new strategies in cancer treatment.