Potential of Plasma Applications in a Circular Food Systems Approach

Oliver Schlüter[1,2], Julia Durek[1], Shikha Ojha[1]

[1]Quality and Safety of Food and Feed, Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB), Max-Eyth-Allee 100, 14469 Potsdam, Germany; [2]Department of Agricultural and Food Sciences, University of Bologna, Piazza Goidanich 60, 47521 Cesena, Italy

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INTRODUCTION:
Cold plasma technology is leading major breakthroughs in addressing a plethora of issues in the agriculture and food sectors, ranging from mitigating produce losses due to pathogens and pests to enhancing the yield and safety of food. Being an ionized gas, cold atmospheric pressure plasma (CAPP) constitutes of a complex mixture of active agents, such as UV photons, charged particles, radicals and other reactive nitrogen, oxygen and hydrogen species [1].
The complexity of these molecule-molecule interactions underlines the importance of a tailor-made process design. In order to achieve the goal, which might be a gentle microbial inactivation in most cases, plasma sources need to be adapted to the specific purpose of application. This will be one of the major tasks in the field of CAPP and food before large-scale processes can be implemented in industry [2].

OBJECTIVES:
The aim of the presentation is to discuss the important development of criteria to assess safety and quality attributes related to plasma treatment of foods, which requires not only a detailed, standardized characterization of the process parameters and the method, but also elucidation and characterization of potential changes to substances in the treated foods. CAPP induced physical/chemical/biochemical/microbiological changes in different food matrices will be discussed along the value-added chain.

METHOD / DESIGN:
The introduction of a new decontamination technology in industry requires understanding of the mechanisms of microbial inactivation and the associated interactions between process and product. Therefore, experimental studies will be presented with the following objectives: i) to investigate the underlying inactivation mechanisms in plasma treatment of microbial contaminants; ii) to clarify how the different process- and product-related parameters influence the inactivation process; and iii) to evaluate the treatment effects on relevant quality parameters of selected food materials.

RESULTS:
The individual aspects follow a comprehensive overall approach, from the targeted inactivation of microorganisms on temperature-sensitive food systems to the customized influence of quality attributes along the entire food value chain. The multi-scale approach takes into account the influence of cold atmospheric pressure plasma on molecules, macromolecules, single cells, complex plant food systems and food processing equipment [3].

CONCLUSIONS:
Future perspectives for the transfer of plasma applications to industrial food production will be discussed and examples for possible implementation concepts of the plasma technology in a circular food systems approach will be derived.

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Corresponding author: oschlueter@atb-potsdam.de; oliver.schluter@unibo.it