inactivation of microorganisms on dry and also heat sensitive surfaces. The inactivation of microorganisms on the surface of dry products, like herbs, spices, and/or almonds is difficult, because of the higher resistance especially of sporulated microorganisms when compared to a medium with a lower water activity. The main challenges in plasma processing of food materials are: i) proper selection of the plasma source, ii) characterization of product-process interactions including quality and safety attributes, and iii) optimized process design and up-scaling for industrial application.

In this presentation different plasma sources were discussed regarding their inactivation of selected microorganisms, e.g., *Bacillus subtilis* spores (PS832). A radio-frequency (RF) plasma jet was used for the direct treatment, working with argon as a process gas with the admixture of O_2 and N_2. Furthermore, a DBD (dielectric barrier discharge) system in a static atmosphere was used with different process gases (air, N_2, O_2). For an indirect treatment plasma processed air (PPA) was used, which was generated by a microwave driven plasma torch. The different generated plasmas were characterized using optical emission spectroscopy, gas analysis tubes and the quantification of ozone. Furthermore, the temperature inside the different plasmas was measured. A quantitative PCR assay was used to detect the effect of the plasma treatment on the spore DNA, by monitoring the destruction of *dna*K fragments. Additionally, selected isogenic *B. subtilis* mutant strain spores were plasma treated to evaluate the main inactivation effects of different plasma sources. Photons emitted by the generated plasma ((V)UV) take a key role in the inactivation process, as shown for direct treatment using DBD and plasma jet systems, but for PPA the inactivation process is dominated by diffusion of reactive species.

S22 Dilemma in Constructive Use of Risk Assessment in a Variable World: All Microbes are Equal But Some Microbes are More Equal Than Others

Risk assessment often deals with variability and uncertainty, while food safety management often needs to make discrete decisions. The objective of this proposed symposium is to facilitate connecting probabilistic variability (and uncertainty) in Quantitative Risk Assessment (QRA) on the one side and management need for "discrete" decisions on the other side, for a better understanding of how to manage food safety risks in a variable world.

Microbiological criteria, processing targets and limits for CCPs, are examples of "lines in the sand." Decisions from legislation or in standard settings are often discrete. But we live in a variable world: microbiology, food processes, raw materials, humans all are inherently variable. All these aspects are treated in QRAs, but sometimes this variability, as well as explicit communication of uncertainty, undermines the understanding and the confidence in these analyses and their applications.

Making models more "accurate" than reality is simply not possible in a variable world, making them more realistic is possible. Understanding the magnitude and sources of variability and uncertainty can aid in decision making, including selecting the most efficient control measures.

The symposium brings speakers together from academia, industry and government to share the latest developments in QRA, lessons learned and experiences in constructive use of QRA to inform decision making under variability and uncertainty. The symposium intends to make connections between risk assessments and decision makers in government, industry and beyond.

Microbiological Sources and Impact of Variability on QMRA (Exposure Assessment and Hazard Characterisation)

HEIDY DEN BESTEN, Wageningen University, Wageningen, Netherlands

Quantitative microbiology is used in risk assessment studies, microbial shelf-life studies, product development, and experimental design. Realistic risk estimation is, however, complicated by different sources of variability. The variability in hazard characterization is fairly unexplored, though highly relevant. The final concentration of microorganisms at the moment of consumption (exposure assessment) depends, amongst others, on the variability in the storage times and temperatures, variability in product characteristics, variability in process characteristics, variability in the initial contamination of the raw materials, and last but not least, microbiological variability. This presentation compares different sources of microbiological variability in growth and inactivation kinetics of a pathogen, namely experimental variability, reproduction variability (within strain variability), strain variability (between strain variability) and variability between individual cells within a population (population heterogeneity), and prioritizes their importance. Also, the microbiological variability is compared to other variability factors encountered in a model food chain to evaluate the impact of different variability factors on the variability in microbial levels encountered in the final product.

Dealing with Variability in Industry Risk Assessments to Support Safe Product Design

ALEJANDRO AMEZQUITA, Unilever, Sharnbrook, United Kingdom

Making decisions on the safety of food products under uncertainty and based on variable data/information may undermine confidence in the decision. This has traditionally led to the application of deterministic calculations with conservative assumptions (to account for uncertainty and variability) in the food industry when establishing the basis for safety of new products. Performance criteria and related metrics based on such conservative