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## **Sterilization of granular materials in a low pressure Plasma Circulating Fluidized Bed Reactor**

Denis Butscher<sup>1</sup>, Philipp Rudolf von Rohr<sup>1</sup>

<sup>1</sup>ETH Zürich, Zürich, Switzerland

butscher@ipe.mavt.ethz.ch

The application of conventional thermal or chemical sterilization methods is often limited since many products are sensitive to heat, moisture and a variety of chemicals. Radiation sterilization is a rather novel method to sterilize products, however it is not accepted without reserve among consumers, especially in the case of gamma irradiation. A promising alternative to these methods is plasma sterilization. The sterilizing effect of a plasma treatment was successfully demonstrated in numerous research activities (mostly on flat substrates, inoculated vials or medical devices). It is agreed that the synergetic combination of UV inactivation, photodesorption resulting from UV photons and the etching by reactive species is responsible for the effective destruction of microorganisms.

In our research project we focus on the plasma sterilization of powders and granular materials for food and pharmaceutical applications (e.g. wheat grains). Therefore, we use a low-pressure and low temperature plasma to meet the thermal limits of food processing. In order to obtain a sufficiently high treatment time and high plasma - particle interaction we follow a multipass approach by using a circulating fluidized bed reactor. Particles are lifted by a binary gas mixture in the riser tube of the low pressure plasma circulating fluidized bed reactor and sterilized by an inductively coupled plasma. In a cyclone these particles are then separated from the gas flow and collected in a storage tube from where they are repeatedly conveyed to the treatment zone. With the multiple circulations we can realize an adequate treatment time and at the same time limit the thermal load of the plasma to short periods. We successfully managed to combine the high gas flow which is required to lift the granular materials in the riser tube with the low pressure which is essential to ignite and sustain a stable and homogeneous discharge. In a first experimental investigation we could also show the general feasibility of our approach to effectively reduce microorganisms on a granular substrate and we were able to show the effects of variations in the process parameters plasma power, processing time and gas composition on the sterilization efficacy.

### **Keywords**

sterilization

circulating fluidized bed reactor