Particles and Health 2021

Nanotoxicology and Health Session

Presentation Summary

Title: Assessing the impact of nanostructures materials on an advanced *in vitro* intestine model

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The food industry has identified the benefits of nanotechnology and exploited the unique properties engineered nanomaterials (ENM) over the last decade. Nanostructured food processing agents, which are added to prevent caking, to improve flowing or change texture of the food, might be ingested. Authorities as well as consumers are concerned about potential adverse effects of nano-sized materials in food on public health. Considering the high oral exposure of all these food additives, a better understanding of the uptake, accumulation and biological effects of food relevant nano-sized materials at the intestinal epithelium is needed.

Ten differently produced synthetic amorphous silica (SAS) materials with different specific surface areas, different primary structures sizes and different surface charges have been synthesized and characterized. Their biological impact has been screened in Caco-2 cell line, representative for the most common cell type in the intestine. No acute impairment of viability or barrier integrity could be identified. In the second part of this work an advanced co-culture model has been established to better evaluate the impact of food grade materials in a more *in vivo* like setting. The exposition of the advanced co-culture model with six different SAS selected due to the different production routes, specific surface areas and their different silanol content has lead to no differences in the viability, barrier integrity, microvilli function and lipid uptake. Nevertheless, the treatment has shown that the mucus production increases after the treatment with SAS materials that present certain aggregate sizes and a high silanol content. A co-effect has been found for the investigation of the iron uptake. Precipitate SAS with a small specific surface area decreased the iron uptake in the advanced co-culture only in iron uptake but not in the also on the gene level.
The results show that the use of this advanced *in vitro* model could lead to an improved prediction on potential adverse outcomes of food components on the intestine. Mucus seems to be a very important protective barrier in the interaction of food components with the intestinal epithelium and should be studied in more detail. The advanced co-culture model established in this work can be used for a first estimate of the interactions of food components with intestinal epithelium and a further reduction of animal experiments in the future.