Interaction of inorganic nanoparticles with the food matrix: Whey proteins as an example

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Abstract:

Among nanotechnology applications in the food sector, nano-sized SiO_2, TiO_2 and Ag particles are often mentioned. Their behavior in food matrices, however, is largely unknown. Therefore, a study was performed to elucidate nanoparticle-food component interactions in model systems (BSA, β-lactoglobulin) and real foods (whey).

SiO_2 (d=120 nm), TiO_2 (d=88 nm) and three differently coated (surfactant, PVP and citrate) Ag (99% d<20 nm) were included in the study. Hydrodynamic diameters were determined by dynamic light scattering and protein binding to the particle surface was identified by SDS-PAGE.

BSA had higher affinities to nano-scale SiO_2 and TiO_2 than β-lactoglobulin. Lactoferrin was shown to have the lowest affinity to both nanoparticles. When incubated with whey, β-lactoglobulin was observed to be the major protein on the TiO_2 surface. Incubation of whey with the different Ag nanoparticles resulted in a predominant binding of lactoferrin independent of the particle coating.

Binding of proteins to the surface of inorganic nanoparticles depends among others on the nature of the protein, the chemical identity of the nanoparticles and their surface chemistry. It became obvious that the behavior of a nanoparticle in a food matrix cannot be predicted by data received from the incubation of the nanoparticle with single proteins.

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