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Influence of the encapsulated bioactive substance crocin on the stability of solid lipid nanoparticles during processing

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Solid lipid nanoparticles (SLN) show great potential as carriers of bioactive substances thereby enhancing the nutritional quality of foods. Furthermore, depending on their surface chemistry, they can modify food structure related properties like the sensory perception during oral processing of food. The aim of this work was to understand how bioactive substances and proteins influence the heat stability of SLN. Therefore, the impact of a heat treatment on the stability of unloaded and crocin-loaded SLN was investigated in the presence and absence of β-lactoglobulin (BLG).

SLN were prepared by melt emulsification and were stabilized by lecithin and sucrose palmitate, followed by the addition of crocin to the hot emulsion. Additionally, Tween 20 or BLG was used as third emulsifier. SLN stabilized by BLG (BS) or Tween 20 (TS) were subjected to heat treatment in the presence or absence of excess BLG. SLN were characterized regarding size, shape and zeta-potential, and the amount of encapsulated crocin was determined before and after heating.

Upon heating, the particle sizes of unloaded and crocin loaded TS increased to about 2-fold and 1.5-fold of the initial size, respectively. Heating in the presence of BLG led to the adsorption of BLG on the surface of both loaded and unloaded TS, leading to increased particle sizes and zeta-potentials. Furthermore, heat treatment in the presence of BLG resulted in significantly decreased amounts of free crocin. This was probably due to the binding of crocin in BLG aggregates which formed during the heat denaturation. The same effect was also observed for BS. However, the particle size of loaded and unloaded BS was not affected by the heat treatment.

This study will help in understanding heat induced changes in loading capacity and other properties of SLN. This knowledge is important when SLN are used as carriers in complex food systems.