**Impact of micro- and nanostructure on the stability of encapsulated omega-3-fatty acids**

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The principal technologies used for encapsulation of lipophilic food ingredients are spray-drying, coacervation and extrusion. Spray-drying is a valuable, straight-forward and inexpensive technology and therefore the most common technique used in commercial applications in the food industry. The structure of microcapsules prepared by these techniques is referred to as matrix type with the core material homogenously dispersed in an amorphous encapsulant matrix.

Strategies to inhibit the autoxidation of microencapsulated omega-3 fatty acids must take into account the bulk oil, the process of emulsion preparation and the stabilisation of the oil during the encapsulation process and subsequent storage. Research during the past years has shown that the selection of the encapsulant, its drying behaviour and the process conditions have a fundamental effect on the microstructure of the capsule. Among these are the type of emulsifier, the drying kinetics of the matrix, the microencapsulation efficiency and the localisation of the non-encapsulated oil, the drying conditions chosen by the operator and multiple interactions between these variables. Nevertheless, with the current knowledge it is still not possible to predict the stability of microencapsulated omega-3 fatty acids.
Recent data indicate that with respect to the long-term protection of the encapsulated core material the physical characteristics on the nanoscale are of particular importance. Major issues are the structure and composition of the core material-encapsulant interface and the air-encapsulant interface as well as the minimization of air inclusion the within microcapsule and the oxygen permeability. Significant improvement in terms of autoxidation may be achieved by focussing on these variables.
With respect to the industrial practice a key factor for a successful product development is an in-depth investigation of the interplay between encapsulant properties, process engineering parameters and capsule structure on multiple scales. The different requirements concerning the protective environment and the desired release mechanism necessitate individual concepts including a top-down approach and a precise definition of the goals of the microencapsulation process for the multiple applications in the food industry.