Microencapsulation Overview

Microencapsulation is not a new technology, but is being used in new and innovative ways to meet the needs of the food and drink sector. Particles, typically less than 1 mm in diameter, are produced by coating particles, or droplets of the target ingredient, with a uniform and continuous film to modify their properties. Alternatively, ingredient particles, or droplets, are embedded within a matrix material, which degrades under suitable conditions to release the payload. A range of materials are suitable for use as the capsule or matrix material, including lipids, wax, modified starch, cellulose, phospholipids, alginates and other natural biopolymers, such as plant proteins.

Microencapsulation is used as a formulation aid in a diverse range of applications and provides many advantages including:

- converting liquids to solids for improved handling and safety
- providing sustained release formulations
- controlled or delayed release of flavours, minerals, vitamins, prebiotics and probiotics
- masking taste, odour and colour, of fish oils or plant extracts for example
- stabilising volatile flavours and fragrances to improve shelf life
- protection of flavours during high heat processes including deep fat frying
- protection of volatiles during extrusion processing
- suppression of reactions between recipe ingredients in premixes or final products
- protection of sensitive materials from the extremes of pH or exposure to light
- providing tools for forming nanoparticles or nanodispersions
- stabilisation of starter cultures, enzymes, vitamins, provitamins
- economical, efficient and reproducible manufacturing processes.

Selecting the appropriate biopolymers and processes to produce an adequate polymer coating can ensure that ingredients are delivered effectively. The production of stable emulsions, dispersions, or granules made with microencapsulated material, enables the final product to be presented in a form that meets the demands of challenging applications. Common approaches used in the food ingredients sector, include fluidised bed coating, spray drying, spray chilling and extrusion.

Microorganisms have been used as biocapsules as an alternative to traditional microencapsulation processes. In the 1970s, it was discovered that yeast cells (*Saccharomyces cerevisiae*) could be used to trap water soluble substances, for use in medical, cosmetic and food products. The technology was developed for fat soluble ingredients and was commercialised in Europe and the USA, initially as a flavour delivery vehicle.

In a less common approach, cyclodextrins can protect volatile or reactive ingredients by molecular inclusion. Cyclodextrins are cyclic oligosaccharides most commonly comprising a five to seven membered ring. They are polar on their external surface and are relatively water soluble. They possess an inner apolar core which can host fat soluble vitamins and flavours.

Homogenisation technology, including the production of complex emulsions (e.g. water/oil/water), is also important for forming encapsulated ingredients for beverage applications, or for generating uniform feedstock for coacervation, or in spray drying for powder blends.

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