Technical Brief – Microencapsulation

CD R&D Consultancy Services | January 2014

What is microencapsulation? This is not a new technology but is being used in new and innovative ways. Simply, particles of less than 1 mm in diameter are produced, typically by coating particles or droplets of interest, with a uniform and continuous film to modify their properties. A range of materials are suited for use as the capsule material, including: lipids, wax, modified starch, cellulose, phospholipids, alginates and other natural biopolymers.

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

- Converting liquids to solids for improved handling and safety
- Providing sustained release formulations
- Controlled/delayed release of flavours, pesticides or pharmaceuticals
- Masking taste, odour and colour (of fish oils or plant extracts for example)
- Stabilizing 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 the premixes or the final products
- Protection of sensitive materials from the extremes of pH or light exposure
- Providing tools for forming nanoparticles or nanodispersions
- Stabilization of starter cultures, enzymes, vitamins, pro-vitamins
- Economical, efficient and reproducible manufacturing processes

By selecting the appropriate biopolymers and processes to produce an adequate polymer coating, we ensure that your ingredients are delivered effectively. The production of stable emulsions, dispersions, agglomerates or granules made with microencapsulated material enables the final product to be presented in a form that meets the demands of your applications.

The use of micro-organisms as bio-capsules, as an alternative to traditional microencapsulation processes, was first considered in the 1970s. It was discovered that yeast cells (*Saccharomyces cerevisiae*), treated with a plasmolyser, could be used to encapsulate water soluble substances for use in medical, cosmetic and food products. The technology was developed further and the material was commercialized in Europe and the USA, initially as a flavour delivery vehicle by companies including Corn Products Inc/Bestfoods and Micap plc. Yeast offers a readily dispersible water insoluble matrix as a complex delivery system for fat soluble materials, for example essential oils, flavours, biocides, fungicides and herbicides. This technology has the potential of targeted release, flavour retention during high temperature processing and protection from evaporation of volatile components.

As an alternative approach, cyclodextrins can protect volatile or reactive ingredients by molecular inclusion. Cyclodextrins are cyclic oligosaccharides most commonly comprising a five to seven membered ring (α-, β– and γ–cyclodextrin respectively). As they are polar on their external surface these molecules are relatively water soluble. They possess an inner apolar core which hosts non-polar functional groups or molecules such as fat soluble flavours, fragrances and active pharmaceutical ingredients for example.

This is a complex business with revenues valued globally in the billions of Euro for encapsulated products in the food and related industries. Growth in natural colours, and other sensitive materials in high values areas, is a good example where the demands of the product developers and marketers are been met by innovative solutions provided by microencapsulation technologies.