Microencapsulation and Industrial applications for uniform controlled release particles


**INTRODUCTION**

Applying vibrating nozzle processes for the production of microspheres and microcapsules has a lot of advantages when compared to other methods: Vibrating nozzle processes render it possible to produce particles with a monomodal grain size distribution and a single sharp maximum. $d_{\text{max}}/d_{\text{min}}$-values lower than 1.10, 1.05, or even 1.01 are customary for spherical granules produced with a vibrating nozzle microsphere unit designed by BRACE (see Picture 1).

![Picture 1: Size Analysis of Microspheres (Malvern Mastersizer)](image)

BRACE microspheres are solid spheres with a matrix-encapsulated active agent whereas BRACE microcapsules consist of a solid shell and a liquid or solidified core.

These two types of microgranules differ mainly in their release profiles: Microspheres usually show diffusion controlled release profiles with a permanent release rate that is controlled kinetically by means of the particle size, whereas microcapsules expel their content with a single burst as the shell breaks. On the other hand, microcapsules may exhibit extremely slow release rates when appropriate materials are used.
RESULTS AND DISCUSSION
Various applications have shown that microspheres produced with laminar flow breakup processes have many advantages compared to classical preparation methods as spray-drying or spray-cooling. Due to the laminar nature of the flow, no sudden demixing processes occur when the flow is exiting the nozzle. Since the processes lead to monomodal size distributions, no polymorphisms occur. A truly controllable controlled release profile can therefore be designed by manipulating only one process parameter (particle size) instead of various ones such as load, size, drying rates etc.

By applying the double nozzle process for the production of core-shell microspheres, new materials with exiting properties can be obtained. These "real" capsules can be designed to release their contents with a burst as soon as the capsule becomes subject to low pressure, or to release their contents extremely slowly over a long time. Therefore, it becomes possible to provide solutions for both flavour chemistry and textile applications.

Since the processes are easily up-scalable, the retesting and scale-up time from laboratory-size to production-size throughputs is short. Usually, a production unit runs with the same feed compositions and the same parameters as the desktop unit, making it possible to test all parameters and recipes in small scale before putting the production unit into operation.

Since the processes are suitable for a wide range of materials such as alginates, gelatines, agar, waxes/thermoplastics, metal oxides, solutions, polymers etc., it is possible to obtain controlled release solutions for almost any kind of application – from food to feed, cosmetic to pharma, chemistry to automotive.

CONCLUSION
With the patented BRACE vibrating nozzle processes and the corresponding machinery, it becomes possible to produce large quantities of microgranules (microspheres and/or microcapsules) for top grade products. By adjusting just a few parameters, highly controllable products can be obtained that provide controlled release profiles for almost any application.

References