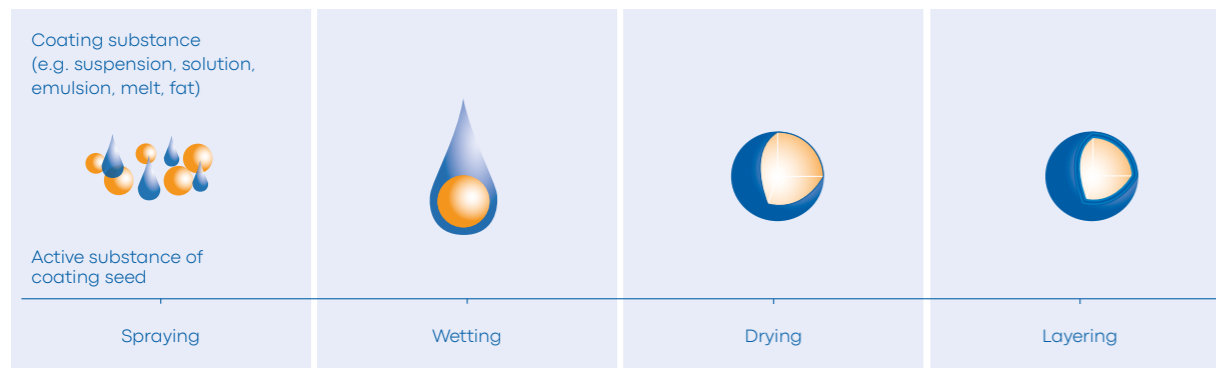


SPOUTED BED COATING

Optimal process for the encapsulation of solids with functional properties

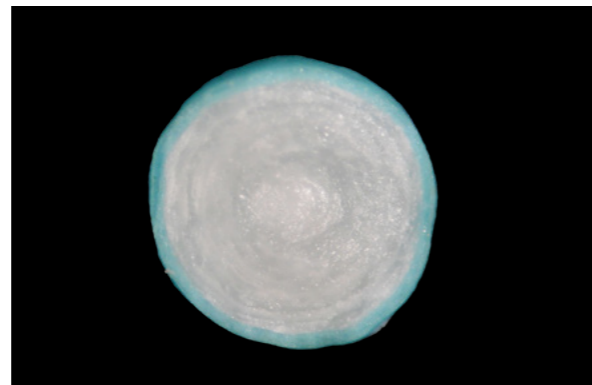
Over the past few years, coating or encapsulation of solid particles (e.g. granules, extrudates, pellets) with functional coating substances has become increasingly important in various industries.

Solid formulation in the pharmaceutical industry, for example, not only demands high formulation accuracy, but also the targeted and predictable release of active agents. By selecting the appropriate coating material, it is possible to determine how quickly or in which environment (e.g. a specific pH value) the active agent is to be released from a tablet or pellet.



↑ Schematic representation of the coating process

Also in the food industry, solid products are increasingly provided with a coating. This coating may, for example, serve to protect the enclosed substance from external influences such as light, oxygen (oxidation) or moisture. The solid particles can also be provided with a coating layer or encapsulated for optical improvement, taste masking, colour differentiation, or the targeted delivery of ingredients (e.g. flavourings). The coating process has huge potential for the development of new products with functional properties.



↑ Coated pellet under the microscope

Spouted bed coating

Coating is a process in which solid particles are covered with a coating substance. A number of apparatus are available for this process, such as drum coater, plate coater or fluidized bed coater. The spouted bed coating process is, in addition to conventional fluidized bed coating such as the Wurster method, a process variant with many advantages:

- Optimum coating results
- Ease of application
- Product-friendly process
- No additional built-in components required
- Reduced process times
- No formation of agglomerates
- Less product loss by abrasion of product or overspray

Spouted bed coating is achieved by the special geometry of the product bin and the design of the distributor plate. With this coating method, both fine particles (powder) and pellets up to a size of about 1 cm can be coated uniformly and gently.

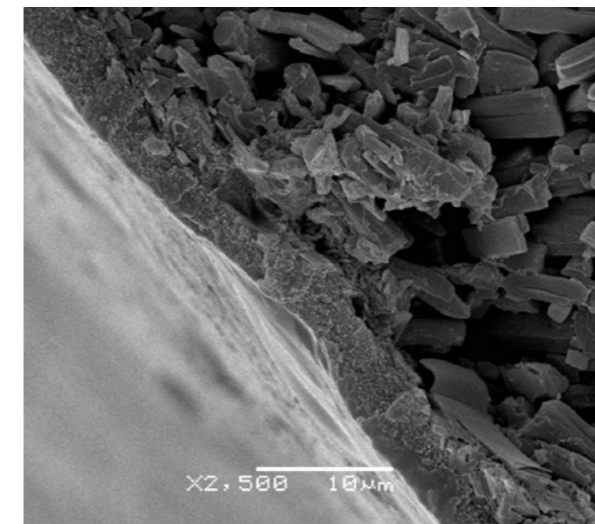
Optimum result

In order to achieve optimum coating results without the formation of agglomerates, the particles have to be brought into a state in which they are completely separated from one another and completely accessible for the coating substance. The spouted bed coating process meets these requirements.

Due to the special fluidisation pattern, there is a very strong separation of the solid particles when they migrate through the fine spray and are thus coated with the coating substance. As with the Wurster process, the product movement is very

defined and uniform so that a regular product circulation is ensured.

The coating liquid is injected in dissolved, suspended or melted form via nozzles in parallel flow to the fluidising air (bottom spray). The surface of the separated solid particles is wetted with the coating liquid and the solvent evaporates. The coating solid is thus applied layer by layer on the core substance (layering). The high heat and mass transfer between gas and solid matter favours this process.



↑ Scanning electron microscope image of a coated pellet

Greater flexibility

Compared to the classic Wurster process, spouted bed coating convinces with a considerably lower complexity, as it does not require built-in components. With the Wurster process, the adjustment of the partition is often a problematic process parameter. Since there are no built-in components in spouted bed coating systems, the process is much gentler, so that also tablets can be coated exceptionally well. The range of effective filling capacities is also much wider than in the Wurster process, which ensures a greater flexibility of the range of applications of the system.



↑ Spouted bed coating in the laboratory processes

Process principle

A gas (often conditioned air) flows through the bulk solid at high speed, creating a jet in the middle of the product bin. Solid particles close to the bottom are sucked from the ring area into the jet and drawn upward, thus forming a fountain. At the same time, the coating material is injected into the jet (from bottom to top) via a two-component nozzle and finely atomised.

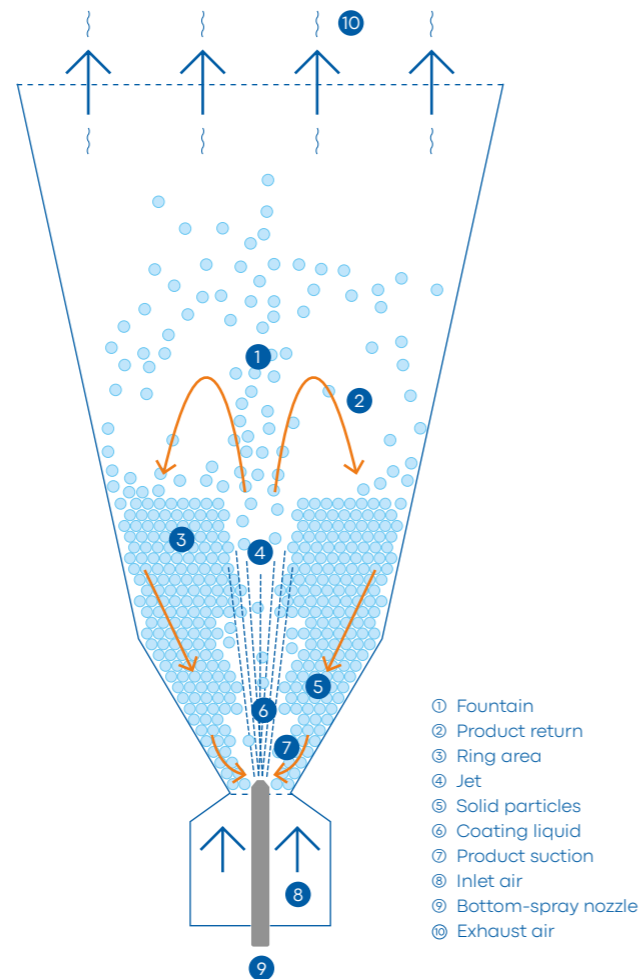


↑ Methionine pellets in cross section

Due to the very strong separation of the particles in the jet, all varieties of products can both be coated very uniformly and without sticking together and dried simultaneously. Due to the widening of the bin cross-section, the gas speed decreases upwards, so that the coated solid particles fall back into the ring area and migrate back down along the product bin wall into the suction area. Under certain conditions, spouted bed coating is also possible in a continuous process.



↑ Citric acid particles coated with fat



Application examples

Sugar + colouring or flavouring agent	→ Optical effects, aromatisation
Citric acid, sugar, malic acid, or vitamin C + fat	→ Hydrophobation
Pharmaceutical products such as tablets or pellets	→ Enteric coating or delayed release of active agents, taste masking, odour masking
Seeds + herbicides or fungicides	→ Protective function, colour coding, change of shape
Fertilisers	→ Protective function; defined release, changes in the surface structure
Enzymes, microorganisms, vitamins + carrier substance	→ Defined release, protection against environmental influences, better storage stability
Flavours + carrier substance	→ Oxidation protection; better storage stability, delayed flavour release
Feed additives	→ Controlled release or temperature stability during pelleting



↑ Sugar and colouring agent



↑ Protective coating applied on seeds



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