

SPRAY DRYING IN THE FLUIDIZED BED

Innovative products with new functionalities

Drying of slurry in spray towers is a well-established process. Drying in a fluidized bed process is a promising variant. This innovative technology is not only a particularly gentle and effective alternative; it also offers a number of other advantages. Application behaviour and product properties can be modified specifically; the final product often outperforms a product from a spray tower in terms of its physical properties and it can be directly processed further.

In fluidized bed plants, various other process steps apart from drying can be performed in parallel. In one and the same machine, the particles acquire additional functionalities through granulation, agglomeration, coating or micro-encapsulation. The particle properties such as particle size, flowability and bulk density can be adjusted accurately and reproducibly. This opens up completely new possibilities for the development and implementation of entirely new product ideas.

More than hot air

The fluidized bed technology is one of the most important methods for shaping liquid and powdery substances. Due to the specific modification of physical properties, products with an individually defined profile can be obtained. Demanding industries such as the food, the pharmaceutical, chemical and fine chemical industries as well as biotechnology benefit from the many advantages of the highly developed fluidized bed process technology:



↑ In the fluidized bed, liquids can be converted into dry granules

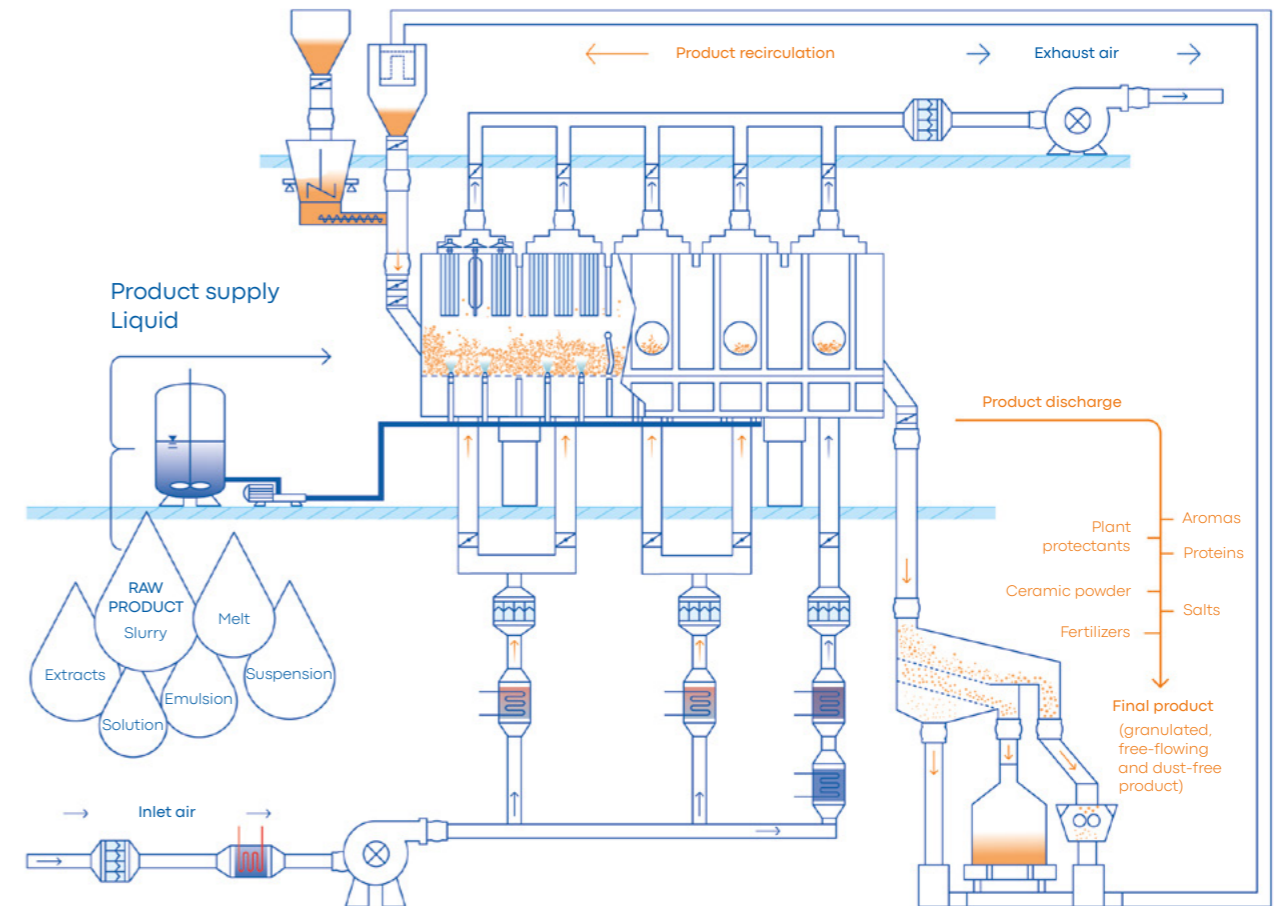
- Efficient drying
- Gentle treatment of enzymes, flavours, vitamins, spores
- Protection against oxidation
- Reduction of the hygroscopicity
- Preservation of the enzyme activity
- Stabilisation of mixtures
- Reduction of fine dust
- Instantisation of powder
- Improvement of the pelleting properties
- Optimisation of the solubility
- Odour and taste masking
- Targeted release of active agents

High efficiency

In the expanded fluidized bed, the conditions for intensive heat and mass transfer are ideal. In a fluidized bed, a gas flows through solid particles (e.g. granules or powder) from below, thus fluidising the product layer and creating a large product surface. While the particles are fluidized, the drying medium, for example air, can optimally act on the particles from all sides.

The particles are not only accessible from all sides for drying air, but also for the application of liquids. If solids-containing solutions, suspensions, emul-

sions or melts are sprayed onto the already fluidized solid particle, the solid does not dry in free space as in classical spray drying, but on the already existing particles. Since the particles are in constant motion, there is no adhesion unless this is specifically aimed for in the process control. Unlike in the spray tower, there has to be a starting product in the plant. Usually, it consists of screened or ground fines from the production process. The other granulation seeds are generated in the process.



↑ Schematic structure of a continuous spray granulation process

Due to the ideal heat and mass exchange and the isothermal conditions in the fluidized bed, the thermal energy introduced is converted directly into vaporisation energy, so that the product temperature during the drying process is considerably lower than in the spray tower. This makes the fluidized

bed process a highly effective yet gentle drying process. The thermal load on the product is much lower and even sensitive components such as enzymes, vitamins, flavours and active agents are treated particularly gently in the fluidized bed, since the retention time can also be adjusted.

Maximum flexibility

The design of AMANDUS KAHL fluidized bed plants allows virtually unlimited variations of the product and process parameters, the temperature, flow and spray adjustments as well as the combination of the processes. We offer plants both for batch and continuous processes. Compared to spray towers, our continuous Conti FB plants are compactly built, which considerably facilitates the layout planning.

Spray granulation

With this process, compact, nearly round granules with excellent physical properties can be produced. In the spray granulation process, slurries are atomised and the obtained drops hit the granulation seeds. In the process, the liquid evaporates and the solid builds up on the granulation seed, thus forming a coating. This is repeated continuously in the fluidized bed so that shell-like granules are produced. Parameters such as particle size, residual moisture and solids content can be set very precisely-

ly in the spray granulation method. The process is suitable for all applications in which a homogeneous, dust-free product with a high bulk density is to be achieved.

Examples of products: Flavours, calcium lactate, aluminium oxide, starch, sodium silicate, zirconium oxide, urea, ammonium sulphate, detergents, menthol granules, calcium carbonate.



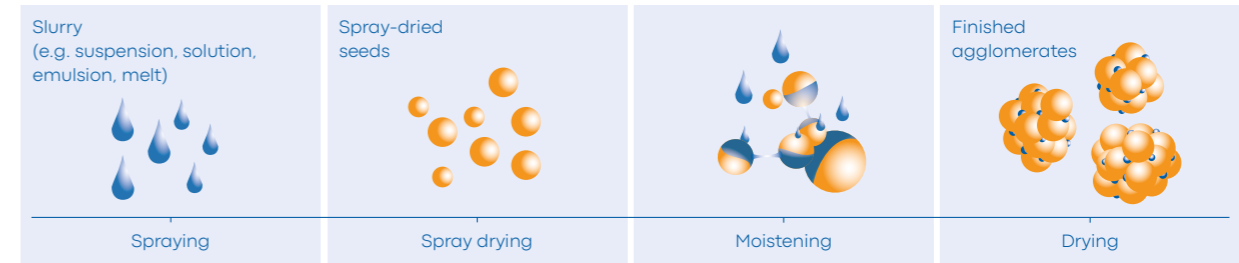
↑ Fluidized bed spray granulation

Spray drying agglomeration

The combined process of spray drying and agglomeration produces free-flowing, dust-free agglomerates with ideal instant properties. In the first process step, a slurry is atomised, the liquid evaporates and spray-dried granulation seeds are produced. In the second step, these fluidized particles are further sprayed with the slurry. This causes liquid and solid bridges to form between the individual

particles, which in turn causes the growth of the agglomerates. The combination of both processes produces a wide range of product variations.

Examples of products: Malt beverage, plant protectants, ginseng, flavours, vitamins, plant extracts, spore ferments, instant coffee, proteins, beverage powders, enzymes.

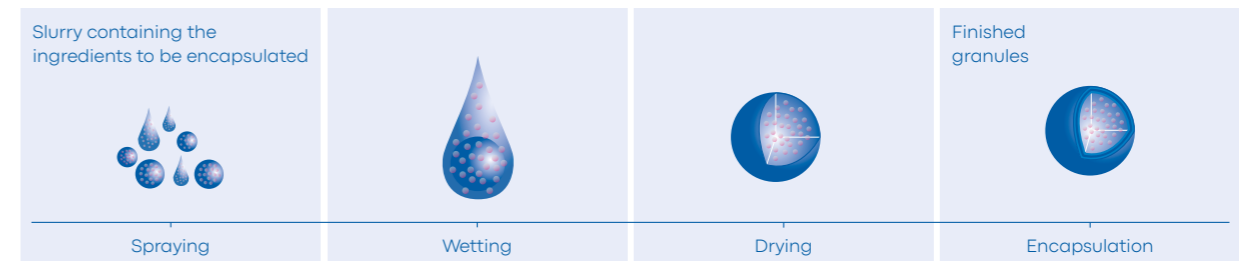


↑ Spray drying agglomeration

Micro-encapsulation

Micro-encapsulation ensures the homogeneous incorporation of solid and liquid active agents into a carrier substance. Particles with a well-defined profile are produced which are resistant to external influences. This enables the targeted and time-delayed release of pharmaceutical active agents or flavours, for example.

Examples of products: Flavours, vitamins, lactic acid bacteria, enzymes, starter cultures, fish oils, omega-3 fatty acids, pigments, amino acids, minerals.



↑ Micro-encapsulation

New functionalities

While conventional spray towers are designed only for drying the liquid raw material, the various fluidized bed processes ensure the specific definition of the individual properties of the solids.

- Active agents, vitamins, flavours or enzymes can be firmly incorporated into the final product at a stable mixing ratio, thus ensuring homogeneous distribution.
- Through simultaneous agglomeration, dust-free, free-flowing particles can be produced, which are characterised by good instant properties or improved pelletability.
- If the process is properly controlled, particles that have been transformed into granules can display a round, smooth surface, are dense and compact and have a high bulk density.
- Several components of the recipe – either solid or liquid – can be combined without segregation to form a homogeneous compound. Usually, the homogeneous final product is dust-free and perfectly free-flowing.
- The particle size distribution can be adjusted within a wide range, so that different product qualities can be produced.



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