



Technical Paper

Process Technology Food, Feed & Fine Chemicals

Spray Granulation Gives Solid Materials Customized Properties

The properties of spray-granulated products can be as varied as their appearance

Weimar, March / 17 / 2015 – **Flowability, dustlessness and easy dosing - these are some of the plus points of granulates produced by fluidized or spouted bed technology. The product design can be specifically influenced by process engineering.**



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03/17/15– page 1 of 7

Whether for subsequent use as solid compounds in washing agents, food or feed products or to increase the stability of chemical substances, e.g. reduction of the decomposition risk, or for volume reduction to make transport and storage easier, or for the production of stable multi-component systems, e.g. ceramics or catalysts, or also to

minimise risk potentials - a variety of industrial applications require a conversion of one or more raw materials or substances being available in form of liquids to a long-term stable solid product form with exactly defined properties.

Spray granulation processes using fluidized or spouted bed technology provide processing options for the production of free-flowing granulates directly from the liquid. This process can be



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03/17/15– page 2 of 7

used for a variety of material systems, applications and industries as the product properties can be varied by the selection of specific process parameters and technical apparatus configurations. Spray-granulated products are typically characterised by the following properties:

- Dustlessness, good abrasion resistance
- Roundness, narrow grain size distribution
- Very good pourability and flowability
- Excellent dosing properties
- Compact structure, frequently with an almost closed surface
- Low hygroscopicity due to a lower specific surface compared to powders or agglomerates
- High bulk density compared to powders or agglomerates
- Versatility in the application

These product properties are required in nearly all industries. In the food- industry, phosphates, stabilizers, additives, sweeteners, fatty acids or flavouring agents are spray-granulated, for example. The chemical industry uses the same process for detergent components, fragrance, silicates, diverse salts or salt mixtures and special chemicals with a high purity.

In the fertilizer industry, very innovative products can be efficiently produced, e.g. multi-component-products or special fertilizers. Also very complex material systems such as plant protection products, ceramics, catalysts, glass components are dried by spray granulation.

Further applications fields for the process include the treatment of thermally sensitive products such as enzymes, proteins, yeasts or micro-organisms.

For this, the spouted bed technology (ProCell design) is preferably used as it allows users to work with considerably shorter residence time in the apparatus in contrast to the classic



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fluidized bed. Furthermore, spray granulation can be used for actives or additives of various types and origin. Active ingredients for pharmaceutical applications can be processed to granules directly after the upstream chemical synthesis, for example.

It is quite simple: The principle of spray granulation

Spray granulation combines convective drying/solidification and particle formation in a single process step. It generates compact particles (granulates) by spraying solid-containing liquids on a fluidized or spouted bed where the solvent (normally water but also organic solvents etc. are possible) evaporates and a particle growth takes place due to the remaining solid matters.

This process is often called granulation drying or layering as it starts with a granulation seed (also known core as or nuclei) which is typically from the same material as the solid matter sprayed by the liquid phase. The granulation seeds are generated either directly in the process itself by internal seed generation such as spray drying or abrasion, or by returning fine particles or grinding of oversized granulates from the sieving-milling circuit and thus there is no need to feed them as a solid raw material.

This simple basic process principle can be influenced to a great extent, which can be used for product design. To this end, diverse technical options and process-influencing parameters can be used to achieve desired granulate properties. These are:

- For the spray liquid: its solids content, its type (solution, suspension, melt, emulsion, etc.), its viscosity or tackiness, its composition (additives, binders, etc.).
- For the design of the spray system: the spray nozzle principle (two- or multicomponent nozzles, pressure nozzles, etc.), the nozzle orientation (top or bottom spray), the position and number of nozzles, the droplet size and droplet velocity.



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- For the processing conditions: the temperature of the spray liquid (and atomization medium), the temperature in the process chamber (product temperature), the intensity of the particle movement (air velocity, air distribution, etc.), residence time, temperature gradient, drying or solidification velocity.
- For the machinery: Fluidized or spouted bed, batch or continuous operation of the process, internal seed generation or sieving-milling circuit.

Encapsulating of sensitive materials from the liquid

If different raw materials and actives are mixed as a liquid and are then spray-granulated, granulates will develop, in which the components are distributed very equally. In this way, also liquids can be enclosed in a solid matrix. Sensitive substances can be well protected by this.

This encapsulation process is in particular used in the feed and food- industries. If required, the spray granulates can be coated with a protective film in an additional process step.

Beyond product and process development Glatt provides all the services from the idea, project development, research, implementation up to turn-key projects including aftersales-service. This single source approach allows a very efficient project execution and the use of synergies. For example, production cost can be reduced by integrated heat recovery or connected process steps including also the liquid production.

For the development of spray granulation processes, experimental studies in the Technology Center are indispensable. For feasibility studies on a laboratory scale, pilot tests for scale-up and the manufacturing of product samples, the Weimar Technology Center a wide range of fluidized and spouted bed apparatuses, solids processing and liquid handling systems as well



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as an analytical laboratory for raw material and product characterisation for process development.

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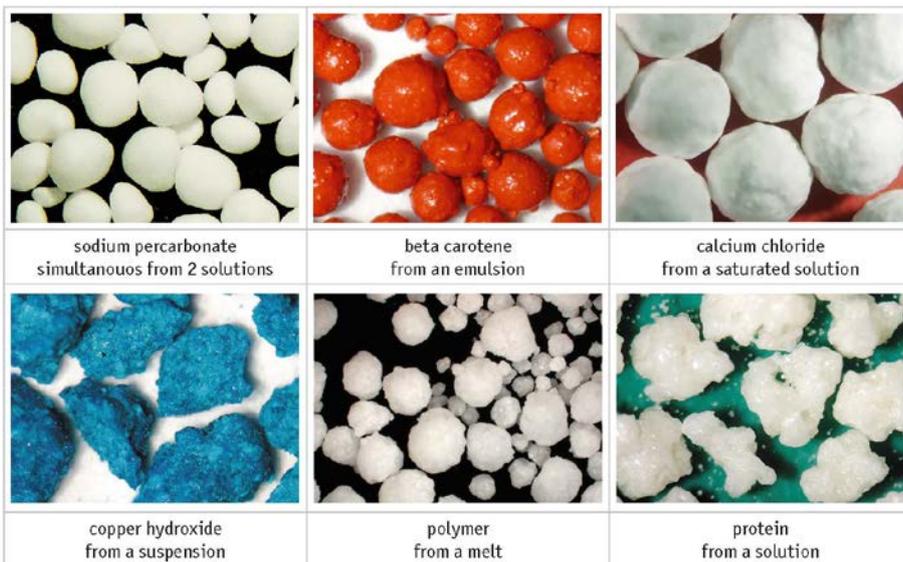


Figure 1: Examples for products made by spray granulation

Spray granulation

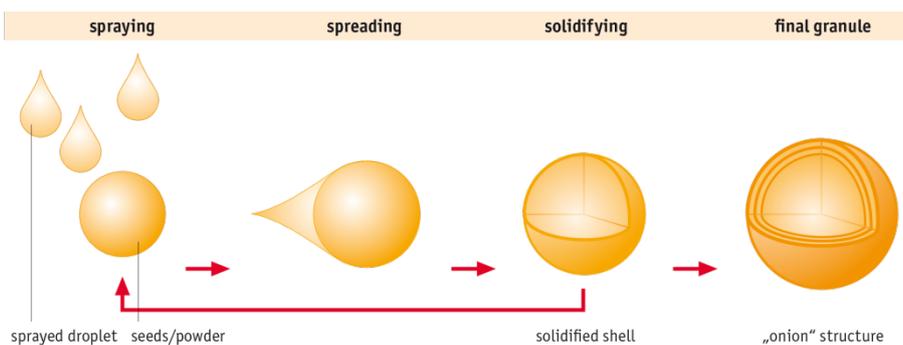


Figure 2: The principle of spray granulation: Convective drying or solidification and particle development take place in a single process step



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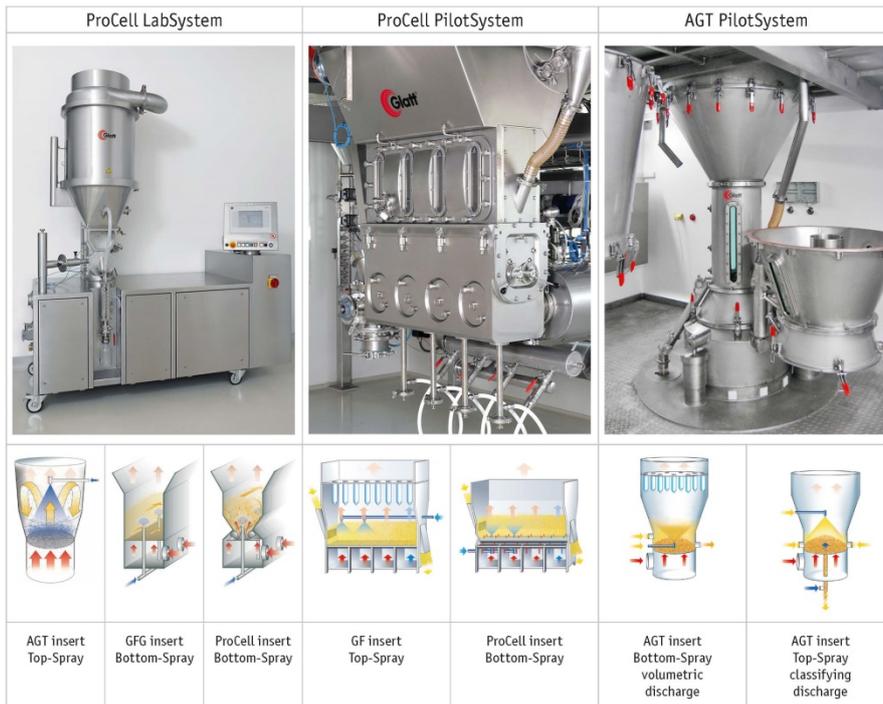


Figure 3: Product and process development in the Glatt Technology Center Weimar shows the wide range of possibilities