

POWDERS THROUGH INKJET TECHNOLOGY



TNO innovation
for life

A new method of producing powders is available at the TNO drying facility. With full flexibility powder functionality can be tuned towards the needs of the user.

MONODISPERSE POWDERS

Powders are a large product class in the food industry. Controlled production of well-defined powders opens up new possibilities. Printing technology provides optimum control of the production of monodisperse droplets whereby controlled drying of these droplets produces highly monodisperse powders. Employing this method on the research scale drying facility enables TNO to create these powders and optimise the functionality.

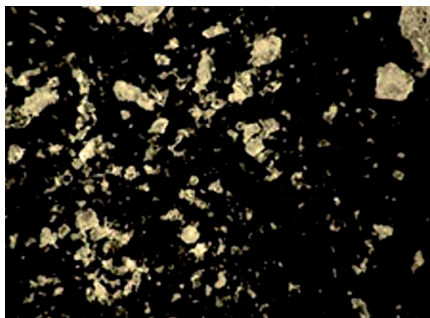
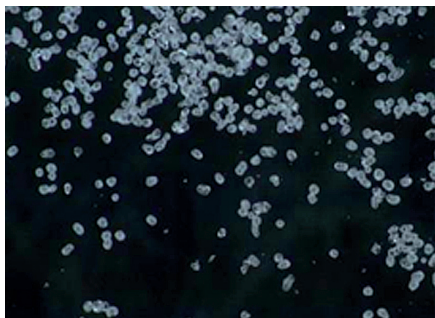
POWDER PROPERTIES

A wide range of materials can be processed in the drying facility. The method of atomisation is very mild, offering the possibility to create sensitive emulsion droplets, for instance. Based around highly viscous materials, product feed of up to 500 mPa·s has been processed. The monodispersity of the droplet and powder particles produced

in the drying facility lead to well-defined product properties, including dissolution rate, release, flow capability and storage stability. The drying step can be optimised for the specific droplet size, which enables detailed insight to be gained on the effect of different process conditions on powder functionality. Several monodisperse powders can be blended to create designer powders, which will extend the range of possible functionalities.

STATE OF THE ART

The atomisation method is based on inkjet printing whereby a liquid jet is created and is forced to break up in a controlled manner. This results in the formation of monodisperse droplets. To maximise the benefits of the printing process, the airflow drying the droplets must be fully controlled. Therefore, TNO developed the drying facility that evaporates solvents using a laminar co-flowing drying medium.



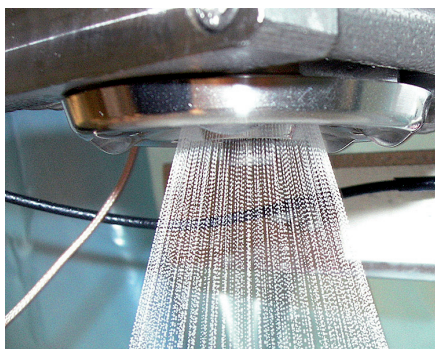
Maltodextrin powders produced with TNO's multinozzle process in a conventional tower (left) and a traditional spray drying process (right).

This laminarity and the absence of recirculation zones in the research pilot allow full control of the flow and drying behaviour of the droplets. When dried carefully, the droplets result in a monodisperse powder.

FUTURE DEVELOPMENT

Since the printing process creates no small droplets there is a total absence of fines. This results in a higher yield and no specific measures need to be taken to filter fines out of the airflow. Consequently, the process gives rise to the opportunity of closed-loop processing, which enables energy recovery. Furthermore, drying with other media than air, for instance nitrogen or CO₂, is possible. Sensitive products can be dried via this method, or a change in powder properties be gained, for instance, influencing powder porosity and general shapes.

The system typically avoids droplet collisions, so the initial droplet becomes a single solid particle. To have more flexibility with the powders, controlled agglomeration is desired, where exactly the amount of droplets needed form a single powder particle. With the control the research facility provides, agglomeration can be realised as needed.



Multi-nozzle monodisperse printing.

RETROFIT

On an industrial scale, full control of the drying flows has not yet been obtained. Creating monodisperse droplets via inkjet technology in a traditional spray drying tower is a first step towards this control. TNO currently has a multi-nozzle print head with a capacity of around 100 l/h and is investigating the development of heads with larger capacities. Integrating multi-nozzle print heads in traditional spray drying towers is a significant step towards this new product class. These print heads can be fitted into existing spray-drying set-ups.

USING THE TECHNOLOGY

TNO is well equipped to translate research-scale powder production to industrial needs. Our vast experience in process analysis, design of experiment and equipment design means that the next step in powder production can be achieved.



TNO.NL/DRYING

TNO

TNO is a contract research company, with a broad knowledge of several fields. TNO initiates technological and societal innovation for healthy living and a dynamic society.

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