

Steering Agglomeration

Publieke samenvatting / Public summary

Aanleiding

Agglomeration in spray dryers has major influence on critical application properties, such as bulk density, flowability, and reconstitution behaviour. Agglomeration during spray drying occurs when a partially-dried droplet collides with another partially-dried droplet or with a fully-dried (agglomerate) particle. There is a complex relationship between drying of droplets and agglomeration dynamics. The period, which starts with generation and exposure of a droplet to high inlet air temperature (resulting in extreme drying rates) and ends with collision with another partially-dried droplet or fully dried (agglomerate) particle is crucial for steering the agglomeration process.

Doelstelling

In industrial practice, agglomeration is optimised by adapting the position and/or angle of (usually) high pressure nozzles, air flow pattern and presence of fines return to obtain agglomerated powder of desired quality. This approach is trial-and-error based and needs to be continuously repeated for different spray drying systems and products. Moreover, lack of control of agglomeration negatively impacts operation efficiency of spray dryers (e.g. due to fouling and lower production capacities) and leads to significant material losses (in the form of off-spec product) during large scale production. It is estimated that for the Netherlands, annually 0.9-1.5 PJ energy or 200-300 kton CO₂ eq emission may be reduced by improving agglomeration control in spray dryers. Moreover, improved agglomeration control will contribute to reduction of fine dust emission from dryers, for

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which increasingly strict regulations are reinforced by the government. This project therefore aims at developing scaling-relations to steer sticky behaviour and agglomeration in spray drying.

Korte omschrijving

We develop these by 1) studying drying kinetics, evolution of sticky surface properties and binary particle collisions at the single droplet scale and 2) investigating sticky zones and agglomeration behaviour in well-defined spray drying systems to move away from current empirical approaches.

Resultaat

Translation of critical parameters obtained in single droplet drying studies will lead to recommendations for process conditions in spray drying, e.g. nozzle positions and angles, airflow and temperature.

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.

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