Nano spray drying maltodextrin from solution and emulsion

Nano Spray Dryer B-90:
Maltodextrin as a suitable encapsulant for nano spray drying processes

1. Introduction

Spray drying technology is commonly used to transform liquids (solutions, emulsions, suspension) into solid powders. It has been employed for decades to encapsulate food ingredients, e.g. flavors, lipids, and carotenoids. In addition but it is also widely used in the chemical and material industries to enhance features such as ingredient conservation, particle properties, powder handling and storage. Spray drying can also be used for applications in the pharmaceutical industry such as drug delivery [13].

In food microencapsulation, carbohydrates such as starches, maltodextrins and corn syrup solids are usually used as encapsulating agents. Maltodextrin is an intermediate carbohydrate between starch and corn syrups. Due to their properties, maltodextrins are used in a large range of application in the food industry as carrier for flavours, fragrances and oils, bodying agents or coatings [4].

This study aims to investigate the maltodextrin particles produced using the Nano Spray Dryer B-90 HP.

2. Experimental

Microparticles were prepared by spray drying maltodextrin solutions of 1% (w/V) and 20% (w/V) (Instant Maltodextrin 19, SHS Gesellschaft für klinische Ernährung GmbH, Heilbronn, Germany) using the tall set up of the Nano Spray Dryer B-90 HP. The Nano Spray Dryer B-90 HP was operated in open loop using pressurized air with a pump speed of 20 % and a frequency at 125 kHz as shown in in Table 1.

Table 1: Process parameters.

Nebulizer	Maltodextrin concentration [%]	Gas flow rate [L/h]	Inlet temperature [°C]	Spray power [%]
Small	1	120	100	80
Small	20	150	100	80
Large	1	120	100	10
Large	20	150	100	80

3. Results

The application study demonstrated the feasibility of spray drying maltodextrin with the Nano Spray Dryer B-90 HP. The SEM pictures of dried powder typically showed spherical morphology. Depending on the solution concentration, particles from 0.548-5.57 um (Figure 1) could be obtained with recovery yields greater than 40 %.

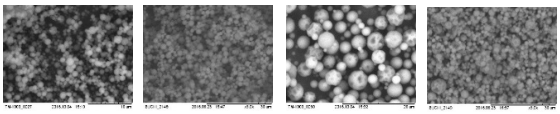

Figure 1 : SEM pictures of the dried powder. Left to right: Maltodextrin 1 % with narrow nebulizer, Maltodextrin 20 % with narrow nebulizer, maltodextrin 1 % with large nebulizer, Maltodextrin 20 % with large nebulizer.

Solutions with a solid concentration of up to 20 % could be sprayed through the small spray nebulizer, however, the throughput was reduced by a factor of 3-4 when spraying a 20 % solution compared to a 1 % solution.

Table 2: Parameters and results summary of Maltodextrin (1-20%) spray drying.

Nebulizer	Large	Small
Gas flow rate	150 L/min	120 L/min
T Inlet	100 °C	100 °C
T Outlet	36-44 °C	33-39 °C
Spray rate	10-80 %	80 %
Pressure	73-74 hPa	51-52 hPa
Feed rate	20 %	20 %
Particle size	0.867-5.57 um	0.548 – 4.0um

The particle size and size distribution appear to increase with nebulizer size and with Maltodextrin concentration in the solution, this finding is in agreement with this reported by Arpagaus [1].

4. Conclusion

Maltodextrin particles from 0.548-5.57 um can be produced with the Nano Spray Dryer B-90 HP. Solutions with maltodextrin concentrations of up to 20% could be spray dried and produced spherical particles.

The size and size distribution of the particles were increasing with nebulizer size and solution concentration.

5. References

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