Spray Drying
Microcapsules

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1. Introduction Spray Drying

Spray drying is a fascinating continuous process to transform liquids (solutions, emulsions, suspensions, slurries, pastes or even melts) into micron size particles with adjustable distribution, shape, porosity, density and chemical composition.

Application are found in the food, pharmaceutical, chemical and material industries.

For microencapsulation, spray dryers are used for :

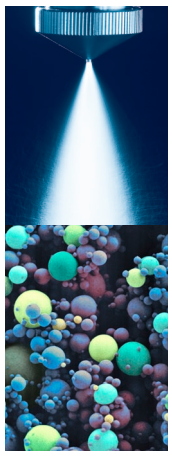
- Encapsulation of oils for easier handling and for the use in solid products (taste and flavour masking)
- Controlled Drug Release for efficient use of medicine.
- Protection of a sensitive product with packing them in a carrier (e.g. protein, peptides and microorganisms)
- Easier handling and dosing of expensive products in a cheaper carrier

2. Mini Spray Dryer B-290 – Particle technology in the lab

The Mini Spray Dryer B-290 offers quick and gentle drying of aqueous and organic solutions to free flowing powder.
It is the ideal laboratory spray dryer for R&D feasibility studies on innovative materials like microcapsules or microparticles.

Features and benefits:

- Glassware enables visible spray process
- Short set-up and cleaning times
- Integrated nozzle cleaning function
- High performance cyclone separation
- Optional closed cycle with Inert Loop B-295
- Easy scale-up of the process
- On-line Spray Dryer Application Database

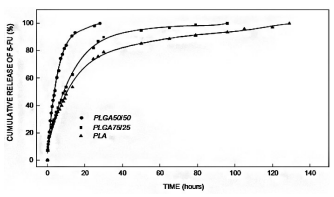


Technical data:

Evaporation capacity	1 L/h water
Sample volume	30 mL – 1 L
Drying air flow rate	up to 35 m³/h
Spray flow rate	0.1 – 1 L/h (5-8 bar)
Heating power	2300 W
Max. inlet temperature	220 °C
Chamber size (D, H)	16.5 cm, 60 cm
Dimensions (L x W x H)	60 x 50 x 110 cm
Weight	48 kg table-top
Nozzle	Two-fluid co-current
Typical yield	40 – 60%
Particle size	2 – 25 µm

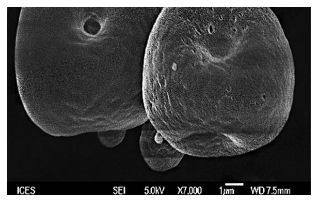
3. Application examples and photographs

PLGA biodegradable polymers



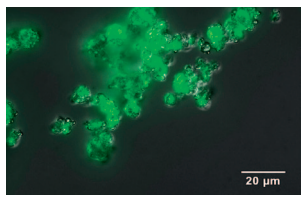
5-Fluorouracil-loaded microspheres [1]

Polyacrylate



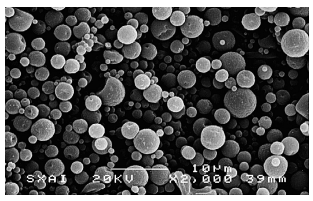
Hollow micro particles as potential drug carriers for inhalable products [2]

Tuberculosis vaccine



Fluorescence marked M. smegmatis, spray dried with leucine [3]

Chitosan



Design of microcapsules for colonic drug delivery [4]

Insulin

Insulin dry powders for inhalation [5]

Soy oil

Microcapsules of soy oil with gelatine and maltodextrine [6]

Strawberry flavour

Solid strawberry flavour with gum arabicum and maltodextrine [7]

Vitamins

Gentle method for englobing Vitamins in gelatine [8]

Tomato

Tomato powder with enrichment of suggars, proteins and salt [9]

Product	Application	Spray conditions	Results
5-Fluorouracil in PLGA [1]	Controlled drug release, drug delivery	B-190, temperature 62 – 65 °C / 50 – 53 °C, 1.8 wt % polymers and 0.2 wt % fluorouracil in DCM	Yield > 40 %, encapsulation efficiency 50 – 70 %
Polyacrylate [2]	Potential drug carrier for inhalable products	B-290, temperature 100 – 140 °C/ 60 – 80 °C, poly acrylate suspension in water / ethanol 30 % / 70 %	Spherical hollow particles with a median size of 10 µm
Tuberculosis vaccine [3]	Medical treatment of disease	B-290, temperatures 100 – 140 °C / 40 °C, M. smegmatis suspension mixed with leucine (FDA approved)	Good yield, 70 % of leucine is ideal concentration, 25 % CFU (colony forming units)
Chitosan microspheres [4]	Design of microcapsules for colonic drug delivery	B-190, temperatures 170 °C, 1 % chitosan in water	Good yield > 50 %, drug load > 5 %, mean size 2 µm
Insulin [5]	Insulin dry powder for inhalation (diabetes treatment)	B-191, temperatures 120 °C / 62 °C, insulin / mannitol 20 / 80	Good yield > 40 %, mean size 3 µm
Soy oil [6]	Microcapsules for food and feed	B-290, temperature 150 °C / 90 °C, 10 g gelatine, 5 g maltodextrine, 5 g soy oil, 0.3 g emulgator	Good yield > 50 % Easier handling and better dosing of powders
Strawberry flavour [7]	Encapsulation of strawberry flavour	B-290, temperatures 160 °C / 95 °C, 3 g aroma, 20 g maltodextrine, 2.5 g gum arabicum for in 100 g water	High yield > 70 %, solid powder for easier handling and dosing
Vitamins [8]	Vitamin E & A as heat sensitive food additives	B-191, temperatures 100 °C / 55 °C, spray gas flow 650 L/h	Dried vitamin without denuturation, easy to dose as solid product
Tomato [9]	Enriched tomato powder for food and feed industry	B-191, temperatures 110 – 140 °C, 14 % solid tomato pulp including 5.6 % proteins, 2.2 % suggars and 1.1 % salt	Good yield, encapsulation efficiency of 27 %

4. References

[1] Blanco 2005 J. of Microencapsulation 22, 6, 671 - 682
[2] Hadinoto 2006 Ind. Eng. Chem. Res., 45, 3697-3706
[3] Wong 2007 PNAS USA
[4] Lorenzo 1998 J. of Contr. Release, 52, 109–118
[5] Buttini 2008 Dep. of Pharma., University of Parma, Italy
[6] Nestle AG, Switzerland
[7] Silesia Flavours, Germany
[8] BFA für Fischerei 1979 Germany
[9] Goula 2003 Drying Techn., 21, 7, 1273-1289

Visit our detailed on-line Spray Drying Application Database www.buchi.com

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