Spray Drying
Pharmaceuticals

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1. Introduction Spray Drying

Spray drying is an ideal one step drying operation process to transform pumpable liquids (solutions, emultions, slurries, pasters or even melts) into a dry powders. Liquid droplets are atomised by a nozzle device and spra - yed into a hot drying gas.

Spray drying offers a wide range of applications in the fields of pharma- ceuticals, medicals, nutraceuticals and biotheraupeutics.

Applications:

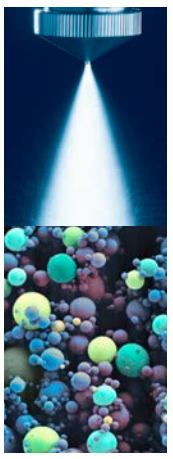
- Powders for pulmonary therapy: generated particle size down to 5 µm and low particle density for easy transport to the lung
- Microencapsulation: coating of active materials like peptides and proteins in bio - degradable polymers for easy controlled release and improved bioavailability
- Spray dried heat sensitive vaccines: alternative to freeze drying, powders contai - ning more active bacterial cells

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

The Mini Spray Dryer B-290 is the ideal laboratory instrument for R&D feasibility studies of API's and its formulations into an inhala- ble, oral or injectable drug. It offers quick and gentle drying of aqueous and organic solutions or emulsions to stable and free- flowing powders.

Features and benefits:

- Glassware enables visible spray process
- Short set-up and cleaning times
- Cleaning in Place decontamination function
- High performance cyclone separation
- Optional closed cycle with Inert Loop B-295
- Easy scale-up of the process
- Spray drying under sterile-like conditions

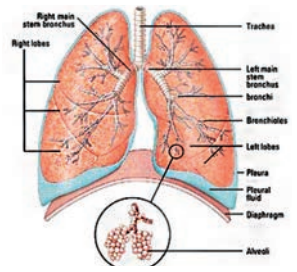


Technical data:

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

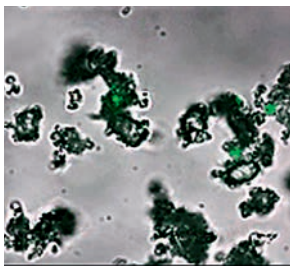
3. Application examples of spray dried pharmaceuticals

Lung Structure

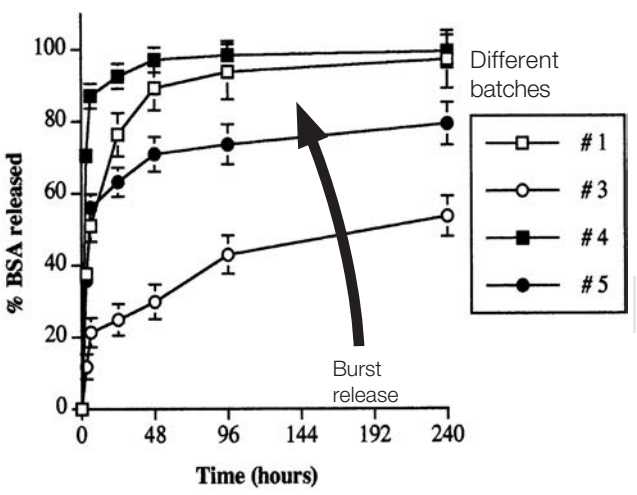


Dry Powder Inhaler

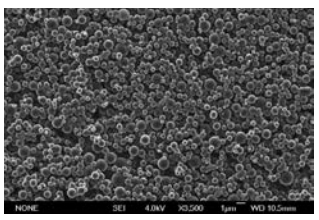
Tuberculosis Vaccine



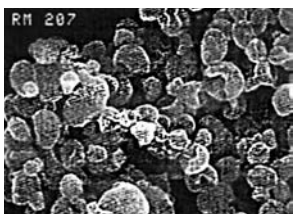
Bovine Serum Albumin



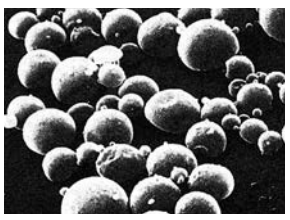
Diazepam microparticles



Superoxide dismutase



Vitamin D3



Product	Application	Spray conditions	Results
Diazepam [2]	Lipophilic model drug for controlled drug release	B-190, solvent DCM/CFM (1:1), polymer conc. 3 % (w/w), drying temperature 44 – 63 °C, pump feed rate 2 – 6 mL/min	Spherical particles, 5 – 14 µm, drug encapsulation 70 – 85 %, drug release is 50 – 80 % in 20 h
Superoxide dismutase (SOD) [3]	Antioxidant enzyme therapy	B-190, 0.5 % (w/v) polymer concentra-tion and sucrose, inlet temp. 45 °C, outlet temp. 34 °C, pump flow rate 4.5 – 5.0 %, air flow rate 500 L/h	Mean particle size 4 – 10 µm
Vitamin D3 [4]	Antitumoral activity fortifica- tion of foods	B-190, solvent DCM/CFM, polymer conc. 1 – 5 %, inlet temperature 51 °C, outlet temp. 34 °C, pump rate 2.5 – 4.5 mL/min	Particle size < 10 µm, drug encapsulation 61 %, drug release 30 – 60 % in 300h
Etanidazole [5]	Radiotherapy, cancer treatment	B-191, solvent DCM, polymer concentration 1 – 5 %, drug concentration 0.5 – 3.0 %, inlet temperature varied 45 – 70 °C	Particle size 1.5 – 2.5 µm, drug encapsulation 67 – 96 %
Bovine serum albu - mine [6]	Antigens stabilizing protein for drug delivery systems	B-190, solvent DCM/CFM, polymer conc. 0.5 – 3 % (w/v), inlet temp. 44 – 54 °C, pump flow rate 3 – 5 mL/min	Spherical particles, size 3 – 9 µm
Protein [7]	Protein drug delivery systems	B-290, carrier zinc hydroxyapatite / PLA	Spherical particles with the smooth surface, 1 – 20 µm size distribution, drug delivery protein without degradation

4. References

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

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