Unopex B 15
Mini Spray Dryer

Content

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Introduction

Spray drying is a well-known method which consists on the transformation of aqueous or organic solutions, emulsions etc., into dried particles, taking advantage of a gaseous hot drying medium.

Spray-drying mechanism is based on moisture elimination using for that a heated medium (typically air) to which the feed product is subjected.

The drying proceeds until the desired moisture content is reached in the sprayed particles and the product is then separated from the air.

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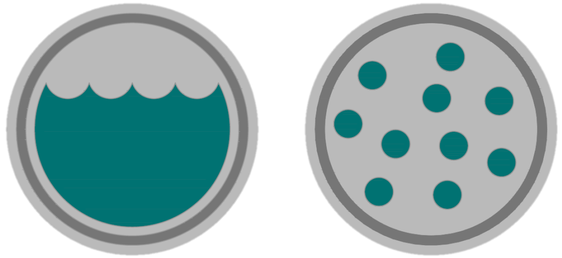
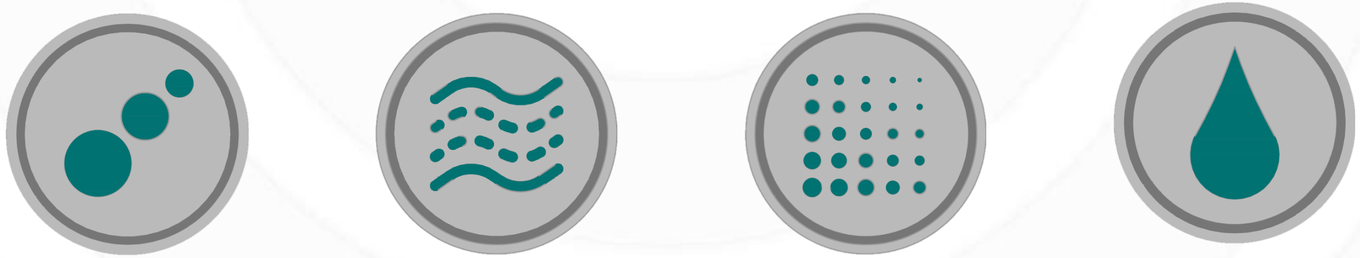
Spray Drying Process

Spray drying converts a liquid into a dry powder.



Spray drying allows for control over particle size, particle density, flow characteristics, and moisture content of the product.



Particle size

Flow characteristics

Density

Moisture content

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Spray Drying Process

The process may be described by three major phases:

1. Atomization

   The spray drying process starts with the atomization of the feed solution into small droplets. Atomization optimizes heat and mass transfer by increasing the surface area of the feed. It provides combining ideal conditions for the evaporation process.

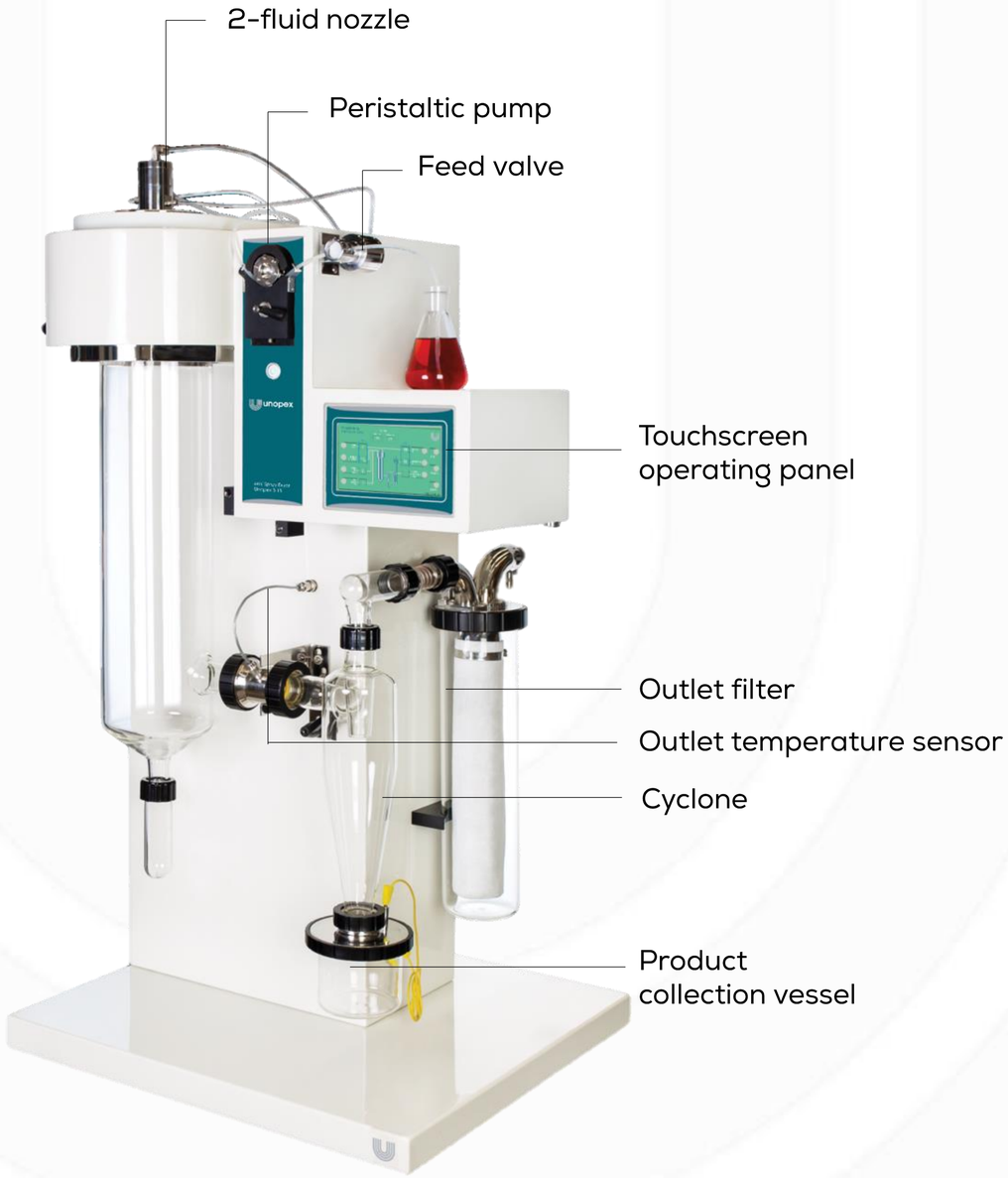
2. Droplet-to-particle conversion

   After atomization, air comes into contact with the spray. The solvent content of the droplets removes and turns into dried particles.

3. Particle collection

   The dried particles need to be separated from the drying gas. This process takes place in two stages. In primary separation, the most dense particles are recovered as they settle on the conical bottom of the drying chamber. In the secondary separation, the finest or smallest particles are transferred to external devices where they are separated from the humid air.

B 15 Mini Spray Dryer



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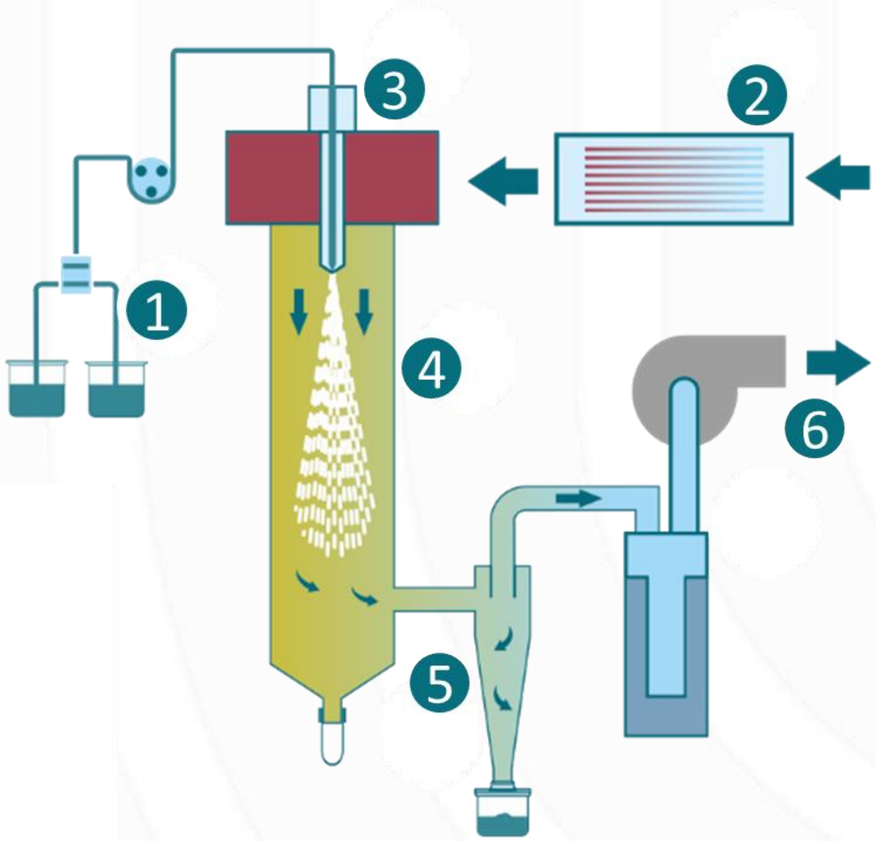
B 15 Mini Spray Dryer

Working Principle



1. Solution or suspension is injected into the drying chamber through a nozzle.
2. Drying gas is injected into the drying chamber.
3. The nozzle atomizes the solution into small droplets.
4. As the droplets of solution fall through the chamber, moisture evaporates from the droplets and they become particles.
5. The drying gas carries the particles to the cyclone where the particles are separated from the gas.
   Powder is collected.
6. The drying gas is filtered and exhausted.

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Fields of Application

- Foodstuffs
- Milk end egg products
- Pharmaceuticals
- Nutraceuticals
- Flavours and colourings
- Plant and vegetable extracts
- Cosmetics
- Biochemicals
- Fine chemicals
- Ceramics and advanced materials
- Polymers and resins

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Technical Specifications

model	Unopex B 15
evaporating capacity	max. 1,5 L/h (water)
drying air inlet temperature	max. 220 °C
feed pump	peristaltic, variable speed
configuration	co-current
atomization system	2-fluid nozzle
nozzle cleaning	automatic
blower	variable speed
material of construction	borosilicate glass, 1.4401, 1.4404
heating power	3 kW, PID controlled
connection voltage	220 V, 50 Hz
operating panel	touchscreen operating panel
computer connection	data transfer with usb drive
dimensions (L x W x H)	800x600x1400 mm
accessories	inlet and outlet filters, safety curtain

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Key Features

Laboratory Spray Drying for small samples and particles

- Laboratory scale reproducible powder production
- Spray drying, microencapsulation and spray chilling with one product
- Simple and fast installation
- Quick and gentle spray drying
- Clear view of the process due to glass assembly
- Trouble-free spraying over long periods with 2-fluid nozzle
- High performance cyclone
- Two different versions of the glass cylinders
- Outlet gas filter for the protection of users and the environment
- Safe operation with plexiglass safety curtain
- Display and easy setting of process parameters with touch screen operating panel
- Automatic feed switch valve and nozzle cleaning
- PLC control
- Glass parts can be assembled and cleaned quickly by just one person
- Dehumidifier and Inert Cycle accessories for solvents and mixtures
- Lowest maintenance and spare parts costs
- Scale up to high product volumes
- CE compliant

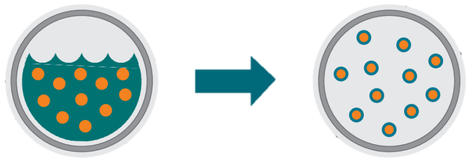
Microencapsulation

Spray drying can be used as a microencapsulation method.

In microencapsulation the product is mixed with a carrier and then spray-dried so that the carrier protects the product.

Reasons for the use of microencapsulation

- protection of the product from surrounding environment (temperature, moisture, etc.), protection from degradation or flavor loss, extension of its shelf life
- masking of the undesired properties (taste, odor) of the active material
- decrease of the evaporation of the active material to the outside environment
- controlled release of the active material under desired conditions
- conversion of liquids and sticky solids to free-flowing powders



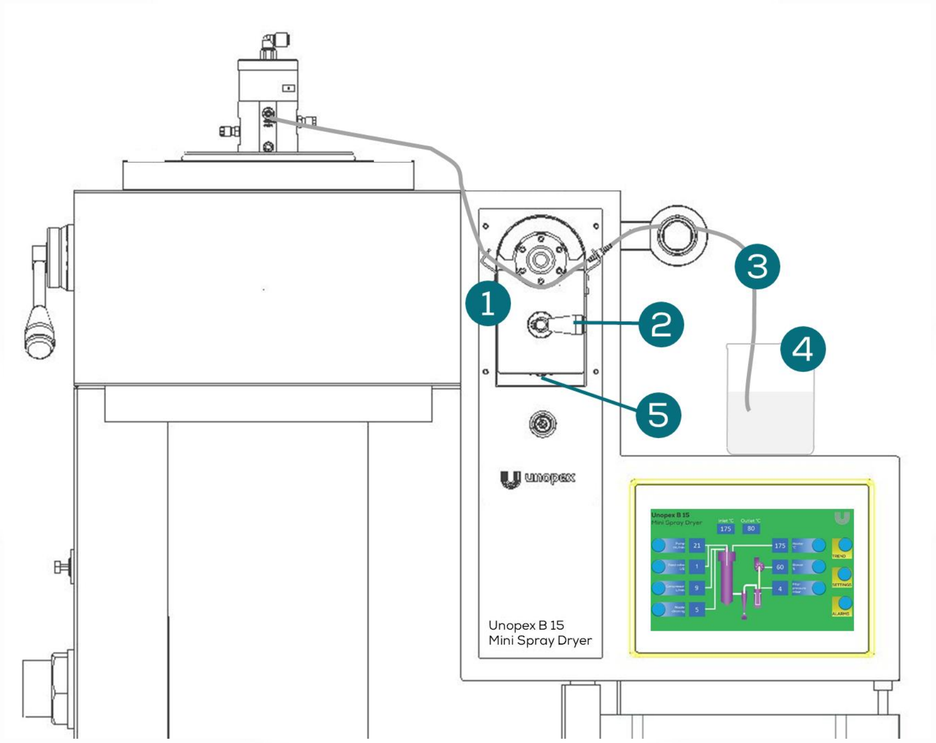
Process of encapsulation by spray drying

- The process starts with the preparation of a wall solution.
- The active core material is then added to the wall solution.
- The core/wall material mixture (emulsion or dispersion) occurs with a vigorous mixing.
- The mixture is fed into the spray dryer.
- In the spray dryer, the core/wall material mixture is transformed into droplets by nozzle atomizer and hot air flowing contacts the atomized particles and evaporates the water.
- The dried particles, consisting of dry matrices in which the core material is held in a micro dispersion, are separated from the gaseous medium in the cyclone and fall into the collection flask.

Key Components

Peristaltic Pump

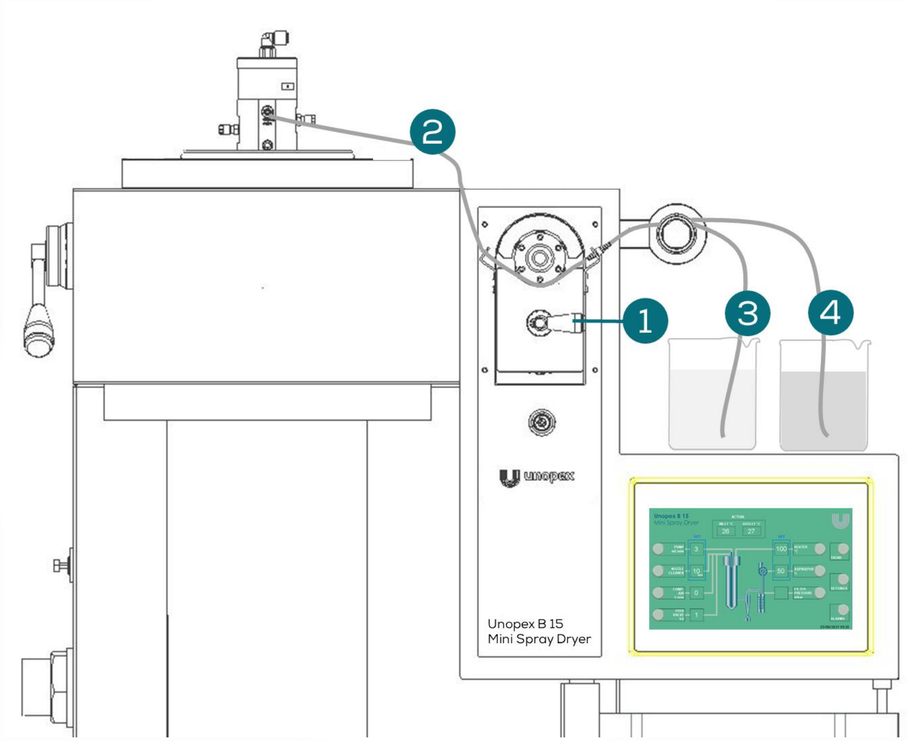
The peristaltic pump recirculates the solution to be sprayed between the feed solution vessel and the nozzle atomizer.



Key Components

Feed Valve

Feed valve enables the changeover from a pure solvent feed to sample solution feed.



Key Components

Nozzle

Two-fluid nozzle is the type of nozzle in which two phases are fed into the nozzle, i.e. the feed solution and the compressed atomizing air. Compressed air creates a shear field, which atomizes the liquid and produces a wide range of droplet sizes.

Key Components

Drying Chamber

Drying chamber is the part where moisture evaporation and the formation of dry particles takes place.

Two different drying chamber geometries:

- Traditional chamber with separator for aqueous solutions and horizontal outlet
- Second chamber for optimal yield or drying with organic solvents and vertical outlet

For aqueous solutions

For organic solvents

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Key Components

Cyclone

The air flow containing dry particles coming from the drying chamber creates a vortex in the cyclone. The centrifugal force created by this vortex separates the particle-gas flow.

- Anti-static coating to prevent electrostatic binding and loss of the product
- Simple construction
- Centrifugal separation forces

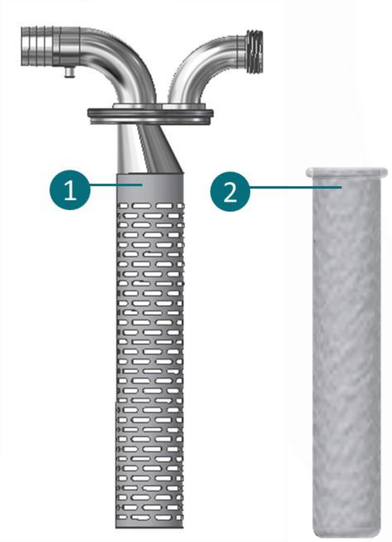
High Performance Cyclone

- High performance cyclone has been developed to achieve a higher level of particle separation and higher collection efficiency compared to the standard cyclone.
- The high performance cyclone has been optimized to capture a broader range of particle sizes, 1-25 µm, including finer particles that may be more challenging to collect. Collection efficiency can exceed 90% for a broader range of particle sizes, including finer particles.
- Capable of capturing higher percentage of particles from the liquid feeds having low solid content.

Key Components

Outlet Filter

The polyester outlet filter recovers small particles so that they don't get released into the environment.



- Protects your lab environment
- Minimizes your exposure
- Allows you to monitor the pressure drop of the system
- Filter bag can be washed and reused
- Charge at the end of a sample set
- Take care if potent or excess product on the filter. Consider proper PPE and disposal vs washing.
- Captures powder not vapor phases

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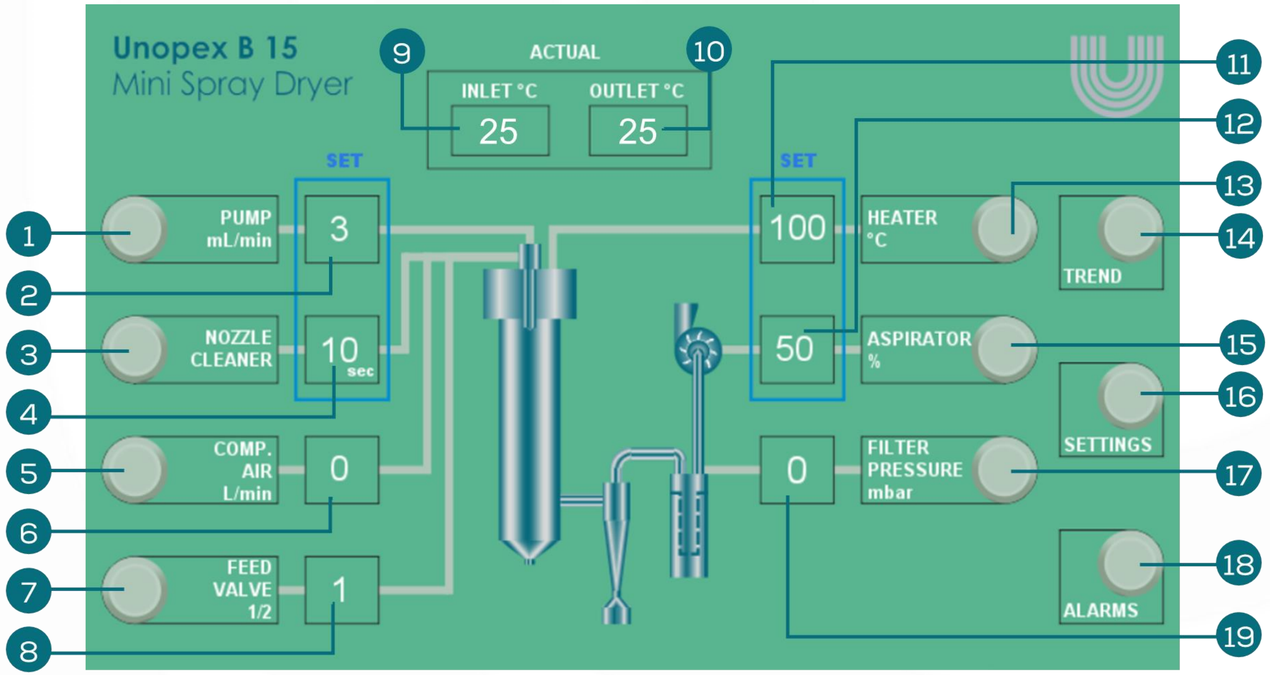
Key Components

Touchscreen Operating Panel



(1)	peristaltic pump ON/OFF
(2)	set value peristaltic pump
(3)	feed valve to change feed selection
(4)	display area for valve (1/2)
(5)	compressor ON/OFF
(6)	display area atomizing air flow
(7)	nozzle cleaner ON/OFF
(8)	set value nozzle cleaner
(9)	display area inlet temperature
(10)	display area outlet temperature
(11)	set value inlet temperature
(12)	set value blower output (in % of max. blower rate)
(13)	heater ON/OFF
(14)	trend page entering
(15)	aspirator ON/OFF
(16)	settings page entering
(17)	filter pressure
(18)	alarms page entering
(19)	display area filter pressure

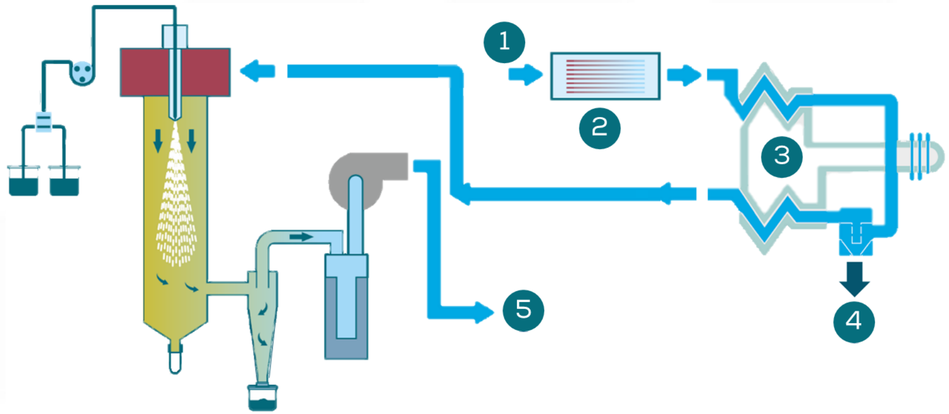
Complementary Units

B 45 Dehumidifier

Unopex B 45 Dehumidifier can be used to condition drying air, to work continuously with water and organic solvent mixtures and for inlet air cooling in spray chilling operation.

Use in open mode in combination with Unopex B 15 Mini Spray Dryer enables spray drying under constant and reproducible humidity conditions.

- Improved spray drying capacity, constant and reproducible humidity conditions
- Removal of more water per hour
- Control and measurement of relative humidity
- Enables to work with water/solvent mixtures in combination with Unopex B 60 Inert cycle

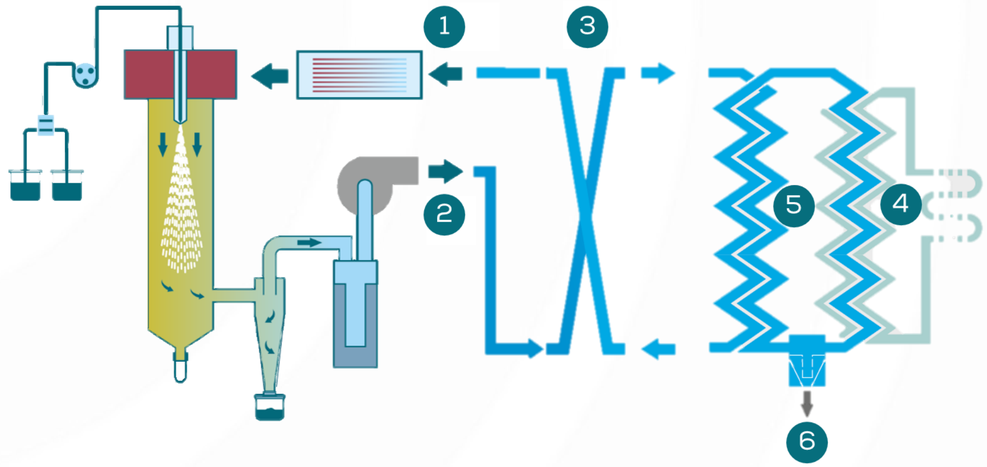


1. Dryer gas inlet 2. Inlet filter 3. Cooling unit 4. Condensed water 5. Dryer gas outlet

Complementary Units

B 60 Inert Cycle

- Unopex B 60 Inert Cycle enables safe operation of B 15 Mini Spray Dryer with 100% organic solvents under inert conditions.
- Use in closed cycle in combination with B 15 Mini Spray Dryer, B 45 Dehumidifier and external heat exchanger enables to work with water/organic solvent mixtures safely.
- Safe and explosion free working conditions due to real time oxygen control



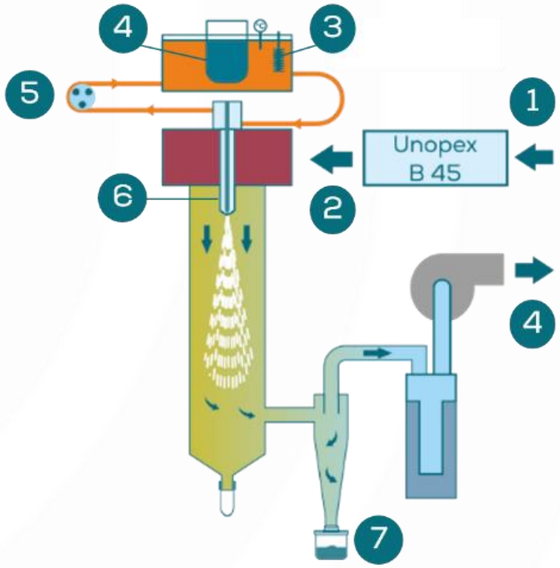
1. Dryer gas inlet
2. Dryer gas outlet
3. Heat exchanger
4. Cooling unit
5. Condenser
6. Solvent drain

Complementary Units

B 92 Spray Chilling

Unopex Spray Chilling Unit is used in combination with B 15 Mini Spray Dryer to make powders directly from molten feed samples by solidification.

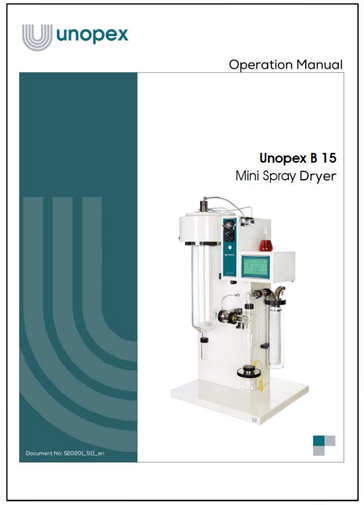
- Easy installation on the top of the Unopex B 15 Mini Spray Dryer
- Electrical heater, temperature probe and metering valve
- Nozzle with heating jacket to prevent any blocking
- Digital control panel



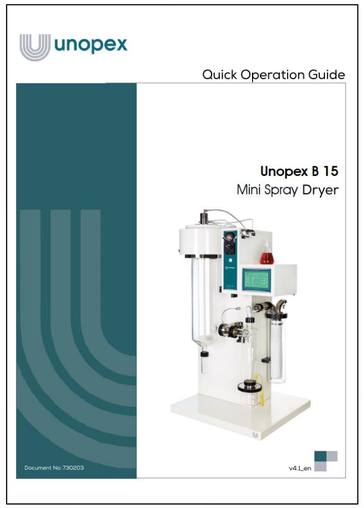
1. Air inlet 2. Cooled air 3. Heater
4. Molten feed sample 5. Heating liquid circulation
6. Spraying nozzle 7. Solidified powder product

Provided Documents

- Operation Manual



- Quick Operation Guide



- Calibration Certificates

- IQ/OQ documentation (optional)

Scale Up

Scale Up from Research to Pilot and Industrial Production Scale

A small spray dryer is particularly useful for initial trials.

Unopex B 15 Mini Spray Dryer is an ideal instrument for research and product development purposes.

The results from a successful spray drying test conducted on the Unopex B 15 Mini Spray Dryer can be utilized in the scale up procedure to Unopex B 230 Pilot Scale Spray Dryer and to industrial production.

Unopex B 15

Unopex B 230

Evaporation Capacity	max. 1,5 L/h (water)	0,5 - 6 L/h (water)
Drying air inlet temperature	max. 220 C (-+ 1 C)	max. 350 C (+ 1 C)
Drying air flowrate	max. 60 m3/h	max. 115 m3/h
Heating power	3 kW, PID controlled	9 kW, PID controlled
Atomization system	2-fluid nozzle	2-fluid nozzle, rotary atomizer
Particle diameter range	5-25 µm	5-80 µm
Operation conditions	open, closed cycle	open, closed cycle
Dimensions (L x W x H)	800x600x1400 mm	2000x1500x2500 mm

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Achieving Together

We are thrilled to contribute to researchers and producers all over the world to easily realize their projects that protect nature and serve humanity with our expertise, experience, motivation, talent, product and services.

Thank You !

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