Spray dryer
Spray cooler

www.preci.co.jp

Contact for inquiries

PRECi Co., Ltd.
Kawasaki office and Powder Technical Center
4-16-20 Kainan-dori, Kawasaki-ku, Kawasaki-shi, Kanagawa 210-8052 Japan
T: +81-46-322-7865

Headquarters and Tokyo office
2-11-4 Totsuka, Totsuka-ku, Tokyo 114-0016 Japan
T: +81-3-3833-4540

Kawaguchi office and Biotechnical Center
3-16-21 Rokka, Kawaguchiko-shi, Saitama 332-0023 Japan
T: +81-48-238-6333

Precision Cleaning Test Center
5-123 Rokka, Kawaguchiko-shi, Saitama 332-0041 Japan
T: +81-48-238-6333

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Spray drying

Spray drying, which produces a dry powder from a liquid or slurry, is one of the most popularly-used continuous drying processes. A liquid including solutions, emulsions, wet slurry and suspensions is sprayed via a spray nozzle or a rotary atomizer into a drying chamber. Continuously feeding heated gas while increasing the surface area of sprayed droplets rapidly dries and makes granules. Therefore, degeneration of the powder is exceptionally low and the process can be the preferred process of thermally sensitive materials. Dried granules are highly close to spherical in shape and have excellent fluidity. For foods and pharmaceuticals, they will be easily soluble in water. For inorganic materials such as metallic powders and fine ceramics, high-density molds can be obtained.

Applicable fields

Spray dryers are used in a variety of industries. Below are some of the fields that we have been involved with.

| Food | Collagen, Chitosan, Agaricus, Propolis, Herbal medicine extracts, Lactobacillus, Green tea extracts, Vitamin C, Stevia, Hulain, Dextrin, Glucose, Havan, Dairy products, Seasoning, Algae, Albumen, Fishery products |
| Chemicals and Pharmaceuticals | Polymers, Pigments, Yeast, Enzymes, Biopharmaceuticals, Medical products, Agricultural Chemicals, Dental materials, Surfactants, Antibiotics, Cosmetics |
| Steel and Metals | Rare metals, Alloys, Rare earth materials |
Process design

The capacity of spray dryers is generally measured by water evaporation volume. However, we believe that the most important aspect is to target both powder formation and production efficiency. Even if two spray dryers have the same water evaporation capacity, the process design will differ depending on the material characteristics and operating conditions. Our engineering specialists provide spray dryers that exactly match your needs by carrying out unique testing, evaluation, and process designing for each project based on our expertise and technical knowhow accumulated over many years. We also take environmental and safety requirements seriously. In order to save energy, our unique heat exchanging process allows you to reduce both CO₂ and energy costs. Our technologists also design the most suited process to meet your strict safety requirements and legal regulations.

Process flows

Open-cycle system

Closed-cycle system

Atomization modes

Rotary atomizer

Our specially-designed rotary atomizers are suited for the particle size range of 20 - 200μm. The particle size can be controlled by disc shapes and rotating speed. Compared to other atomization modes, a rotary atomizer is able to create granules with a sharp particle size distribution and high fluidity.

Rotary atomizer

As our design principle, a motor direct link system is applied as a standard feature in order to obtain a long lifespan and easy maintenance. Currently, we are carrying out various technical developments such as the use of non-contact seal, reduction of mechanical noise, and further simplification of maintenance.

<table>
<thead>
<tr>
<th>Model</th>
<th>PR-05K</th>
<th>PR-10K</th>
<th>PR-15K</th>
<th>PR-22K</th>
<th>PR-37K</th>
<th>PR-55K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotational speed</td>
<td>4000rpm</td>
<td>4000rpm</td>
<td>4000rpm</td>
<td>4000rpm</td>
<td>4000rpm</td>
<td>4000rpm</td>
</tr>
<tr>
<td>Capacity</td>
<td>~150kg</td>
<td>~150kg</td>
<td>~150kg</td>
<td>~150kg</td>
<td>~150kg</td>
<td>~150kg</td>
</tr>
<tr>
<td>Power</td>
<td>0.5kW</td>
<td>0.9kW</td>
<td>1.4kW</td>
<td>2.2kW</td>
<td>3.7kW</td>
<td>8.4kW</td>
</tr>
</tbody>
</table>

Disc

We have developed our unique disc design in order to reduce the rotational speed even when the same particle size is targeted. It allows for a lifetime much longer than high speed rotating atomizers. A variety of materials such as stainless steel, fine ceramics, and coated materials are also available.

<table>
<thead>
<tr>
<th>Model</th>
<th>PR-05S-D</th>
<th>PR-05S-B</th>
<th>PR-05S-Q</th>
<th>PR-05S-B</th>
<th>PR-07S-B</th>
<th>PR-25S-B</th>
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</thead>
<tbody>
<tr>
<td>Rotational speed</td>
<td>3000rpm</td>
<td>3000rpm</td>
<td>3000rpm</td>
<td>3000rpm</td>
<td>3000rpm</td>
<td>3000rpm</td>
</tr>
<tr>
<td>Capacity</td>
<td>~150kg</td>
<td>~150kg</td>
<td>~150kg</td>
<td>~150kg</td>
<td>~150kg</td>
<td>~150kg</td>
</tr>
<tr>
<td>Power</td>
<td>3.2kW</td>
<td>3.2kW</td>
<td>3.2kW</td>
<td>3.2kW</td>
<td>7.0kW</td>
<td>21.0kW</td>
</tr>
</tbody>
</table>

* D: Motor direct drive model B: belt drive model

Nozzles

The most appropriate nozzle can be selected depending on the liquid’s characteristics and operating conditions. A variety of materials such as stainless steel, fine ceramics, special alloys and coated materials are available.

Two-fluid nozzle

Two-fluid nozzle atomization is suited for granules below the particle size of 20μm. One fluid is the liquid to dry and the other one is compressed gas to impact the liquid to be atomized. By controlling the liquid concentration, viscosity, and gas-liquid ratio, it is possible to target single-micron particles. Our unique nozzle is specially designed to prevent clogging even for high-concentration and high-viscosity fluids.

Single-fluid nozzle (Pressure nozzle)

A single-fluid nozzle atomizes by the kinetic energy of the liquid pressure. As the pressure increases, the flow through the nozzle increases, and the size of droplets decreases. A variety of nozzle orifices can be selected to meet suitable material properties and operating conditions. By creating the condition of universal-joint nozzles, a smaller drying chamber can be designed in situations of a limited footprint.
Powder collections

Dual collection method  Cyclone collection method  Bag filter collection method

The powder is collected at two points beneath the drying chamber and the cyclone. Spherical powder with good fluidity can be collected from the drying chamber and fines are collected from the cyclone. This method can therefore be beneficial for grading the powder.

A cyclone separates particles from the gas stream by centrifugal force. It is generally used for producing light or fine powders. A multi-stage cyclone is also available for specific requirements.

Fabric filters in the bag-house separate powders from the gas stream. It is suitable for collecting extra fine particles where efficient collection cannot be achieved by a cyclone. A variety of filter materials including pre-coated filters can also be selected.

*Please contact us for further information, as there are other methods available,

Materials

As a standard feature, SUS (AISI) 304 with buff #300 finishing is used in powder contacting part. Depending on the material characteristics, other materials such as SUS (AISI) 316, SUS (AISI) 316L, fluororesin coating and higher finishing levels can be selected.

Heat sources

A variety of heat sources including electricity, steam, LNG, LPG, kerosene, heavy oil, exhaust heat and other heat sources within a factory, and a combination thereof can be selected. Depending on the cleanliness of the operation, the heat source can be selected from either a direct heating or indirect heating system. HEPA filters can also be selected. In case of indirect heating, a high level of energy saving can be achieved by circulating the exhaust heat of the heat exchanger.

Energy-saving system

By recycling the heat of exhaust gas that would normally be wasted, a high level of energy efficiency can be achieved. With our unique environmentally friendly system, not only the operating cost, but the CO₂ emissions can also be reduced.

More than lab-scale

Spray Boy is an ideal all-in-one spray dryer for R&D. It is designed for easy disassembly and cleaning and is capable of more high-level condition settings than general experimental spray dryers. Everything needed for operation including bag filters comes standard.

Integrated system

Spray Boy is an integrated movable unit designed for easy set-up and relocation. Major components such as a touch screen, a liquid pump and a workbench are all equipped as standard. This integrated system allows an operator to control everything from one place.

A variety of options

A variety of options can be selected to meet your additional needs. Options include: closed-cycle system, HEPA filter, heat insulation unit, and fluororesin coating.
Small-scale spray dryer, R-Series

Best standard spray dryer.
Enables you to scale up your operation.

Designed to enable scaled up operations

- Inlet and outlet fans come standard to control the internal pressure of the drying chamber, and allow for scaled up operating conditions in the future.

Visibility and operability

- The R-Series spray dryer has a large inspection window to allow you to easily check operating conditions. It is also equipped with a large door for easy cleaning and maintenance.

Flexible design

- All atomization modes can be selected with a variety of options. The R-Series can also be configured to operate both open-cycle and closed-cycle systems. A heat-resistant HEPA filter can be installed for high-purity materials.

<table>
<thead>
<tr>
<th>Model</th>
<th>R80</th>
<th>R100</th>
<th>R120</th>
<th>R140</th>
<th>R160</th>
<th>R190</th>
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</thead>
<tbody>
<tr>
<td>Drying chamber diameter (mm)</td>
<td>2800</td>
<td>2900</td>
<td>3100</td>
<td>3300</td>
<td>3600</td>
<td>3900</td>
</tr>
<tr>
<td>External dimension W (mm)</td>
<td>1900</td>
<td>2100</td>
<td>2200</td>
<td>2400</td>
<td>2700</td>
<td>3400</td>
</tr>
<tr>
<td>External dimension D (mm)</td>
<td>2200</td>
<td>2300</td>
<td>2500</td>
<td>2900</td>
<td>3100</td>
<td>3500</td>
</tr>
<tr>
<td>Water evaporation capacity (kg/h)</td>
<td>4 5 8 14 22 28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heater capacity (kW)</td>
<td>6 8 10 18 28 35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*The external dimensions include hot air generator, spoutline and bag house.
*Water capacity is a calculated value based on an inlet temperature of 230°C and an outlet temperature of 80°C.
*Water evaporation capacity is subject to change depending on the atomization mode, inlet temperature, outlet temperature, gas flow, and the installation site conditions.
*The specifications and other information indicated in this publication may change without notice.

Turning spray dryer, TR-Series

Rotate & clean up.
Cleaning innovation you have never seen.

Easy cleaning

- The drying chamber can be rotated 90 degrees to allow for easy cleaning, without the need for getting inside.

Ideal for R&D and small-scale production

- TR-Series is the best solution for high-mix low-volume production and production of high-purity materials as well as R&D use.

Flexible design

- All atomization modes can be selected with a variety of options. The TR-Series can also be configured to operate both open-cycle and closed-cycle systems. A heat-resistant HEPA filter can be installed for high-purity materials.

<table>
<thead>
<tr>
<th>Model</th>
<th>TR80</th>
<th>TR100</th>
<th>TR120</th>
<th>TR140</th>
<th>TR160</th>
<th>TR190</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drying chamber diameter (mm)</td>
<td>2800</td>
<td>2900</td>
<td>3100</td>
<td>3300</td>
<td>3600</td>
<td>3900</td>
</tr>
<tr>
<td>External dimension W (mm)</td>
<td>1900</td>
<td>2100</td>
<td>2200</td>
<td>2400</td>
<td>2700</td>
<td>3400</td>
</tr>
<tr>
<td>External dimension D (mm)</td>
<td>2200</td>
<td>2300</td>
<td>2500</td>
<td>2900</td>
<td>3100</td>
<td>3500</td>
</tr>
<tr>
<td>Water evaporation capacity (kg/h)</td>
<td>4 5 8 14 22 28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heater capacity (kW)</td>
<td>6 8 10 18 28 35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*The external dimensions include hot air generator, spoutline and bag house.
*Water capacity is a calculated value based on an inlet temperature of 230°C and an outlet temperature of 80°C.
*Water evaporation capacity is subject to change depending on the atomization mode, inlet temperature, outlet temperature, gas flow, and the installation site conditions.
*The specifications and other information indicated in this publication may change without notice.
Pilot-scale spray dryer, P-Series

Small footprint, big capacity.
Detailed & customized design to get exactly the right process.

Advanced heat-recycling system
Our environmentally friendly heat-recycling system enables up to 25% energy savings. The specially designed exhaust heat circulation system recovers the heat of the exhaust gas with high efficiency.

Flexible design
All the atomization modes can be selected with a variety of options. The P-Series can also be configured to operate as both a spray cooler and spray dryer, as well as open-cycle and closed-cycle systems.

Production-scale spray dryer, D-Series

Solutions for a competitive edge.
Designed for high yields with energy saving technology.

Technology & Experience
Through our experience of having installed spray dryers as large as 10 meters in drying chamber diameter (processing capacity of 24t/h), we provide the know-how of how to obtain a high yield while saving energy. We also offer automated systems such as a fully-automated operation system and CIP cleaning system.

Flexible design
All the atomization modes can be selected with a variety of options. D-Series can also be configured to operate as both a spray cooler and spray dryer.

Facility examples

- Atm. mode: Rotary atomizer
  Drying chamber diameter: Ø4000 mm
  Water evaporation capacity: 86 kg/h

- Atm. mode: Rotary atomizer
  Drying chamber diameter: Ø4000 mm
  Water evaporation capacity: 100 kg/h
  Liquid material processing capacity: 100 kg/h

- Atm. mode: Pressure nozzle
  Drying chamber diameter: Ø4800 mm
  Water evaporation capacity: 1200 kg/h
  Liquid material processing capacity: 350 kg/h

- Atm. mode: Pressure nozzle
  Drying chamber diameter: Ø4800 mm
  Water evaporation capacity: 1200 kg/h

Table: Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>P220</th>
<th>P240</th>
<th>P260</th>
<th>P290</th>
<th>P300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter (mm)</td>
<td>2200</td>
<td>2400</td>
<td>2600</td>
<td>2900</td>
<td>3000</td>
</tr>
<tr>
<td>W (mm)</td>
<td>3700</td>
<td>3900</td>
<td>4200</td>
<td>4500</td>
<td>4600</td>
</tr>
<tr>
<td>D (mm)</td>
<td>3900</td>
<td>4400</td>
<td>4900</td>
<td>6300</td>
<td>6500</td>
</tr>
<tr>
<td>H (mm)</td>
<td>3900</td>
<td>4400</td>
<td>4900</td>
<td>5500</td>
<td>5700</td>
</tr>
<tr>
<td>Capacity (kg/h)</td>
<td>32</td>
<td>40</td>
<td>48</td>
<td>53</td>
<td>60</td>
</tr>
<tr>
<td>Power (kw)</td>
<td>40</td>
<td>50</td>
<td>60</td>
<td>66</td>
<td>80</td>
</tr>
</tbody>
</table>

*The external dimensions include hot air generator, riserline and bag house.
*Heater capacity is calculated value based on an inlet temperature of 250°C and an outlet temperature of 90°C.
*Water evaporation capacity is subject to change depending on the atomization mode, inlet temperature, outlet temperature, gas flow and the installation site conditions.
*The specifications and other information indicated in this product may change without notice.
Spray cooler

Spray cooling is a process where materials are taken from a melted state to a solid powder form. A spray cooler utilizes technology derived from spray dryers, where melted material is atomized and cooled down in an airstream to create spherical congealed powders with good fluidity.

Process design

A spray cooler utilizes technology derived from spray dryers. Therefore, the basic process flow such as atomization modes and product collection methods are all similar to that of spray dryers. Testing of a spray cooler can be arranged at our Powder Technical Center (PTC).

Testing and Consignment processing

From the early stages of R&D to large 24-hour-production planning as well as any concerns about your current production process, we offer high-value testing and consultation services with great know-how accumulated over many years. The Powder Technical Center (PTC) is located in Kanagawa prefecture, Japan, with a wide variety of spray dryers and analytical equipment. Our highly experienced and qualified testing engineers offer services with advanced process evaluations by measuring and analyzing the characteristics of your applications such as solid content, viscosity, moisture content, particle size distribution and particle formation. These evaluations are reflected in the testing process in real-time to achieve your specific requirements. We also offer a consignment processing service. The service is available in capacities of up to a few tons of liquid material per batch.

Do you have any requirements like this?

- Sample/trial powders are needed for my development of new materials
- Consignment production is required as we do not have the facility in-house
- Unable to purchase a new dryer as we are still at earlier phase
- Product samples are needed until our new facility starts operating
- We don’t have the time and resources to gain production knowhow
**Available facilities**

**Spray boy**
- Atomization mode: Two-fluid nozzle
- Water evaporation capacity: up to 3 kg/h

**TR160**
- Atomization mode: Rotary atomizer, Two-fluid nozzle
- Water evaporation capacity: up to 15 kg/h

**P260**
- Atomization mode: Rotary atomizer, Two-fluid nozzle, Pressure nozzle
- Water evaporation capacity: up to 30 kg/h

**D350**
- Atomization mode: Rotary atomizer, Two-fluid nozzle, Pressure nozzle
- Water evaporation capacity: up to 50 kg/h

*Water evaporation capacity is subject to change depending on the operating conditions.*

**How to apply**

We accept inquiries by telephone and email, and via our website. When making an inquiry, we request that you fill out our ‘Testing/Consignment processing check sheet’ in order to help us understand your requirements. The check sheet can be downloaded from our website.

1. Evaluate requirements & submit a quotation
2. Send the check sheet
3. Confirm the implementation date
4. Implementation

...Carried out by customers.  ...Carried out by us.

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**Rental service**

We started our official spray dryer rental service requested by our customers a few years ago. By taking this action, we have realized that the service is ideal for customers who want to try our spray dryer before purchase, or want to use one for only a certain period of time. During the rental period, we provide customer support service and consultation for your operating conditions.

**Ideal for the following customers**

- We want to use the facility for a certain period only
- The facility will be no longer necessary once a project is completed
- Although our production is outsourced, we want to accumulate production knowhow
- We do not want to hold fixed assets
- Although our new material is confidential, we need consultation regarding our operations

**Rental facilities**

<table>
<thead>
<tr>
<th>Model</th>
<th>Spray Boy</th>
<th>TR80</th>
<th>TR120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atomization mode</td>
<td>Two-fluid nozzle</td>
<td>Two-fluid nozzle, Rotary atomizer</td>
<td>Two-fluid nozzle, Rotary atomizer</td>
</tr>
<tr>
<td>Water evaporation capacity</td>
<td>up to 3kg/h</td>
<td>up to 4kg/h</td>
<td>up to 4kg/h</td>
</tr>
<tr>
<td>Targeted particle size</td>
<td>a few micrometers to 30μm</td>
<td>a few micrometers to 40μm</td>
<td>a few micrometers to 60μm</td>
</tr>
<tr>
<td>Monthly rental fee</td>
<td>(please contact us)</td>
<td>System Open-cycle System</td>
<td></td>
</tr>
</tbody>
</table>

*Please contact us regarding the rental conditions and monthly fees.*
*The monthly rental fee does not include transportation, installation and test run.*
*The rentals is for a monthly period.*
*The monthly rental fee does not include transportation for returning the facility at the end of the contract.*