

Sample Determination for Spray Drying

Spray drying continues to be the preferred drying method for several heat-sensitive materials in food, medicinal, and industrial applications because of its low-cost and efficient properties of converting liquid to fine dried powder. This method employs an atomizer and heating gas to transform liquid into dry powders, granules, or agglomerates. Some products that are dried using this process include milk, beverages, vitamins, colorings, detergent, and other powders.

The spray drying process starts by pre-concentrating the liquid to be dried, increasing its solid content and reducing the amount of liquid that has to be evaporated in the spray dryer. The solution or suspension is fed into the drying chamber through a nozzle where the drying gas has been continuously flowing. The feed undergoes a process called “atomization” where optimal conditions for evaporation are created using a nozzle or rotary atomizer which converts the solution into fine droplets within the chamber.

Evaporation then starts once the droplet makes contact with the heated gas, leaving the dried solids at the bottom of the chamber. The drying gas carries the dried solids out of the chamber and the cyclone separates the particles from the drying gas. The powder is collected in the product vessel directly attached to the bottom of the cyclone.

Spray drying can be used in a wide range of applications such as pharmaceuticals, food & beverage, agriculture, chemicals, polymer, ceramic, cosmetics & fragrances, and materials research. Its application is widespread across many industries. It can also be used for heat sensitive and heat resistant substances. Furthermore, spray drying increases product shelf life and reduces product weight making it easy to transport.

The type of spray dryer determines particle size, bulk density, crystallinity degree, organic volatile impurities and residual solvents. The quality of the powder remains constant during the entire spray drying process. However, changing the parameters like nozzle size, inlet temperature and flow rate and sprayed pressure may alter the final product.

THINKING ABOUT YOUR FINISHED PRODUCT

Apart from scale, components, and the overall spray drying system type, users must also think about the final product that they want to achieve at the end of the spray drying process.

Consider the powder specifications you need to have at the end of the process such as dissolution, moisture percentage, flowability, microbiological standards, and particle size. For example, even factors such as powder color can be controlled through the use of colloidal or micellular dispersions or multilayer emulsions prior to spray drying.

Your feed formula and specifications will also play a role in the selection process as more often than not, materials to be spray dried will require a formula. Apart from the active ingredient and water, your feed formula may also include a carrier, a flow agent, an emulsifier, and an antioxidant. For actives, ask yourself the following:

- Does it have a low flash point?
- Is it hygroscopic?
- Is it water or oil soluble?
- What is its purity?
- Does this material have a standard % load range?

Here are some additional guide questions that you might want to ask yourself to give you a clearer idea as to the spray dryer unit you will need:

- What is your target particle size?
- What temperature profile will you need?
- How much moisture should your finished product have?
- Is the liquid feed material a solution or dispersion?
- Is the finished powder hydrophilic, flowable, or tacky?
- What is the viscosity of the liquid slurry?
- Are there any limitations or requirements for storage and handling the raw material or final product?
- What is the percentage of solids going into the spray dryer?

Yamato offers 3 different models of [laboratory spray dryers](#). These products can be used for experimental purposes to determine spray drying parameters such as drying temperature, sample feed rate, air flow rate, droplet size, and solvent content of dried powder.

- [ADL311SA](#) is an economical laboratory spray dryer featuring excellent performance, simple operation and easy set up and clean up.
- GB210 is the versatile spray dryer and granulation 2 in 1 system. [GB210A](#) is the spray dryer and [GB210B](#) is the granulation unit. Easy to switch by changing the glassware.
- [DL410](#) is the large capacity laboratory spray dryer with higher processing capability, suitable for R&D and semi-production purpose. This unit can obtain bigger particle size.

Determining if your samples will work with the existing Yamato spray dryer models is an easy process. The initial recommended step would be to complete the **Yamato Spray Dryer Preliminary Survey Sheet** and email it to us. Information provided will determine if any of Yamato's existing spray dryer configurations are suitable for your requirements. Yamato can then offer a sample test at Santa Clara, California or Minami Alps Factory in Japan.

With over 125 years of experience in the industry, Yamato Scientific America is equipped with providing utmost quality service and high performing products in the scientific market. All products are manufactured in compliance with stringent quality standards and international regulatory requirements.

Whether you are ready to make a purchase or still need to do more research, Yamato Scientific America is here to help. Contact us at **1-800-292-6286** or reach us at **customerservice@yamato-usa.com**.

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SPRAY DRYER PRELIMINARY SURVEY SHEET

1. *Company Information*

Industry	
Company Name	
Address	
Contact Person	
Phone Number	
Email Address	

2. *Spray Dryer Model Interested in*

Model	Description	Check Preference
ADL311SA	Economical Spray Dryer System	<input type="checkbox"/>
ADL311SA + GAS410	Economical Spray Dryer System + N2 Gas Sealed Circulation System	<input type="checkbox"/>
GB210A	Versatile Spray Dryer System	<input type="checkbox"/>
GB2010A + GAS410	Versatile Spray Dryer System + N2 Gas Sealed Circulation System	<input type="checkbox"/>
DL410	Larger Spray Dryer System	<input type="checkbox"/>
DL410 + GAS410	Larger Spray Dryer System + N2 Gas Sealed Circulation System	<input type="checkbox"/>
GB210B	Versatile Spray Dryer System for Granulation	<input type="checkbox"/>

3.1 Sample and application

Application	Check	Sample Description (indicate chemical name if possible)
Food and Feed	<input type="checkbox"/>	
Pharmaceutical	<input type="checkbox"/>	
Ceramic	<input type="checkbox"/>	
Chemical	<input type="checkbox"/>	
Metal Powder	<input type="checkbox"/>	
Plastic	<input type="checkbox"/>	
Others	<input type="checkbox"/>	

3.2 Solvent and concentration (% of non-volatile content)

Solvent Name	Concentration (%)	pH	Viscosity (cP)

3.3 If with drying temperature limit, please provide details:

Melting Point (°C)	
Glass transition temperature (°C)	
Temperature limit for the sample (°C)	

3.4 Sample Condition

Condition	Check
Solution	<input type="checkbox"/>
Slurry	<input type="checkbox"/>
Emulsion	<input type="checkbox"/>
Others	<input type="checkbox"/>

3.5 For SLURRY sample

Primary particle size (μm)	
Particle shape (spicula, sphere, flattened, etc.)	
Attenuation (If necessary), acceptable?	<input type="checkbox"/> Yes <input type="checkbox"/> No

4.1 Purpose of spray drying

Target	Check
Drying	<input type="checkbox"/>
Fine powder	<input type="checkbox"/>
Agglomeration	<input type="checkbox"/>
Amorphous	<input type="checkbox"/>
Encapsulation	<input type="checkbox"/>
Others	<input type="checkbox"/>

4.1 Desired particle size

Particle size	Check
03. ~ 2	<input type="checkbox"/>
2 ~ 10	<input type="checkbox"/>
10 ~ 25	<input type="checkbox"/>
25 ~ 50	<input type="checkbox"/>
Over 50	<input type="checkbox"/>

5. Handling precautions (carcinogenic, corrosive, irritant, magnetic, ignitable, etc)

NOTE:

When information is reviewed and approved by Yamato, a fee of \$800 for a one day test is collected prior to testing. Requesting party is responsible for shipping cost of the sample to and from Santa Clara, CA or Japan factory, if necessary.

SPRAY DRYER

Facility Requirement Guide

ADL-311SA and GB-210 require:

1-Air compression system

- Recommended Air source requirement: 28L/min and 3Kg/cm² compressed air
- Minimum requirement: 13.SL/min and 2kg/cm² compressor air

2-Electrical power source and male plug

- Recommended plug specification: 250V and 30A

DL-410 requires:

1-Air compression system

- Recommended specifications: 28L/min and 8Kg/cm² compressed air
- Minimum requirement: 13.5 L/min and 4Kg/cm² compressed air

2-Electrical power source and male plug

- Recommended plug specification: 250V and 30A

GAS-410 requires:

1-N₂ gas source

- 99% or higher (99.998 recommended)
- Minimum requirement: 13.SL/min and 2kg/cm²

2-Electrical power source and male plug

- Recommended plug specification: 250V and 30A

PLEASE SEE YAMATO RECOMMENDATION FOR COMPRESSOR, AIR COMBINATION, POWER PLUGS.