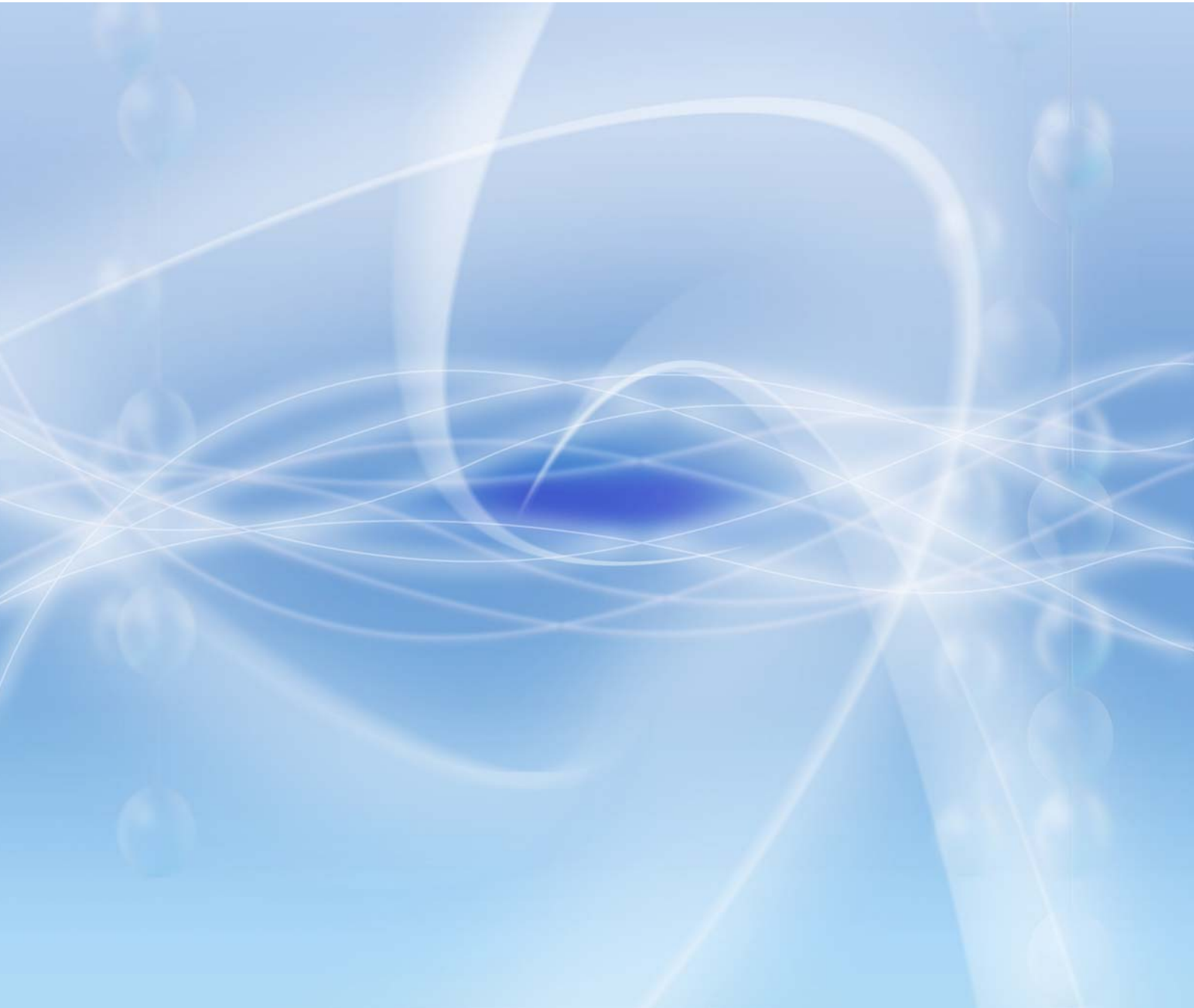


Vacuum Freeze-Drying Equipments



Introduction of vacuum freeze-drying

Almost all farm products have seasonable, local, hard store and transport problems, but those disadvantages may well solve by freeze-drying process. Those products may add water to recover their shape and flavour when they will be use. The vacuum freeze-drying is the best ideal drying process.

Vacuum freeze-drying is a developed method, by which the product of containing water is quick frozen at low-temperature state and the chamber is evacuated became a vacuum, then the ice sublimates and directly turns vapor to condense and discharge by refrigerating unit until water content reduce 95~98%, but product will still on the plate tray. Therefore the product maintained constant volume and turned into lacunose and floppy after drying, and will kept fresh and nutrition preferably to improve its additional value.

Our vacuum freezing-drying units adopt imported low-temperature compressors to run circulating refrigeration system and cooperate with imported vacuum pumps and circular cool/hot mediums in drying process. Our units are easy operating and their products will keep uniform quality and easy reconvert.



green algae



string bean



natto



natto powder



tangerine



pineapple



kiwi



banana



yolk



custard powder



mysterious fruit powder



Monascus purpureus



lactobacillus of goat milk



Isoflavone



apian pupa



drone pupa



shark cartilage



burdock



durian



apple



pineapple



garlic



mulberry powder



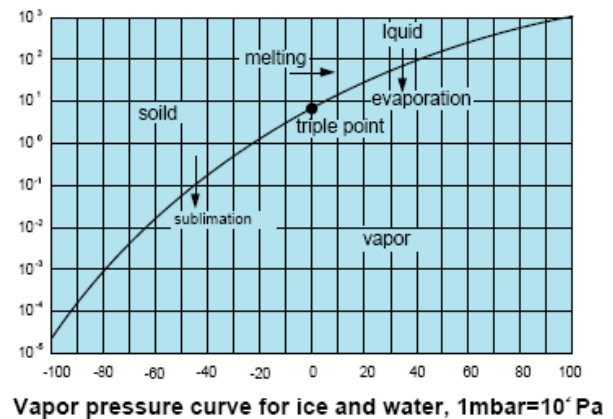
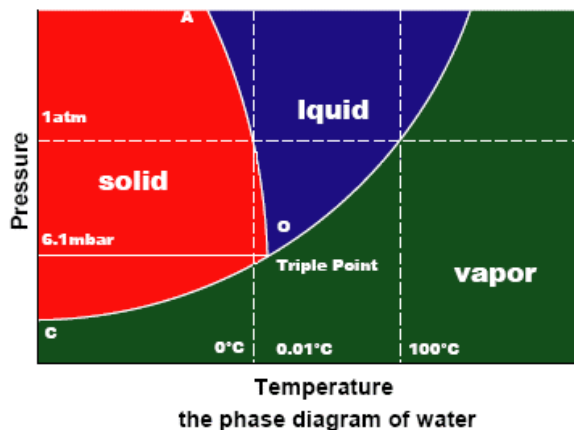
albumen powder

Principle of vacuum freeze-drying

Vacuum freeze-drying is a kind of technology to obtain the dry products. The wet-product of containing water is quick frozen under triple-point temperature state firstly, and make the moisture turns into the ice of the solid state, and then the ice will sublimes and directly turns vapor under the proper vacuity. The vapor will be condensed into water to drain by condenser and the product becomes dried finally.

1. Basic concept of Vacuum Freeze-Drying --Sublimation

The principle of sublimation is briefly explained using the phase diagram of water (freeze drying of mainly aqueous solutions, see vapor pressure curve). In the phase diagram of water, the OA, OB and OC called vaporization line, fusion line, and sublimation line. At any point on the curves, the temperature and pressure allow two phases to exist in equilibrium: solid and liquid, solid and vapor or liquid and vapor. If the atmospheric pressure is higher than 6.11 mbar, water passes through all three phases (solid, liquid, gas) when the temperature is lowered or raised. At 6.11 mbar the melting pressure curve, vapor pressure curve and sublimation pressure curve meet in one point called triple point(0.01°C). At this point, all three phases occur in parallel (simultaneously). Below this point, i.e. when the pressure is lower than 6.11 mbar, the ice is converted directly from a solid to a gaseous phase on reaching the sublimation pressure curve (vapor pressure curve above ice). In theory, the operation of the Vacuum Freeze-Drying is only needed under the point. But the real operation condition is much more harsh, Usually in the vacuity of 0.5- 1.5mbar and under the temperature between about -25 °C, could guarantee the harmony of the vacuum freeze-drying.



2. The process steps of freeze drying

- (1)Pre-freezing : The products are frozen to 10~20°C under solidifying point.
- (2)Drying : Keeps the water contents in ice phase under vacuum (e.g. at 0.01 mbar).
- (3)Additionally necessary energy input (= heating) : The material remains in the solid/ice phase.
(Physical law : the vacuum is responsible for the product temperature.)

Application and comparison of freeze-drying

1. Compare

(1) Advantages :

- (A) The shape, color, nutrition, flavour, element and taste of ingredients are only a little transition.
- (B) Products had no vitiations, kept little residual water content (1~3%) and low bacteria number, and easy storage and transport under normal temperature.
- (C) The substances of products kept uniform and they were easy comminuting to deliquesce and reconvert.

(2) Disadvantages :

- (A) The cost of facilities is high and the refrigerating unit is difficult to operating under minus 60°C, and the required performance of vacuum pump is high.
- (B) The hygroscopic and brittle order of product is high, so the airtight and careful packing is necessary.

2. Application :

- (1) Vegetable: mushroom, carrot, sweet corn, spinach, celery, kernel of string bean, cabbage, shredded shiitakes, red pepper, green onion, garlic, wood ear, caraway, green asparagus.
- (2) Meat: beefsteak, pork slices, chicken, duck
- (3) Seafood: shrimp meat, squid, little silver fish, crabmeat, shredded scallop.
- (4) Cook food: bean curd, miso soup, sauce powder, vinegar powder, tea concentrate, coffee concentrate.
- (5) Health care food: royal jelly (bee milk), pollen, fishbone glue, garlic extract, tea extract, extract of glossy ganoderma, shiitakes extract, enzyme, antibiotics.
- (6) Ice & fruit power: strawberry powder, banana power, pineapple power, kiwi fruit...etc.
- (7) Others: microbe (various germ), yeast, medical serum & blood plasma, specimens of biology & somatology, physic antibiotics.



Vacuum freeze-drying unit (1)



Vacuum freeze-drying unit (2)

Specifications table of vacuum freeze-drying units

Item \ Model	Unit	KLCV-10	KLCV-50	KLCV-100	KLCV-200
Drying chamber	mm	650Φ×700L	1050Φ×1200L	1250Φ×1450L	1450Φ×1750L
Material		SUS 304	SS400	SS400	SS400
Cover of chamber		screw front cover			
Shelf area	m ²	0.9	4.5	9	18
Fixed effective layers		3	8	12	14
Shelf spacing	mm	85	75	75	75
Plate tray	mm	500 ^W ×600 ^L ×25 ^H	650 ^W ×850 ^L ×25 ^H	700 ^W ×1080 ^L ×25 ^H	700 ^W ×920 ^L ×25 ^H
Quantity of tray		3	8	12	28
Heat transfer area	m ²	1.8	9	18	36
Circulating pump	kW	0.37	0.75	1.5	2.2
Heater	kW	4	10	14	18
Condenser	mm	650Φ×700 ^L	1050Φ×1200 ^L	1250Φ×1400 ^L	1450Φ×1700 ^L
Temperature		-40°C~-50°C	-40°C~-50°C	-40°C~-50°C	-40°C~-50°C
Condensing capacity	kg/H ₂ O	10	50	100	200
Refrigerator	kW	3	15	22	30
Blower	kW	0.75	1.5	2.2	2.2
Vacuum pump	kW	1.5	2.2	3	1.5+3.7
Cooling water pump	kW	0.37	0.75	1.5	2.2
Electrical apparatus		Torr vacuumeter and electronic thermometer			
Summary of system					
Horsepower 220V~380V	kW	8.9	21	32	43
Electrical heater	kW	4	10	14	18
Water quantity for operating	m ³ /cir	0.3	0.8	1.5	2
Install area	m ²	4	12	18	50

Remarks :

- (1)As table described above, vacuum freeze-drying units are standard specifications. Welcome to order special specifications.
- (2)Specifications are subject to change without notice for further improvement.

Specifications table of vacuum freeze-drying units

Item \ Model	unit	KLCV-400	KLCV-600	KLCV-1200
Drying chamber	mm	1650Φ×2600L	1850Φ×3200L	2050Φ×4700L
Material		SS400	SS400	SS400
Cover of chamber		hinged screw front cover		
Shelf area	m ²	36	54	108
Fixed effective series		16	18	20
Shelf spacing	mm	75	75	75
Plate tray	mm	520 ^W ×1080 ^L ×25 ^H	5250 ^W ×960 ^L ×25 ^H	650 ^W ×1080 ^L ×25 ^H
Quantity of tray		64	108	160
Heat transfer area	m ²	70	110	180
Circulating pump	kW	2.2	3.7	5.6
Heater	kW	24	36	---
Condenser	mm	1650Φ×2200 ^L	1850Φ×2800 ^L	2050Φ×4000 ^L
Temperature		-40°C~-50°C	-40°C~-50°C	-40°C~-50°C
Condensing capacity	kg/H ₂ O	400	600	1200
Refrigerator	kW	37.5	56	56×2
Vacuum discharging Vacuum pump	kW	3.75×2	5.5×2	7.5+11
Cooling water pump	kW	3.7	5.6	5.6×2
Electrical apparatus		Torr 真空計、電子測溫計 (Torr vacuumeter and electronic thermometer)		
Summary of system				
Horsepower 220V~380V	kW	60	90	160
Electrical heater	kW	24	36	---
Or steam 5kg/cm ² G	Kg/hr	100	150	300
Water quantity for operating	m ³ /次	2	3	6
Install area	m ²	100	120	200

Remarks :

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