

Rice flour

by SATAKE's small milling unit CMU30A

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Rice flour is a generic term for rice flour made of both non-glutinous rice and glutinous rice. The rice flour type is shown in Figure 1. Rice is the only self-sufficient grain in Japan, but the annual consumption of rice-per-capita has been decreasing year by year due to the diversification of consumer needs.

On the other hand, in recent years, as the national policy aims at expanding the use of rice flour as a substitute for wheat flour in order to improve the self-sufficiency rate, products using rice flour have been developed in various places by improving flour milling technology and bread-making technology, and the use of rice flour has been expanding to various products such as bread, western confectionery, and noodles.

They correspond to the fine-grained flour of Figure 1. Fine-grained flours are expected to be used in new applications different from conventional uses such as Japanese confectionery and rice crackers. These can be divided into applications mainly

by grain size as shown in Figure 2. Satake's flour milling machine in rice flour production - Small-scale flour milling unit CMU30A

We have flour milling machines such as our pin mill and roller mill primarily installed into wheat milling plants. This section describes small-scale flour milling unit CMU30A, which has been marketed in Japan since 2017 and mainly used for rice flour. As a small-scale mill, Satake has SRG05 with capacity of 5kg/h in white rice and SRB10 with 10kg/h. CMU30A is a 30kg/h milling unit with a larger capacity.

Concept of designing and function of CMU30A

CMU30A is a unit system that can be easily moved and installed and is an impact milling system for both dry and wet milling. It was developed based on the concept of compact design, easy maintenance and low-volume production.

It is possible to produce rice flour products with high quality, taste and processability by realising fine grinding with the average product flour particle diameter of approximately 40 μ m. It is designed to eliminate residual product inside and to increase serviceability, utilising lighter removable components, for example.

This milling machine realises a price suitable for new entrants targeting a relatively small amount of flour millers, such as bakeries, roadside stations, and agricultural processing centres. Its main three features are as follows:

1. A milling capability of 5kg/h to 30kg/h enables small scale rice flour manufacturing by in-house milling
2. Unitised design of feeders, milling machines and dust collectors produces high-quality rice flour
3. The unitised unit allows for forklift transfer. After installation, rice flour can be produced simply by supplying air and power. A summary of the units is given in Table 1.

Machine name and process

Each components of the unit is shown in Figure 3. The basic unit includes the control panel, feeder, milling machine, cyclone, air lock, suction pipe and dust collector. The control panel shows start, stop and alarm functions for each section.

The feeder quantitatively feeds the raw material loaded into the hopper to the milling machine. The mill mills the input raw material. While the flour is conveyed out of the mill by air from the dust

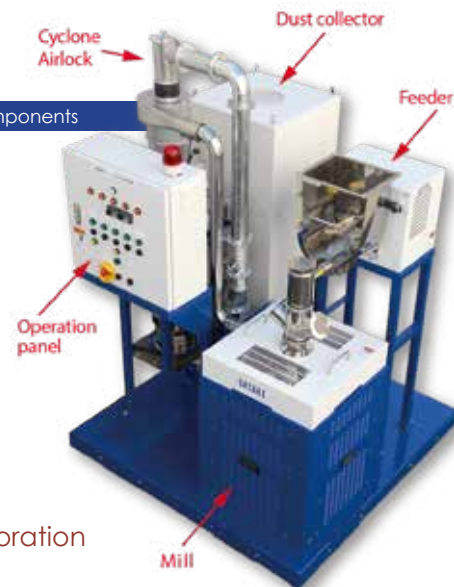


Figure 3: Machine components

Figure 1: Types of rice flour

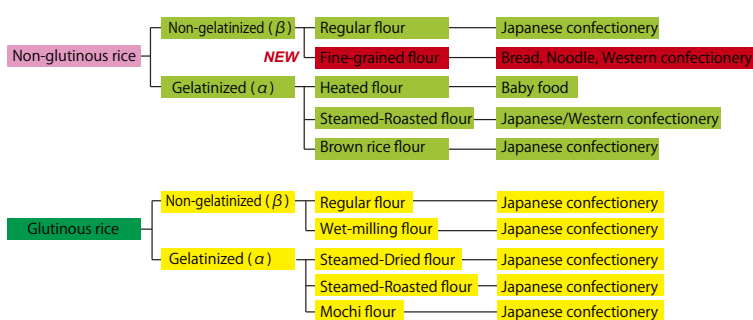
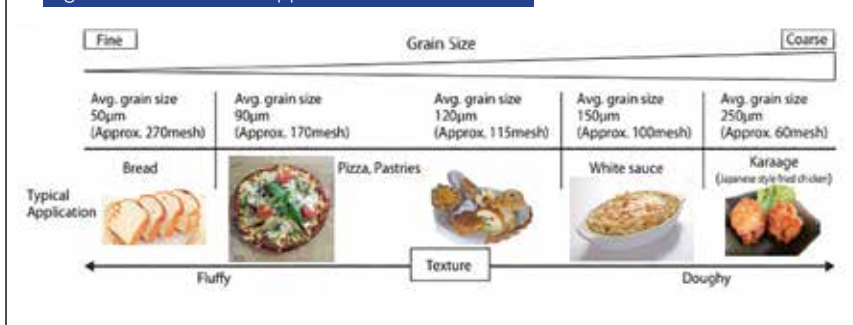


Figure 2: Grain size and applications of new rice flour



collector, it is separated from air by a cyclone through the suction pipe.

Flour is discharged through the airlock in the lower part of the cyclone. When the optional small vibratory sifter is available, sifting check is performed using a 600 μm sieve size for large foreign material in the flour leaving the airlock. The milling process is shown in Figure 4.

Structure of milling machinery

The structure of the milling machine is shown in Figure 5. The raw material fed from the centre of the upper part of the machine is conveyed to the milling section (outside of the casing) by centrifugal force of the rotor and the suction air generated by the dust collector.

In the milling section, the raw material is milled by impact between the raw material and against the wall surface. The milled raw material is wound up to the upper part along the wall surface and then rises by means of suction and the air flow generated by the rotor. This is discharged from the upper part of the milling section to the outside of the machine.

Characteristics of milling machinery

The milling machine is designed not only for optimal milling performance but also easy maintenance and safety. Characteristics of four main components of the milling machine (milling section top cover, milling section cover, rotors, casing) are as described in Table 2.

Wet milling

When wet milling is performed in CMU30A, hot air from a hot air generator is introduced into the milling machine and the

Figure 4: Flour milling process

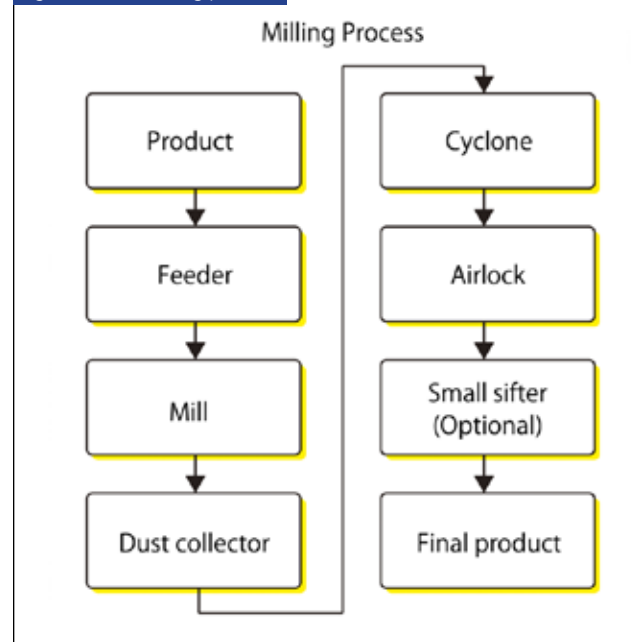


Figure 5: Structures of milling machinery

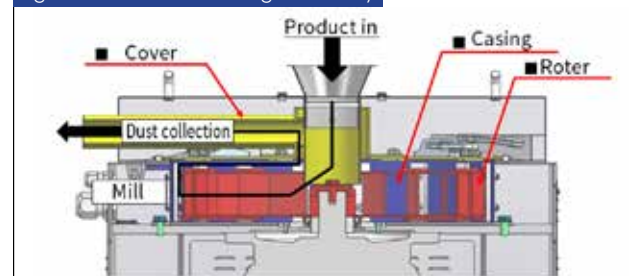


Figure 6: CMU30A wet milling flow

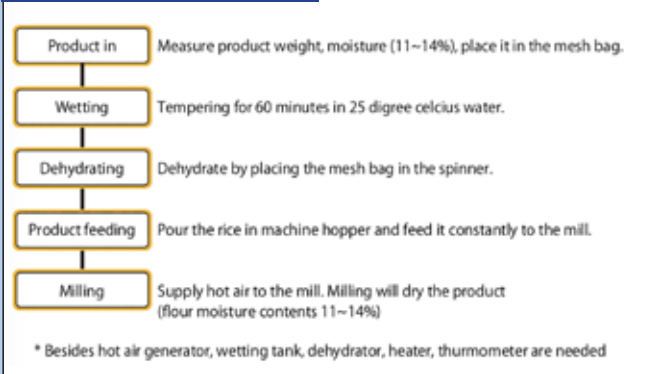


Figure 7- Particle size distribution of dry milling

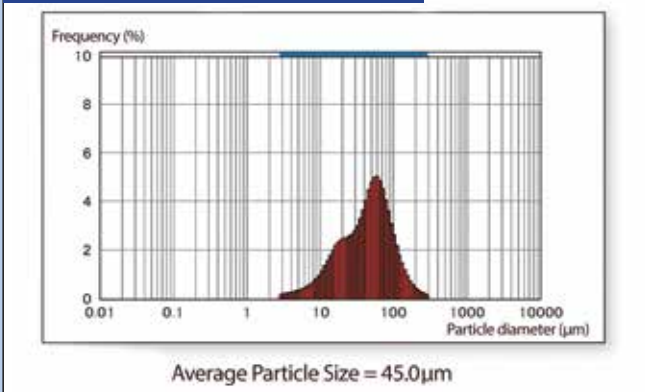
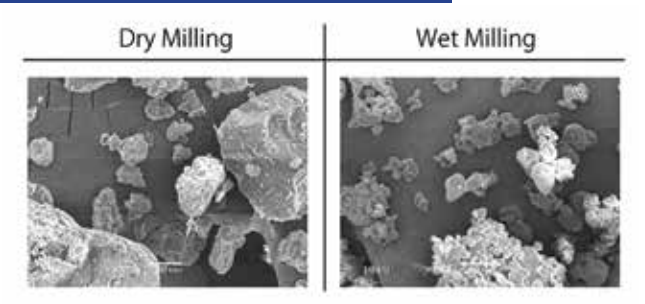


Figure 8- Particles (dry and wet) of rice flour X750



Model	CMU30A
Dimension	(W)1,500mm (D) 1,500mm (H) 2,183mm
Milling capacity	5-30kg/h (white rice pulverisation)
Power	3-phase 200V, 8.75kW
Weight	Ab out 800kg
Option	Small vibratory sieve, hot air generator and feeder

Table 2: Characteristics of milling machinery

	Top cover of milling section Inlet pipe connecting the feeder and milling machine is equipped with a magnet. Magnetic foreign matter is prevented from entering the milling machine. When this cover s removed, the milling machine is not activated by the safety device.
	Milling section cover The inlet of raw materials and the outlet of propducts are intergrated. Because it can be opened and closed by four handles, it is easy to detach and clean.
	Rotor It rotates at about 3,500rpm. Because of the fan shape, air is generated and the raw material is fed into the wall surface of the milling section at high speed. Because it is attached with one bolt, it is easy to detach and clean
	Casing The raw materials are impacted with each other and the wall surface are milled. Only microgranuales lifted to the top are aspirated and conveyed to the product process. Less residue or sticking and easy cleaning and replacement of the consumable parts.

flour is dried while being milled in the milling machine. The moisture content of the flour is adjusted by adjusting the temperature of the hot air generator according to the temperature at the outlet of the milling machine (See Figure 6).

Flour quality

When the raw material was supplied under ordinary white rice at 30kg/h, the average particle size was 40 ± 10 µm. (Reference: 120 µm in the case of the small-scale flour milling machine SRG05C, and 90 µm in the case of SRG10). The particle size distribution is shown in Figure 7. Therefore, the particle size considered suitable for the making of rice flour bread and confectionery has been achieved.

In addition, wheat, oats, buckwheat, and other grains can also be milled. The damaged starch rate is 10-to-15 percent for white rice dry milling and four-to-six percent for wet milling. The difference between dry and wet rice flour particles can also be confirmed by electron microscope. In the dry process, many angular particles are observed, and in the wet process, many small round starch particles are observed (See Figure 8). The following Table 3 shows the reference data of the small-scale milling machine sold by Satake.

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Table 3- List of small-scale flour milling machine series

	SRG05C	SRG10A	CMU30A
Model			
Milling Method	Dry / Impact	Dry / Impact	Dry -Wet / Impact
Capacity (kg/h) - White Rice	0.2 ~ 5.0kg / h	10kg / h	5 ~ 30kg / h
Power	1 Ph/100V/750W	3PH/200V/ 3.7kW+0.4kW x 2	3PH/200V/ 8.75kW
Milling Screen	Milling Screen	0.05mm or 0.1mm	No Screen
Mesh Screen	Mesh Screen	100 Mesh	Optional 600µm mesh screen
Optional Screen	-	120 Mesh	
Particle Size (µm) - Rice Flour	Avg. 120µm	Avg. 90µm	40µm±10µm
Subject Material	White Rice, Brown Rice, Buck Wheat	White Rice	White/Brown Rice, Wheat, Buck Wheat
Hopper	3kg	White Rice 15kg	White Rice 20kg
Features	Compact, quiet operation (70db)	Low temratrue, efficient milling	Dry/Wet milling, easy installation
Product Usage	Rice bread, Wheat bread, Noodle	Japanese/Western confectionary, Rice bread	