Wet *vs* dry

Understanding the difference between the two rice flour milling methods

by Maxtex, Thailand

Producing Rice Flour through wet milling & dry milling are two of the most commonly used techniques, with the processing of the grain commonly divided into these two categories. This article also touches on semi-drying milling, but the main focus is to explore & compare the two most common techniques.

To understand the difference between the two, and the challenges that are involved in the milling process, an understanding of the basics is a good place to start.

What is rice flour milling?

The use of mechanical energy to break down rice grains through various mechanical accessories including grinding, pegs, rods, pebbles and screens. When the rice varieties are moved through the mill, the mill's components act on the solids in the mixture to tear them apart or crush them, further reducing them in size.

The rice milling process helps to maximise the yield of the mix's ingredients and can improve the resulting product's functionality as well. For example, milling can help improve colour development, properties, and product flow.

The difference between wet & dry

Now that we have a basic understanding of the Rice Flour Milling process, let's examine the difference between wet milling and dry milling. Dry milling typically uses particle-on-particle contact to reduce materials' size, while wet milling involves dispersing the material in a liquid and using solid, grinding elements to reduce size.

Rice varieties can be broken down through either one of these processes, but wet milling, which we'll discuss first, tends to be a more intensive process than dry milling. Wet milling, also known as wet grinding, is decanted to obtain wet flour after which it is dried in hot air before sieving to desired particle size. Once the milling process is complete, these particles are ready for use or can be dried and separated for incorporation into additional products.

Wet milling is more complex than dry milling, thanks to the addition of a liquid, but this process also has the power to reduce a product into finer particles. This allows for the production of a greater variety of byproducts and also can result in improved physical properties in the final product.

By contrast, dry milling utilises no liquid element, and is most

frequently used for the particle size reduction of dry materials like powders and granules, or de-agglomerating and de-lumping bulk materials.

While dry milling is a less intensive process, which often makes it the first method considered, wet milling is the best and most efficient way to get to the preferred Rice Flour particle size.

The science of wet & dry milling

In order to successfully incorporate rice or its flour into products, the properties of the material have to be known as they will affect product qualities, consistency and also lead to good consumer satisfaction. Factors influencing the physicochemical properties of rice flour include rice genotype (Iturriaga et al., 2004), amylose content (Varavinit et al, 2003), protein content (Marco and Rosell, 2008) and milling method (Suksomboon and Naivikul, 2006).

Rice flour is generally manufactured using wet-milling method as it is believed to yield flour with superior quality. Chen et al (1999) studied the physicochemical and functional properties of waxy rice flour prepared from dry-milling, semi-dry-milling, and wet-milling methods, and indicated that dry hammer-milled rice shows higher gelatinisation and pasting temperatures, and semi-dry- milled rice results in the lowest pasting temperature, setback viscosity and enthalpy value.

Hammer and semi-dry hammer milled rice gives higher percentages of coarse particles (100–300 μm), cyclone and turbo milled rice leads to a more even particle-size distribution, and the wet-milled rice gives the finest particles (10–30 μm).

The dry-milled rice flour is reported to have more damaged

starch, thus giving better solubility, and lower peak and final viscosities. Therefore, the final quality of rice flour is profoundly affected by the milling type and milling method.

Provided that the physical and functional properties of both dry-milled and wet-milled rice flour are thoroughly deciphered, they can both find application in the food industry.

This study aimed to investigate the physical and chemical properties of flour from several rice varieties as affected by dry-milling and wet-milling methods.

Rice materials

This study used nine Thai rice varieties, Ayutthaya 1 (AY1), Plai Ngahm Prachin Buri (PNG), Prachin Buri 1 (PB1), Prachin Buri 2 (PB2), Rice Department 45 (RD45) (from Prachin Buri Rice Research Center in Thailand, harvested during March, 2011), Khao Dawk Mali 105 (K105; from Pathum Thani Rice Research Center in Thailand, harvested during December, 2010), Shaw Lung 97 (SL97; from Pattani Rice Research Center in Thailand, harvested during March, 2011), Rice Department 41 (RD41) and

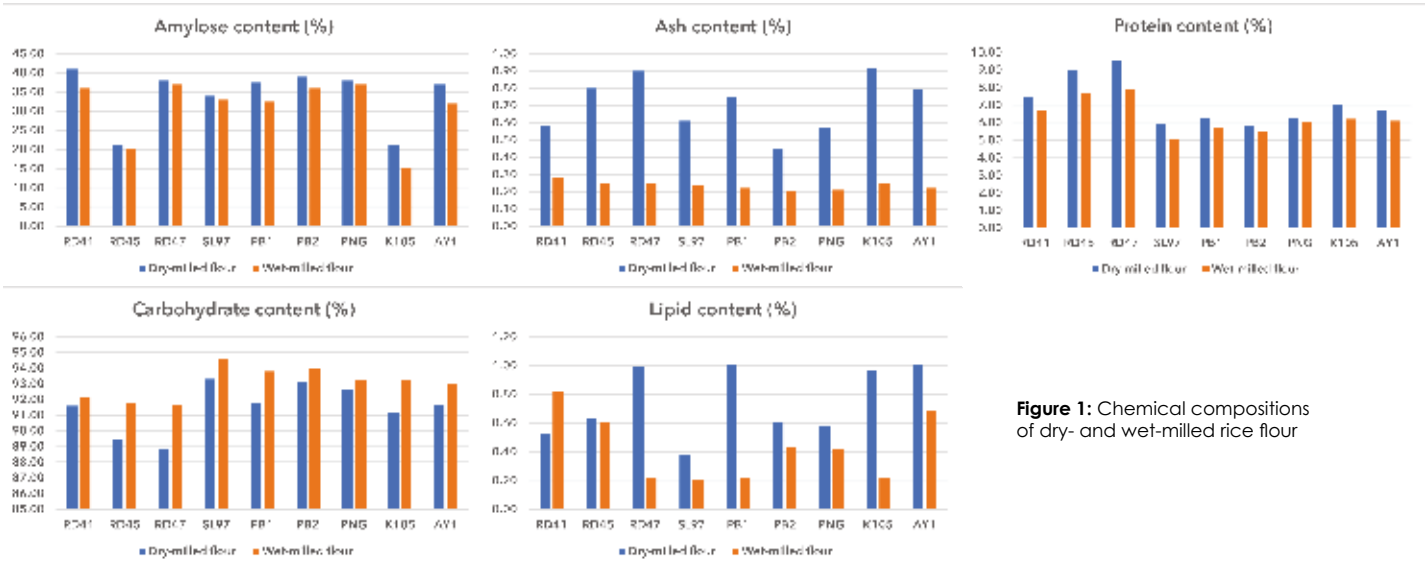

Figure 1: Chemical compositions of dry- and wet-milled rice flour

Rice Department 47 (RD47) (from Phitsanulok Rice Research Center in Thailand, harvested during November, 2010

The rice samples were obtained as milled rice. All samples were stored at 4°C until further analyses.

Dry-milling process

Milled rice grains (500g) were ground twice using a vertical disc mill. Flour samples were sealed in polypropylene plastic bags and stored in a desiccator at room temperature until further analyses.

Approximately 1kg milled rice was soaked overnight in 2L NaHSO3 solution (1.25%) before it was ground using a stone-mill under continuous addition of water to obtain rice slurry. The slurry was filtered through a filter bag to obtain rice cake. The cake was dried overnight in a tray dryer at 40°C.

The dried rice flour was ground and sieved through a 100-mesh sifter. Flour samples were packed in polypropylene plastic bags and stored in a desiccator at room temperature for further use (Varavinit et al, 2003).

Chemical Compositions of Milled Rice

Moisture content of the milled rice from different varieties ranged from 11.1% to 12.7%. Fat content varied from 0.31% to 1.86%. Among the nine varieties, RD47 showed the highest protein content (10.7%) and SL97 showed the lowest protein content (6.3%) ($P \leq 0.05$).

Ash content ranged from 0.18% to 0.79%. Carbohydrate content and crude fiber of milled rice varied between 92.5% to 87.7% and 0.11% to 0.46%, respectively. The rice varieties could be classified into two groups, low amylose rice with amylose content of 17.9%–18.4% (RD45 and K105) and high amylose rice with amylose content of 29.5%–36.5% (AY1, PNG, PB1, PB2, SL97, RD41 and RD47).

Effects of milling on physicochemical properties

Chemical compositions of dry- and wet-milled rice flour are shown in Figure 1. Both dry and wet milling caused significant differences in flour composition. Wet-milled rice flour showed lower protein and ash contents but higher carbohydrate content in all the nine genotypes.

Almost all the nine rice genotypes except RD41 showed lower lipid content under wet-milled treatment than under dry-milled treatment.

Sources: Science Direct: https://mymag.info/e/1449

Summary: Wet milled rice flour has…

1. A much longer shelf life (generally 2 years), due to the removal of impurities whereas dry milled doesn't have a thorough cleaning process which results in a shelf-life of 6 – 12 months. Additionally, wet milled flour hygiene is greater with fewer impurities.
2. The power to reduce a product into finer particles (approx. 100 mesh). This allows for the production of a greater variety of applications and also can result in improved physical properties in the final product. Dry milled particle size is approximately 60 mesh.
3. A much lower ash content whereas a higher ash content in dry milled rice flour makes it less attractive.
4. Slightly less amylose content which is associated with lower blood glucose levels and slower emptying of human gastrointestinal tract compared to those with higher levels of amylose such as dry milled rice flour.