CORNMEAL-MASA

Food and Agriculture Organization of the United Nations

CORNMEAL-MASA

1.- General Information

Cornmeal by definition is dried corn kernels that have been ground in one of three textures – fine, medium, or coarse. It is a popular dry corn because of its long shelf life, freedom from black specks, and bright colour. There are two methods of grinding. The old-fashioned water-ground (also called stone-ground) method – so named because water power is used to turn the mill wheels – retains some of the hull and germ of the corn. Because of the fat in the germ, water-ground cornmeal is more nutritious, but will not keep as long and should be stored (up to four months) in the refrigerator.

The other method to grind the maize is performed by high speed, big volume steel cylinders or hammer mills. Cylinder mills grind grains with rigid or smooth pairs of cylinders that rotate at high speed. Grains are forced between the cylinders which grind and tear the kernels instantly.

Cornmeal can be yellow, white, or blue, depending on the type of corn that is used. Yellow and white corns are the most commonly used for cornmeal. Both grits and polenta are made from dried corn kernels; the difference is how those kernels are milled. When the corn is ground, the coarser particles become GRITS, while the finer granules are used for POLENTA. Stone-ground grits have a chunkier texture and a more "corny" flavour than quick grits. They do take longer to cook than their counterpart, and they also need more stirring to release the starch and soften the grains, but stone-ground grits are certainly worth the effort.

2.- Cornmeal Processing details

2.1-Cleaning

The manufacturers should clean the maize correctly before the processing, using blowing machines and grading equipments.

The maize is separated from the impurities (stones, straw, insects and others) using sieves. This separation, besides contributing to the high quality, prevents the wear and tear of the equipments.

2.2.-Degermination

The present method of producing a cornmeal involves first degerminating kernels of corn so as to separate the horny endosperm portion of each kernel of corn from the remainder of the kernel.

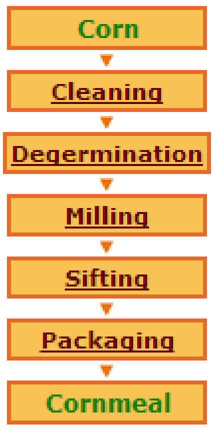
An efficient corn degerminating system consists of 3 major parts; a hydrator, a degerminator and a grain polisher. The hydrator applies moisture uniformly to each maize kernel by means of its slow moving mixing paddles and vibrating housing. It accelerates penetration of moisture through the bran skin and into the germ. By controlling the quantity of moisture added to the grain and the retention time of the grain in the hydrating cylinder, efficient pre-conditioning is accomplished. By the action of moisture, the bran and the germ are encouraged to separate from the core endosperm of the kernel.

In the degerminator, maize enters the annulus formed by a multiple sided perforated screen and an eccentric shaped rotor. Its vertical configuration allows uniform and even action on corn being processed. As the rotor turns, the clearance between the rotor and the screen is constantly changing. Because of this constantly changing clearance with each rotation, a cyclic compression and relaxation occurs in the grain bed. This produces both the effective rubbing action and the pressure necessary for efficient removal of bran and germ, while at the same time controlling breakage to produce a maximum number of large pieces of pure endosperm and limiting fines to a minimum.

In combination with abrasive action resulting from the grain moving across specially designed textured surfaces, this rubbing action simultaneously removes bran and germ from the kernel. The bran and germ then exit the chamber through the perforations in the screen, leaving the clean endosperm to exit at the discharge of the machine. A weighted discharge gate, which can be set manually or automated, is used to regulate the work done and thus the degree of bran and germ removal.

The third key piece is the grain polisher. The grain polisher also uses an eccentric rotor in a polygonal screen to produce cyclic compression and relaxation. It uses lower pressures than does the degerminator. The grain polisher is ideal for the removal of bran only, as is the case when recovery of large germ particles is desired. It is also suitable for secondary polishing of recovered endosperm. In addition, it allows the possible production of value added products, because the flaking grits produced will have very low fat contents and levels of contaminants, such as insect fragments, microbial activity, insecticide, and fertilizer residues.

Cornmeal Processing Details



2.3.-Milling

The cleaned grains are taken to the mills, where they are completely ground. The hammer mills are more commonly used, even though, there are small factories that use the stone ground to the small scale processing.

Stone Milling

The grains can be ground using a system of two matched carved stones; one is stationary and the other rotates at 500-700 rpm. Volcanic and synthetic (aluminum oxide) stones are widely used by the industry. Synthetic stones have the advantage of long lasting.

The typical stone is 10.2 cm thick, 40.6 cm in diameter, and carved radially. The grooves become progressively shallower as they approach the perimeter of the stone. The number, design, and the depth of the grooves vary with the intended product.

Hammer Milling

Currently, where the electric power is available cornmeal industries are using the hammer mill that offer easier facility of work, greater capacity per size and easier maintenance.

Hammer mills use rotating hammer or knives to break-up product that has been fed into the chamber of the machine. The rotating hammers or knives in the chamber of a hammer mill reduce the side of the product by impacting the product and by forcing the product to impact the interior of the chamber. The hammers within the chamber of a hammer are sized so that the end of the hammer almost impacts the interior wall of the chamber. A hammer mill has a screen to form the bottom of the chamber. Once the product has been reduced to the proper size, the product falls through the screen below the chamber.

When are used hammer mills to process grain, several factors may be changed to increase or decrease particle size. The size of the openings in the hammer mill screen greatly determines the size of the particles that are produced. In general terms, feedstuffs that have passed through a 1/8- to 3/16-inch screen have an average particle size of 600 to 800 microns. Screens of one-fourth to three-eighths of an inch normally produce particles that are 800 to 900 microns. However, it is difficult to relate a screen size to specific microns because of equipment variations such as tip speed, wear, moisture content of the grain, and other factors.

2.4.-Sifting

The corn meal particles after grinding may then be sifted, which separates the corn meal particles according to their size.

2.5.-Packaging

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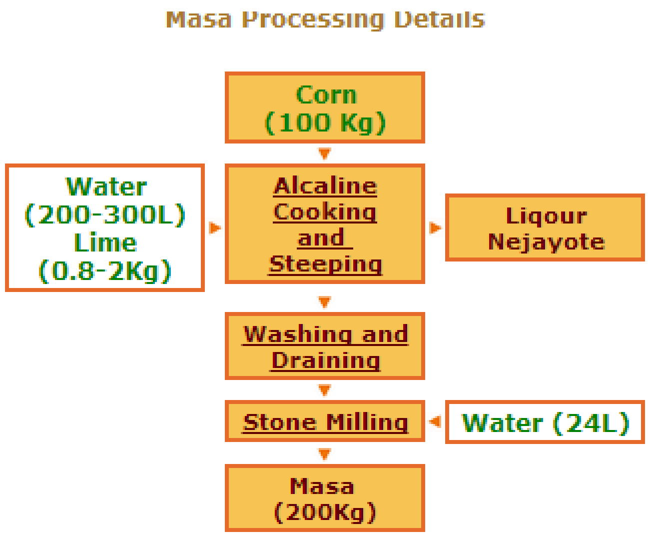
3.- Masa - General Information

Masa is the raw material from which traditional products such as tamales, pozole, atoles, tortillas, corn chips, tortilla chips, and other products are made. The traditional method to process corn into masa, called nixtamalization, was developed by ancient Mesoamericans. In the nixtamalization process, water containing lime is used to cook the grain, although the leachate of wood ashes can still be used (common in some villages in Mexico and Central America).

The alkaline cooked corn, called nixtamal, is washed to remove excess lime and pericarp tissue, and stone ground to form a dough called masa, which is, then, dried and ground into flour. The major advantage of using dry masa flour is the product flexibility and its improved shelf life.

4.- Masa Processing details



4.1.-Alkaline Cooking

The first step to process corn into masa is the alkaline or lime cooking. Different forms of lime (CaO and $Ca(OH)2$) mined from local sources are used. The solubility of lime in water decreases as the temperature increases. Only 0.67g of lime can be solubilized per litre of water at 79.5ºC, whereas 1.2g/L can be solubilized when the temperature drops to 21ºC. Lime treatment facilitates pericarp removal during cooking and steeping, controls microbial activity, affects the flavour, aroma, colour, shelf life, nutritional value and improves gelatinisation.

The temperature of cooking depends on the product that the masa will be processed, but it can range between 85 and 98ºC for 5-40 min.

During cooking, the starch is partially gelatinised, and other grain components are hydrated and altered.

Cooking depends on the characteristics of the corn and the interaction of temperature, time, lime concentration, size of cooking vessel, and frequency of agitation.

Optimum cooking and steeping time are determined subjectively by evaluating the extent of pericarp removal, kernel softening, and overall appearance of the nixtamal.

The steep liquor (called nejayote) is drained, and the cooked-steeped maize is processes in the next step. Nejayote waste is highly alkaline, with high chemical and biological oxygen demands, and is considered an environmental pollutant; thus it has to be properly treated (aerobic treatment, bioreactor, etc.) before discarding.

4.2.-Whashing and Draining

The clean nixtamal is stone ground, using equipments very similar to the ones described for cornmeal. Stone milling operation is a very important step, because it distributes the hydrated starch and proteins throughout the ungelatinised portion of the endosperm, forming the masa. The degree of grinding dictates the type of masa produced: Masa for table tortillas must be fine ground, and more hydrated (55-58%), whereas coarse, less hydrated (51-53%) ones are preferred for fried products, such as tortilla chips.

After grinding, the nixtamal contains 48-53% moisture, and is ready for further applications. In recent commercial productions, the masa can be dried and milled to originate dry masa flour, which is advantageously distributed for domestic and industrial purposes due to its prolonged shelf life and convenient preparation. Drying is, though, a critical operation and is generally done by air suspension or belt dryer. Warm air flows countercurrent to the masa, which must be dried to a moisture content of about 8-10%. The dry particles are hammer milled, sieved for different particles sizes and may be blended to produce dry masa flours with optimum particle size distribution for different applications. Flour is packaged in paper material with an inner layer of polyethylene to restrict moisture uptake and improve shelf life.

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