

**PROCESSING
TECHNOLOGY OF CEREALS
ASFE 2201**

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RICE ENRICHMENT / FORTIFICATION

Introduction:

- ✓ It is white rice which has been mixed with an assortment of vitamins and nutrients to make it more nutritious.
- ✓ The packaging usually clearly indicates the level of enrichment in the grain, although those levels may vary after cooking, depending on how the rice is cooked.
- ✓ Example: Short grain sushi rice, long grain jasmine rice.
- ✓ When rice is processed into white rice, a great deal of the nutritional value is lost.
- ✓ The fiber and nutrient rich outer bran is stripped first, leaving behind the germ and endosperm.
- ✓ In many cases, the nutritious germ is lost as well during the polishing process. As a result, white rice is not terribly nutritious, naturally.
- ✓ Therefore, some producers add vitamins and minerals back in after the rice has been processed, or they include vitamin pellets in their sacks of rice so that their rice will provide more nutritional value.

- ✓ Especially in developing nations, enriched rice is extremely important.
- ✓ Since rice is a staple food for millions of people around the world, it is important for rice to be highly nutritious.
- ✓ In regions with a high volume of white rice consumption, nutritional deficiencies have been noted.
- ✓ It is hoped that sales of enriched rice will reverse this trend, by supplementing the daily diet with more vitamins and minerals.
- ✓ Even after enrichment, enriched rice is not as nutritious as whole brown rice.
- ✓ In addition, it **should not be rinsed**, because the nutrient coated rice will lose value if rinsed.
- ✓ Many companies also recommend that enriched rice be cooked in a minimum of water, so that nutrition is not lost during the cooking process.
- ✓ However, enriched rice is certainly better than plain white rice, especially for people who are relying on it as a staple food.

- ✓ Rice can be fortified by adding a micronutrient powder to the rice that adheres to the grains or spraying of the surface of ordinary rice grains in several layers with a vitamin and mineral mix to form a protective coating.
- ✓ Rice can also be extruded and shaped into partially precooked grain-like structures resembling rice grains, which can then be blended with natural polished rice.
- ✓ Rice kernels can be fortified with several micronutrients, such as iron, folic acid and other B-complex vitamins, vitamin A and zinc.

Methods of Rice Fortification

- ✓ Fortification methods,
 1. Hot extrusion,
 2. Cold extrusion,
 3. Coating and
 4. Dusting of rice.

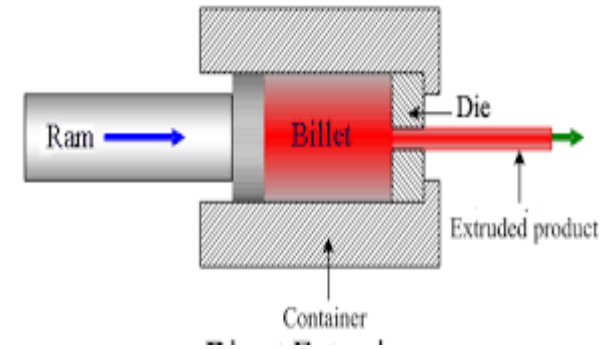
- ✓ Cold extrusion and coating method – similar to the process of pasta production.

- ✓ But hot extrusion method produced **the best quality product** and maintained the most nutrients. However, it was the most expensive.

- ✓ While dusting is the **least expensive** method, it is not **recommended for developing countries where** washing and rinsing rice before cooking is common and it results in nutrients being washed away.

1. Hot extrusion

- ✓ It passes dough made of rice flour, vitamin/mineral mix, and water through a single or twin screw extruder and cuts it into grain-like structures that resemble rice grains.
- ✓ This process involves relatively high temperatures (70-110°C) obtained by preconditioning and/or heat transfer through steam heated barrel jackets.
- ✓ It results in fully or partially pre-cooked simulated rice-like grains that have similar appearance (polish and transparency) as regular rice kernels.
- ✓ The two companies who are using the technologies: China and Philippines.



2. Cold extrusion

1. It is a process similar to one used for manufacturing pastas, also produces rice-shaped simulated grains by passing a dough made of rice flour, vitamin/mineral mix and water through a simple pasta press.
2. This technology does not utilize any additional thermal energy input other than the heat generated during the process itself, thus is primarily a low temperature (below 70°C), forming process resulting in grains that are uncooked, opaque and easier to differentiate from regular rice kernels.

3. Coating

- ✓ It combines the vitamin/mineral mix with ingredients such as waxes and gums.
- ✓ The mixture is **sprayed to the rice** on the surface of grains in several layers to form the rice-premix and then is blended with polished rice.
- ✓ Philippines and the United States use this process.

4. Dusting

- ✓ It is observed only in the U.S, involves dusting the polished rice grains with the powder form of the vitamin/ mineral premix.
- ✓ The vitamin/ mineral mix sticks to the grain surface because of electrostatic forces.

PROCESSED RICE PRODUCTS

1. Rice flour:

- ✓ This is made in pulverizing machines.
- ✓ Rice flour of 9-13 per cent moisture content, contains 5-9 per cent of protein, 0.4-1.0 per cent of fat and yields 0.4 to 0.7 per cent ash.
- ✓ It is used in refrigerated biscuit manufacture to prevent sticking, in baby foods as a thickener, and in waffle and pancake mixes as a water absorbent.
- ✓ In India, rice flour is also used in the preparation of vermicelli, and papad.

2. Parched rice products:

- ✓ About 4-5% of total supplies of rice in India is converted into rice products-parched rice, parched paddy and rice flakes.

a. Parched rice/Puffed rice:

- ✓ Parched rice is prepared by throwing rice into sand heated to a high temperature in an iron or earthen pan.
- ✓ On stirring, rice begins to crackle and swell. Then the contents of the pan are removed and sieved to separate the parched rice from sand.
- ✓ Parboiled rice is preferred in making parched rice.
- ✓ Parched rice is a crisp product with a grayish to brilliant white colour and is sold either salted or unsalted.
- ✓ It is eaten as such or used mixed with buttermilk or milk.



b. Puffed rice from paddy:

- ✓ Popularly known as “murmuralu”.
- ✓ Paddy is soaked in water to increase the moisture content to about 20%.
- ✓ The moist paddy is puffed by subjecting to sudden heat treatment at 250-270°C for 30-40 sec.
- ✓ The husk splits off and the rice is puffed.
- ✓ Puffed rice prepared in the above manner is made into balls with jaggery and used as a snack.
- ✓ Puffed rice is used in snack foods and breakfast cereals, and is also a popular street food in some parts of the world.
- ✓ It is also used in temples and gurudwaras as prasad.
- ✓ A traditional puffed rice called muri is made by heating rice in a sand filled oven.



c. Rice flakes (Beaten rice) :

- ✓ Popularly known as “poha”.
- ✓ Rice flakes are produced in large quantities, both on a cottage industrial scale and on a commercial scale in India.
- ✓ The process is as follows :
- ✓ The paddy is soaked in hot water at 70-80°C for about 20 minutes.
- ✓ The water is drained off.
- ✓ The soaked paddy is toasted in a pan at about 250-275°C till a few grains start puffing.
- ✓ The toasted paddy is immediately subjected to flaking by either pounding with a heavy iron pestle or with a heavy iron roller.
- ✓ The husk is pulverized during the flaking process.
- ✓ Rice flake is a precooked product and can be readily reconstituted by soaking in warm water for 20 minutes.
- ✓ It is widely used in India for the preparation of snacks.

3. Rice starch:

- ✓ Rice starch granules are quite small and are embedded in a protein matrix.
- ✓ To separate them from protein, broken rice is steeped for 24 hours with 0.3% caustic soda.
- ✓ The caustic soda treated, granules are washed, dried and ground into flour.
- ✓ The flour is then mixed with about ten times its weight of caustic soda solution.
- ✓ This removes gluten.
- ✓ After 24 hours, the starch that settles down is removed, washed and dried.
- ✓ Rice starch is used in puddings, ice-creams and custard powder.

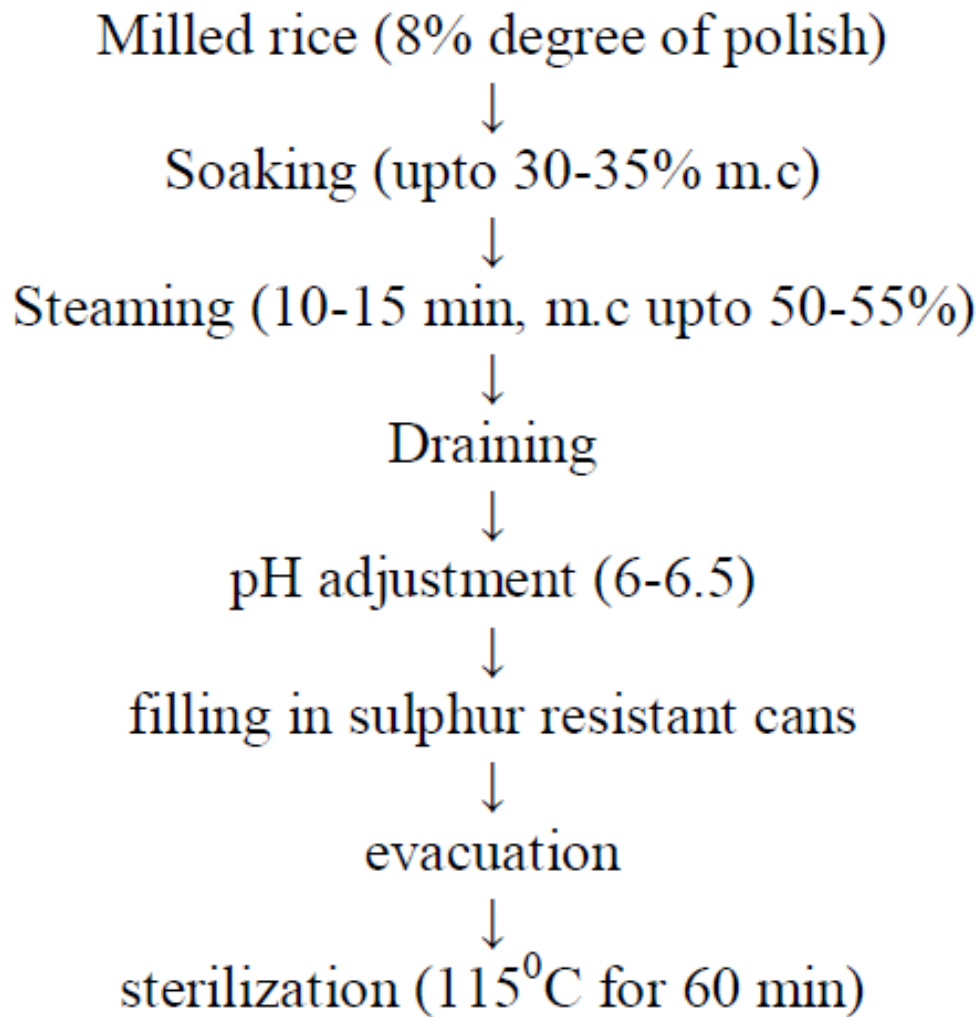
4. Instant Rice

- ✓ Instant rice, also known as **minute rice**, is rice that has been precooked and dehydrated so that it cooks more rapidly.
- ✓ Regular rice requires approximately **20 minutes** to cook while instant rice needs anywhere between **5 and 10 minutes**.
- ✓ Because it has already been cooked, all that is necessary to prepare instant rice is to simply re-hydrate it with hot water.

Preparation process:

- ✓ The rice is blanched in hot water, steamed, and rinsed.
- ✓ It is then placed in large oven for dehydration until the moisture content reaches approximately 12 % or less.
- ✓ The basic principle involves increasing moisture of the milled white rice by using steam or **water to form cracks or holes** in the kernels.
- ✓ The fast cooking properties come from the fact that, when recooked, water **can penetrate** into the cracked grain much more quickly.

5. Canned rice:



Defects in canned rice:

1. Discoloration
2. Lumping
3. Off flavor
4. Inconsistency in texture
5. Pastiness
6. Swelling or bulging