

INFRASTRUCTURE





Cereals Processing Toolkit



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1.- Physical Layout

Infrastructure and processing site layout

When setting up a bakery it is essential that the condition of the building - the materials of construction and its position - are all suitable for food production. The plant should not be located near swamps, ditches or refuse dumps where insects and rodents are likely to be found. The site should allow waste water to drain away freely and have suitable facilities to dispose of waste food and rubbish. A supply of clean water is essential.

Physical layout

Basic services

Equipment

Physical layout

Ideally the operational areas of the bakery building should be at ground level, with the raw ingredients entering at one end and the finished goods leaving at the other.

The different operations should be kept separate from each other to prevent contamination. For example, perishable raw materials should be kept separate from non-perishable ones.

Packaging materials should be stored separately from the food items.

If possible, toilets should be located outside the processing building. If they are in the main building, there should be two doors between the processing room and the toilet.

Workers must have access to handwashing facilities with soap and clean towels.

The building should be constructed with smooth walls. The joint between the wall and floor should be rounded for easy cleaning. The building lines should be simple and square, without crevices and small places that can attract dust and may become birds nests. Windows should be covered with mosquito mesh to prevent the entry of flies and other insects.

The floor should be made of good quality concrete and should slope to a central drainage channel so that at the end of the day the whole area can be hosed down.

The drainage channel should be fitted with a heavy iron grating that can easily be removed for cleaning. The outlet of the drain should be covered with wire mesh to prevent rodents entering.

The ceiling and walls must be made from washable and easily dried materials. They must not be absorbent or porous.

The lighting should be natural if possible. If artificial lights are used they must not get in the way of the processing. The bulbs should be protected to prevent glass falling into the products if the lights are broken.

It is important to have good ventilation, especially where heating takes place. Large window openings should be covered with mesh to allow air and natural light into the building, while preventing insects and birds.

2.- Basic Services

Three basic services are required for a basic food processing operation:

Electrical power

It is preferable to have access to electricity for lighting and for the operation of machinery. The electricity points should be situated high up the walls and away from water supplies so that they do not get wet during hosing down of the building.

Drinking water

Drinking water should be available in sufficient quantities to allow for the safe, hygienic processing of food. Water must be protected from all possible sources of contamination. The storage tank must be covered. Clean water is often a scarce commodity and therefore efforts should be made to conserve it. Clean water must be available at all times. It is recommended that an elevated storage tank is used that is not reliant on the use of electricity. The use of a storage tank allows the water to be treated with a disinfectant. It is recommended that chlorine is added to water as a disinfectant. The recommended dosage is 2 ppm of free chlorine, which is equivalent to 100ml sodium hypochlorite solution per 2000 litres of water. At this level, the chlorine disinfects, but does not affect the taste of the water.

Disposal of waste water and material

Provision should be made for the disposal of waste water and waste material

Basic facilities

A small to medium scale fruit and vegetable processing unit must have the following basic facilities:

Reception of raw material

The plant must have a special area for the reception and storage of raw material until it is required. This area may simply be a shed or an appropriately designed room. The area should be clean, away from direct sunlight and with control over the temperature and humidity according to the type of material being stored. Care should be taken to ensure that rodents, birds and insects cannot get into the store building. The raw material storage area should not be used for the storage of other products that could contaminate it such as cleaning materials and pesticides. The quality of the finished product is directly dependent on the quality of the raw material. Thus the conditions of the storage area are of great importance. The storage area should have basic equipment such as weighing scales for the reception of raw material.

Processing room

The processing room is the main place of activity. The different materials used during processing and the various pieces of equipment are kept here. Ideally, the room should be large enough to house all the equipment needed for the various stages, to allow the process to be continuous and improve the efficiency of processing.

Quality control

Quality control operations should be carried out in a separate room. The room should be equipped with basic equipment such as a sink, running water and a bench or table where the tests can be carried out. The equipment for testing should be kept in this room.

Storeroom for finished products

The storeroom should be clean and airy, free from damp and away from direct sunlight. The temperature of the room should be kept as low as possible to maintain the quality of the stored products. The storeroom should be fitted with shelves to allow neat and tidy storage of the processed foods. Processors should regularly test the quality of the stored products and make sure they rotate the stock, selling the oldest stock first.

Other facilities

Some equipment needs to be stored outside the main processing area, but still accessible to the processor. The boiler or steam generator needs to be housed outside the main processing area to avoid contamination of the foods.

Sanitary facilities

All sanitary facilities - changing rooms, toilets and hand washing areas should be kept separate from the processing area to avoid cross contamination.

Small Equipment

In addition to the large pieces of equipment, there are various smaller items, some of which are essential and others that facilitate the process. The following are all optional extras:

- Glaze brushes are used to give a glossy surface to the products
- Table sweeping brushes that are only used to clean the working surfaces
- Hard and soft floor brushes and floor scrubbing brushes are all required for cleaning - Nail brushes for the operators to keep their hands clean
- Table dusting boxes that are used to shake a thin layer of flour onto the table for kneading
- Plastic two gallon buckets and basins that are used for mixing ingredients
- Two dipping forks for decorating cakes
- One funnel that is used to transfer liquids from one container to another
- Various hand whisks that are used as beaters
- Two sets of knives - one set of cutting knives and one of palette knives

- Liquid measures that are used to measure the correct amount of water for dough
- Oven gloves that are used to remove hot trays from the oven
- An oven peel which is a flat shovel made of wood or metal fitted with a long handle that is used to remove goods from the oven
- Two sets of pastry cutters - one fluted and one plain, that are used to cut shapes out of pastry
- One set of dough piping tubes and a piping bag for cake decoration
- Various pots and bowls for holding and mixing ingredients
- Rolling pins
- Two sets of balance scales and weights. A large capacity for weighing big ingredients such as flour and a smaller set for added ingredients such as yeast
- Metal table scrapers for scraping the sides of the mixing bowl
- Three spatulas for stirring and beating small quantities of mixture
- Plastic storage baskets that are large enough to hold 20 x 800g loaves
- Wheeled metal bulk storage bins for ingredients
- Steel baking trays of varying sizes
- Strapped bread tins that are used for baking bread
- Miscellaneous bread tins for speciality breads
- Small tart/cake tins for making small fluted and plain pies and tarts
- Miscellaneous sizes of cake tins and hoops for baking sandwich cakes
- Four sheathed dough thermometers
- Two sugar thermometers (if sugar confectionery is made)
- Four to six waste bins for the safe and hygienic disposal of rubbish
- Wheeled steel racks for the temporary storage of products
- Wheeled steel or wooden double-sized racks for holding cooling bread.

3.- Equipment

Buying bakery equipment requires careful thought to decide what is the best for the individual's specific needs. It is a good idea for buyers to visit trade fairs, manufacturers, equipment retailers and operating bakeries to see the equipment in action. First time buyers should seek advice from experts. Several factors that should be considered when buying new equipment include the following:

- the robustness of the equipment - the simplicity of servicing, cleaning and maintenance - whether the equipment can be repaired locally - what spares must be help - how long it will take to get replacement parts.

There are many different types of equipment available, some of which are essential to the bakery while others are optional, labour saving devices. It is important to think carefully about what is essential and what the plant can manage without.

The following is a guide to the types of equipment available.

Ovens

The oven is the most important (and only real essential) piece of equipment required by the bakery. The type of oven required depends on the size of the operation and type of products being made. Ovens can be purchased from manufacturers, made locally by engineers or built from bricks and clay. They can be heated using electricity, gas or solid fuel.

The oven capacity of a bakery controls the production volume of baked goods. It is important to consider the versatility of the oven to meet the needs of the bakery. The actual running costs of an oven depend on several factors:

- how efficiently the oven space is used with products being baked. Empty oven space becomes a cost to the operation. - planning the production to make the best use of the heat (and cool) of the oven. For example, baking bread first as it requires the hottest temperature and meringues last as they can be baked in a cool oven and left to dry overnight in the remaining heat of the oven.

The following is a description of some of the types of oven available:

Beehive oven

This oven is built from fired brick or clay in the shape of a dome or beehive. It has an open hearth with an opening at the front. A fire is made inside the dome and allowed to burn until the walls of the oven are sufficiently hot. The fire is then removed and the goods are baked using the heat that is retained in the walls of the oven. Once the fire has been removed, the hearth is wiped with a wet rag before the loaves are put in. This cools the surface and increases the humidity of the air. Some skill and experience is needed to judge the correct temperature at which to remove the fire and put the bread in. The capacity is limited by the size of hearth and heat retention properties of the walls. The ovens are suitable for domestic use or small-scale bakeries.

Improved Ghanaian baking oven

This oven is based on the traditional direct-fired dome-shaped oven. It is built with clay fire bricks held together with clay containing salt. The base of the oven is filled with broken glass and salt-containing clay to improve heat retention. It is covered with a layer of fired bricks and clay to make a smooth floor. The outside of the oven is coated in a thin layer of clay and the opening is covered with a moistened sack to prevent charring and to make a good seal. The capacity of the oven is about 100 500g loaves. Adding a shelf can double the capacity and save time and fuel. Baking time is about 20-25 minutes for a batch of 500g loaves. This type of oven is suitable for a small-scale business.

Double oil-drum oven

This is a simple indirect-fired oven that consists of a baking cavity made from two oil drums. One drum is pushed inside the other and is set over a fire box. A chimney is attached to the outer drum and both drums are enclosed in a box that is filled with dirt to insulate the oven. About 15cm of loose sand is placed in the base of the oven to help distribute the heat and prevent burning of the bread. This type of oven is relatively quick and easy to construct. It heats up quickly but only has a small capacity (10-12 500g loaves).

Oil drum and brick oven

This type of oven was designed to allow village bakeries to be established at low cost. It consists of a fire box that is made from a brick wall built on top of a concrete base with a gap at one end for the stoke hole. The ovens are made from a 200 litre oil drum that is cut in half and mounted on steel plates. It is possible to make a larger four-oven construction by using two oil cans. The oven takes about 3 hours to heat up and 20 minutes per batch to bake. Capacity of the double oven is about 18-24 500g loaves per batch. If the four-oven model is used the output can be sufficient for a village bakery. Other baked goods can be made at the end of the bread baking using the heat from the oven cooling down.

Band travelling oven

In this type of oven products are fed in at one end of the oven on a moving belt and pass through the heated section to the other end. The speed of passage through the oven can be controlled to allow for baking of different sized products. These ovens come in a range of sizes and can be linked into a fully automatic plant. These type of ovens are suitable for baking large batches of the same product as they are most efficient to operate when kept full. They are not very good for bakers who make a range of different products in small quantities. The ovens are quite expensive and are better suited to medium to large-scale operations.

The swing-tray oven.

This is a type of travelling oven that operates with the products being fed in on broad swinging trays that hold 3-4 baking trays each. The products emerge from the same opening they were fed into. The temperature and speed of passage through the oven can be controlled to accommodate different sizes of breads.

The rack oven

This type of oven has a simple design and does not take up much space. It is versatile and can bake a variety of goods that need the same temperature. The oven can contain up to 8 racks. The products are wheeled into the oven onto a revolving floor that rotates the trays while they are cooking. Hot air is distributed over and under the trays to ensure the uniform baking of the products.

Other equipment

Flour sifter/sieve

This is a utensil with a mesh of wire or nylon through which the dry materials can be passed to remove and large particles or foreign objects. Although a flour sifter may be viewed as an optional piece of equipment, it is essential as a point of hygiene control as it removes any dirt or foreign bodies from the flour.

Dough mixer

This machine mechanically mixes the ingredients together. It is not essential for very small-scale operations, but for medium to large scale bakeries it is an essential piece of equipment. The best type of mixer is one with a two speed mixer, bowl guard and moveable mixing bowl, plus two spare bowls. Mixers are available in a range of sizes to suit most needs.

Bowl hoist

This is only required by medium to large scale bakeries. Even then, it is often viewed as an optional piece of equipment, but is labour saving and can prevent damage to the equipment and injury to the workers. The hoist lifts the bowl and dough up to the dough divider hopper and refills the hopper, thus preventing the bowl being scratched by knives, which is likely to happen if the dough is removed by hand.

Hand divider

This piece of equipment is useful for small to medium scale bakeries that make small bread rolls. A hand operated dough divider can cut 36 pieces of dough of equal weight to form into rolls. It can be bolted onto a table or fixed on a moveable stand. Each machine is supplied with a steel cutting pan and to enhance throughput, it is recommended that the baker buys two spare pans. This type of machine is very simple to operate and to clean.

Dough divider

This is a piece of equipment designed for larger bakeries. It can automatically divide the bulk dough in the hopper into equal pieces using the principle of mechanical suction. It can cut dough into various sized pieces, from 200g up to 2000g at an hourly rate of between 750 and 1800 pieces. Care must be taken to ensure the divider is properly cleaned and greased with vegetable oil after use.

Conical ball moulder

This moulder is sometimes known as the umbrella moulder. It quickly moulds the cut dough pieces into ball shapes and passes them on to the prover. In some models the moulder and prover are combined in one machine. Without the moulder, the dough balls are moulded by hand.

Interim prover.

This is a cabinet into which steam and heat can be applied and in which the bread and rolls are proved prior to baking. The main purpose of the interim prover is to rest the moulded dough pieces. In the combined machine, the moulded balls pass into the prover where they rest for a set time depending on the size. The provers are available in a range of sizes and fitted with temperature and humidity controls. They also have ultraviolet lights that help control bacteria.

Final moulder

This machine gives the dough a final mould before it is placed in the tin or on trays.

Final prover

This is a chamber into which racks of fermented products can be wheeled to rest until they have risen to the size required for baking. They vary in size according to the production

volume. The prover has a heater and steam unit that keep the chamber at 35-43°C with a humidity of 85%.

Upright planetary mixer

This is an upright mixer that is used for making cake batters, fermented doughs, confectionery and for whisking creams. They are available in a range of sizes, from the table model to large floor-based machines. Most machines have two detachable bowls of different capacity and a whisk, dough hook and beater.

Pastry brake

This machine can be either mechanical or hand operated. It is used for rolling out pastry or dough into sheets. The dough is passed back and forth through two revolving rollers until it is the desired thickness. The main advantage of this machine is that it produces sheets of consistent thickness each time it is used.

Generator

In areas where the electricity supply is erratic, expensive or non-existent, it makes sense to have a generator and/or solar heating panels.