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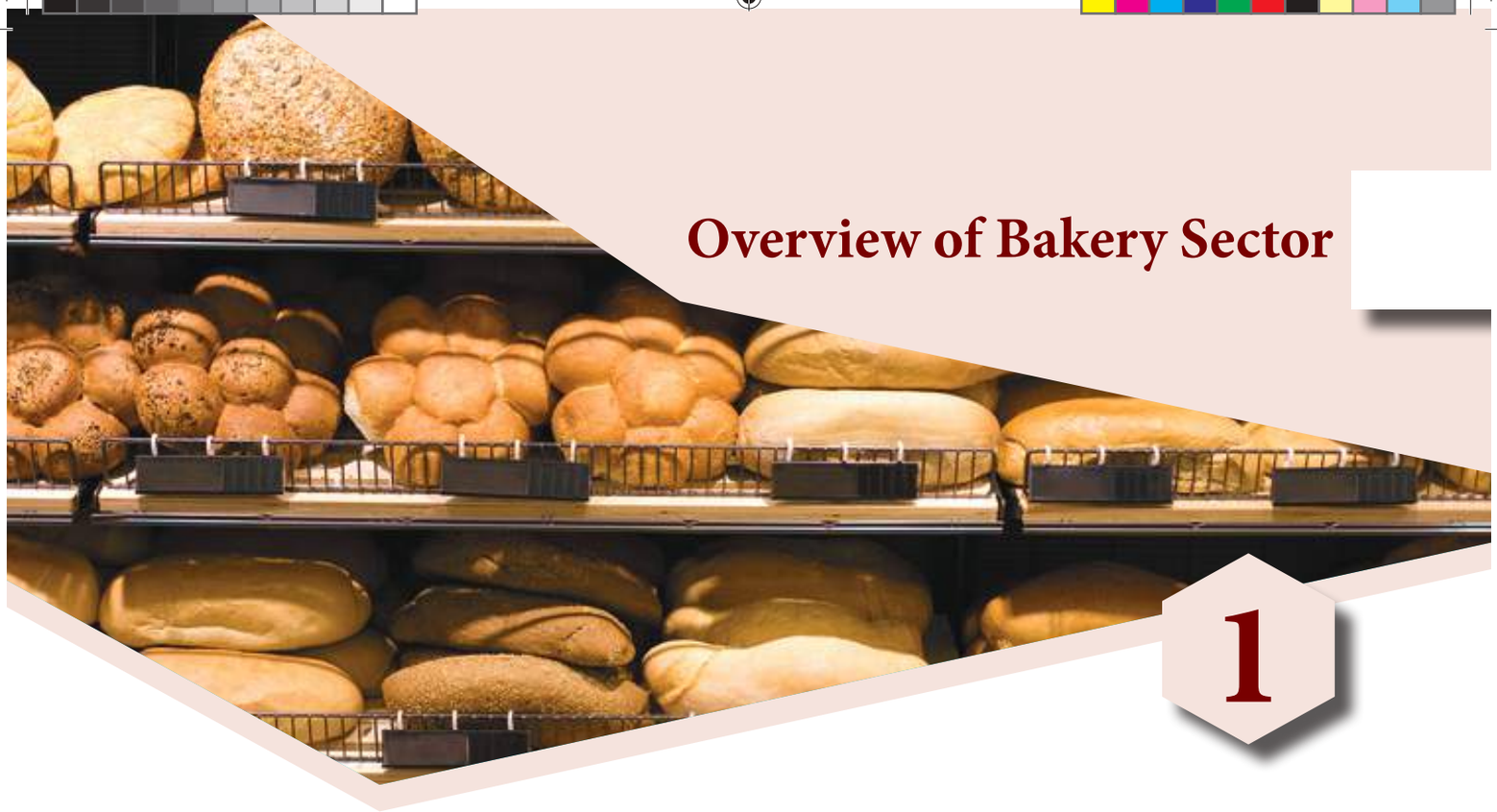

Overview of Bakery Sector

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Learning Outcomes

- Describe the importance of bakery sector.
- Identify the tools and equipment used for making bakery products.
- Knowledge of the preparation process.
- Identify the raw material (ingredients) used in bakery.

Introduction

Bakery products, due to high nutritive value and affordability, are an item of huge consumption. Due to the rapid population increase, the rising foreign influence, the emergence of female working population and the fluctuating eating habits of people, all have gained popularity among people, contributing significantly to the growth trajectory of the bakery industry. Bakery holds an important place in food processing industry. With regard to bakery products, consumers are demanding newer options, and the industry has been experiencing fortification of bakery products in order to satisfy the burgeoning appetite of the health-conscious Indian. A number of healthy products have been launched in the bakery segment, and are gaining popularity at a high rate. The mounting presence of bakery chains has further triggered the growth in the sector.

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Definition:

Baking is the cooking of food by dry heat in an oven in which the action of the dry convection heat is modified into steam. The dry heat of baking changes the form of starches in the food and causes its outer surfaces to brown, giving it an attractive appearance and taste. The browning is caused by caramelization of sugars. When baking, consideration must be given to the amount of fat that is contained in the food item. Higher levels of fat such as margarine, butter or vegetable shortening will cause an item to spread out during the baking process.

Bakery (or baker's shop) is an establishment which produces and sells flour-based food, baked in an oven such as bread, cakes, pastries and pies, etc.

Baker is someone who make, bake and sells breads, rolls, biscuits or cookies, and crackers using an oven or other concentrated heat source. The place where a baker works is called a bakery.

Importance of Bakery Products in Our Daily Life

- People of all ages are affectionate towards different bakery products, because of their taste, colour and easy to digest nature. They eat and serve different bakery products in their parties and festivals. Celebrating any moment of happiness is incomplete with bakery products.
- Bakery products are becoming prominent day by day. They are very popular because of its taste and simple to digest. Bakery items are usually loved by all. Nowadays individuals have virtually no time to invest much on making breakfast, it is the bread and bun or biscuits which had occurred instead of other sorts of stuff. Honouring any time of pleasure is incomplete with bakery items.
- They are good supply of snacks and therefore are broadly available. Bread may be the essence of bakery items. Without bread, no bakery items are complete. It is made by baking dough of flour and water. Adding bread to veggies, butter, fruits and spices or herbs constitutes a perfect mixture of sandwiches. Bread includes white and brown bread. Delicious cakes, pastries, pizzas and burgers are the choice of next-generation. Well, take the example of your morning tea, won't you miss the taste of tea or coffee without crunchy biscuits?
- There are numerous varieties of bakery products like, cakes, biscuits, brownies which are popular worldwide. Bakery

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products serve the best principle and all products are hygienic made of fruits, flour, nuts, honey, eggs, flour, sugar, flavours for taste, and colours for look.

- Cakes are typically the most popular bakery items. The moment one listens to the title of cake or chocolate mouth is stuffed with water. Cake serves the objective of honouring pleasure and happiness. Cakes refer to round, flat, unleavened breads, which were cooked on the hot stone. Which is made from chocolates, vanilla, strawberry, sugar and eggs. Even cake also provide wide selection which includes Rum, Cream Cheese Coffee Cake, Boston cream cake, Carrot Cake, Chocolate Almond Torte, Chocolate Blueberry Cake, Chocolate Meringue Cake, Coconut Cake, Orange Chiffon Cake, etc.,. If birthday is incomplete without cakes then snacks without snacks isn't good. Both cakes and snacks complement one another.
- One more benefit of bakery products is time saving. By serving bakery products to sudden unexpected guests, homemakers save their time and prove their homely skills. It does not require much time in preparing meals, if you have ready-made breads or buns at home. Their durability, taste, and eye-catching appeal make the product famous.
- Bakery products are used on a daily basis and are liked by all. Whether it is for any special occasion or not, bakery products due to their sweetness and attractive colours fills the air with sweet aroma of love.

1.1.1 Baking Process

Baking is a process of a dough or batter as it bakes. And are basically the same in all baked products, from breads to cookies and cakes.

The seven stages in the baking process are as follows:

1. Formation and expansion of gases

The gases primarily responsible for leavening baked goods are carbon dioxide, which is released by the action of yeast and by baking powder and baking soda; air, which is incorporated into doughs and batters during mixing; and steam, which is formed during baking.

Some gases, such as carbon dioxide in proofed bread dough and air in sponge cake batters are already present in the dough. As they are heated, the gases expand and leaven the product. Some gases are not formed until heat is applied. Yeast

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and baking powder form gases rapidly when first placed in the oven. Steam is also formed as the moisture of the dough is heated.

2. Trapping of the gases in air cells

Gases are formed and expand; they are trapped in a stretchable network formed by the proteins in the dough. These proteins are primarily gluten and sometimes egg protein. Without gluten or egg protein, most of the gases would escape, and the product would be poorly leavened. Breads without enough gluten are heavy.

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3. Gelatinization of starches

The starches absorb moisture, expand, and become firmer. This contributes to structure. Gelatinization of starches begins at about 140°F (60°C).

4. Coagulation of proteins

Like all proteins, gluten and egg proteins coagulate or solidify when they reach high enough temperatures. This process gives most of the structure to baked goods. Coagulation begins when the temperature of the dough reaches about 165°F (74°C). Correct baking temperature is important. If the temperature is too high, coagulation starts too soon, before the expansion of gases reaches its peak. The resulting product has poor volume or a split crust. If the temperature is too low, the proteins do not coagulate soon enough, and the product may collapse.

5. Evaporation of some of the water

This takes place throughout the baking process. If a baked product of a specific weight is required, allowance must be made for moisture loss when scaling the dough. For example, to get a 1-lb loaf of baked bread, it is necessary to scale about 18 oz dough. The percentage of weight loss varies greatly, depending on such factors as proportion of surface area to volume, baking time, and whether the item is baked in a pan or directly on the oven hearth.

6. Melting of shortenings

Different shortenings melt and release trapped gases at different temperatures, so the proper shortening should be selected for each product.

7. Crust formation and browning

A crust is formed as water evaporates from the surface and leaves it dry. Browning occurs when sugars caramelize, starches and sugars undergo certain chemical changes caused by heat. This contributes to flavour. Milk, sugar, and egg increase browning.

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Baking Methods:

Three Baking Methods can be identified.

- Dry Baking:when baking, steam rises from the water content of the food;this steam combines with the dry heat of the oven to cook the food, e.g. cakes, pastry, baked jacket potatoes.
- Increased Humidity Baking: when baking certain foods, e.g. bread the oven humidity is increased by placing a bowl of water or injection steam into the oven, thus increasing the water content of the food and so improving the eating quality.
- Bain Marie: when baking, place food in a container of water (bain marie) which modifies the heat so that the food cooks more slowly, does not overheat or overcook.

1.1.2 Overview of bakery Industry

The bakery sector comprises the largest segment of the food processing sector in India and offers huge potential for growth. In India there are more than 2,000 organised or semi-organised bakeries producing around 1.3 millions tonnes of the bakery products and 1,000,000 unorganised small-scale bakeries producing 1.7 millions tonnes. Bread and biscuits are the most popular bakery items and account for 80% of the total market. Not surprisingly, India is the world's second-largest producer of biscuits after the USA. The bakery industry has achieved third position in generating revenue in the processed food sector. The market size for the industry was estimated to be worth US$ 7.6 billion in 2015. Bakery products are an item of mass consumption in view of their low price and with rapid growth and changing eating habits of people, bakery products have gained popularity among masses. Trends in baking continue toward lighter, healthier products, and those containing allergen-free, organic, and whole-grain ingredients. Interest in inclusions and fortification continues to increase among consumers of baked goods. They include fibre, antioxidants, omega-3 oils, and vitamin and mineral fortifications. The addition of inclusions to baked products requires modifications to the original product formula, thus creating a new product from an existing one. Such modifications can be challenging to bakers as changes in formulation may result in the need for changes to equipment, processes and ingredient costs. The use of whole and alternative grains and grain products continues to drive new product development. In response to the demand for products that are free from gluten and other allergens, baked goods using flours made from buckwheat, quinoa, millet, amaranth, flax, corn, rice, sorghum, wild rice, and other non-wheat

grains remain a popular trend in baking. These flours offer tastes and textures that are uniquely different from wheat flours, which also serve the trend toward more types of artisan and handcrafted breads. Commercial bakeries that produce gluten-free products must maintain strict sanitation standards to avoid contamination if products containing gluten are also produced in the bakery. Key issues that the industry is facing include the need for improvements in hygienic practicesas well as technology apart from availability of skilled manpower at all levels of bakery operations. The lack of technology and upgradation in manufacturing and packaging has been a factor affecting industry growth. Most of Indian bakeries are either manual or semi-automatic. Increased competition and changing customer choices have induced bakery operators to look for sophisticated baking equipment and technology to sustain growth and improve standards. Bakery skills are in strong demand in the bakery and hospitality industries. The sector reports a strong need for more training institutes which can produce skilled workers who are knowledgeable not only about the trade but are also competent in implementing the food safety and hygiene requirements prescribed in the country's food laws.

1.1.3 Categories of Bakery Products

Bakery products are the easy, readymade food items which are easily available on demand. These are available from long time but now the liking of these items is rapidly increasing. In the present era there is large number of bakery products available in the market. The popular bakery products are being classified as under:

1. Bread

In modern days bread is becoming one of the most essential food item in human diet, due to its readymade availability and high nutritive value. It is the most consumable wheat-based bakery products. It is the most popular breakfast item in almost every family. It is also easy to manufacture and also cheap as compared to other bakery products. Mainly wheat flour is used to prepare it.

Bread is a very old bakery product. The history of bread starts with Neolithic age and marches through time according to ingredient availability, advances in technology, economic conditions, sociocultural influences, legal rights and evolving tastes. The earliest breads were unleavened. Variations in grain, thickness, shape and texture varied from culture to culture.

2. Biscuits

Biscuits are the important items of Bakery industry. It has now become a common item of consumption among all classes of the community. With tea or Coffee, a biscuit makes a tasty nutritious snack. This highly nutritious and easy to digest product can be preserved for a long time. It is within the reach of even lower-class people. It is available on small shops at all places. It is the most common snack used by all the people. Biscuit is made of simple wheat flour, sugar etc. By varying the ingredients and flavours it is possible to produce a variety of biscuits. About 50 percent of the total biscuit production in our country is of glucose. It is highly demandable product. It is liked by the people of all age-groups. It is available in all rates, Cheap as well as costly. Its demand is continuously growing. These are easily digestible item. The plant and machinery used in making biscuits is not heavy and expensive. Biscuits are found in both sweet and salty tastes.

Biscuits also have very old history but these are not as old as bread. Biscuits are found in all shapes such as square, circled, rectangle etc. Due to their increasing demand, there is a bright scope for new entrants as well as for existing manufacturers. The major brands of biscuits are Britannia, Parle, Bakemen, Priya Gold, Elite, Cremica, Dukes, Horlicks, etc. In addition of these brands. There are also a large production of this item is manufactured by the units having no brand in the area of the study.

Bread is also a raw material of many other Bakery products. Wheat flour, yeast, sugar, salt, water and shortening agent are required as raw materials to manufacture bread. The plant, machinery and the technology required to manufacture the bread, are completely available in India. Since the consumption of Bread is increasing rapidly day by day, the demand also is increasing enormously.

The production of bread is estimated at 11.5 lac tonnes per annum. In this sector 25-30% of the production is from organized sector units. There is a lot of scope for introducing anti-diabetic bread or breads of high/low calories and so on. The major players in the bread industry that hold about 80% of the market share are Britannia and Modern Industries Ltd.

3. Cake

Cake is a new bakery product compared to the other bakery products. It was earlier famous in the Western countries but now becoming popular in other parts of the world too. In the olden times it was considered the rich men's item and mostly famous among Christians. But with modernization, it is gaining popularity among all the communities. It is a perishable product made of wheat flour, cream, gel, sugar and milk. It is of two types viz egg cakes and fruit cakes. Egg is mostly used in this to make it fluffy. Egg cakes are more perishable than fruit cakes.

Cakes are used in all parties and on all happy occasions. Mostly the young generation has developed the taste of this item. But the use of cakes is mostly confined to urban areas. These are not very popular in rural areas due to its low accessibility. It is not available everywhere except big bakeries. Plant and machinery used in preparing cakes is expensive and needs good investment. Its scope is increasing in India also.

4. Patties

Patties are the bakery product made of wheat flour and other vegetables. It is the most common bakery product these days which can easily satisfy the hunger of a person as it is easily available everywhere on bakers and confectioneries. It is salty in taste and is found in many types such as simple potato patty, vegetable patty, cheese patty, mushroom patty, non-veg. patty etc. Egg is added to its flour to make it crispier. It is baked in ovens. It is a perishable food product and losses its taste another day. It is triangular as well as square in shape. It is widely popular item and is liked by the people of all ages especially by the young generation. They use to take it in their meals as well as in refreshment. There is large market for this bakery product because, it is reasonable in price and can be afforded by every middle-class people. It is mostly available in urban areas and rural people hardly get it to use.

5. Pastries

This bakery product is sweet in taste and is a highly perishable food product. Its taste is very much similar to the cream cakes and is found in small pieces. It is made with wheat flour, cream, sugar, fruit flavours, chocolates etc. It is very sensitive bakery product and needs cool place to preserve. It is made in fruits flavours and chocolate flavours and is made similar to cakes. Its taste remains good only for one or two days after it is manufactured. In winters it can be preserved for two- three

days but in summer season it starts losing its taste the next day as cream, a milk product is used in preparing it. Pastries are mostly found in rectangle and triangle shape. Being a bakery product of the western countries, it is now becoming popular in our country also. Children, youths and even the adults have developed the taste for the pastries. It is available at reasonable price. But the main drawback is that it is not easily available in rural areas due to its early perishable nature.

6. Burger

Burger is a salty bakery product. It is highly nutritious and hunger satisfy product. A person can satisfy his hunger by consuming this product. It is made of buns and various vegetables. Burger is a readymade product available immediately on demand and it needs less time to prepare. It is baked in ovens and packed in silver foils. Before eating these are again reheated in microwave ovens. Burger is also a perishable product and become stale after some time, but it is less perishable than other milk bakery products like pastries, cakes etc. These are round in shape and comparatively simple to prepare. This fast food is made up of two buns made of wheat flour. One bun is put at the bottom and in between mixed cooked and raw vegetables are put and then the other bun is put at the top. Since the bread is dry, to make it moist certain type of sauces / butter or cheese is placed in between the buns. These things are attached with a thin stick and are baked at a high temperature in microwave. It is consumed in all weathers. Burgers are in demand at a large scale from earlier times but in the present time their demand is increasing rapidly day by day.

7. Pizza

Pizza is a round shaped bakery product. It is salty in taste. It is the most common fast food popular among the people especially the youths and the children's. It is made in many flavours, such as cheese pizza, onion capsicum pizza, mushroom pizza etc. It needs various raw materials to prepare it. It is prepared on pizza base pasting tomato sauce on it and adding vegetables, cheese, mushroom, spices sauce etc. It is light in taste and has high calorific value. It is also baked in ovens at a high temperature. Pizza is a highly perishable product and is preserved very carefully. It is a new bakery product in India which was earlier popular only in foreign countries. Due to advent of the foreign culture pizza is also becoming the taste of the youths and the children's.

8. Rusk

Rusk is the bakery product which is made of wheat flour and suji. It is light sweet in taste and is consumed as snacks with tea and milk. Its preparation process is very simple. It can be preserved for a long period of time i.e. upto 2 to 3 months. Rusk is very old product in our country.These are very cheap bakery product and even poor people can afford to consume it easily. These are popular in urban as well as rural areas.

9. Namkeen

As its name suggests namkeens are salty in taste and are found in different flavours. Some namkeens are also salty as well as sweet or sour in taste. These are very old bakery products and consumed on large scale all over the country. It is not very much perishable and can be preserved for 2 to 3 months. It is simple to prepare and is a mixture of many different items. The more items are added to the mixture, the more its taste increases. Its taste depends upon the quality and the freshness of the material used in it. The market for namkeen is very wide from very early days in our country and it is increasing day by day. There is a good scope for the producers in this field due to growing demand of this item.

10. Sandwich

Sandwich is a new bakery product in our country. Earlier it was famous only in foreign countries. It is very simple food item with high calorific value. Only few spices are used in preparing Sandwiches. It is a good accessible item in urban areas and can satisfy the hunger to a large extent. It is salty in taste. It is a readymade product which can be prepared in very less time and not much appliances are needed to manufacture it. Sandwich is a perishable product and becomes very quickly stale due to the presence of cream in it. It is triangle in shape. Bread, cream, butter

and vegetables are needed to manufacture it. It is packed in thin plastic, transparent sheets and is consumed in all types of weather. It needs a moisture free place for its storage.

Sandwich is gaining popularity among the children, youths, adults and even the old-age people as it is not very spicy. It is a moderately priced product and can be consumed by middle class families too.

1.1.4 Roles and Responsibilities of Baking Technician:

- Prepares, produces, and bakes breakfast pastries, breads, rolls, and some desserts.
- Develops new products for a la carte or menus on a rotating basis.
- Decorates baked goods, such as cream pies, using a pastry bag.
- Sets time and speed controls for mixing machines, or blending machines, so that ingredients will be mixed or cooked according to the instructions.
- Measures or weigh flour or other ingredients to prepare doughs, fillings, or whipped cream, using scales or containers.
- Prepare garnishes as needed for baked goods.
- Maintains adequate supply of all prepared products on hand and ensures the proper storage and refrigeration.
- Keeps spoilage/waste to a minimum by ordering and utilizing proper quantities and rotating products.
- Lines up baked products in mobile carts according to the needs of the particular outlet or function.
- Utilizes any and all leftovers into usable products.
- Cleans, breaks down, and puts away all baking equipment including: ovens, mixers, proofer, floors, freezer, and refrigerators, etc.,

Baker Qualifications/Skills:

* *Demonstrated knowledge of skill in ability to safely and effectively operate standard foodservice equipment*
* *Adaptability*
* *Decision-making*
* *Oral communication*
* *Self-motivated*
* *High energy Level*

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* *Multi-tasking*
* *Planning, problem solving, and teamwork*

Education, Experience, and Licensing Requirements:

* *High school or diploma*
* *Minimum two (2) years of baking experience*
* *Current SERVSAFE certification or has successfully completed a sanitation course within the past year*
* *Associate's degree in hotel or institutional food preparation preferred*
* *Current food handler's card and other certification as required by federal/state/local law*

1.2 Tools and equipment used in bakery unit

The food service industry have these 13 essential pieces of equipment to set up a bakery:

1. Mixers

Mixers are the foundation of a productive bakery. A large dough mixer, an emulsion blender with whisk attachments, and countertop mixers are typically considered necessary.

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2. Oven

Different bakeries will have different ovens depending on what they plan to make. Stone deck ovens create amazing hearth breads, and convection ovens are good for cakes and cookies.

3. Dough proofer

Proofers make the dough-rising process simple, by optimizing heat and humidity. Dough is uniformly proofed, which streamlines the production process.

4. Bakeware

Quality bakeware is essential because it is used heavily each day. Cutting costs early may result in bakeware that dents or breaks easily. Always look for quality bread pans, muffin tins, cake pans, etc.

5. Small wares

In addition to necessities like spatulas, spoons and mixing bowls, you'll also need pastry knives, icing tips and flour sifters. It's wise to make a list so nothing is forgotten.

6. Dough sheeter

Planning to open a pastry shop? Rolling out dough by hand is time consuming. A dough sheeter can standardize the process and save tons of time.

Notes

7. Bread slicer

Planning to offer fresh breads? Many patrons will want the option to have it cut. If bread is your business's focus, a bread slicer is a necessity, as it will allow you to quickly cut uniform slices for easy packaging and sale.

8. Sheet pan racks

All those delicious baked goods you'll be making need space to cool. Research the wide range of sheet pan racks available to match your space / capacity needs.

Notes

9. Dry storage Rack

Dry ingredients are the foundation of many baked goods. Proper storage is essential for ingredients like flour or sugar.

10. Refrigerator

Eggs, milk and cream are key ingredients in many baked products. Make sure they are safely stored in the correct refrigeration unit.

Notes

11. Doughnut fryer

Want to be part of the current designer doughnut. Doughnut and funnel cake fryers are necessary to create those sugary, tasty treats no one can resist.

12. Display case

Visibility of products is essential for any bakery's for tantalize customers, as they walk in the front door with a quality glass display case to showcase all your baked goods.

13. Wood Top Work Table

A wood top preparation table is the best surface for bakers to refine their craft. Ideal for kneading dough, flouring, and other various preparation tasks.The wood top can be a baker's best friend when working.

1.3 Baking Ingredients Categories and its functions

Baking ingredients categories

- Flour
- Sugar
- Fat
- Eggs
- Milk
- Shortening agent
- Leavening agent

Flour

Wheat is the most common type of flour used in bread baking. It includes all-purpose flour, bread flour and whole wheat flour. Wheat is rich in gluten, a protein that gives dough its elasticity and strength. When yeast and flour are mixed with liquid and then kneaded or beaten, the gluten forms and stretches to create a network that traps the carbon dioxide bubbles producedby the yeast. Recipes with whole wheat flour have less gluten and make denser loaves. That's why these recipes generally require some all-purpose flour which increases the gluten and makes lighter, taller loaves.

Sugar

In any given recipe, sugar is performing a number of functions you're probably not aware of. For one, it adds texture, like keeping your baked foods soft and moist. It is also yet another

leavened, though working in conjunction with fat, eggs, and liquid ingredients. Sugar sweetens by the sugar caramelizing in the recipe, and adds that "crunch" to the crusts of cakes and cookies.

Fat

Butter, margarine, shortening or oil add flavour and make bread tender and moist. Fat slows moisture loss, helping bread stay fresh longer. Fat is heated with liquid.When using Rapid rise yeast. Do not substitute oil for margarine/shortening unless the recipe calls for it.

Eggs

Eggs do a lot in baking, but most importantly they're a leavening agent (adding volume), and are a binder, meaning they keep the finished product together. You can use the whole egg, for flavour, binding, thickening, or glazing, or you can use egg whites and egg yolks for separate things. Egg whites are a drying agent, and add moisture and stability. Egg yolks contribute to texture and flavour. Eggs add food value, colour and flavour to breads. They also help make the crumb fine and the crust tender. Eggs add richness and protein. Some recipes call for eggs to be used as a wash, which adds colour.

Milk

The protein in milk softens, contributes moisture, and adds colour and flavour to baked goods. It's a double-whammy in terms of function, as it gives the dough or batter strength and structure, as well as adds tenderness, flavour and moisture.

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Shortening agent

Shortening is just 100%, solid fat made from vegetable oils, almost exclusively used in baking. When you use shortening instead of butter in baking, you'll get a softer and more tender, though taller and less flavourful, product.

Leavening agent

Leavening agent substance causing expansion of doughs and batters by the release of gases within such mixtures, producing baked products with porous structure. Such agents include air, steam, yeast, baking powder, and baking soda.

Advantages of Bakery Sector:

* *A wide range of savoury and sweet foods can be produced*
* *Bakery products yield appetizing goods with eye-appeal and mouth-watering aromas*
* *Bulk cooking can be achieved with uniformity of colour and degree of cooking*
* *Baking ovens have effective manual or automatic controls*
* *There is straightforward access for loading and removal of items*

Disadvantages of Bakery Sector:

* *Requires regular attention*
* *Ovens are expensive to heat*

Practical Activity

Visit a nearby bakery unit for understanding the various production and bakery products.

1. Bread roll

Objective:

To know how to prepare the bread roll

- The world's oldest oven was discovered in Croatia in 2014 dating back 6500 years ago. The Ancient Egyptians baked bread using yeast, which they had previously been using to brew beer. Bread baking began in Ancient Greece around 600 BC(BCE), leading to the invention of enclosed ovens.
- The first bakery invented on July 7, 1928, a bakery in Chillicothe, Missouri introduced pre-cut bread using the automatic bread-slicing machine, invented by Otto Frederick Rohwedder. While the bread initially failed to sell, due to its "sloppy" aesthetic, and the fact it went stale faster, it later became popular.
- Most would think first of ancient Egypt where it is believed bread was first baked around 17,000 BC (BCE). And yet there is evidence to show that grindstones in Australia were used to turn seeds to flour 30,000 years ago."
- It is believed that the first actual birthday cake was made in Germany in the Middle Ages. The Germans would celebrate children's birthdays with cake, calling the celebration Kinderfest. Cakes originally were a course, bread-like product, and later became a much sweeter version, called Geburtstagorten.

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Ingredients:

1. Flour	200 gm
2. Yeast	5 gm
3. Salt	2.5 gm
4. Sugar	5 gm
5. Oil	10 ml
6. Egg	1 no.
7. Poppy seeds	to sprinkle

Procedure:

1. Weigh all the ingredients as per the recipe formula.
2. Sieve flour with salt.
3. Dissolve yeast, with sugar and 5 gms flour in 30 ml of Luke warm water and leave it in warm place for15 minutes to prepare a flying ferment.
4. Add flying ferment to flour and knead well into soft and pliable dough using oil.
5. Cover the dough with a wet cloth and leave in a warm place for first proving for about 20 minutes.
6. Knock back the dough and divide the dough into eight pieces.
7. Round each piece and mould into fancy shapes.
8. Place on a greased baking sheet leaving sufficient space for expansion.
9. Allow to rise until double in size in a proving chamber.
10. Apply egg wash using a pastry brush and sprinkle poppy seeds.
11. Bake at 210° for 10-12 minutes.
12. Remove from oven and place on a wire rack to cool properly.

2. Sweet Buns

Objective:

To know how to prepare the Sweet Bun

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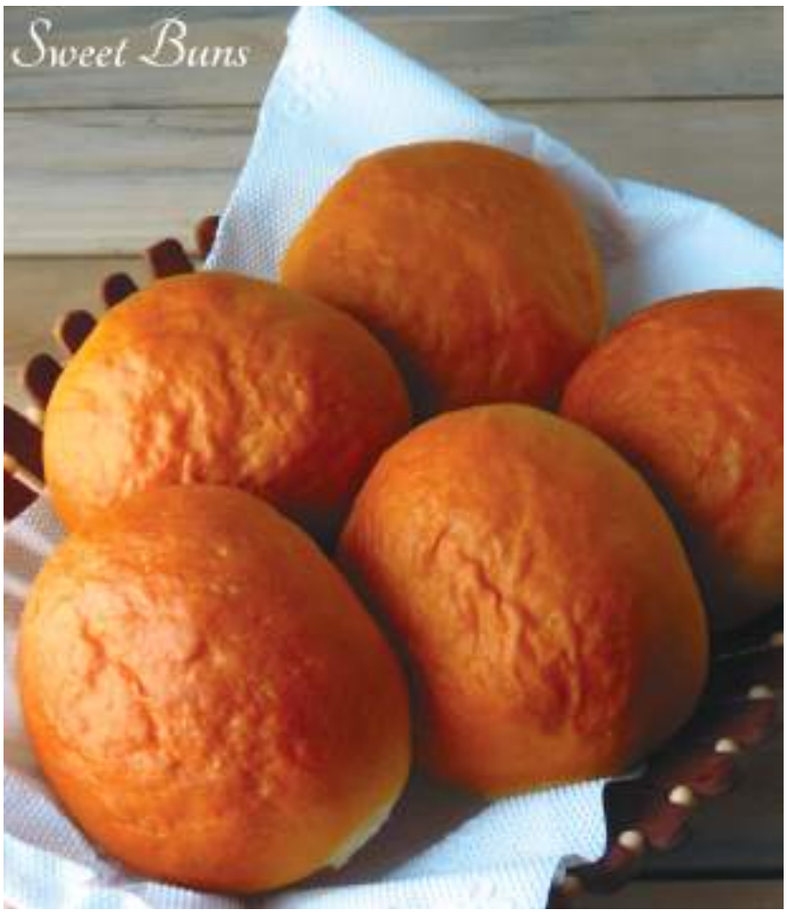

Ingredients:

1. Flour	200 gms
2. Yeast	40-60 gms
3. Egg yolk	240 gms
4. Malt or corn syrup	60 gms
5. SMP (Skimmed milk powder)	80 gms
6. Lemon essence	10 ml
7. Vanilla essence	10 ml
8. Water	1000 ml
9. Salt	30 gm
10. Sugar	300 gm
11. Shortening	240 gm
12. Jam For filling	

Procedure:

1. Sieve flour with salt.
2. Prepare yeast ferment with yeast, sugar and little flour.

3. Add yeast ferment, and rest of the ingredients in flour and mix.
4. Prepare soft pliable dough.
5. Leave it in warm place for first proofing.
6. Knock back the dough and let it relax for 30 min, now the dough is ready for make up into fancy shapes. 7. Scale the dough into 30gms Pieces.
7. Round up pieces, dip in coarse granulated sugar and place on bun trays about two inches apart.
8. Then make an indentation in the center of each bun and fill it with jam.
9. Complete proofing and bake 210°.
10. Brush with warm jam immediately after baking.

03. Chart Depicting the categories of bakery products

1. Biscuit

Composite flour

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Mixing of dry ingredients (flour, sugar, milk powder, baking powder and salt)

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Addition of eggs and water

↓

Dough Dough Kneading

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Dough Rolling

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Greasing of tray (with margarine)

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Dough Cutting Cutting

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Preheating of Oven (200°C for 10 min)

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Baking (200°C for 25 min)

↓

Cooling of biscuits (5-10 min)

↓

Biscuits

↓

Packaging

↓

Storage

04. Identification of tools and equipment in bakery classroom through physical demonstration and audio-visual aids.

05. Sensory Evaluation of Various ingredients used in baking

a. Taste

b. Touch

c. Smell

d. Sight

06. Flour Testing:

a. Gluten Development

b. Water Absorption Power

Glossary

Bake	:	Cook with dry, radiant heat in an oven.
Batter	:	A mixture of flour, eggs, dairy, or other ingredients that is liquid enough to pour.
Beat	:	Stir together very rapidly in order to incorporate air. This can be achieved with a spoon, whisk, electric mixer, or food processor.
Blend	:	Stir ingredients together until well mixed.
Caramelize	:	Heat a sugar substance until it begins to turn brown.
Combine	:	Stir ingredients together just until mixed.
Cream	:	Beat together sugar and butter until a light, creamy texture and colour have been achieved. This method adds air to the batter, which helps the leavening process. Sometimes eggs are also added during the creaming step.

Knead	:	Combine dough by hand on a hard surface. This involves folding the dough over, pressing down, turning 90 degrees and then repeating the process. Kneading mixes the dough as well as developing gluten strands that give strength to breads and other baked goods.
Proof	:	Allowing bread dough to rise or yeast to activate.
Whip	:	Stir briskly with a whisk to incorporate air.
Whisk	:	A kitchen tool made of wire loops that tends to add air as it mixes substances together.
Double – Whammy	:	with the heat-wave and the electricity breakdown problems, Indians were hit with a double whammy this summer.

Evaluation

I. Choose the correct answer (1 Mark)

1. _____ is the most popular Breakfast item in in almost every family

   a. Cake b. Bread

   c. sandwich d. Biscuits

2. Breads without enough_____ are heavy.

   a. Starch b. Gas

   c. butter d. Gluten

3. _____ make the dough rising process simple by optimizing heat and humidity

   a. Mixers b. Oven

   c. Dough proofer d. Dough sheeter

4. Coagulation Begins when the temperature of the dough reaches about

   a. 165°F b. 162°F

   c. 145°F d. 160°F

Notes

5. _____is the very simple food item with high calorific value.

   a. Pizza b. Patties

   c. sandwich d.rusk

6. _____ are the foundation of a productive bakery

   a. mixers b. Oven

   c. dough proofer d. Bread slicer

7. The most common type of flour used in bread baking is_____

   a. rice b. Ragi

   c. bajra d. wheat

8. _____ add food value,colour and flavour to breads.

   a. milk b. Fat

   c. egg d. butter

9. Gelatinization of starches begins at about _____

   a. 142°F b.140°F

   c. 141°F d. 140°F

10. _____ is a nutritious and hunger satisifiable product.

    a. Pastries b. Burger

    c. namkeen d. Pizza

II. Write in two lines **(2 Marks)**

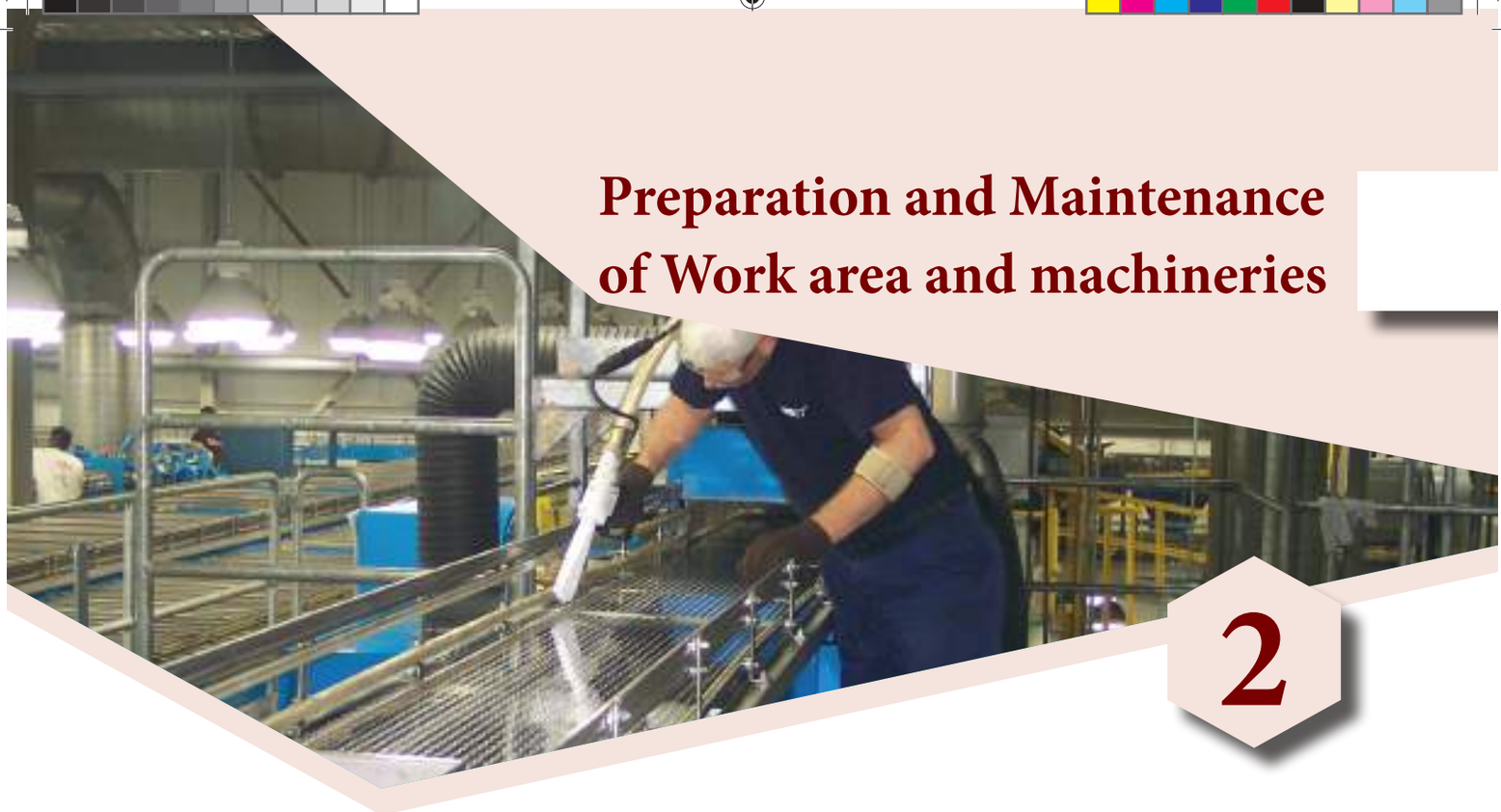
1. Define Baking
2. Define Bakery
3. Define Baker
4. Instead of butter which one is used in baking?
5. What is the role of milk in baking?
6. Why is bread becoming the most important food item in the human diet?
7. Which one is the readymade product available immediately on demand? and How is it made?
8. Write a short note on sandwich
9. What are the ingredients used in the bakery products?
10. Enumerate the role of gluten present in the wheat flour
11. Why do recipes with whole wheat flour require some all-purpose flour?

Notes

12. What are methods used in baking?
13. What is meant by the baking process?
14. The bakery product is mostly liked by the young generation which is used in the parties? Identify that product and give brief notes
15. Which bakery product has high calorific value?

III. Write in three lines (3 Marks)

1. Suresh wants to be the baking technician, tell him about the baking technician's rules and responsibilities
2. Explain in details about the baking ingredients categories and its function
3. Biscuits are the important items of bakery industry- Explain it
4. Ram wants to start a new bakery unit. Tell him the tools and equipment used in the bakery unit.
5. What are the advantages and disadvantages of the bakery sector?
6. Explain in details about any five bakery products



Preparation and Maintenance of Work area and machineries

2

- Describe the importance of personal hygiene and sanitation of the baking technician.
- Prepare work area and equipment for baking in oven.
- Utilize materials and equipment for cleaning and maintenance of the work area.
- Maintain work areas, machines and tools.

Learning Outcomes

Introduction

Hygiene and sanitation are very important in any food industry. Hygiene is a set of practices performed to preserve health. According to the World Health Organization (WHO), "Hygiene refers to conditions and practices that help to maintain health and prevent the spread of diseases. The word hygiene derived from Greek word "HYGEIA" meaning the" goddess of health".

Concept of Hygiene

Concept of hygiene is related to medical, personal and professional practices and to most aspects of living. Maintaining hygiene is important in controlling and reducing spreading of disease and outbreak of unwanted health hazards. Hygiene practices are implemented for maintaining health and safety of people. Introducing good hygiene practices in day to day life are considered to be good habits by a society while the neglect of

Notes

hygiene can be considered disgusting, disrespectful or even life threatening.

Importance of Hygiene

Hygiene plays a vital role in promoting and protecting the health and well-beingof hundreds of people. The food, material and equipment are subject to constant handling by people at every stage of food production and service, therefore helps in maintaining mental, social and physical well being

2.1.1.Personal hygiene and sanitation

Personal hygiene refers to all conditions and measures necessary to ensure the cleanliness of a person's clothes and body. Otherwise Personal hygiene refers to maintaining the body's cleanliness.

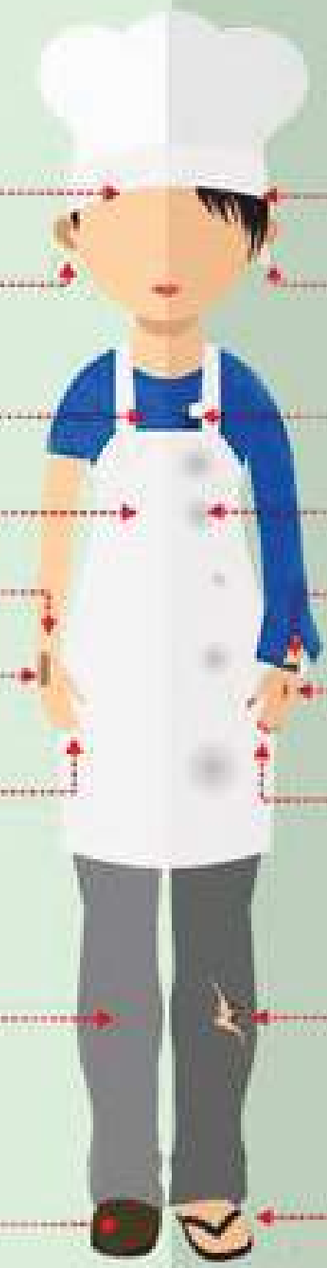
Sanitation comes from the Latin word Sanitas, which means health. Sanitation refers to creating and maintaining hygienic and healthful conditions.

Sanitation and personal hygiene are important for keeping the food safe. Food worker need to be healthy and clean to prepare safe food. They need to practice good personal hygiene and use clean surfaces, equipment, and utensils when preparing foods.

Food handlers need to be healthy and clean to prepare safe food. The food Handler should keep his hands, arms and exposed parts very clean. Personal cleanliness of food handlers is most important to prevent food borne illness.

FOOD SAFETY

Personal Hygiene



- Hair should be properly tucked inside the cap
- Hair coming outside the cap
- No earing or necklace / chains
- Earing and necklace/chains
- No outer pockets
- Outer pocket and contents
- Wear neat and clean colthes
- Dirty clothes
- No wrist watch/rings
- Wirst watch/rings
- Cover all wounds
- Open and bleeding wounds
- Nails should be short and clean
- Long and painted nails
- Tom clothes should be repaired or replaced
- Tom clothes
- Wear clogs and safety shoes
- Bare foot/slippers

SAFE FOOD MAKES HAPPY CUSTOMERS

The following personal hygiene habits should become a part of their behaviour

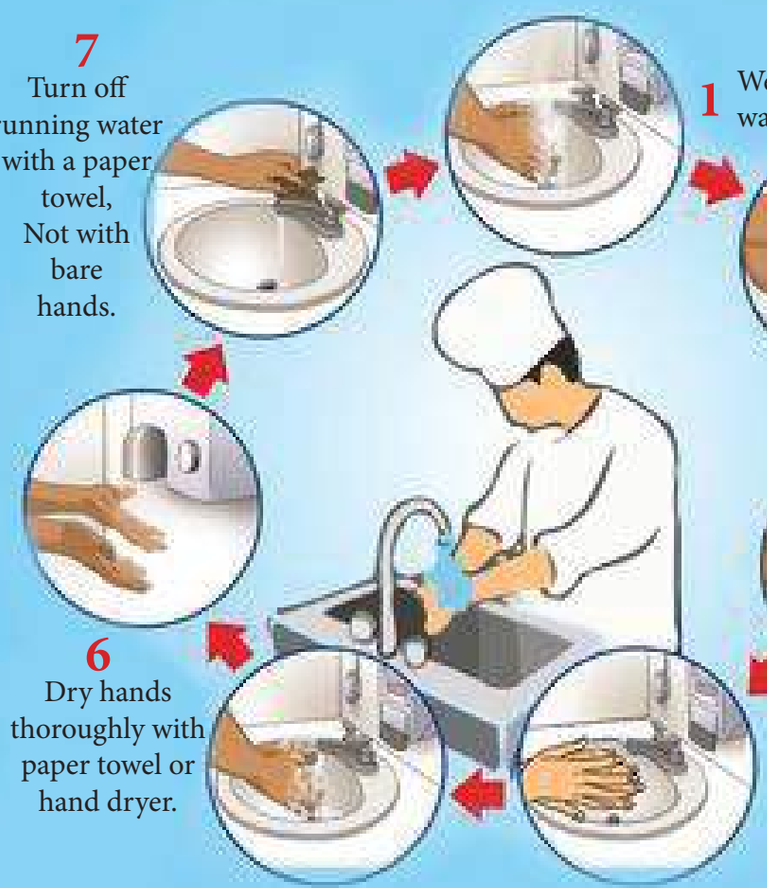
Food Safety is in Your Hands

Wash Your Hands

- Before & after handling food
- After handling soiled equipment/utensils
- After using toilet
- After coughing / sneezing / blowing nose / eating / smoking

Do these steps at a hand washing sink, Not a food prep sink.

Wash Your Hands the Right Way



1 Wet your under warm running water

2 Apply soap

3 Rub hands together for 20 seconds, up to elbows.

4 Wash backs of hands, wrists, between fingers and under finger nails.

5 Rinse hands well under running water.

6 Dry hands thoroughly with paper towel or hand dryer.

7 Turn off running water with a paper towel, Not with bare hands.

Notes

1. All food handlers should wear suitable clean protective clothing, head covering, face mask, gloves and footwear.
2. Food handlers should always wash their hands with soap and clean potable water, disinfect their hands and then dry with hand drier or clean cloth towel or disposable paper. They must wash their hands regularly especially
   - before starting work
   - on returning to work after each break
   - after handling raw food or any contaminated material, tools, equipment or work surface, after eating, smoking, coughing or blowing the nose
   - after handling waste food .
   - after using the toilet.
3. They should trim their nails and hair periodically.
4. Food Handlers should avoid certain hand habits such as
   - scratching nose,
   - running finger through hair,
   - rubbing eyes, ears and mouth,
   - scratching parts of body, etc.

When unavoidable, hands should be effectively washed before resuming work after such actions.

5. Street shoes inside the food preparation area should not be worn while handling and preparing food.
6. Food handlers should not handle soiled currency notes/cards to avoid cross contamination
7. Food handlers should not be engaged in smoking, spitting, chewing, sneezing or coughing over any food.
8. They should not eat any food, drinking beverages or chewing gum in food preparation area.
9. Food handlers should not wear jewellery in food processing or food service areas, as they contain dirt and bacteria. It can fall into the food and can contaminate the food.

2.1.2. Importance of protective clothing

In most industries employees wear protective clothing to protect themselves and their clothing from the materials with which they are in contact. Every person working in a food handling area should maintain a high degree of personal cleanliness and

should wear suitable, clean, and appropriate, protective clothing such as chef coat, apron, gloves, hair caps, socks, shoes, etc. It protects the wearer from injury due to burnt impacts, electrical hazards, heat, chemicals and more.

Protective clothing is not only to protect employees from injury but also to prevent cross-contamination with food preparation. It promotes a safe and healthy workplace, and also they make the staff look very professional.

Protective clothing should be light in colour, mostly white and preferably made up of cotton. It should be comfortable so it does not obstruct smooth movement while working. It should be laundered/washed regularly and kept clean. Regular repair and replacement of lost button etc. is also essential.

The Purpose of Protective Clothing

Kitchens are busy places to work, consisting of hot ovens, sharp knives, open fires and sometimes slippery, greasy floors. When staff wear the proper protective clothing (PPE) in the kitchen it largely reduces potential injury from cuts, burns, falls and more. So, it helps to keep the workers safe,

Some protective clothing used by bakery workers are

Chef coat

This thick cotton cloth protects from the heat of stoves and ovens. It can also protect from splatters from hot oil or grease during cooking. The double breasted jacket is used to add protection to the wearer's chest and stomach area from burns from splashing liquids. This white coat also helps to show cleanliness

Notes

Aprons

Are the most essential item for kitchen staff or food processing workers. A simple apron can improve hygiene levels in the workplace and establish a professional tone for service. Aprons can shield the employee's garments from food splatters, stains and burns and acting as the ultimate form of protection.

Notes

Gloves

When handling and preparing all kinds of food, bakery workers should always wear protective gloves. The main types of gloves are listed below:

Oven gloves

It safeguards the employee's hands when handling hot cookware such as baking trays and pans that have been in direct heat with an oven or stove.

Notes

Freezer gloves

Insulated gloves with strong grips that protect the hands from frostbite, which can occur when workers spend long periods of time in freezers or refrigeration storage units.

Cut-resistant gloves

Made from strong, durable materials that prevent skin from being sliced open by sharp knives, scissors or glass during food preparation.

Notes

Disposable vinyl gloves

Protects hands from hot irritant foods such as chillies.

Hair caps

Bakery workers should wear white caps or protective headgear to protect the food from hair. It also protects the hair and scalp from the effects of steamy air. This helps to ensure that hair and dandruff does not contaminate food or surface.

Shoes

Bakery workers should wear Anti-slip shoes. Because there is a possibility of liquid or oil spills and harmful substances falling to the kitchen floor. It makes the floor greasy and slippery. These shoes reduce the risk of slip-and-fall accidents in the workplace. Protective clothing should not be worn outside the food premises

Notes

to prevent contamination from bacteria and dirt and physical contamination from buttons etc falling into open food.

2.2.1. Preparation of work area

All bakery personnel should observe and practice rules of cleanliness such as keeping the body clean. The bakery should provide hot showers for bakery personnel. Clean white uniforms including headgear should be worn while on duty. Arm pits should always be covered. Hands should be washed with soap and hot water when returning from work after any absence, particularly after using the toilet. Personnel having skin eruptions or infectious cuts should never be allowed to work with food.

Location and surroundings

Location of Bakery Establishment shall be located away from environmentally polluted areas and industrial activities which produce disagreeable or obnoxious odour, fumes, excessive soot, dust, smoke, chemical or biological emissions and pollutants, and which pose a serious threat of contaminating food; areas subject to flooding; areas prone to infestations by pests; and areas where wastes, either solid or liquid, cannot be removed effectively.

To facilitate adequate drainage. The drainage shall flow in a direction opposite to the direction of food preparation / manufacturing process flow. The openings of the drains shall be thoroughly covered with wire mesh to prevent insects and rodents from entering the processing area.

The walls shall be made of impervious, non-absorbent, washable and non-toxic materials and require a smooth surface easy to clean up to a height appropriate for the operations and wherever necessary, disinfect.

Notes

Ceilings and overhead fixtures shall be designed, constructed, finished and maintained so as to minimize the accumulation of dirt, condensation and growth of moulds and shedding of paint or plaster particles. Sufficient number of windows and exhaust openings shall be provided to minimize accumulation of dirt.

Windows, roof vents, doors & all other openings to outside environment shall be well screened with wire-mesh or insect-proof screen as applicable to protect the premise from fly and other insects / pests / animals & the doors be fitted with automatic closing springs. The mesh or the screen should be of a type which can be easily removed for cleaning.

Doors shall be made of smooth and non-absorbent surfaces so that they are easy to clean and wherever necessary, disinfected. Regular maintenance of door shall be conducted to prevent any mould growth or termites with ageing.

The exhaust fans shall be provided with flaps on outer side and the other openings shall be adequately covered with screens to avoid entry of birds and pests and the same shall be maintained.

Light fittings, just above the process area, shall have shatter-proof protective covers to avoid the glass, dust or insects from contaminating the food.

Layout and Design of food establishment premises

Building and surrounding area shall be designed, constructed and maintained in a manner to prevent conditions which may result in contamination of food. The material movement should be done in one direction only (no backward flow), to prevent cross contamination. - The floor of food processing / food service area shall be made of impervious, non-absorbent, washable and non-toxic materials. Floor surfaces should remain dry and shall be maintained in a sound condition. The wall-floor juncture should be rounded or coved to facilitate easy cleaning. - The drainage system shall be properly maintained to avoid any stagnation of water and therefore do not provide any chance for pest harbourage. Floors shall be sloped appropriately.

2.2.2. Preparation of the machines and tools

Mixer

It is advisable to use mixer only when at least 50 kg flour is used every day. A unit producing bread, cake, biscuits i.e. assorted bakery products on small scale should install a heavy-duty type multipurpose cake mixer because it would be useful for bread

Notes

dough kneading and cake mixing as well as egg beating and sugar-fat creaming. Generally, high speed, low speed, variable speed vertical/horizontal mixers are available. The spiral and high-speed mixtures are preferred.

A high-speed mixer machine produces a lot of heat through friction hence they are provided with a jacket, which keeps the dough cool. it is essential for uniform dough development. Modern high-speed mixers are provided with the facility for self-lubrication. As a precautionary measure, push-button switch should be provided to the operator.

The frame of any mixer is made up of mild steel / cast iron which is mounted with an electric motor of 0.33 to 10 hp (mainly 0.5 to 1.5 hp for small bakeries) as per requirement. They usually have a gear system so that the speed can be changed. The capacity of bowls may vary from 10 to 200 kg and are made up of stainless steel. The speed of arms varies from 70 to 370 rpm (Revolutions Per Minute) for slow speed and high speed. The arm shape is made in such a way that it can carry out folding, kneading and stretching action (in case of bread dough) and aerating (in case of creaming purpose) or just simple mixing (in case of cookies and biscuits dough preparation).

Dough Divider

This machine divides the bulk dough volumetrically into individual dough pieces to maintain the weight as closely as possible. Hence, the dough density (which is highly affected by the extent of fermentation) should be even otherwise the weight might change. Nowadays, such dough dividers are available which can make 1 to 8 pieces at a time and also make 20 to 30 strokes/minutes (however, it is considered the best practice to have a machine having 15 to 18 strokes/minutes). It is advisable to purchase a dough divider when 200 to 250kg flour are used every day. Normally, a worker can cut 500 to 600 pieces in an hour, therefore it is advisable to purchase a divider on comparative economic calculations.

Rounder

Rounding machines basically consist of an external or internal revolving surface against which the freshly scaled dough piece is held by a spiral track or trough. As the surface revolves, it carries the irregularly-shaped dough piece upward in the spiral rounding trough, imparting to the dough a rolling motion. This motion results in uniform rounded dough ball with a thin, smooth and dense skin that not only eliminates the stickiness of the cut

Notes

dough surface but also serves as a carbon dioxide gas-retaining membrane. The revolving surface may have the form of a conical bowl, an umbrella or a drum.

Intermediate Prover

Intermediate prover generally consists of overhead enclosures that house an endless, tiered conveyer that supports dough carriers in the form of either trays or canvas loops. In these enclosures, dough pieces are rested for 10 to 15 minutes. They are equipped with proper temperature and humidity controller.

Moulder

It is economically viable for a baker to purchase a moulder when he is using 150 to 200 kg flour perday.

Final Prover

After moulding and panning the dough loaves are carried to a steam box, which is just like a steam-room. The accurate control system for temperature and RH is established for maintaining the quality of products. The final prover is made up of stainless steel.

Proof box, intended for manual loading, with castered racks moving on floor tracks should be limited to a depth of four racks to facilitate their movement through the box. Where more capacity is involved, suspending the racks from monorails for easier handling generally provides a satisfactory solution. In the instances, where box depth exceeding seven racks is required, motorized monorails will be found to be the most effective way in facilitating rack movement.

Oven

Oven is referred as the heart of the bakery industry. The construction and design of modern ovens depend on types of products to be baked, nature of the fuel to be used, a system of heat application & mode of its transmission, flexibility for controlling the amount & intensity of heat, and the cost of oven construction, operation & maintenance. Looking at all the factors most of the small and medium scale bakeries in India using fire-wood oven are now installing the gas-fired oven. Very small-scale units may use the electric oven after calculating operational cost (i.e. cost of electric fuel). However, it will be much popular in high-class small-scale bakeries like the bakery division of five-star hotels. Diesel fired ovens are preferred as they are cheaper than electric fuel for medium to large scale operations. However, wherever gas (LPG / CNG) supply is easily available, gas-ovens are preferred.

Notes

Bread cooler

At present, a room equipped with suitable conditions is used for cooling the bakery products so that atmospheric conditions might not affect cooling. Alternatively, rack coolers, similar to rack oven of bread processing is preferred. It is generally air-conditioned and hence enclosed and frequently the exterior panels of rack coolers are omitted. Which facilitates the flow of natural convection air currents through the racks. However, the usually dense concentration of loaves that is found in rack coolers during operation may require forced air circulation to improve the cooling rate.

Slicer

Despite many precautions, the bread loaf cannot be sliced properly by hand, hence every bread producer must purchase bread slicer. Generally, reciprocating slicers are used for slicing purposes. In which, straight blades are mounted (at intervals that yield the desired slice thickness) on two frames which move up and down in opposite directions at a high speed. This reciprocating motion is imparted to the frames by a small electric motor through a crank-shaft and levers. Slicing is performed by gently pushing the loaf through the oscillating blades. The frames may be mounted either vertically, in this case the bread conveyer feeding the cutting zone is slanted at a downward angle or they may be tilted toward the feed side, in this case the conveyer is then on a level plane. The purpose is to obtain angle cutting and to have the top crust of the loaf contact the cutting blades first.

Packing Machine

Normally, the bakery products are packed in polyethylene bags. A plate type electric heater is attached to a table, which seals the bag when touched, is preferred for small scale bakery industry. The machines are developed on the same basis which can either be foot or hand-operated. It seals the bag in between two arms of the machine.

2.2.3. Unit Operations

Unit operations are classified according to the type of transport phenomena and belong namely to:

- Mass transfer
- Energy (heat) transfer
- Momentum transfer operations

Notes

A unit operation may imply a physical or chemical modification:

Physical modification

Size reduction, sieving, mixing, pumping, pneumatic conveying, mechanical conveying, sedimentation, filtration, heating (e.g. baking, frying, extrusion, pasteurization, evaporation, distillation, hot drying), cooling (e.g. refrigeration, blast freezing, freeze-drying).

Chemical modification (involves chemical reactions that render new products)

Fermentation, neutralization, browning, enzymatic processing, malting.

Some operations involve simultaneous heat and mass transfer, one example is oven baking of bakery products.

Process flow sheeting

Choosing the best process configuration requires building a clear process flowsheet. It is a "plant model" of all process streams, equipment, control systems, transport/conveying systems, by-product streams and waste streams.

A simple example of this could be the location of a heat source (e.g. boiler for production of saturated steam that is needed in a proof box) and a point of heat/moisture evacuation (e.g. exhaust/venting systems).

Material and energy balances

Once process flow sheeting and determination of unit operations have been completed, material and energy balances become essential for process design. No process stream and its respective flow rates or amounts (e.g. tons/batch, pounds/second) can be determined without prior performance of material and energy balances.

Product composition and related engineering data (physical, thermal and transport properties) are needed to complete material and energy balances. The amount of materials and heat used is key for the following stages such as process costing and equipment design.

Material and energy balances can be carried out using process modelling and simulation tools. Such software tools simulate what could be happening in a real manufacturing plant with after all processes have been integrated.

Access to required unit operations, composition data banks for pure components and stock mixtures, possibility to schedule

Notes

operations, use of real process parameters and engineering data, are all necessary for an accurate and realistic execution of material and energy balances.

2.2.4. Food safety standards and Regulations

1. These regulations may be called the Food Safety and Standards (Recovery and Distribution of Surplus Food) Regulations, 2019.
2. They shall come into force on the date of their publication in the Official Gazette and Food Business Operator shall comply with all the provisions of these regulations by 1st July, 2020.

1. Definitions

1. In these regulations, unless the context otherwise requires,-- (a) "Act" means the Food Safety and Standards Act, 2006 (34 of 2006); (b) "food donor" means any person or food business operator who donates surplus food; (c) "Schedule" means a schedule annexed to these regulations; (d) "surplus food" means any leftover unused portions of safe food that have not been served to the customers; (e) "surplus food distribution organisation" means any person or any organisation that collects surplus food from food donor and distributes directly to any person free of cost without any profit.
2. All other words and expressions used herein and not defined, but defined in the Act, rules or regulations made thereunder, shall have the meanings assigned to them in the Act, rules or regulations, respectively.

3. Scope

These regulations specify the responsibility of the food donor and surplus food distribution organisations those who are engaged in distributing the surplus food to any person free of cost.

4. Responsibilities of food business operator

1. Any food donor having surplus food may donate such food to any surplus food distribution organisation in accordance with the provisions of these regulations.
2. The surplus food shall be maintained in accordance with the requirements specified in Schedule–I.
3. The food business operator shall not distribute unsafe food to any surplus food distribution organisation.
4. The surplus food shall be handed over to surplus food distribution organisation at a reasonable time before it gets

Notes

spoiled or its expiry, as the case may be, so that the food is made available to needy persons for consumption within the shelf life of the food.

5. Responsibilities of surplus food distribution organisation

1. Surplus food distribution organisation which is serving food to needy person shall be regulated in accordance with the provisions of the Food Safety and Standards (Licensing and Registration of Food Business) Regulations, 2011 and such foods shall be obtained from reliable sources having valid registration or license in accordance with the provisions of the Act.
2. The surplus food distribution organisation shall have proper facilities for transport, storage and reheating, and shall comply with the requirements specified in Schedule-I.
3. No surplus food distribution organisation shall distribute surplus food after the expiry of its shelf life.

6. Labelling requirements of donated foods

1. The requirements for labelling of donated food depends on whether the food is in its original package or has been prepared as meal.
2. Donated pre-packed food shall bear its complete original label, including name of the item or food, manufacturer information, list of ingredients, and date of expiry.
3. Donated prepared food shall be labelled with the name of the food, the source of the food, the date of preparation and last date of consumption and also specify whether the food is vegetarian or non-vegetarian.
4. The information on the label shall not be masked in any manner.

7. Maintenance of record of surplus food

The food donor and surplus food distribution organisation shall maintain the record of surplus food as specified in Schedule-II.

8. Monitoring Committee

The Commissioner of Food Safety of the State or, as the case may be, the Union territory shall constitute a monitoring committee for surplus food at State level consisting of two members from State enforcement agency, one representative from Department of Consumer Affairs of the respective State, one

Notes

member from nongovernmental organisation , one representative from surplus food distribution organisation and one representative from industry association and other relevant stakeholders.

9. Functions of monitoring committee

1. The monitoring committee shall monitor and make recommendations on the improvement of the operations by the surplus food distribution organisation and food donors.
2. The monitoring committee may also conduct training programs in health and hygiene for the food handler of food distribution organisation and also make recommendations on issues arising from implementation of the provisions of these regulations.

10. Guidance and support by Food Authority

1. The Food Authority may issue guidelines on collection and retrieval of food, which is near to their expiry, for donation and provide guidance to support the operations of food business operators covered under these regulations.
2. The Food Authority may also specify the time before the expiry, at which food shall be segregated. Schedule-I (see regulation 4 and 5) 1. Handling of surplus food by the food business operator. – (1) Surplus foods that are to be handed over to food distribution organisation shall be safe and segregated in to perishable and non-perishable. (2) The segregated food shall be packed appropriately so as to avoid contamination during handling and storage.
3. Perishable and non-perishable surplus food shall be stored in hygienic condition at optimum temperature to ensure their safety.
4. Surplus food shall not be kept with any waste material or products.
5. The food donor shall give an advance notice to the surplus food distribution organisation so as to ensure a timely distribution and consumption of the food within its shelf life.

2. Handling and distribution of surplus food by the surplus food distribution organisation

1. Surplus food shall be picked up from the food business operator's facility and packed in clean and covered containers. Such food containers shall have the required date marking such as pick-up date and the use by date of food.

Notes

2. Surplus food shall be stored and transported in clean and sanitized vehicles in appropriate hygienic condition at appropriate optimum temperature suitable for perishable and non-perishable food separately. Insulated containers and ice packs, if necessary, may be used to maintain food temperature during handling and transportation. Food transport equipment/ utensils that are intended to be in direct contact with food products should be constructed with non-toxic, food grade materials, which shall also be easy to clean and maintain.
3. Surplus food shall be distributed or served to the needy before the expiry of surplus food or until food is fit for human consumption, as the case may be.
4. Food that is not fit for human consumption shall be put in a container clearly marked as "Food for Disposal".
5. Food shall be stored off the floor and away from walls and non-food items. storage area, including the floor, pallets and shelves shall be cleaned regularly.
6. Where refrigerator is used for storage of surplus food, these shall be cleaned at least once a week to remove stains, ice particles and food particles. The temperature in the refrigerator shall be maintained below 7°C.]
7. Doors, windows and roofs of storage area shall be well sealed to prevent pest entry and a pest control program shall be in place for such areas.
8. All employees or volunteers that work with distribution organisation and come in direct contact with food shall keep their finger nails trimmed and shall wear clean outer garments and wash their hands before starting work, and as often as necessary, especially after eating handling or using the washroom, etc.
9. Avoid eating food, drinking beverages, or using tobacco in any form in areas where food is exposed, or in areas used for washing equipment or utensils shall be avoided.
10. No person shall come in contact with food during any illness that is communicable through food. Cuts, boils and wounds shall be covered.
11. All employees or volunteers that work with distribution organisations and come in direct contact with food shall have training in health and personal hygiene.

Notes

2.3.1. Cleaning Materials and equipment

1. Mixers

- Fill a sink with Warm water and mix in 3 or 4 table spoon of dishwashing detergent. Unplug the stand mixer before you begin the cleaning process.
- Immerse only the beaters of the commercial mixer into the skin and scrub them with a sponge to remove all food residue.
- Wipe the rest of the commercial mixer using a Soapy, soft cloth. If food particles won't come off by simply wiping, lay the wet cloth on the debris for a few minutes and scrub again using the soft cloth.
- Use the sponge to scrub off hard-to-remove material if necessary. Rinse off the beaters and the rest of commercial mixer using warm, clean water and a soft cloth.
- Wipe the appliance using the dish towel store it ready for its next use.

2. Oven

- Mix white distilled vinegar with **baking** soda in a ratio of 1:2. Add a drop of dishwashing soap to the mixture, and enough water to produce a thick paste. Use this paste on the **oven** interior in the same way you would use store-bought **oven cleaners**.
- **Remove Shelves** If your oven has removable shelves, take them out before you start. These shelves can easily be soaked in a basin filled with warm water and dishwashing soap, rinsed, and wiped dry.
- **Remove Food Residue** Scraping off excess food residue will mean your oven cleaning products are more effective.
- **Apply oven cleaner to the interior** Only cover the bottom, sides, and door panel. Ensure an even covering with a brush. Avoid applying to door seals and elements. Always make sure to follow the instructions on the label of any oven cleaner.
- **Leave the solution to work** Close the oven door and give the oven cleaner about 30 minutes to work – the oils and chemicals in the solutions will break down tough stains, making them easier to lift off.
- **Scrub** Use a medium bristled brush to scrub the entire area, except the elements and the fan. Pay special attention to

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problem areas, such as the door interior and the bottom of the oven.

- **Wipe** off excess solution and dirt using a washable cloth. Make sure you rinse your cloth several times to avoid simply spreading dirt around the oven.

3. Baking Pans

- Wipe away exce-ss. Using a paper towel, wipe away excess grease or solid residue from the **baking pan**.
- Make a paste. For heavily stained areas, **clean** pans with a paste of **baking** soda and Simple Green All-Purpose Cleaner.
- Fill sink with Simple Green solution.
- Soak.
- Scrub.
- Wash.

4. Dough Proofer

The interior of your **Dough Proofer** will need to be disinfected daily to avoid bacteria build up from the condensed water. Connect with the chemical company you work with and the manufacturer of your **proofer** to find the best solution for your application. The solution might be a basic bleach mix

5. Bread Slicer

Use a dampened rag with a little sanitizer on it to wipe down the equipment, including the blade. Always wipe down the **bread slicer** with hot water (ring out the rag so it's just damp) after **cleaning** to prevent the risk of **bread** tasting like sanitizer.

2.3.2. Common Detergents & Sanitizers

1. The Common Sanitizers:

The two common sanitizers used in restaurants are Chlorine and QUAT.

- **Chlorine Based Sanitizers:**
  - * Used almost exclusively for ware washing.
  - * The positive is that it's an instant kill. The negative is that it is unstable and "flashes off" rendering it useless soon after mixing a solution.
  - * Due to its flash off, it must be tested frequently because even in 15 minutes it can no longer be within the health department limits. This is why it is mainly used in dish

Notes

machines, as they have a controlled process that kills the germs and flushes out on each cycle.

* Another negative is that it will rust equipment, eat away at metals and damage clothing or fabric. It also dries out the skin and is harsh in many different ways, which is another reason it is mainly used in dish machines.
* It also has an obnoxious smell.

- **QUAT Based Sanitizers:**
  * A product that is based on Quaternary Ammonium (QA) cations.
  * Used for all other areas in the restaurant.
  * Has a 10-second kill, meaning it must be in contact for 10 seconds in order to the kill the germs, but it is steady and consistent.
  * It is forever stable and doesn't lose its potency for killing germs over time no matter the frequency it's being used at.
  * It is not a harsh chemical in any way shape or form.
  * It is very light in odour.

2. QUAT Sanitizers Are More Cost Effective:

- Chlorine is cheap, however, QUAT is actually more cost effective due to its dilution rate. For each part of QUAT you're somewhere between 256-512 parts of water and 1 gallon of QUAT sanitizer will make as many as 500 gallons of sanitizing solution.
- Plus, partnering with a company that properly dilutes the chemicals will also save money as they will only use the necessary chemical without any waste, whereas employees may use excess chemicals, costing you more money.
- The right way is always going to be less expensive.

3. Concentrations Are Important:

- It's important to work with a chemical vendor to ensure sanitizers are used within a system and that they have proper concentrations all the time.
- Without a system, employees will attempt to measure very precise and small ratios without the proper equipment making it difficult to dilute at the proper ratio.
- This is an issue because too little sanitizer can result in unacceptable efficacy, while too much sanitizer can yield residues that do not meet standards.

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4. Sanitizers Must Be Tested Every Day:

- Restaurants are responsible as per the health department to test their sanitizers every single day.
- Test strips are an easy way to test quickly.
- Because Chlorine is unstable it can be good one day and not the next, especially in a warm area like a kitchen. While QUAT doesn't have this problem, there is an issue of measuring precisely to ensure the correct dilution, hence why it's important to not depend on an employee to measure but instead to work with a chemical partner with the proper equipment and knowledge.

5. Washing is Vital Prior to Sanitizing:

- While washing an item cleans it, sanitizing is necessary to kill the bacteria and viruses. This is why it's important to make sure items are washed before using any sanitizing chemicals. This goes for everything in a restaurant from dishes to utensils to employees' hands.
- In other words, sanitizers are not suitable for washing, but rather should be used in addition to washing. Thus meaning that a chemical like bleach is not a great cleaner, as it kills germs. While it makes stains disappear it doesn't mean the stain isn't there.

6. Sanitizers Reduce the Risks of Food-Borne Illness:

- Sanitizers are important to eliminate the risks of food-borne illness. Without proper sanitation of kitchen surfaces, equipment and employees' hands, microbes can be transferred from one food to another leading to food-borne illness.

Sanitizers should be used throughout the whole restaurant. Below are some examples of where they should be used along with tips to improve their uses.

1. Back of the House

- **Employee Hand Sanitation**
  - Alcohol-based hand sanitizers that contain at least 60% alcohol are recommended as a component of hand hygiene by the Centers for Disease Control and Prevention (CDC).
  - Hand sanitizers are not as effective when hands are dirty or greasy which is why when using sanitizers employees should wash their hands first and then use the sanitizer.
  - Visit the CDC page for more info on when and how to use hand sanitizers.

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- **Surface Sanitizers and Disinfecting Chemicals**
  - * Sanitizers should be used on all prep and cooking surfaces, on cooking utensils, kitchen walls and floors and on all equipment such as grills, hoods, sinks, faucets, ovens, coffee machines and more.
  - * It's important to make sure the sanitizer is strong enough and that you use the sanitizer for the proper amount of time.
- **Glass and Dishware Sanitizing**
  - * The most important function of your glass washer or dishwasher is to kill germs due to the fact that if people get sick you won't have a restaurant anymore.
  - * The secondary function is then for the equipment to clean the ware.
  - * If you don't have enough chemical in the sanitizing cycle and/or your dish washing machine does not have the correct temperature setting, the glasses and dishes will not be disinfected and cleaned well.

2. Front of the House

No matter what type of restaurant you have, it's necessary to keep your business clean to achieve high customer satisfaction and reduce the risk of spreading germs. Below is a list of important areas to clean frequently with sanitizers and disinfectants.

* Tables, chairs and booths
* Condiment shakers, bottles and other items on the table
* Door handles
* Windows
* Floors
* Bathrooms

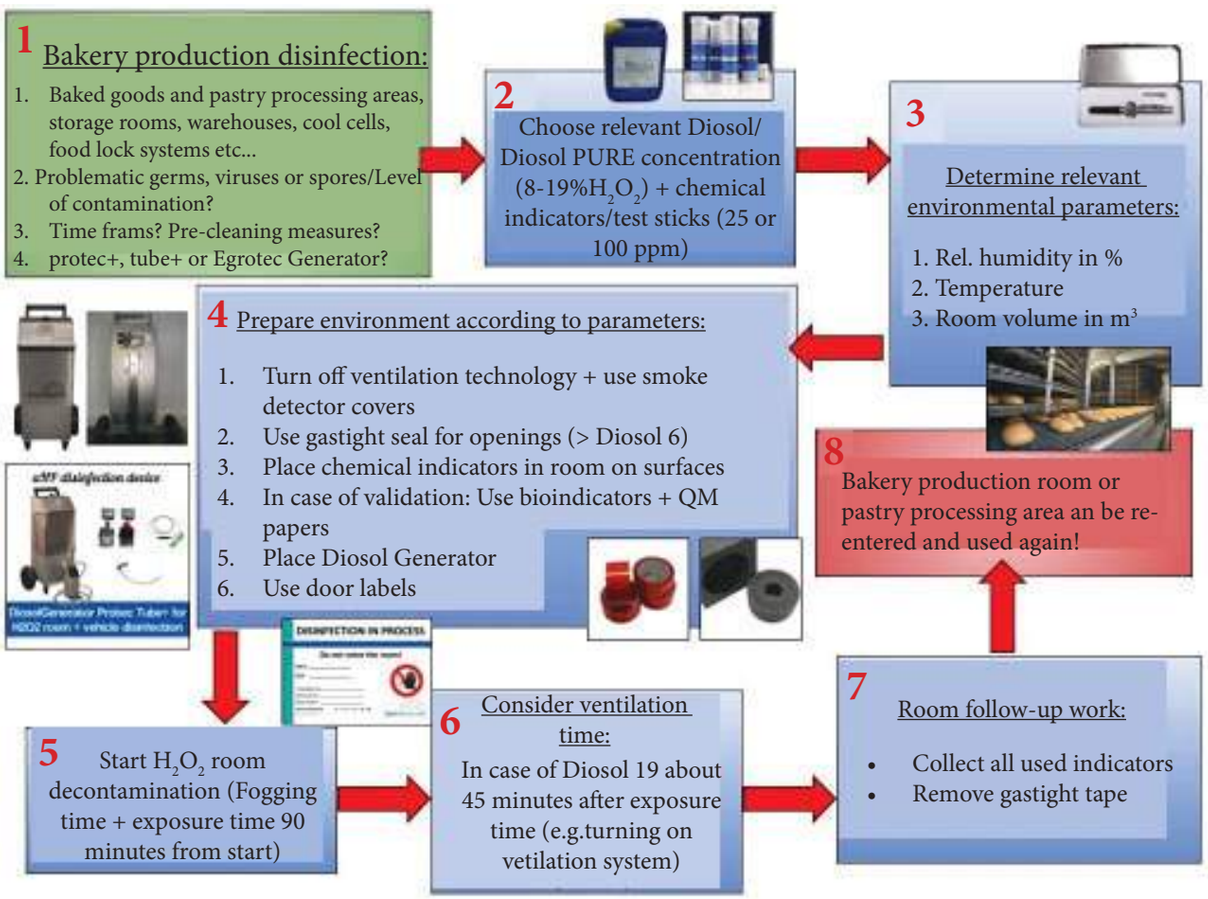
Sanitizers and disinfectants are vital for customer and employee health. Given that cleanliness can affect your business' livelihood, restaurant owners need to make sure they're using quality chemicals in the right places in the restaurant. Connect with your local chemical company to ensure you have the products needed to achieve a clean restaurant.

2.3.3. Disinfection of tools and equipment

An overview of Cleaning and disinfection in bakeries:

Cleaning and disinfection of bakeries is a key component of good hygiene practice. Cleaning and disinfection are considered

to be highly important in a bakery, and any other kitchen or food processing plant for that matter. All bakery equipment must comply with certain hygiene standards to prevent biological, chemical and physical contamination of baked products. The bakery industry is one of the largest market in the food industry, and as a result, the need for bakery cleaning and disinfection products is expected to grow during the forecast period. The slightest negligence in proper cleaning and disinfection has the potential to ruin both the consumer base and the business. Furthermore, there are problems associated with pest infestation, which can range from moths to rodents. Therefore, the outlook for the growth of the global bakery cleaning and disinfection products is expected to be largely positive during the forecast period.



Cleaning and disinfection in bakeries

Dynamics of Bakery cleaning and disinfection products:

The global bakery cleaning and disinfection products market is expected to grow on the backdrop of the growth of the global bakery market, which is currently staggering at around 2% per year. Cleaning and disinfection products are regarded by the bakery as crucial to keep a check on the multiplication of

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microorganisms. In addition, manufacturers of machinewashing equipment are emphasizing on technology integration to enable faster and more efficient cleansing. The Asia Pacific region represents key growth opportunities for the global bakery cleaning and disinfection products market during the forecast period. Key emerging countries in the Asia Pacific region such as Greater China and India are expected to witness more than average growth in the regional cleaning and disinfection products market, i.e. a CAGR of around 3%, during the forecast period. Hence, these countries are anticipated to generate substantial demand for bakery cleaning and disinfection products in time.

Segmentation of Global bakery cleaning and disinfection products market:

Globally, the bakery cleaning and disinfection products market has been segmented as – on the basis of substrate and product type.

On the basis of substrate, the global bakery cleaning and disinfection products market is segmented as –

- Stainless steel
- Zinc and Aluminium
- Concrete
- Mild Steel
- Others

On the basis of product type, the global bakery cleaning and disinfection products market is segmented as –

- Manual cleaning
  - * Clothes
  - * Mops
  - * Brushes
  - * Pads
  - * Others
- Chemical cleaning
- Machine Washing
  - * Automatic machines
  - * Semi-automatic machines

Mild dish soap and hot water clean most baking utensils and equipment as effectively as any cleaning product. Always line baking sheets with parchment paper before using; the black stains

left by baked-in sugar won't scrub off. Some equipment, such as baking stones, pastry brushes and wood rolling pins, need a different approach. As a guideline, anything stainless steel can go in the dishwasher, or you can clean it with soap and water. Store baking equipment in a dry cupboard, and don't stack anything on a baking stone. Store baking utensils in a kitchen drawer or utensil holder.

A wooden rolling pin is the essence of a kitchen -- one look and you can tell if its owner bakes regularly. Wooden rolling pins season over time, absorbing the natural oils of the doughs they touch. Never wash a wood rolling pin with soap.

Scrape any dough from the pin using a wooden or plastic scraper, and wipe it down with hot water. Dry it with a towel. Rub down the pin with mineral once or twice a month, depending on use, for increased longevity. If you're concerned about bacteria, mix 1 teaspoon of bleach with 1 quart of water; wipe down the pin with the solution and let it air dry.

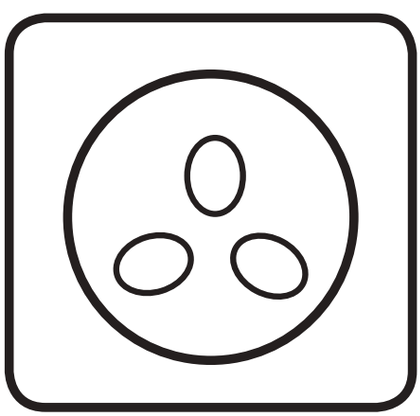
2.4.1 Working units and their functioning

Oven

Ovens cooking functions are displayed on the front panel via symbols. Understanding these oven symbols is not only important for successful cooking but also important to keep your oven in good nick. Using them incorrectly could cause your oven to trip or fuses to blow and that's a major inconvenience, even if you have good oven insurance.

To help you understand the various oven symbols and their baking/cooking functions, here are the ten commonly used symbols.

1. Fan oven



A fan in a circle represents an oven that uses a fan to distribute heat generated from a circular element that surrounds the fan. Ideally, the heat distribution should be even, so that it doesn't matter where the food is placed in the oven, it cooks perfectly every time.

Fan ovens are designed to heat up faster, reduce cooking time and decrease energy consumption. Fan ovens are great for baking multiple trays at a time (biscuits, cupcakes and muffins on the top, middle and lower shelves respectively). They're also recommended if you like your meat cooked the 'chefy' way, tender on the outside and rare on the inside.If you have a combination oven and you want to use the fan, then the symbol won't have a circle around the fan.

2. Conventional heating

The symbol for conventional heating is two lines, one at the top and one at the bottom of a square. The lines represent the two heating elements used, one at the top and one at bottom of the oven. Instead of a fan, the heat is diffused by natural convection. Use the conventional heating mode for roasting meat and vegetables or baking cakes.

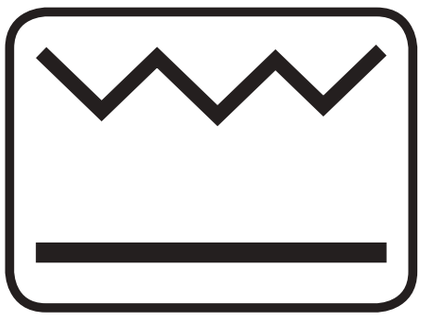
3. Bottom element heat

The symbol is a single line at the bottom of a square, which represents the lower heating element in use. This method is ideal for baking something that requires a crispy base such as pizza. It is also used for baking a casserole.

4. Bottom element heating with grill

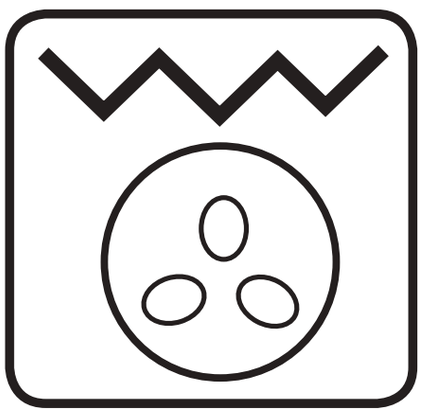
The symbol for this function is the zigzag (grill) line at the top and a straight line at the bottom of a square. It's a good function to use for cooking pies, quiches, and crispy pizzas.

5. Fan with grill

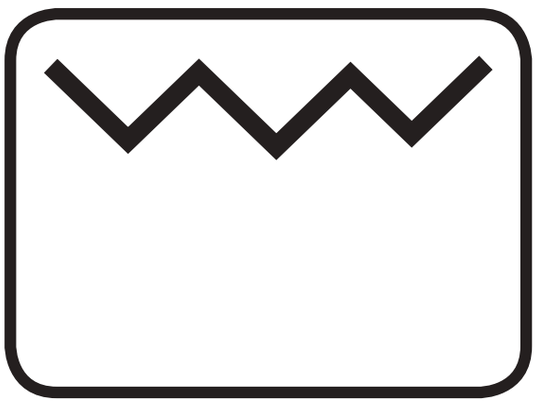


The symbol is the zigzag line at the top of a square with the fan symbol underneath. The fan distributes the heat, while the grill roasts from the top. The grill cycles on and off to maintain the temperature setting. This method is ideal for cooking meat and poultry.

6. Grill



The symbol is simply a zigzag line at the top of a square. Using the full grill allows you to cook food for virtually your whole family plus guests. There may also be a half-grill setting, which means only the centre of the grill element gets hot. You'll need to place food dead centre to get even cooking. Grills ate great for crisping and browning food, so use yours to make toast or toasted sandwiches, melt and brown cheese on lasagne and make delectable mushroom steaks.



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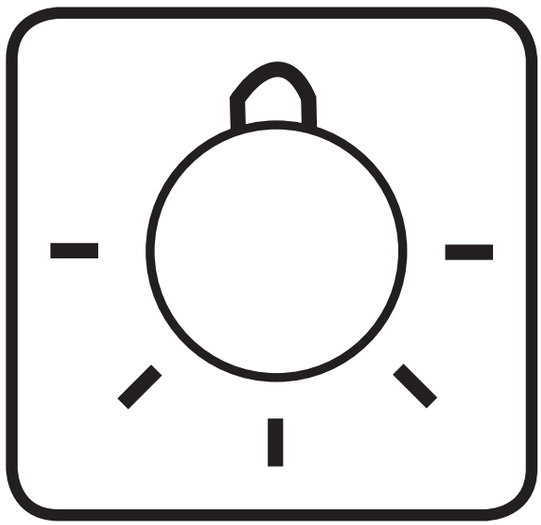
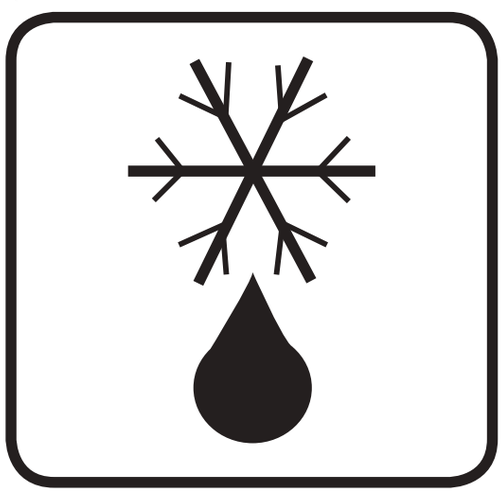
7. Oven light

Rather obviously, the symbol is a light bulb in a square. Some ovens cook with the light on automatically so you can see progress easily, but other ovens have a light switch so that you have to turn it on and off to see what's potting.



8. Oven defrosting

Not all ovens have a defrost function, but if yours does, you'll see it on the symbol that looks like a snowflake above a drop of water. In this mode, the oven fan is switched on but no heat is generated. The air circulation defrosts the food. It's great if you forgot to take food out to defrost overnight and you need to make a plan quickly.



9. Warming oven

The symbol is a dish with 'steam' lines rising above it. Use the function to keep food warm, without cooking it anymore. Food should stay moist and not dry out when using the warming function.

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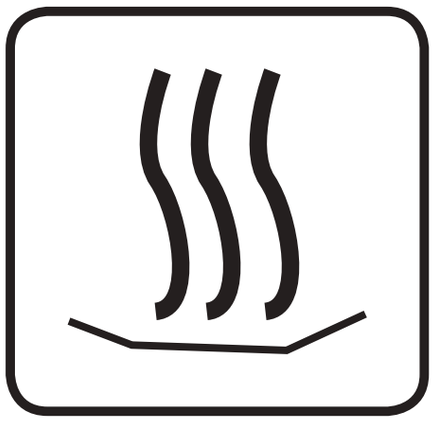
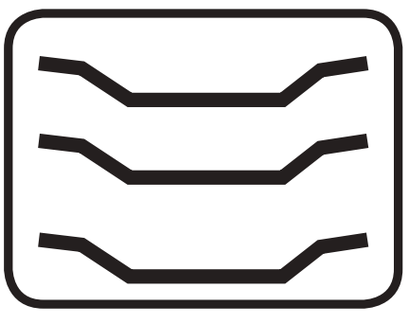


10. Plate warming

The symbol for this function is three dishes lined horizontally above one another. Dinner party etiquette dictates that you must serve plates warm. This setting keeps your plates safely warm without damaging the china.



Planetary Dough Mixer

Notes

A planetary mixer is a tool that is used by the number of industries which is usually used for mixing several items or ingredients such as adhesive, paste, granulation and many more products ranging from medium to high viscosity to form a proper mixture that is smooth, lumps free, paste-like texture in consistency.

Working of the Planetary mixer

A planetary mixer can have different number, shape or size of blade which is mounted on its unique axis which are hanging above the mixing bowl. They are selected and can be designed as per the requirements. The appearance of planetary mixer blades is similar to the blades of the fan. The blades present in the planetary mixer rotate on their axis while the ingredient use travels around the center of mixing bowl. It ensures the mixing of ingredients to be blended in a fast and effective manner.

Generally, the planetary mixers are available in different size and on the basis of their size, the quantity of the substances to be blended is decided. They can be used for blending a very large batch size to a small batch size depending on the purpose of their use. They are basically not used for blending liquid substance instead of that they are actually used for blending a mixture of difficult and thick ingredients. Planetary Mixture generally is composed of –

- A Bowl where actual placing of ingredient takes place.
- Mixing element which can be hooked, flat beater or any system.
- Motor used for starting the process of whisking of the element.
- Operator Box that allows the operator to control the mixing process, timing, speed etc.,

The different types of beater designs are represented in figure.

Sweet Dough

Wire whip

Marshmaloow

Batter

Drop Centre

Sponge

Hook

Scraper

2.4.2 Hygiene and Sanitation standards in processing unit

Standard Hygiene - its necessity

- Standards have become more stringent.
- Increase in automated processing – Baking, convenience products – require suitable cleaning and disinfection processes that are adapted to production.

Hygiene should be checked at

- Source of ingredients
- Delivery of ingredients
- Storage of ingredients
- Mixing / Processing
- Baking
- Packing / Wrapping
- Storage

Source of Ingredients

- Can be contaminated with pesticides, Herbicides, other chemicals, foreign bodies and pests.
- Reputable suppliers.
- Ingredients screened (Sieved, filtered, metal detected) by supplier.

Notes

Delivery of Ingredients

- Received material – Packaging Damaged / Dirty.
- Contaminated by other products E.g. Chemicals
- Check for infestation.
- Deterioration of ingredients, (out of code)
- Should be visually checked.

Storage Ingredients

- Contamination of outer packaging, contamination of opened part-used products.
- Deterioration of ingredients stored.

Precautions

- Store covered
- Date-coded
- Use on first-in-first-out basis.
- Rotate Stock.

Mixing / Processing

- Contamination from damaged broken utensils or equipment.
- Metallic contamination at some stage.

How can avoid?

- Regular Inspection, Maintenance, Repair
- Replacement of damaged items.
- Staff awareness / training in basic hygiene procedures and personal hygiene rules.

B**aking**

- Survival of spores which can cause mould or rope.

Practices to be followed:

- Good quality Flour.
- Storage in a cool place.
- Clean baking equipment.

Packing / Wrapping

- Contamination by fragments of packaging or contamination from dirty baskets or trays.

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Hygiene Measures:

- Ensure packaging is free of debris.
- Remove debris, packaging waste regularly.
- Use of clean baskets or trays.

Storage

- Contamination by dust or debris.
- Store in clean area.

Great Sanitation is More Important Than Ever

Sanitation has always been important in bakeries and other food service establishments. But now, the stakes are even higher.

The COVID-19 pandemic has caused bakeries and other foodservice establishments to temporarily close their doors around the world, with the exception of takeout service. When doors reopen, consumers and regulators will most likely demand even higher sanitation standards. Sanitation, in fact, may make the difference between businesses that survive and those that shutter their doors forever.

A Visibly Clean Bakery is a Marketing Advantage

Maintaining a visibly clean and tidy bakery has always been important. Well-kept food service establishments outperform unkept establishments even in normal times. That's why sanitation practices that keep the workplace clean and orderly have always been essential. They protect employees and customers, maintain regulatory compliance and ensure that your bakery turns out consistently great products.

Students working toward a degree or diploma in baking and pastry learn many important lessons in preparing delicious treats and artisanal loaves of bread. They also learn the importance of meeting the highest standards for food safety and sanitation.

Keep these essential guidelines in mind as you explore the possibilities of a career in baking:

Personal Hygiene is Crucial

"Good sanitation starts with every individual."

Good sanitation starts with every individual who works in a bakery. Careful attention to personal hygiene makes all the difference in keeping food free of any pathogens that staff members could carry on their bodies, hair or clothes. Every bakery should establish and enforce strict standards of cleanliness

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for all employees, especially those who come into direct contact with ingredients or finished items.

Common rules for bakery workers include directives to always come into the business wearing clean clothing and keep a hairnet on throughout the day. It is a requirement that all employees wash their hands before touching ready-to-eat items such as pastries or bread, before food preparation, after handling raw ingredients and any time they visit the bathroom.

Wash Utensils and Surfaces

Dirty kitchen utensils or surfaces that come into contact with food can become major hazards. Cooking and baking professionals always have to be on the lookout for cross-contamination, which can be dangerous to customers. Carelessly using the same tools or cutting boards for different tasks without cleaning them might lead to foodborne illness or an unexpected allergic reaction.

In addition, any items that are left dirty might attract insects or rodents. The last thing you want is pests making themselves at home in your bakery. Thorough, regular cleaning is an essential line of defense against serious health risks.

Stay on Top of Equipment Maintenance

Bakers rely on an array of machines to prepare their goods efficiently, such as mixers, dough shelters, and bread slicers. In some cases, it may be a challenge to take a machine apart and keep it clean. Still, it's important to take the time to perform these tasks on a regular basis, so pieces of food aren't left inside.

It's particularly vital to keep proofing cabinets clean. These warm environments are ideal for allowing bread to rise before baking, but they can also be hospitable spots for bacteria. Bakeries should have a policy of washing out proofing cabinets with warm water and mild soap on a daily basis.

Cleaning out storage and properly disposing of waste keeps a bakery running smoothly.

Properly Store All Food

Refrigeration and freezing units are a top priority for sanitation efforts. That starts with keeping cold storage at the right temperatures and covering food before placing it inside. Strict first-in, first-out practices and labelling procedures can head off many potential issues with improper handling or spoilage.

For walk-in coolers and freezers, always switch off the lights

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when no one is inside. You'll save on your electricity bill and make it easier for the unit to keep food at the necessary temperature. Employees should follow the manufacturer's instructions for regularly cleaning out refrigerators and freezers and dispose of any food that is no longer usable.

As cases of COVID-19 continue to spread, food service businesses must demonstrate the highest standards of cleanliness in order to protect customers and employees.

Developing skills in the baking and pastry arts is about more than making fantastic breads, pastries and cakes. It's also about learning how to keep a business functioning at its best and meeting the demands of routine maintenance and sanitation.

2.4.3 Standard Operating Procedures (SOPs) for Disposal of Waste Materials

Bakery waste and its disposal management

Bakery process generates lots of waste which can be either disposed of or can be recycled in many cases. Bakery waste management needs clear strategy for identification, segregation, storage and disposal.

Bakery Waste which are generated are

Process waste

- Dough
- Flour dust
- Sugar dust
- Burnt biscuits
- Broken Biscuit
- Burnt loaves or rejected loaves
- Market returned old bakery products

These can be sold out to suppliers who deals into cattle feeding. Precaution should be taken that none of these have contamination so that it can be used for cattle feeding.

Packaging

- Wrappers
- Tins
- Cardboard boxes
- Bags
- Cores
- Polythene

Notes

- Sacks
- Plastic Trays and Pallets

Most of these are can be recycled by packaging material suppliers

Solid waste

- Metallic scrap
- Wooden Pallets and other
- Papers
- Bakery waste water dry Sludge

Metallic scrap can be sold to scrap merchants, Dry Sludge and other can be sold to land filling contractors. Bakery waste water can be treated can be used for gardening and other cleaning purpose.

Other waste are

- Fat & oil contaminated
- Spent Oil from machinery

Could be sold to recyclers. Bakery waste recycling are being adopted by various companies to save cost and implement resource conservation.

2.4.4 Cleaning and Maintaining Machinery and Equipment

Bakery equipment is what keeps production rolling and the kitchen open. When it breaks down, it causes a major interruption in your work flow and a loss in sales. To minimize breakdowns, make bakery equipment maintenance a priority.

Some ways to keep your work place clean:

1. ***Regular cleaning of the work place (Ex: Sweeping & Dusting)***
2. ***Regular cleaning and maintenance of the equipment and utensils.***
3. ***Proper garbage disposal on a regular basis.***
4. ***Develop a pest control system. (Ex: Pest – O – flash)***

Here are five ways to keep your ovens, mixers and other equipment functioning smoothly:

1. Follow a Regular Cleaning Schedule

Above all else, the most important bakery equipment maintenance tip is to clean your machines regularly. Equipment failure is usually caused by a lack of cleaning. Not only is it unsanitary to leave particles of flour, pieces of dough and baking

oils in the machine, it can also cause a build-up that impairs proper function. Make sure the machines are cleaned after every shift, and institute a weekly or monthly in-depth cleaning schedule.

2. Clean with the Right Products

While some machines only need water for cleaning, some need soap too. Make sure to follow the manufacturer's recommendations. Don't try out a new cleaning product until we are sure it's can be used with that machine. Many equipment warranties are conditional, based on whether maintenance instructions were followed correctly. This includes cleaning the machine properly. If it's proven that the machine's problems are due to user error, we could lose warranty coverage.

3. Perform Preventive Maintenance

Inspect the machines during the in-depth cleaning sessions and check on all the visible parts. If we see that some pieces are worn, loose or need oiling, take care of it right then. Staying proactive with repairs will also help minimize breakdowns. Taking care of the little issues will help prevent larger problems.

4. Stock Up on Spare Parts

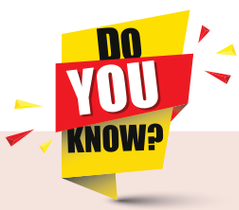
It's not a bad idea to order backup spare parts for oven or mixer. Whether it's a belt or blade, having a stock can help shorten the time in bakery equipment is idle. Bakery won't have to wait for the part to arrive — we just have to call a repair service and hopefully get same-day results.

5. Follow Manufacturer Usage Instructions

Make sure you `fully read the operational manual and closely follow the manufacturer's guidelines. Train each member of bakery staff to use the bakery equipment the right way. Not only is this important for maintaining the machines, it's essential for warranty protection.

Activity:

1. ***repare a chart pasting the different types of small and large equipment used in confectionery.***
2. ***What do you understand by Personal hygiene?***
3. ***Mention any five ways of maintaining personal hygiene.***



- October 15 is Global Handwashing Day
- May 15 is Hand Hygiene Day
- Every ingredient has a specific chemical job
- Flour gives a confection a structure
- Baking powder or soda adds air bubble
- Egg adds like a glue holding
- Oil & butter makes it tender
- Milk or water gives moisture
- Putting baked goods in the fridge actually makes them go stale faster

Practical Activity

01. Demonstration of how to wear protective clothing including Head Cap, Apron, Gloves, socks, shoes, etc.,

Objective:

To know how to wear a protective clothing.

Write the uses of

a) Head Cap

b) Apron

c) Gloves

d) Socks & Shoe.

Notes

02. Personal Hygiene & Sanitation

Objective:

Demonstrate the handwashing technique

Procedure:

1. Wet hands with water
2. Apply single shot of soap
3. Rub hands palm to palm
4. Rub back of each hand with the palm of other the hand with fingers interlaced
5. Rub palm to palm with fingers interlaced
6. Rub with backs of fingers to opposing palms with fingers interlocked
7. Rub each thumb clasped in opposite hand using rotational movement
8. Rub tips of fingers in opposite palm in circular motion
9. Rub each wrist with opposite hand
10. Rinse hands with water
11. Dry thoroughly

03. Work area & equipment

Objective:

Demonstrate preparation of the machines and tools required for production.

Procedure:

Prepare a chart pasting the different types of small and large tool used in confectionery.

i) mixer

ii) Dough Divider

iii) Bread Cooler

iv) Slicer

04. Demonstrate the unit operations – (Bread Making)

Objective:

Monitoring the technical flow – phase control

For every step of the technical flow, there are specific parameters to be monitored:

Notes

Procedure:

Observe the following

- Mixing–temperature of ingredients, time and speed of mixer, final temperature
- Bulk fermentation: time, temperature, acidity
- Dough mixing: time and speed, temperature
- Resting: time, ambient temperature and humidity
- Final mixing: time and speed, final temperature
- Dividing: pieces weight, time
- Dough piece proving: time, temperature and humidity of chamber
- Baking: time, temperature
- Cooling: time, temperature

05. Demonstrate the Food safety standard and regulation through the audio-visual aids

Objective:

Prepare a chart for the Food safety Standard and regulations

Procedure:

Make a different type of charts

06. Demonstrate the practical video of the cleaning procedures in the bakery laboratory

Objective:

Video and Practical demonstration of the cleaning procedures in the bakery laboratory.

Procedure:

Watch the videoand write the cleaning procedures.

07. Demonstrate of the working units

Objective:

write down thefunctions of the following working units

i) Oven

ii) Planetary Dough mixer

Notes

Glossary

Personal Protective Equipment (PPE)	:	Clothes, materials or devices that offer protection from pesticides; especially important when handling or applying toxic pesticides. e.g., gloves, apron, boots, coveralls, hat, respirator and goggles.
Secondary Information	:	usually on the back or side of a pesticide label or container, the secondary information gives instructions on how to use the pesticide and what to do in order to protect the health and safety of both the applicator and public.
Moisture	:	Water contents of the substance.
Plasticity	:	The consistency of feel of shortening.
Levulose	:	A simple sugar found in honey and fruits.
Lactose	:	The sugar of the milk.

Evaluation

I. Choose the correct answer (1 Mark)

1. _____ is a set of practices performed to preserve health.

   a) Hygiene b) Sanitation

   c) Cleaning d) Food Safety

2. _____ is referred as the heart of the bakery industry.

   a) Moulder b) rounder

   c) Oven d) Dough Divider

3. The symbol of _____ is a dish with steam lines rising above it

   a) Oven defrosting b) Warming Oven

   c) Grill d) Plate warming

4. _____ protects hands from hot irritant foods such as chillies.

   a) Chef coat b) Disposable vinyl gloves

   c) Cut-resistant glove d) Oven gloves

Notes

5. The symbol of _____ is simply a zigzag line at the top of a square.

   a) Conventional heating b) plate warming

   c) Grill d) warming oven

II. Answer the following: **(2 Marks)**

1. Define: Hygiene
2. Enumerate the importance of Hygiene
3. What is meant by personal hygiene and sanitation?
4. List out the protective clothes
5. What is meant by physical modification?
6. What is meant by chemical modification?
7. What are the cleaning materials and equipment used in bakery?
8. Name two common sanitizers used in restaurants.
9. Give brief notes on Warming Oven
10. Explain – SOP.

III. Answer in detail: **(3 Marks)**

1. Enumerate the personal hygiene habits?
2. What are the purpose of protective clothing and explain any Five?
3. Write the responsibilities of food business operator and surplus food distribution organisation.
4. Explain Cleaning materials and equipment
5. Write any five working units and their functioning
6. Explain Standard operating procedures (SOPs) for disposal of waste materials.
7. Elaborate in detail about cleaning and maintaining machinery and equipment.
8. Explain in detail about unit operations.

Food Microbiology

3

- Enumerate the importance of microbes in food processing Identify types of microbial contamination (Bacteria, yeast, mould, fungus) in baked foods.
- Handle/ dispose the microbial contamination in bakery products.
- Describe the shelf life of bakery products.

Learning Outcomes

Introduction

We already know that the microorganisms use our food as a source of nutrients for their own growth. This, of course can result in deterioration of the food. By increasing their numbers, utilizing nutrients, producing enzymatic changes and contributing off flavours by means of breakdown of a product or synthesis of new compounds they can "spoil" a food.

Food microbiology is specifically concerned with the desirable and undesirable effects microbes can have on the quality and safety of food products.

3.1. Food Spoilage

Spoilage is the process in which original nutritional value, texture, flavour of food are damaged, such food become harmful to people and unstable to eat. Most foods deteriorate in quality following harvest, slaughter or manufacture, in a manner that is

dependent on food type, its composition and storage conditions. Various external forces are responsible for the spoilage of food.

Food spoilage can be defined as the unwanted change in the composition and quality of food from its normal state. It can be an observable change in the odour, colour, taste or sight of the product.

Food spoilage and deterioration is no accident. It is a naturally occurring process. Spoiled foods may not cause illness because there are no pathogens or toxins present, but changes in texture, smell, taste, or appearance cause them to be rejected. To understand how to maintain the quality of food and prevent spoilage, we need to know what can cause it.

3.1.1 . Factors that cause food spoilage

1. Microorganisms.
2. Enzymes.
3. Air.
4. Insects, Rodents, Parasites and Other Creatures.
5. Physical Damage.
6. Temperature.
7. Time.

a) Microorganisms

Many types of microorganisms can cause food problems. The microorganisms that can cause food-borne illness are called pathogenic microorganisms. These microorganisms grow best at room temperatures (60-90°F), but most do not grow well at refrigerator or freezer temperatures. Pathogenic microorganisms may grow in foods without any noticeable change in odour, appearance or taste. Spoilage microorganisms, including some kinds of bacteria, yeasts and moulds, can grow well at temperatures as low as 40°F. When spoilage microorganisms are present, the food usually looks and/or smells awful.

Notes

Major causes of food spoilage

Physical	• Temperature • R.H. • Light • Mechanical damage
Chemical	• Enzymatic reaction • Non enzymatic reactions • Rancidity • Chemical interaction
Micro organisms	• Bacterial • Yeast • Molds
Others	• Insects • Rodents • Animals • Birds

b) Enzymes

Enzymes, substances naturally present in food, are responsible for the ripening process in fruits and vegetables. Enzymes are responsible for texture, colour and flavour changes. For example, as a banana turns from green to yellow to brown, not only does the colour change, but there is also a change in the fruit's texture. This is the result of enzyme action.

c) Air

Oxidation, a chemical process that produces undesirable changes in colour, flavour and nutrient content, results when air reacts with food components. When fats in foods become rancid, oxidation is responsible. Discoloration of light-coloured fruits can be reduced by using an antioxidant, such as ascorbic acid or citric acid, before freezing. Vapour-proof packaging that keeps air out helps reduce oxidation problems.

d) Light

Light exposure could result in colour and vitamin loss. Light also may be responsible for the oxidation of fats. Foods stored in dark coloured glass containers may help to overcome oxidation.

Notes

e) Insects, Rodents, Parasites and Other Creatures

These creatures require food to survive and damage food, making it more vulnerable to further deterioration. Proper handling and storage is needed to maintain food safety.

f) Physical Damage

Bruises and cracks on raw produce leave areas where microorganisms easily may grow. Improperly packaged foods, dented cans and broken packages provide places for microorganisms, air, light and creatures to enter. Gentle handling of food items will help to maintain food quality and safety for a longer period.

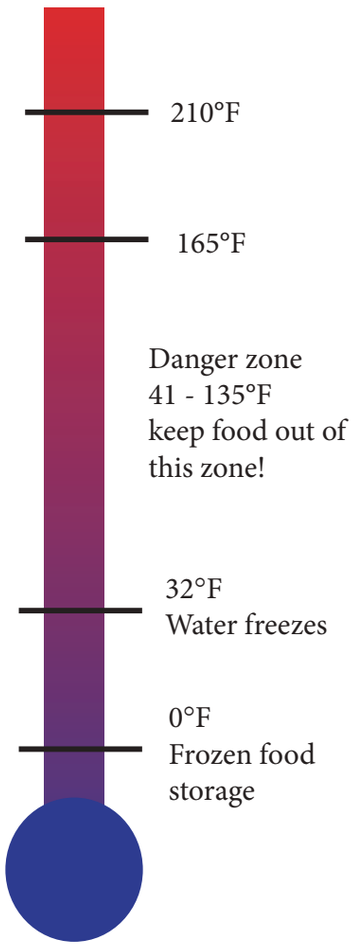
g) Temperature

Temperature affects storage time, and food deteriorates faster at higher temperatures. Recommended temperatures for storage areas are:

Cupboard/Pantry 50-70°F

Refrigerator 34-40°F

Freezer 0°F or below



Microorganisms, both spoilage and pathogenic, grow rapidly at room temperature. To slow microbial growth, the enzymatic and oxidation processes, store foods at lower temperatures.

h) Time

Microorganisms need time to grow and multiply. Other reactions, such as oxidation and enzyme action, also require time to develop. Purchase reasonable quantities, especially of perishable foods, to help avoid long-term storage.

3.1. 2. Source of microorganism in food

Microorganisms have great importance and impact on our lives, but not always in a pleasant way. They are fundamental for obtaining some food products, but are also the main cause of most cases of food and cultivar deterioration. There are many types of microorganisms of different forms and more or less complex structures. Bacteria, moulds, and yeasts are, among all, those that generally have a greater impact on food deterioration. Many factors contribute to the presence of microorganisms in foods, The primary sources of entry of microorganisms into foods are:

- **Soil**
- **Water**
- **Air**
- **Food**
- **Food Handlers**
- **Utensils and equipment**
- **Cross-contamination**

a) Soil

Soil being the rich source of several kinds of microorganisms immediately contaminates the plants and edible plant parts, and the surface of animals with the soil associated microorganisms. As the soil particles are carried into aquatic environment through wind, rain and other means contamination of water takes place with several soil micro-flora. Therefore, it is not uncommon to find several microorganisms both in soil and water environment. (E.g.,Bacillus, Clostridium coliforms, salmonella, enterococci etc,).

b) Water

Water holds micro-flora whose composition reflects its origin and level of pollution. In a Public health point of view, the presence of faecal microorganisms deserves particular attention because the presence of these microorganisms may indicate the presence of pathogenic microorganisms, which through this source can easily propagate to other foods.

In order to avoid the risk of food contamination with water microorganisms, it is sufficient to use good microbiological quality water, while: - washing food; - Preparing food and beverages; - Making ice or freezing water to cool/conserve food.

c) Air

Air is an excellent conveyer of microorganisms from other sources. The composition of air does not allow the development of microorganism because they can't find any nutrients in it. So, what we find in air are microorganisms from the surrounding environment . Some activities or gestures carried out by man are the main cause for the "introduction" of microorganisms in air. Simple gestures like shaking your head – especially with long free hair, sneezing or coughing, transfer to the air many microorganisms of the human flora.

In order to reduce the contamination of airborne microorganisms, all we have to do is follow some simple rules: - Keep food covered every time possible; - Regularly, remove dust from surfaces; - Avoid keeping food in places where there is a lot of air agitation (ventilators, air currents, etc); - Reduce the air load (for example, by filtration); - Avoid over crowded places.

d) Food

Each product, whether animal or vegetable origin, holds characteristic flora, that essentially depends on the environment where it was brought up or produced. Generally, internal

Notes

vegetable product tissues contain few microorganisms. On the contrary, external tissues carry a very extended and varied load of microorganisms, due to greater exposure to air, soil and other sources of microorganisms.

e) Food Handlers

Food handlers play an important role regarding the flora of food and food products. Along with air, they constitute one of the main sources of food microorganisms. Just like animals used as a food source, man also possesses a specific flora adapted to various environments that are found on the human body. Coliforms and Staphylococcus aureus are the main microorganisms related to food contamination by man. These microorganisms are originated from faecal matter (coliforms) and handlers´ skin. Special hygiene care is required when handling cooked food or food that is going to be consumed raw.

f) Utensils and equipment

Utensils and equipments don't have their own micro-flora. The micro-flora they possess is a reflex of cleaning and maintenance care that they undergo. Poorly clean machines and accessories are inevitably contamination sources. The same happens with other utensils, knives, cutting boards and recipients. It is fundamental that the same utensils are not used to manipulate or store different foods in order to avoid cross contamination.

g) Cross-contamination

This transfer can occur through utensils, hands, cloths, etc. The presence of pests, especially flying insects, along with the use of unsealed food containers, constitutes great risk to

the occurrence of cross contaminations. Like this, a clean surface or uncontaminated food can be contaminated by a microorganism brought from another place.

It is of great importance to avoid cross contamination between raw foods, which are almost always contaminated and cooked foods. Everything that comes into contact with raw foods (utensils, equipments, hands, etc.) must be thoroughly washed before being handled with cooked foods.

3.1.3. Microbial growth in food

Most foods serve as a good growth medium for many different microorganisms. Considering the variety of foods and the methods used for processing, it is apparent that practically all kinds of microorganisms are potential contaminants and can cause changes in appearance, flavour, odour and other qualities of foods.

Food microbes are the microbes that can be used in order to process and alter the unsafe product in consumable one. These food microbes can be live bacteria, yeasts or moulds. Food microbes carry out the fermentation process in food stuffs and helps to preserve perishable foods and to improve their nutritional and organoleptic qualities. Micro-organisms have been used since ancient times to make bread, cheese, yoghurt and wine.

Microorganisms in food production

Generally, microorganisms are of great importance in our lives. It is difficult to dissociate some daily gestures/ habits to the absence of microorganisms. During our meals we ingest foods in which microorganism have or had a fundamental action . Most commonly used microorganisms are yeast, bacteria, moulds, or a combination of these. A good example of microorganism usage in food production is the process of fermentation, which results in the production of organic acids, alcohols and esters. These help to either: Preserve the food / Generate distinctive new food products.

Yeast in food production.

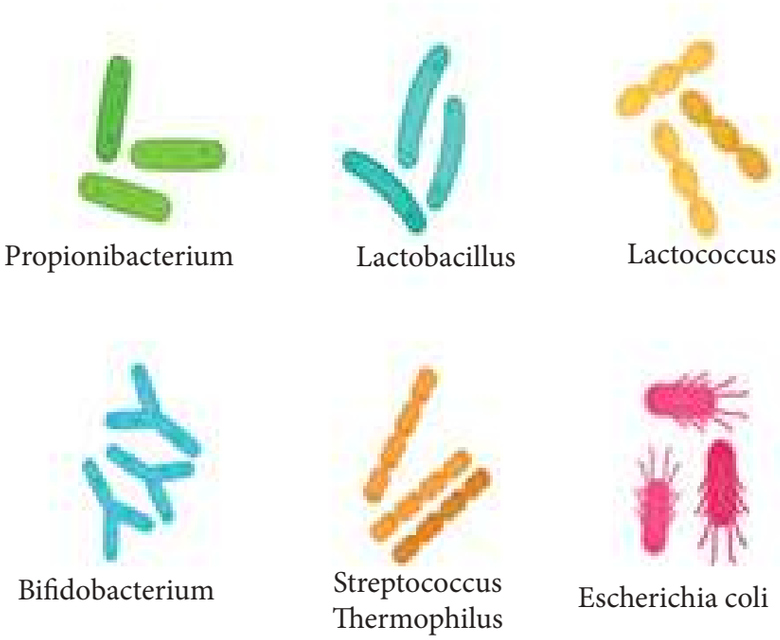
Leavened bread and bakery products: Saccharomyces cervisiae ferments sugars to produce CO_2, the gas that gives the porous structure of bakery products. It also contributes to the flavour by formation of alcohols, aldehydes, esters etc. E.g., Beer, Wine, Vinegar, Pickles.

Bacteria in food production

Fermented milk products: Lactobacillus, Lactococcus, Bifidobacterium . A variety of foods including Indian dosa, rabri: fermentation by Leuconostoc mesenteroides, S. faecalis.

Probiotics

are live food supplements used in yoghurt and other fermented milk products. It includes Lactobacillus acidophillus and Bifidobacterium bifidum. A minimum of 108 bacteria per 1 ml must get to the colon alive to have any significant effect. These bacteria improve the microbial spectrum in the gut and thus contribute to the following effects:



a. Influence immunity and hence prevent or make diarroheal diseases milder.

b. Decrease the risk of colon cancer.

c. Decrease cholesterol absorption.

d. Produce acids that decrease the pH in the gut and thus increase the absorption of minerals such as calcium and phosphorous.

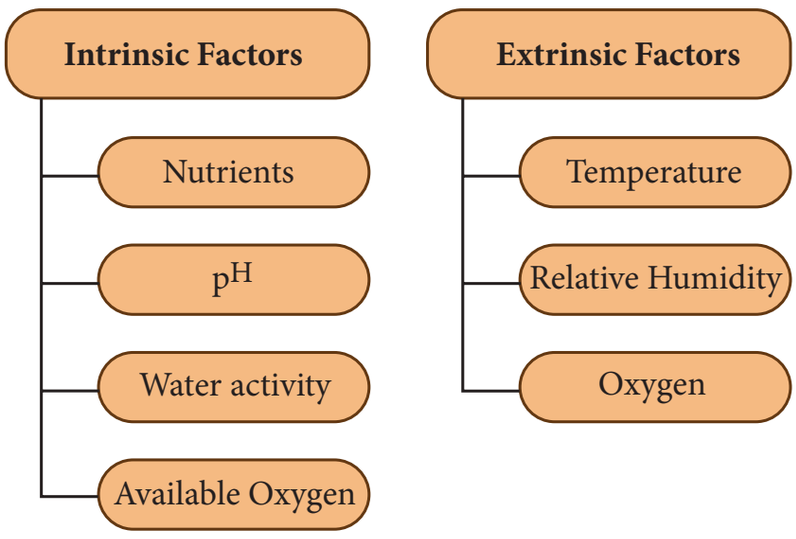
Mould in food production

Cheese:

Penicillium roqueforti and Penicillium camemberti (note that this one produces mycotoxin at 25°C, therefore the cheese production must happen at 15°C) Dry salami: makes the use of Penicillium and Scopulariopis moulds. Soy sauce: Aspergillus spp, especially A. oryzae, are involved in this production. There is also a subsequent lactic fermentation where lactic bacteria produce lactic acid. Sake: is produced using a combination of the mould Aspergillus oryzae and yeast .

3.1.4. Factors that influence microbial growth

Microorganisms require a set of factors that allow them to grow/live in certain environments . The various factors that influence the growth of microorganisms in foods are generally designated as intrinsic and extrinsic factors. The first correspond to physical chemical characteristics of the food while the second correspond to storage and environment conditions .



A. Intrinsic factors

Intrinsic factors are those that are related to the physical chemical characteristics of food. They are nutrients present in food, pH of the food, water activity, oxygen availability.

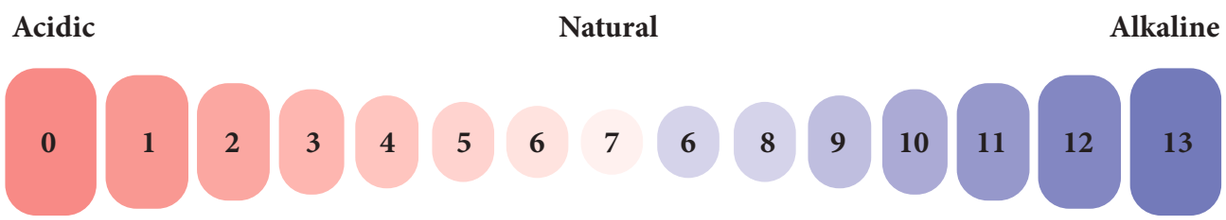
1.Nutrients

The more or less contents in proteins, sugars and other nutrients are going to determine what type of microorganisms are, preferably, able to grow on that food. The presence of vitamins, amino acids, etc., is going to allow the growth of some of the most demanding organisms, nutritional wise. Generally, moulds are the least demanding nutritional wise, followed by yeasts and then by bacteria.

2. pH

pH measures the acidity of a food. Acid Substances with a pH level between 1 and 6 (for example: lemon, vinegar, most fruits) Neutral Substances with a pH level close to 7 (for example: water) Alkaline or basic Substances with a pH level between 8 and 14 (for example: detergents, soaps, caustic soda).

pH levels vary with the amount of acid or basic compounds in an environment. Consequently, the higher the amount of acid substances in a food, the lower the pH level which means the more acid the food is. Acidification has been largely applied in the food industry and even at the domestic level, as a method able to increase the foods shelf life. It is convenient to refer that the pH level not only affects the growth of microorganisms in food, but also the survival rate during storage and diverse conservation treatments.



3. Water activity

The amount of water in a food is one of the main factors that determine the facility that a certain microorganism can grow on it, and consequently deteriorate it. From earlier days, man has used methods that increase the shelf life and microbiological stability of foods, by reducing the amount of available water. Ancestral food preservation methods, such as drying, salting and the addition of sugar were based on the basic principle of reducing the amount of available water. The greater the amount of sugar or salt in a food, the less quantity of available water will exist and the possibility for microbial growth will also be smaller.

4. Available Oxygen

The amount of oxygen in an environment has also influence on the type of microorganisms that can grow in a certain food and on the rate of their multiplication. The use of air tight packages results in the reduction of available oxygen in food.

Extrinsic factors

Extrinsic factors are those related food storage conditions and environment conditions . These are generally the factors that we most manipulate and control on a daily basis: temperature, humidity and oxygen.

1. Temperature

Temperature is one of the most relevant factors on microbial growth. If we think about food safety, this definitely ends up being the most important of all factors. When considering food-borne intoxications, it is not by chance that the use of risk temperatures during the conservation of food/meals, as well as the use of improper temperatures during food preparation/processing (under processing) are pointed out as being the main causes of the occurrence of food intoxications

Microbial growth is slower, if the temperature to which they are exposed decreases or increases in relation to the optimum temperature. Microbial growth stops when temperatures are under the minimum value or above the maximum value, but do not always result in the death of the microorganisms. As long as very high temperatures (used during cooking food) allow the destruction of a major part of microorganisms, the same doesn't happen at low temperatures. Freezing does not cause the destruction of microorganisms; it only maintains them in an inactive state . Unfreezing will eventually allow them to develop. Therefore, the correct use of temperatures during the maintenance food and food products is fundamental for its preservation and longer shelf life.

2. Relative Humidity

A very high relative humidity level favours microbial growth, especially those that are found on surfaces. Foods must be stored in low relative humidity conditions; otherwise, the humidity that is present in the surrounding environment will eventually end up increasing the amount of water in foods, and consequently, increase the risk of microbial proliferation.

3. Oxygen (atmosphere)

Oxygen is fundamental for the survival of many organisms. In the first case, the organisms are designated as aerobic and in the second case as anaerobic. Other organisms exist in the middle of these two extremes that are capable of growing in the presence or absence of oxygen; some even grow better if they are before a higher concentration of carbon dioxide, etc . The knowledge about how modifying the surrounding atmosphere can cause negative effects on some microorganisms and positive on others, has lead us to use, for some years now, modified atmosphere, controlled atmosphere or vacuum food packages to keep products fresh.

3.2. Types of microorganisms

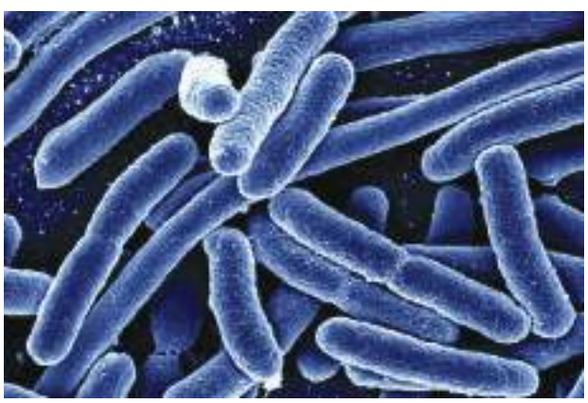
The tiniest life forms are bacteria, yeasts, moulds, and viruses, termed "micro organisms" because of their size (micro meaning small and organism meaning living being). Microorganisms may have at least one of four functions in a food. They may have a useful function, cause spoilage, be a health hazard, or be inert. The inert microorganisms do not find an environment favourable for growth. In most cases of food-borne illness, spoilage, or useful activity, the microorganisms grow and multiply. Organisms that cause food-borne illness are of more concern than are other types of microorganisms.

Useful organisms are those which produce desirable changes in food, such as converting milk to cheese, sugar to

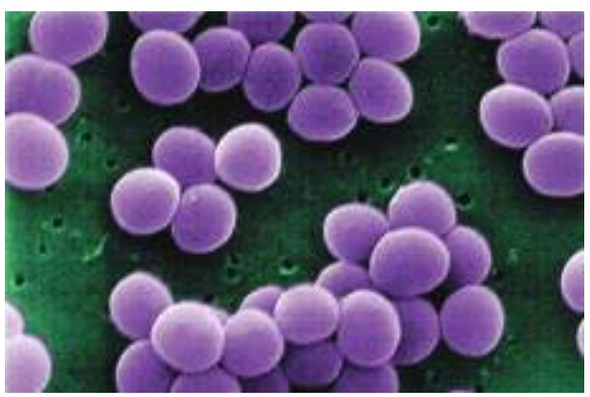
alcohol, and cabbage to sauerkraut. These changes are referred to as fermentations. The microorganism does not always have to be present to have a useful function, since enzymes can be separated from the organism, and the enzymes used to produce the desired reaction. Another function of useful organisms is the production of single-cell protein which can be used as food. Spoilage organisms and useful organisms are similar in that they both produce changes in the food. The difference between them is that one is desirable and the other is undesirable.

a) Bacteria

Bacteria are the most important microorganisms to the food processor. Most are harmless, many are highly beneficial, some indicate the probable presence of filth, disease organisms, spoilage and a few cause disease. There are thousands of species of bacteria, but all are single-celled and fall into three basic shapes: spherical, straight rods, and spiral rods. Bacteria can be placed into two groups based on their ability to form spores: spore formers and non-spore formers. As you may have guessed, spore formers can form spores, and non-spore formers cannot form spores. Four major spore-forming bacteria are C. botulinum, C. perfringens, B.cereus, and Bacillus anthra. **The cis (B. anthracis)**. These bacteria are normally present everywhere in the environment, which can make them difficult to control in a food-processing facility. Some useful bacteria are of great importance in the food processing industry. **Acetobacter sp**. These bacteria, also known as "vinegar bacteria", cause significant spoilage in the wine industry but are necessary for vinegar production. These bacteria are aerobes and in the presence of oxygen convert ethyl alcohol to acetic acid. These bacteria can be easily destroyed by heating to 65°C.



(a) Bacilli [image courtesy of CDC/Brian J.Beck (ATCC)]



(b) Cocci (image courtesy of CDC/Pete Wardell)

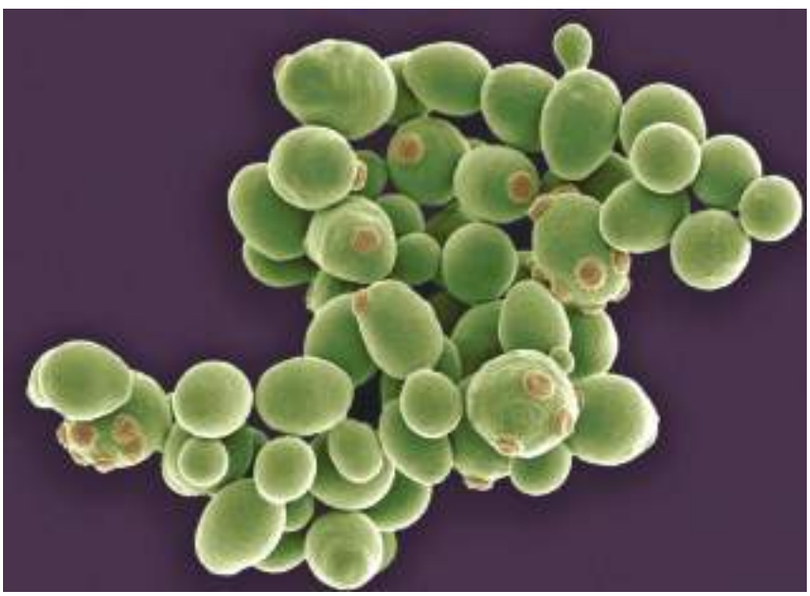
(c) Commas (image courtesy of CDC/Colorized by James Gathany)

(d) Spirilla (image courtesy of CDC/Claudia Molins)

Different Shapes of bacteria

b) Yeast

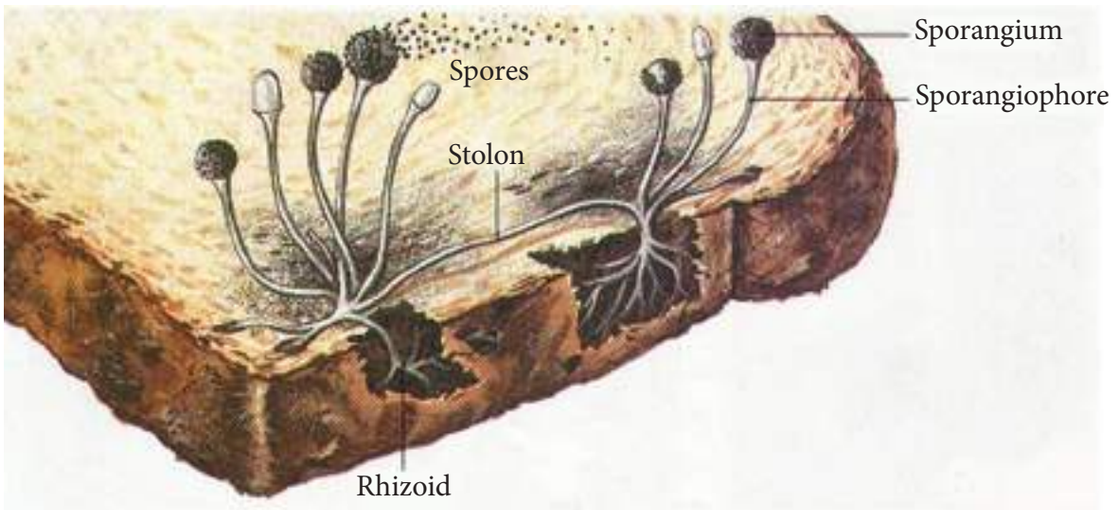
Yeasts are unicellular fungi which are widely distributed in nature. They are somewhat larger than bacteria. Most yeasts are spherical or ellipsoidal. Yeasts that multiply by means of 'budding' are known as 'true yeasts'. Yeasts grow luxuriously at a moderate temperature in a solution of sugar in plenty of water. Under suitable conditions the sugar is converted into alcohol and carbon dioxide is evolved. This is the reason that carbon dioxide is evolved from food materials spoiled by yeasts and pushes out corks from bottles with great force. Boiling destroys the yeast cells and spores completely. Some of the yeasts which grow on fruits are Saccharomyces, Candida and Brettanomyces.



c) Moulds

Moulds are multicellular, filamentous fungi which are devoid of chlorophyll. They are larger than yeasts. They are strict aerobes and require oxygen for growth and multiplication and

tend to grow more slowly than bacteria. They thrive best in closed, damp and dark situations with an adequate supply or warm, moist air but require less free moisture than yeasts and bacteria. They prefer sugar containing substances and may spoil jams, jellies and other sugar-based products. Acid medium favours their growth and, therefore, they grow well in pickles, juices etc. Moulds are sensitive to heat; boiling quickly destroys moulds and their spores. The most important moulds are: a) Penicillium sp. (Blue moulds) b) Aspergillus sp. (Black moulds) c) Mucor sp. (Gray moulds) d.Bysslchlamyces fulva.



d) Viruses

Viruses are the smallest and simplest microorganisms. Unlike bacteria, yeasts, and moulds, viruses are incapable of reproducing independently. Instead, they must first invade the cells of another living organism called the host, before they can multiply. Hence, they are parasitic, viruses which infect bacteria, called bacteriophages, cannot infect human beings or other animals On the other hand, several animal viruses, known as zoonotis, can infect human beings.

The viruses are important to the food process in two respects:

As a bacteriophage of lactic or other fermentative bacteria. Bacteriophage infections of starter cultures can interfere seriously with the manufacture of cheese, buttermilk, sauerkraut, pickles, wine, beer, and other desirable fermentative products.

As disease transmitted by food to human beings. Although viruses require a live host cell and cannot multiply in foods, they can remain viable and infectious for long periods of time, even under highly adverse conditions, such as drying, freezing and pasteurization.

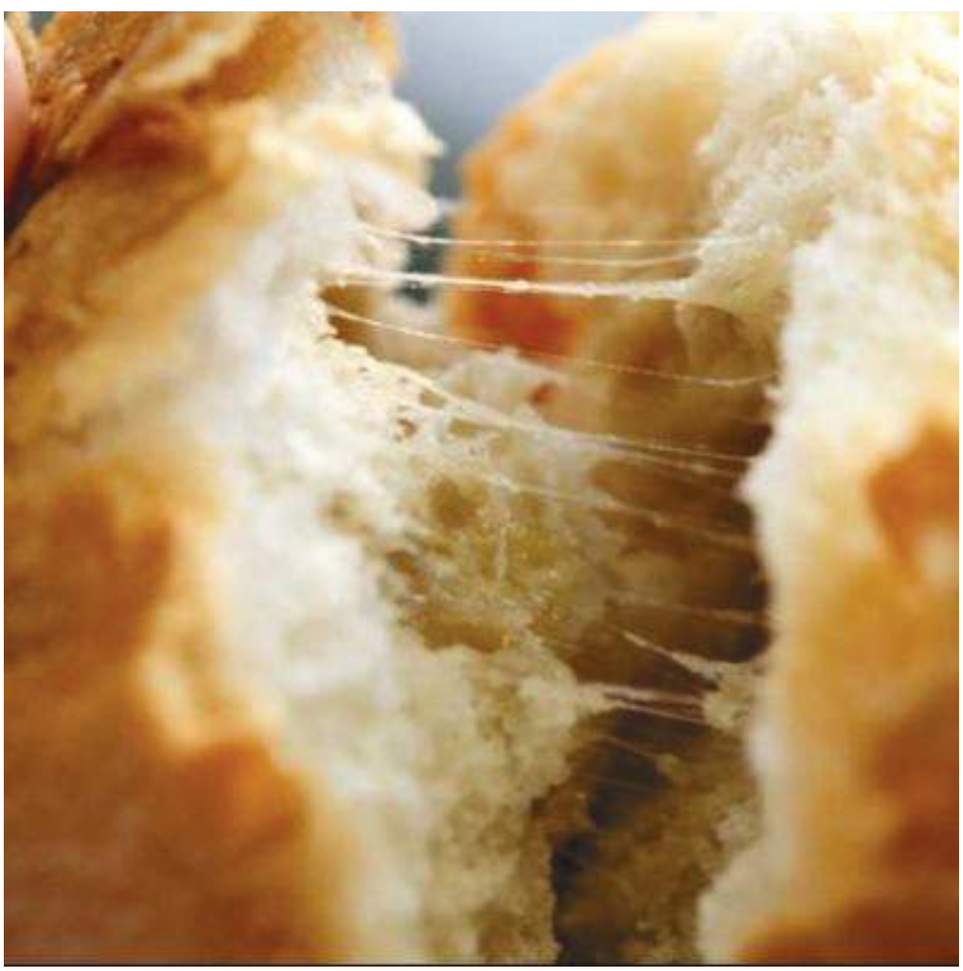
3.2.1. Spoilage in baked products

A wide variety of bakery product exist, including leavened and unleavened breads, rolls, buns, croissants, English muffins, crumpets, cakes, pastries, waffles, pancakes, cupcakes and sweet rolls. Bakery products are an important source of nutrients viz., energy, protein, iron, calcium and several vitamins. Commercial bread and biscuits contain around 7.5 per cent to 7.8 per cent protein respectively. These bakery products are typically baked at temperatures that are sufficient to destroy all bacteria, yeasts and moulds in the product. Most baked products have a dry outer crust that prevents the growth of bacteria that may recontaminate the products. However, typical pH values (between 5.4 and 7.5), high moisture content (water activity in the range of 0.75-0.98) and ambient storage temperatures act as favourable factors for the growth of spoilage microorganisms and can result in substantial economic losses to wholesale bakeries. The microbial spoilage caused by bacteria, yeast and fungi and enzymatic spoilage caused by lipoxygenase can be differentiated from one another and from unspoiled bread analogues after 48 hours using Cluster analysis, prior to signs of visible spoilage.

a) Bacterial spoilage

Bacteria also have a potential to contaminate baked products although their growth is more restricted by low water activity and low pH. The spores of Bacillus subtilis for examples

are heat resistant; 55 per cent remain active in amylase after 20 minutes at 65°C. This microorganism, which is present in raw ingredients, e.g., flour, sugar, and yeast, causes rope in bread. Ropey bread is characterized by discoloration from brown to black, the release of a rotten fruit odour and having an extremely moist, stringy bread crumb. This problem usually occurs in the summer season when the climate is warm and humid. Ropiness can develop very rapidly under warm and humid conditions. Ropy spoilage in bread is first detected by an odour similar to that of pineapple. Later, the crumb becomes discoloured, soft and sticky to the touch, which makes the bread inedible. . Prevention of rope problems require strict sanitary as well as good manufacturing practices designed to control the spores of Bacillus species. Preservatives, such as propionate, can be usually used to eliminate this problem. Staphylococcus aureus is one type of bacteria known to contaminate pie fillings. This microorganism has also been implicated in food poisoning outbreaks from cream filled bakery products. Other bakery ingredients, such as chocolate, desiccated coconut and cocoa powder have been found to be contaminated with Salmonella.



Notes

Baked goods containing such high-moisture adjuncts as pie fillings and pastry creams are susceptible to contamination by food-spoilage organisms, including Salmonella and Streptococcus. Cream and custard pies are recognized health hazards when stored at room temperature for any length of time, and some communities ban their sale during summer. Storage in frozen form eliminates the hazard.

b) Yeast spoilage

The yeast problems in bakery products can be divided into two types:

(a) visible yeast which grows on the surface of the bread in white or pinkish patches and, (b) fermentative spoilage associated with alcoholic and essence odours and hence osmophilic yeasts. Yeasts, which cause surface spoilage of bread are mainly Pichia burtonii("Chalk mould"). Contamination of products by osmophilic yeasts normally results from unclean utensils and equipment. Therefore, maintaining good manufacturing practices will minimize the contamination by osmophilic yeasts.

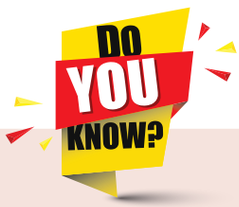
c) Mould spoilage

Mould spores are generally killed by the baking process in fresh bread and other baked products. Therefore, for bread to become mouldy, it must be contaminated either from the air, bakery surfaces, equipment, food handlers or raw ingredients after baking during the cooling, slicing or wrapping operations. This means that all spoilage problems caused by moulds must occur after baking. Bread crust is rather dry and if the relative humidity of the atmosphere is below 90%, moulds will not grow on it. Also, moulds are relatively slow to develop, so that in dry climates the surface of a slice of bread may dry before mould growth is

sufficient to be visible. The most common bread spoilage moulds are Penicillium spp., although Aspergillus spp. may be of greater significance in tropical countries. Pencillium spp., is the common blue green bread mould having very flat appearance. Aspergillus spp. is another mould of fluffy appearance and black sporangia.

Staling

Undesirable changes in bakery products can occur independently of microbial action. Staling involves changes in texture, flavour, and appearance. Firming of the interior, or "crumb," is a highly noticeable alteration in bread and other low-density, lean products. Elasticity is lost, and the structure becomes crumbly. Although loss of moisture produces much the same effect, texture staling can occur without any appreciable drying. Such firming is due to changes in the molecular status of the starch, specifically to a kind of aggregation of sections of the long-chain molecules into micelles, making the molecules more rigid and less soluble than in the newly gelatinized granule. Bread that has undergone texture staling can be softened by heating to about 60–65 °C (140–150 °F). However, its texture does not return to that of fresh bread, being gummier and more elastic. In addition, care must be exercised to prevent drying during heating.



- Retail Bakers– These bakers are the ones that you are more likely familiar with. Retail bakers work primarily in grocery stores, bakeries, artisanal stores. The main point differentiation is that these bakers generally work in smaller qualities, keeping the store well stocked. Sometimes they work behind the counter taking orders from customers.
- Commercial Baker– These bakers differ from retail bakers because they work in manufacturing facilities that produce breads and pastries in high yields. When you walk into their work environment you can expect to see high-volume mixers and large oven. As well, they often operate large, automated machines such as commercial mixers, ovens and conveyors
- Yeast - All commercial breads, except salt-rising types and some rye bread, are leavened with bakers' yeast, composed of living cells of the yeast strain Saccharomyces cerevisiae. A typical yeast addition level might be 2 percent of the dough weight.

3.3. Handling and disposal of contaminated baked products

Bakery products, like many processed foods, are subject to physical, chemical and microbiological spoilage. While physical and chemical spoilage limits the shelf life of low and intermediate moisture bakery products, microbiological spoilage by bacteria, yeast and moulds is the concern in high moisture products. Many industrially produced baked goods emerge from the baking process with a surface that is essentially sterile but post bake handling can quickly lead to fungal, microbial surface contamination as a result of exposure to airborne contaminants as well as equipment contact.

Bakery wastes result from various bakery management decisions and can occur at every stage of bakery production:

- They can consist of unsold breads and bakery products that have reached the end of their shelf-life and are then discarded as waste.
- They can result from inappropriate lot sizes/minimum order quantities. Big pack sizes of pre-mixed ingredients may yield surplus that need to be stored or discarded. In a similar way, bakery waste can result from inappropriate size of production batch and result in wasted dough.
- They can be low quality products: default size or texture, burnt products, etc.
- Food waste, non-edible by product & other refuse shall not be allowed to accumulate in food handling or storage areas. It shall be removed periodically with a minimum daily removal so as to avoid accumulation & overflow in food handling, food storage, other working areas & adjoining environment. Labelled materials, products or printed packaging designated as waste shall be disfigured or destroyed. Removal and destruction should be carried out by approved disposal contractors. Waste stores and dust bins must be kept appropriately clean, free of pests and in closed conditions and shall be disposed as per local rules and regulations including those for plastic and other non- environment friendly materials.

3.4. Shelf life evaluation of baked products

All food has a limited shelf life. This varies depending on the food type, how it is packaged and how carefully it is stored. The shelf life is defined as " The length of time a food can be kept under stated storage conditions while maintaining its optimum safety and quality. " The shelf life of a food must be assessed carefully and with the full knowledge of the risks involved, to avoid putting the consumer and ultimately the Food Business Operator (FBO) at risk. Setting shelf-life typically involves a number of steps. This often includes shelf-life studies which aid in determining the length of time the product will meet certain standards in relation to parameters such as microbiology, taste, appearance, vitamin levels and smell.

Active packages can also be designed to inhibit microbial growth. The presenters noted that a number of spoilage organisms are aerobic, meaning incorporating an oxygen absorber into the package can slow their growth. Moreover, these oxygen absorbers slow the oxidation of vitamins and antioxidants, which can be lost during product storage and distribution.

Notes

it is a mandatory requirement that foods carry a use by date or the date of minimum durability – in the form of a best before date.

USE BY:

Must be used for those foods which are highly perishable from a microbiological point of view. After a relatively short period, these foods are likely to present a risk of food poisoning, and so this relates to the safety of the food. 'Use By' expires at midnight on the date shown. Typically, this form of date coding is found on fresh and ready to eat foods such as cream cakes or cooked meat. After the 'use by' date food is deemed unsafe and it is a criminal offence to sell it.

BEST BEFORE/BEST BEFORE END:

This kind of expiry date is used to indicate the period for which a food can reasonably be expected to retain its optimal condition and so relates to the quality of the food. This is the point at which the taste or eating quality may begin to decline. The food will still be safe to eat beyond this point but it will not be at its best. In view of the vast range of food products, the expected shelf life related to the quality of the product can range from a few days (bread and baked goods) to greater than a year (canned goods, dry goods, frozen food). Similarly, the 'best before' date accommodates the wide range of shelf life applied to such products. Accordingly,

the Regulations recognise that the format of the coding needs to be flexible for the range of dates covered. For a shelf life under 3 months, an indication of the day and the month is sufficient; between 3 months and 18 months an indication of the month and year is sufficient; for more than 18 months, an indication of the year is the minimum required The type of expiry date must therefore be taken into account when reviewing the shelf-life that is assigned to ingredients, work in progress or products that are ready for sale.

Factors affecting shelf life

Both intrinsic and extrinsic factors influence the shelf life of food products. Intrinsic factors include the initial quality of the food (use of quality ingredients and low microbial load), the inherent nature of the product (fresh, perishable food will have a shorter shelf life compared to processed, shelf stable foods) and product formulation (presence of a preservative or anti-oxidant extends shelf life).

Extrinsic factors that affect shelf life are processing methods (heat treatment or high-pressure processing will reduce microbial load and extend shelf life), barrier properties of the packaging (materials with low oxygen transmission rate and low water vapour transmission rate protects the product from oxidation and moisture gain or loss, respectively), transportation and storage conditions (elevated temperatures and relative humidities can shorten shelf life), and consumer handling (temperature control is variable in a home environment).

What is Shelf Life Extension?

Shelf life extension is an effort to make food safe for long periods, still keeping its original quality. Baked products beyond their shelf life can become:

- Stale, firm and dry

- Less resilient
- Not as flavourful
- Unsafe due to microbial growth

Advances in bakery processing technologies and ingredients innovation have led to significant shelf-life extension. For example, breads and buns that traditionally lasted 6 or 10 days, now remain soft, springy and mould-free up to 3 weeks.

Application

To extend the shelf life of products, different ingredients and processes can be used. Strategies depend on the end product, and if it is a clean label or not. Here are some solutions to slow both mould and staling.









Preventing mould spoilage :

- **Mould inhibitors :** can be clean label mould inhibitors or artificial preservatives.
- **pH and Acidity :** lowering the pH of the final product using acidulates or long dough fermentations, such as sourdough and pre ferments.
- **Cleaning and Sanitation :** implementing good cleaning and sanitizing practices in critical product-contact surfaces. For

example, pay attention to the mixer, divider, conveyors and cooler. Mould spores cannot survive the baking process, so sanitation is key for controlling mould growth or product recontamination after baking.

- **Implementation of HACCP principles :** a HACCP plan is a systematic approach to food safety management that identifies and evaluates food safety hazards.
- **Water content :** controlling water activity and moisture content in baked products can be done with optimum baking and cooling conditions.
- **Packaging :** using adequate packaging method and materials. For example, modified atmosphere packaging (MAP) reduces mould growth and increases shelf life.

Slowing down staling rate and moisture loss :

- **Emulsifiers crumb softeners :** although they do not produce softer fresh bread, they do slow the rate of firming over time. Some examples are lecithin, mono- and di-glycerides, amphiphilic proteins, alpha-cyclodextrin, DATEM, SSL and CSL.
- **Hydrocolloids :** can slow crumb moisture loss. When choosing hydrocolloids, keep in mind their capacity to make liquids dense. Also, their water holding capacity, hydration rate, and the effect of temperature on hydration.
- **Enzymes :** alpha-amylase, xylanase, and lipase have significant anti-staling effects. Hydrolysis of starch by alpha-amylases release dextrins and other oligosaccharides.
- **Long fermentations :** using dough systems that require long bulk fermentation before mixing. For example, sourdough or yeast preferments like sponges and poolish.
- **Freezing :** freezing temperatures pretty much stop all chemical reactions and molecular motion. So, this prevents starch from recrystallizing after baking.

Good Manufacturing Practices (GMPs) Good Manufacturing Practices* (GMPs) are the basic operational and environmental conditions required to produce safe foods. They ensure that ingredients, products and packaging materials are handled safely and that food products are processed in a suitable environment.

Practical Activity

1. Enlist useful microorganism for bakery products

Materials Required:

1. Pictures of bacteria, fungi, yeast .
2. Scissors
3. Adhesive/glue.
4. Record note book.

Procedure.

Search and collect pictures of microorganisms .

Cut the pictures neatly.

Apply glue and paste it in the record notebook.

Label the pictures.

Write a brief note about the use of microorganism in bakery.

2. Identify microbial growth in baked goods

Materials Required:

1. A piece of bread, cake.
2. Small plastic box - 2 no's.
3. Magnifying glass/microscope.

Procedure:

1. Place a piece of bread and cake in seperate plastic boxes for one week and observe the following. Write your observations in the record note book.
   a. Growth of microorganism.
   b. Colour change.
   c. Flavour.
   d. Texture.

3. Identification of baked food infected by bacteria, moulds and fungus

Materials Required:

1. A piece of bread.
2. Small plastic box - 1.
3. Magnifying glass/microscope.

Procedure:

1. Place a piece of bread in a plastic boxes for one week and observe the following microbial growth. Write your observations.

S.No.	Microorganism	Appearance	Colour change	Odour
1.	Bacteria			
2.	Mould			
3.	Yeast			

Conclusion:

4. Practical activity on handling microbial contamination

Materials Required:

1. Note book, pen.

2. Camera/ mobile phone with camera.

Procedure:

Visit a nearby bakery industry/unit /shop/local distributor with your teacher.

Observe the following. (a) Different process used to control microbiol growth.

(b) Packaging (c) use by date. (d) waste disposal.

Prepare a report of the field visit.

5. Practical activity on shelf life evaluation in ingredients and finished products.

Materials Required:

1. A piece of bread, cake, biscuit.

2. Magnifying glass.

Procedure:

Collect samples of bread, biscuits and cake from two different bakeries and inspect the following. Write your observations.

BREAD - a. Crust b. Flavour c. Air pockets d. Glossy interior e. Finish.

BISCUITS - a. Mouth feel b. Crispiness c. Softness d.Smoothness e. Crunchiness

CAKE - a. Appearance b. Taste c. Frosting d. Baking e. Flavours.

Glossary

Aerobic	:	microorganisms are those, which require free oxygen for growth.
Anaerobic	:	microorganisms are those, which grow best in the absence of free oxygen.
Enzymes	:	Enzymes are biological catalysts possessing efficiency and specificity and are mostly protein in nature.
Fermentation	:	was used for the production of wine but at present it encompasses the foods made by the application of microorganisms including lactic acid bacteria (LAB).
Micro-flora	:	The community of microorganisms, including bacteria, moulds and yeasts that live in or on another living organism or in a particular habitat.
Pathogen	:	Organisms that cause illness. These organisms include bacteria, protozoa, or viruses.
pH	:	Level of acidity or alkalinity in a product.
Low acid foods	:	The foods having pH above 5.3 are called low acid foods. For example: peas, corn, lima beans etc.
Medium acid foods	:	The foods which have pH between 4.3 and 5.3 are called medium acid foods. For example: asparagus, beets, pumpkin, spinach etc.
Acid foods	:	Foods which have pH between 3.7 and 4.5 are called acid foods. For example: pears, pineapple, tomatoes etc.
High acid foods	:	Foods having pH 3.7 or lower are included in this category. For example: Berries and sauerkraut.

Notes

Pichia burtonii	:	(Hansenula and Hyphopichia are obsolete synonyms) is a genus of yeasts in the family Saccharomycetaceae with spherical, elliptical, or oblong acuminate cells.
Sake	:	A Japanese alcoholic drink made from fermented rice, traditionally drunk warm in small porcelain cups.
Sauerkraut	:	It is the product of characteristic flavour, obtained by lactic fermentation of cabbage in the presence of 2-3% of salt .
Spore	:	A highly resistant, dormant structure formed in response to adverse environmental conditions. Bacterial spores are usually very resistant to heat, long periods of dryness, and other adverse conditions that normal vegetative cells cannot survive.
Vinegar	:	The word vinegar is derived from two French words, vin and aigre meaning sour wine but the term is used to denote a condiment prepared from various sugar and starch containing materials by alcoholic and subsequent, acetic acid fermentation.
Bakers' yeast	:	The strains of Saccharomyces uvarum used to make bread.
Wine yeast	:	S. cerevisiae var. ellipsoids.
Distillers yeast	:	High alcohol yielding strains of S. cerevisiae var ellipsoid used to higher alcoholic beverages.

Evaluation

I. Choose the correct answer (1 Mark)

1. Food spoilage and deterioration is no accident. It is a _____ occurring process.

   (a) Chemical (b) Natural

   (c) Selective (d) Biological.

2. The composition of air does not allow the development of microorganism because they can't find any _____ in it.

   (a) Bacteria (b) Nutrients

   (c) Virus (d) Food

3. Moulds are multi cellular, filamentous fungi which are devoid of _____.

   (a) Chlorophyll (b) Vitamins

   (c) Minerals (d) Oxygen

4. Find the foods which have pH between 4.3 and 5.3.

   (a) peas, corn, lima beans.

   (b) asparagus, beets, pumpkin, spinach.

   (c) pears, pineapple, tomatoes.

   (d) Berries and sauerkraut.

5. Match the following:

   (a) alpha-cyclodextrin (1) Enzymes.

   (b) anti-staling (2) Quality of the food

   (c) Extrinsic factor (3) Emulsifiers

   (d) Intrinsic factor (4) Low oxygen

6. Coliforms and _____ aureus are the main microorganisms related to food contamination by man.

   (a) Staphylococcus (b) Saccharomyces

   (c) Mould (d) Yeast

II. Answer the following: (2 Marks)

1. Define food spoilage.
2. List the different types of microorganisms.
3. What are enzymes ?

4. What is meant by oxidation ?
5. List the recommended temperature for food storage ?
6. What are the control measures you will suggest to avoid food contamination through water?
7. What do you understand by cross contamination. suggest ways to avoid it ?
8. What are food microbes ?
9. What are probiotics ?
10. What are bacteriophages ?
11. What is Shelf Life Extension?
12. Write notes on use by date of a bakery product.

III. Answer in detail: (3 Marks)

1. Explain the source of microorganism in food ?
2. Explain the use of microorganisms in food production.
3. What are the factors that influence microbial growth in food ?
4. Explain the role of Nutrients in food spoilage.
5. Explain the role of pH to increase the shelf life of foods.
6. Microbial growth stops when temperatures are under the minimum value or above the maximum value. Discuss.
7. Unsold breads and bakery products have reached the end of their shelf-life in your bakery. Suggest the methods you follow to discard them.
8. Explain the role of mould in food production.
9. What is the role of yeast in bakery products ?
10. Explain the different types of microbes in food spoilage.

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PRE PREPARATION AND BAKING THE PRODUCTS IN THE OVEN

4

- Utilize oven for baking products.
- Plan production for baking products in an oven.
- Prepare the common bakery products using different types of dough.

Learning Outcomes

Introduction

Baking is probably the oldest cooking method. Bakery products, which include bread, rolls, cookies, pies, pastries, and muffins, are usually prepared from flour or meal derived from some form of grain. Bread, already a common staple in prehistoric times, provides many nutrients in the human diet.

Baking refers to a process "to cook by dry heat" and is therefore next to cooking another essential way of preparing food from raw staple crops. During the baking process the dough is transformed into eatable food (nutritional improvements) and at the same time, microorganisms causing spoilage are destroyed prolonging keeping time of the product (food preservation). Unlike other cooking methods, baking does not alter the nutritional value of the food item, e.g. the fat and calorie content of the food.

Notes

Baking is probably as ancient as human kind. The first civilizations in recorded history, the Egyptians and Mesopotamian people, cultivated wheat. They learned the art and craft of baking bread after discovering that wheat kernels could be eaten in a palatable form by grinding and turning them into flour, and then adding water to create paste which could be cooked and consumed. At the time, fire and manual work were key for the development of primitive baking processes.

The Egyptians developed the first ovens. The earliest known examples are cylindrical vessels made of baked Nile clay, tapered at the top to give a cone shape and divided inside by a horizontal shelf like partition. The lower section is the firebox, the upper section is the baking chamber. The pieces of dough were placed in the baking chamber through a hole provided in the top. Baking techniques improved with the development of an enclosed baking utensil and then of ovens, making possible thicker baked cakes or loaves.

4.1. Oven

An oven is an enclosed cavity or tunnel where dough or batter is surrounded by a hot environment and becomes baked and transformed into bread, cookies, or other products. In order to bake the products, ovens use energy generation sources, e.g., combustion of fuels such as gas or oil, or electricity. The released available energy from these sources is transferred to the products by means of radiation, conduction, and/or convection. The oven sets and maintains the proper conditions of heat flux, humidity, and temperature to carry out the baking process and the removal of moisture from the products.

Notes

In the bakery industry an oven is the most important processing step for several reasons:

1. It is the workhorse of the bakery. The production output of a bakery is usually controlled by the capacity of the oven.
2. Heat and mass transfer phenomena both take place simultaneously inside this piece of equipment, triggering physicochemical and biochemical changes in the product.
3. Baking in the oven is the step that imparts the final characteristics to the products (e.g., shelf life, flavour, texture, colour, aroma).
4. It provides a crucial kill step that prevents pathogens from thriving within the product.

4.1.a. Types of ovens

Depending on their mode of operation and heat transfer mechanism, ovens can be classified as either batch or continuous equipment and as using either direct or indirect heat exchange. The type of oven that suits a bakery's operation may be a function of production capacity, product specifications, floor space, available energy sources, operation efficiencies, construction materials, and maintenance needs.

1. Direct-fired oven (DFO)

DFOs place combusting gas (energy source) inside the baking chamber to heat the air and the products. The heat transfer in a direct gas-fired oven is primarily carried out by radiation from the flames (ribbon burners placed above and below the oven band), top, base and walls of the baking chamber. Direct-fired ovens are very efficient because they convert most of the fuel to heat and process the products, and this lowers fuel consumption and operating costs.

Notes

2. Indirect-fired oven (IFO)

IFOs indirectly heat the baking chamber by using exchangers. This oven is suitable for sensitive bakery products (e.g., cakes, pastries) since the byproducts of combustion remain inside the heat exchanger structure and do not come into direct contact with the dough pieces. This eliminates the risk of contamination and of impregnation of off-odors in the products. This type of oven is less often used nowadays because of its limited power for heat transfer and energy efficiency (amount of fuel burned in a given time versus water loss (evaporated moisture) of the products during baking).

3. Electric oven

Electric ovens have construction features similar to those of DFOs, and operate similarly in terms of heat transfer mechanism to bake the products. This type of oven uses electrical resistances in place of the traditional gas burners of DFOs. Electric-fired ovens have limited use in the baking industry due to their power consumption and costs per kWh. They also face scale-up challenges that require further research and industry application.

Notes

4. Peel brick oven

The peel brick oven was one of the first constructed baking units in human history. It consists of a massive brick material chamber. The chamber is connected to a refractory tile floor that holds the dough pieces. Coal and wood are used as fuel (combustion source). Because of their construction features (insulation capacity of materials and thickness of the walls), these ovens are able to steadily transfer radiant heat to the products, and also maintain high temperatures inside the baking chamber for prolonged periods of time. The ovens are operated manually and require special skills from the baker.

5. Rack oven

Notes

A rack oven is a batch vertical oven into which racks full of sheet pans can be wheeled for baking. This unit can hold 8 to 20 sheet pans per baking cycle. Some units make use of electric or fuel sources, and place fans inside the baking chamber (generation of convection drying) to speed up baking times and to develop special features in the products. This oven is suitable for retail operations due to its floor space economy, and medium to long baking cycle times. 1. The products are baked upon customer order, and are often offered directly (unpackaged) for immediate consumption. 2. These ovens usually have programmable (saved) recipes so that the operator can change baking time and temperature, intensity of air ventilation, and steam impingement frequency.

6. Reel oven (also known as revolving tray oven)

A reel oven is an oven in which trays or shelves are placed on platforms rotating on a central horizontal axis. A high baking chamber is required to accommodate the reel structure, thereby saving floor space. Reel ovens are normally directly fired with gas or electricity, with the heating source located centrally across the floor of the chamber. This type of oven is mostly designed for retail bakeries or baking plants with small-scale production. Reel ovens often do not generate uniform distribution of heat transfer due to their revolving nature and interfering structure for radiant heat transfer. Products placed on sheet pans or trays continuously rotating may present uneven coloring or poor final moisture distribution.

7. Conveyorized oven (also known as traveling tray oven)

Conveyorized ovens replace the reel ovens concept with two parallel endless conveying chains that carry trays of products through the length of the baking chamber, so the dough pieces continually enter and leave the oven. Their main advantages are simplicity of design, and uniformity of baking as the products travel the same path through the baking chamber. A motor drive directly controls band speed, thereby determining baking cycle time. Conveyorized ovens may be single-lap or double-lap. In single-lap ovens, the trays containing the products travel a single pass (back and forth). The trays in a double-lap oven travel through four heat zones instead of the two zones of the single-lap oven.

8. Tunnel oven

Tunnel ovens are continuous mode operation baking units, and are commonly used in large-scale bakeries. This unit typically has a long baking chamber (usually more than 80 meters in length), which goes from one side (loading point) to another (unloading point) in a straight conveying band. The conveyor band material may be built of wire mesh or carbon steel sheets. Tunnel ovens are commonly powered by fuels such as natural gas (used for baking), and electricity (for powering air circulation and conveying system). The baking chamber may be divided into several baking zones. This makes the application of a temperature sequence possible, which provides the baker more flexibility in baking conditions and more complexity for controlling baking parameters.

9. Hybrid oven

Hybrid ovens combine the three modes of heat transfer and take advantage of their synergistic effect on products. This type of oven usually requires a high degree of automation since its construction, control systems, and energy sources are too complex to be manipulated manually.

Notes

4.1.b. Oven baking process and maintenance.

From dough to bread – baking steps

Baking is a high temperature process applied to fermented pieces of dough, that transform the dough in the baked form, the bread. During baking several phenomena occur: product volume development, crumb and crust formation, flavour delivery, bread colour formation, moisture and weight loss.

Dough pieces during baking receive heat from the furnace surfaces (in different ways: conduction, convection and radiation, depending on the type of oven), which are already at about 100°C, and the temperature is constantly increasing. The heated superficial layer extends the warmth to the inner layers that in the end of the process reach 100°C also.

Furnace humidity is also very important for heat exchange, not only for the bread's properties (volume, shape, appearance, colour and crust thickness), but also the speed of baking. More moisture in the oven, more condensed water on the bread surface and, at the same time, increases the heat so that the temperature of the product grows fast.

The water condensation process follows until the surface temperature reaches 100°C (water evaporation) and the opposite process begins, the water evaporation from the superficial layer and then from the inner ones. It is important to stop the baking at the optimum moment, therefore a certain amount of humidity has to remain inside the bread loaf; this internal moisture will migrate to the upper layers during the cooling process.

The baking time is directly proportional to the weight of the dough, so the higher the weight of the dough pieces is, a longer baking time is needed. The same relation is seen in the case of the height of the products, at a certain baking temperature a longer time is involved for bread with larger dimensions.

Maintenance of ovens

Oven maintenance focuses on two major goals:

Prevent food safety hazards (physical, biological, and chemical) from occurring by reducing the likelihood of foreign material contamination, under-processing, and contamination with lubricants. These hazards may pose a food safety risk to customers, not to mention the loss of a good reputation and money.

Prevent mechanical, electrical, and thermal equipment failures that could negatively impact normal oven operation; and increase downtime, which could trigger significant economic losses.

Notes

4.1.2. Fuels used to fire the oven.

Theoretically, anything that burns can be used to heat a baking oven, but in practice, fuel needs careful selection. It is not always best to choose the cheapest energy source in order to be economical. Other factors to that should be considered are the consistent availability of fuel, the type and amount of ash that is formed, the energy value of the fuel and the location of the bakery to prevent smoke disturbances.

Baking requires a larger amount of thermal energy input, e.g. wood, than cooking. Availability and price of fuel are therefore crucial for bakeries as it constitutes their largest operating cost: up to 30 per cent of the bread loaf cost is constituted by fuel costs. Bakers must therefore conduct a careful analysis of their energy needs.

The following fuels may be available:

a. **Mains gas (LPG)** are the preferred options in countries that have an established gas distribution system because they burn cleanly, regulation of heat input is possible instantly, and produce no contamination of products. In some regions gas may be too expensive, and it may be available only in some urban centres.

b. **Electricity** is mostly a question of availability and affordability.

c. **Solid fuels** may be the lowest-cost option in many countries. Traditionally, wood has been cheap or free and hence widely used in bakery ovens, but deforestation in many countries has resulted in legal restrictions on its use and/or increased costs. It also produces a light fluffy ash that can easily contaminate

Notes

products. But wherever biomass is the economically best option, efficient technology may help to overcome the environmental problems and health issues.

Where available, coal is the preferred solid fuel for bakery ovens because it is dense and compact, it has a high calorific (heating) value, it is handled relatively easily and it produces a compact ash that is more easily disposed of than wood ash.

Charcoal is often more expensive than wood and coal, but it produces an intense heat with little smoke. Having skills and experience to control the fire is more crucial for solid fuels.

Notes

Variable temperatures causing quality disturbances and wasteful consumption of fuel may lead to increased expenses.

d. **Liquid fuels** such as kerosene or diesel are not widely used in baking ovens because they risk contaminating products with off-odours or even fires and explosions (petrol).

e. **Solar energy** can also be an energy source for baking purposes.

Preheating Oven

Preheating an oven is especially important with baking when you use yeast, baking soda and baking powder as leavenings, all of which react to heat. Your recipe also cooks faster in a preheated oven because you've got the right temperature from the start and your dish can start cooking properly as soon as you put it in the oven. An oven thermometer will help you calibrate your oven's temperature to see if your own oven runs a few degrees too cool or too hot.

4.1.3. Work plan

Baker's math vis a vis raw material quantities, temperatures, and weight conversions.

Recipes often need to be adjusted to meet the needs of different situations. The most common reason to adjust recipes is to change the number of individual portions that the recipe produces. For example, a standard recipe might be written to prepare 25 portions. If a situation arises where 60 portions of the item are needed, the recipe must be properly adjusted.

Other reasons to adjust recipes include changing portion sizes (which may mean changing the batch size of the recipe) and better utilizing available preparation equipment (for example, you need to divide a recipe to make two half batches due to a lack of oven space).

Notes

Conversion Factor Method

The most common way to adjust recipes is to use the conversion factor method. This requires only two steps: finding a conversion factor and multiplying the ingredients in the original recipe by that factor.

Finding Conversion Factors

To find the appropriate conversion factor to adjust a recipe, follow these steps:

1. Note the yield of the recipe that is to be adjusted. The number of portions is usually included at the top of the recipe (or formulation) or at the bottom of the recipe. This is the information that you HAVE.
2. Decide what yield is required. This is the information you NEED. Obtain the conversion factor by dividing the required yield (from Step 2) by the old yield (from Step 1). That is, conversion factor = (required yield)/(recipe yield) or conversion factor = what you NEED ÷ what you HAVE.

To find the conversion factor needed to adjust a recipe that produces 25 portions to produce 60

portions, these are steps you would take:

1. Recipe yield = 25 portions

2. Required yield = 60 portions

Conversion factor

1. = (required yield) ÷ (recipe yield)

2. = 60 portions ÷ 25 portions

3. = 2.4.

If the number of portions and the size of each portion change, you will have to find a conversion

factor using a similar approach:

1. Determine the total yield of the recipe by multiplying the number of portions and the size of each portion.
2. Determine the required yield of the recipe by multiplying the new number of portions and the new size of each portion.

Find the conversion factor by dividing the required yield (Step 2) by the recipe yield (Step 1).

That is, conversion factor = (required yield)/(recipe yield).

Notes

For example, to find the conversion factor needed to change a recipe that produces 20 portions with each portion weighing 150 g into a recipe that produces 60 portions with each portion containing 120 g, these are the steps you would take:

1. Old yield of recipe = 20 portions × 150 g per portion = 3000 g.
2. Required yield of recipe = 40 portions × 120 g per portion = 4800 g.

Conversion factor

1.= required yield ÷ old yield.

2.= 4800 ÷ 3000.

3.= 1.6.

Key Takeaway

To ensure you are finding the conversion factor properly, remember that if you are increasing your amounts, the conversion factor will be greater than 1. If you are reducing your amounts, the factor will be less than 1.

Adjusting Recipes Using Conversion Factors

Now that you have the conversion factor, you can use it to adjust all the ingredients in the recipe.

The procedure is to multiply the amount of each ingredient in the original recipe by the conversion factor. Before you begin, there is an important first step:

Before converting a recipe, express the original ingredients by weight whenever possible.

Converting to weight is particularly important for dry ingredients. Most recipes in commercial kitchens express the ingredients by weight, while most recipes intended for home cooks express the ingredients by volume. If the amounts of some ingredients are too small to weigh (such as spices and seasonings), they may be left as volume measures. Liquid ingredients also are sometimes left as volume measures because it is easier to measure a litre of liquid than it is to weigh it. However, a major exception is measuring liquids with a high sugar content, such as honey and syrup; these should always be measured by weight, not volume.

Converting from volume to weight can be a bit tricky and may require the use of tables that provide the approximate weight of different volume measures of commonly used recipe ingredients. Once you have all ingredients in weight, you can then multiply by the conversion factor to adjust the recipe.

Adjust a standard formulation designed to produce 75 biscuits to have a new yield of 150 biscuits.

Table1: Table of ingredients for conversion recipe in metric system:

Ingredient	Amount
Flour	1.75 kg
Baking powder	50 gm
Salt	25 gm
Shortening	450 gm
Milk	1.25 l

Solution

Find the conversion factor.

conversion factor = new yield/old yield

= 150 biscuits÷75 biscuits

= 2

Multiply the ingredients by the conversion factor. This process is shown in Table 2 .

Table 2: Table of ingredients for recipe adjusted in metric system

Ingredient	Amount	Conversion Factor	New Amount
Flour	1.75 kg	2	3.5 kg
Baking powder	50 g	2	100 g
Salt	25 g	2	50 g
Shortening	450 g	2	900 g
Milk	1.25 l	2	2.5 l

Notes

Cautions when Converting Recipes

Although recipe conversions are done all the time, several problems can occur. Some of these include the following:

- Substantially increasing the yield of small home cook recipes can be problematic as all the ingredients are usually given in volume measure, which can be inaccurate, and increasing the amounts dramatically magnifies this problem.
- Spices and seasonings must be increased with caution as doubling or tripling the amount to satisfy a conversion factor can have negative consequences. If possible, it is best to under-season and then adjust just before serving.
- Cooking and mixing times can be affected by recipe adjustment if the equipment used to cook or mix is different from the equipment used in the original recipe.

The fine adjustments that have to be made when converting a recipe can only be learned from experience, as there are no hard and fast rules. Generally, if you have recipes that you use often, convert them, test them, and then keep copies of the recipes adjusted for different yields, as shown in Table 3.1 & Table 3.2 Recipes for Different Yields of Cheese Puffs

Table 3.1: Cheese Puffs, Yield 30

Ingredient	Amount
Butter	90 g
Milk	135 mL
Water	135 mL
Salt	5 mL
Sifted flour	150 g
Large eggs	3
Grated cheese	75 g
Cracked pepper	To taste

Table 3.2 : Cheese Puffs, Yield 60

Ingredient	Amount
Butter	180 g
Milk	270 ml
Water	270 ml
Salt	10 ml
Sifted flour	300 g
Large eggs	6
Grated cheese	150 g
Cracked pepper	To taste

Baker's Percentage:

Many professional bread and pastry formulas are given in what is called baker's percentage. Baker's percentage gives the weights of each ingredient relative to the amount of flour (Table 4). This makes it very easy to calculate an exact amount of dough for any quantity.

Table 4: A formula stated in baker's percentage

Ingredient	%	Total	Unit
Flour	100.0%	15	kg
Water	62.0%	9.3	kg
Salt	2.0%	0.3 kg	kg
Sugar	3.0%	0.45	kg
Shortening	1.5%	0.225	kg
Yeast	2.5%	0.375	kg
Total weight	171.0%	25.65	kg

To convert a formula using baker's percentage, there are a few options:

If you know the percentages of the ingredients and amount of flour, you can calculate the other ingredients by multiplying the percentage by the amount of flour to determine the quantities. Table 5 shows that process for 20 kg flour.

Table 5: Baker's percentage formula adjusted for 20 kg flour.

Ingredients	%	Total(kg)
Flour	100.0%	20
Water	62.0%	12.4
Salt	2.0%	0.4
Sugar	3.0%	0.6
Shortening	1.5%	0.3
Yeast	2.5%	0.5
Total weight	171.0%	34.20

If you know the ingredient amounts, you can find the percentage by dividing the weight of each ingredient by the weight of the flour. Remember, flour is always 100%. For example, the percentage of water is 6.2 ÷ 10 = 0.62 × 100 or 62%. Table 6 shows that process for 10 kg of flour.

Table 6: Baker's percentages given for known quantities of ingredients.

Ingredients	%	Total(kg)
Flour	100.0%	10
Water	62.0%	6.2
Salt	2.0%	0.2
Sugar	3.0%	0.3
Shortening	1.5%	0.15
Yeast	2.5%	0.25
Total weight	171.0%	17.10

Use baker's percentage to find ingredient weights when given the total dough weight.

For instance, you want to make 50 loaves at 500 g each. The weight is 50 × 0.5 kg = 25 kg of dough.

You know the total dough weight is 171% of the weight of the flour.

To find the amount of flour, 100% (flour) is to 171% (total %) as n (unknown) is to 25 (Table 7).

That is,

1. 100 ÷ 171 = n ÷ 25

2. 25 × 100 ÷ 171 = n

3. 14.62 = n

Table 7: Formula adjusted based on total dough weight.

Ingredients	%	Total (kg)
Flour	100.0%	14.62
Water	62.0%	9.064
Salt	2.0%	0.292
Sugar	3.0%	0.439
Shortening	1.5%	0.219
Yeast	2.5%	0.366
Total weight	171.0%	25.00

As you can see, both the conversion factor method and the baker's percentage method give you ways to convert recipes. If you come across a recipe written in baker's percentage, use baker's percentage to convert the recipe. If you come across a recipe that is written in standard format, use the conversion factor method.

Advantages of applying the baker's percent approach include:

- Ease and simplicity of scaling up or down formulas to meet higher or lower demands.
- Consistency of results.
- Quickness to correct defects in the formula (it is easier to tell if one recipe is drier, sweeter or saltier than another recipe).
- Ability to check if a formula is well-balanced.

Notes

- Precision of measurement and eliminating/fixing scale errors.
- Common language among bakers when comparing formulas.
- Consistency in production.
- Ease of calculating the water absorption or hydration of the flour.
- Ease in predicting how the final product will look like.

Oven Temperature

Oven temperature is one of the key baking parameters. It can be measured, modified, and controlled in order to influence process conditions directly, thereby affecting a product's final characteristics.

Temperature – is an important parameter that has influence on the entire technological flow, from the raw materials to the final product storage space. Every recipe has the specific temperature for each step in the process, but there are some milestones to be kept in mind and to be used for the calculation of others temperatures.

The optimum temperature for the yeast multiplication is 25 - 30°C, therefore for facilitate the multiplication, the dough temperature should be between 25 and 28°C, depending on the dough type:

25°C – soft dough,

27°C – very soft dough,

23°C – dry dough.

The final dough temperature depends on: ambient temperature, flour temperature, water temperature and the increasing of the temperature caused by the mixing device.

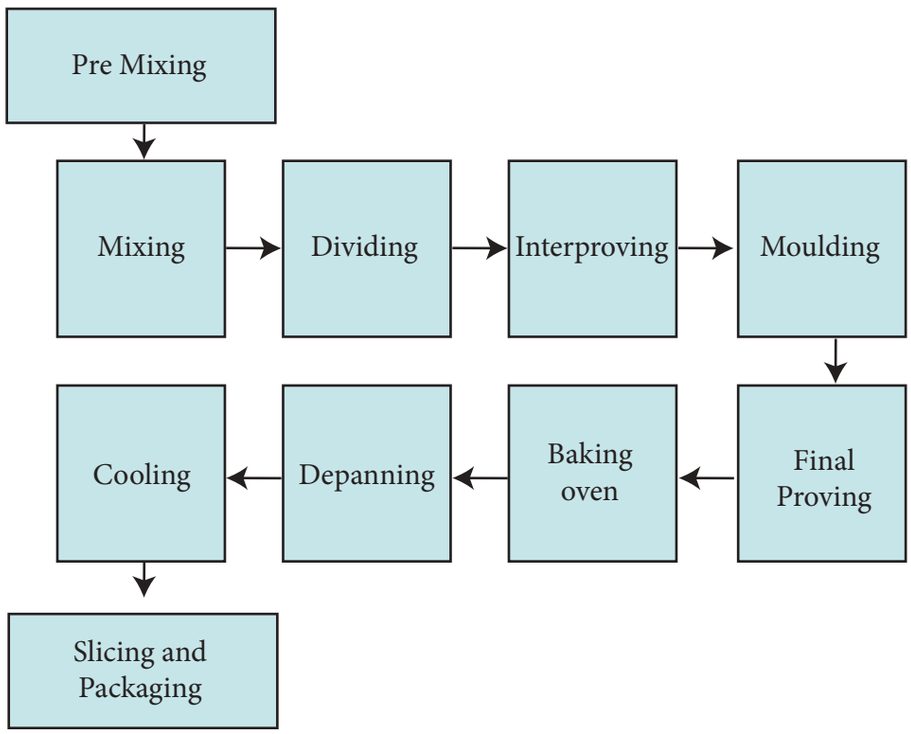
On the other hand, the water temperature could be calculated depending on the final dough temperature, ambient temperature, flour temperature and so on.

4.2. Work plan of the baking :

Processing

1. Mixing
2. Dividing/scaling (for multiple dough batch) and rounding (optional)
3. Bulk fermentation
4. Sheeting and moulding
5. Panning
6. Final proofing
7. Baking
8. Cooling
9. Bread evaluation (scoring)

Flow chart for bread manufacturing process



Notes

4.2.1. Pre - Production sequence for baking :

1) **Sieving :** The flour is generally sieved before mixing the ingredients in order to (a) aerate (b) remove coarse particles and impurities and (c) make it more homogeneous.

2) **Weighing :** All the ingredients are weighed as per the formula. However, it is important to weigh the minor ingredients using a precision balance.

3) **Mixing :** The major objectives of dough mixing process are :

(a) thorough and uniform dispersion of the ingredients to form a homogeneous mixture and

(b) to bring about the physical development of gluten in the dough into a uniform structure having optimum desired dough characteristics with respect to plasticity, elasticity and viscosity.

The essential ingredients of bread are flour, water yeast and salt. The optional ingredients are milk products, shortening, sweetener, yeast foods, oxidizing and reducing agents, dough conditioners, enzymes, enrichment ingredients, mould and rope inhibitors.

The desired dough development in the mixer is achieved by the kneading action of the mixing elements. It is accomplished by blending, stretching, combining, pushing, compressing and folding the dough. The factor that governs the mixing is clearances between the mixing elements between themselves and also between them and mixer walls.

Notes

Stages of dough mixing

1. **Pick up:** dough is sticky, cold and lumpy.
2. **Initial development:** dough gets warmer, smoother and drier.
3. **Clean up:** dough is at maximum stiffness and comes together as one cohesive mass.
4. **Final development:** Dough is at the correct temperature and handling quality (gluten film is visible, and the dough is ready to be discharged from mixer).
5. **Letdown:** The gluten matrix begins to degrade. The dough is too warm and sticky, lacks elasticity and has too much flow.
6. **Breakdown:** dough is beginning to liquefy. At this stage, the dough is not salvageable and cannot be used to make bread.

Mixing is an intensive mechanical operation that produces heat from friction. This is evidenced by the temperature increase in the mass being transformed into dough. For proper machining during makeup, a final dough temperature should be close to 76–82°F (25–28°C).

To assess if the dough is properly developed, perform the gluten film test. A small portion of dough is stretched between the hands into a thin, smooth, translucent film to test its extensibility and elasticity.

Notes

4.2.2. Dough

a) Short crust : The term pastry primarily refers to either savoury or sweet products wrapped in some form of pastry dough. There are many forms of pastry dough, though the most common is short crust pastry dough. The basic ingredients of pastry dough are flour, sugar, milk, shortening, baking powder, and eggs. When these ingredients are combined, they form a dough that is flakier or crumblier than bread dough. The high fat content in pastry dough, and how the fat covers the flour used, is what leads to a flaky pastry. Presentation is also more highly valued in pastries, therefore there is typically more time spent on making this product. This leads to a more expensive product.

When making pastry dough, the goal is to reduce the formation of gluten to an absolute minimum. As a result, pastry chefs have taken many precautions. First, pastry chefs prefer solid fats, such as butter and lard instead of oils. This is because these fats coat flour better and prevent gluten formation better then oil. Second, the temperature of everything is critical. Pastries are often made in a separate part of the kitchen, which is kept colder than the rest of the kitchen.

Additionally, all of the ingredients and utensils used are chilled before hand, as well as after each step of the pastry making process. It is common to mix on a chilled marble stone, or wooden board. Some chefs even put their hands in ice when mixing pastry dough. The mixing process is kept to a minimum so as to prevent the formation of gluten, and not let the dough heat up too much. Lastly, pastries are typically made with pastry flour, which is a low gluten flour made specifically for pastries. It has 8-10% gluten, which is lower than all purpose flour, but higher than cake flour. This flour is typically not bleached either.

b) Straight Dough: Straight Dough also known as no time dough or rapid dough processing. Straight dough is a bread making system or method in which all ingredients (dry and liquid) are placed in the mixer and the dough is then mixed to full development. Unlike the sponge and dough system, where a bulk fermentation period is used, this process does not include a fermentation step after mixing.

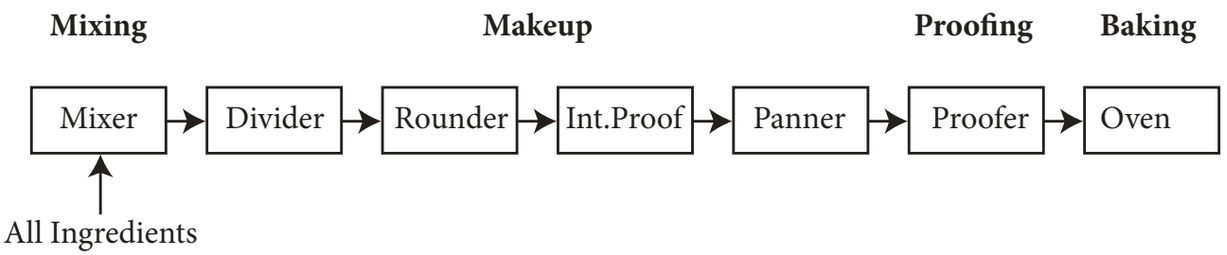
High-speed bakeries use the no time or straight dough system to produce:

- White pan bread
- Whole wheat bread

- Variety bread
- Frozen dough

The goal of the straight dough process is to obtain a high-quality and standardized bread batch in a very short time (3–4 hours from scaling through packaging compared to 6–8 hours in the sponge and dough system). This helps bakers comply with unexpected customer orders and offer a better service through reduction of lead and cycle times.

The following diagram shows the steps for the production of pan bread using the straight dough system:



In this system, the yeast and dough conditioners quickly modify the rheology of the dough to obtain optimum dough handling properties for makeup and gas retention for target volume during proofing and baking.

Processing considerations

- **Mixing:** Dough mixing should be long enough to reach proper gluten development (typically 12–18 min at high speed in a horizontal mixer).
- To shorten mixing times, it is advisable to delay fat, sugar and salt addition. This helps gluten hydrate and develop quickly (clean-up takes much less time), and provides maximum friction against mixer bowl.

Dough temperature. Dough temperature at the end of mixing should be at 82–86°F (28–30°C). This helps to boost yeast activity and slightly decrease elasticity and resistance to deformation for good machining.

c) Sponge and dough method: Sponge and dough is a bread making method that involves two stages:

1. A pre-fermentation step for sponge mixing
2. A dough or final mixing step.

It produces breads with unique flavour and aroma, a soft crumb and an improved shelf-life. For this reason, this method is commonly used in pan bread, buns and other bread varieties.

Notes

The sponge and dough method consists of two distinct mixing stages.

Stage 1: Making the sponge

In this stage, 60%–90% of the total flour is combined with water at room temperature to a 58–65% hydration level (based on sponge flour weight). Then, compressed yeast at 1.5–5.0% (based on total flour weight) is added and shortly mixed just to incorporate ingredients. Next, fermentation follows for 2–8 hours at 75–85°F (24–29°C) and relative humidity of 60–80% to produce the sponge.

Sponge fermentation time varies with:

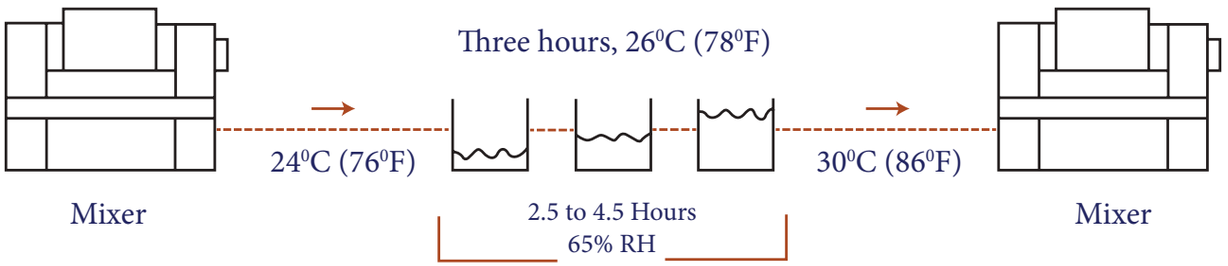
- Temperature
- Ingredients used
- Amount of yeast
- Available food like sugars and
- damaged starch in flour
- Amylase activity of flour
- Water absorption of sponge
- pH of sponge

In small-scale sponge production, the sponge is mixed and stored in the mixer. However, in high-speed bakeries, a separate container such as a trough is used to store the sponge in a fermentation room under controlled conditions. Occasionally, the sponge must be knocked, or punched down, to prevent it from spilling over.

Stage 2: Making the dough

The sponge is added to the remaining liquid and dry ingredients and mixed for 8–16 minutes in a horizontal mixer to form a dough of optimum gluten development. Then, the dough goes to the makeup stage, where it is proofed and baked.

Flow Chart for Sponge and Dough



Once pre-fermentation is complete, the sponge:

- Expands 4–5 times its volume
- Is very soft, pliable, extensible, with an open cell structure
- Has risen 8–10°F (4.5–5.5°C) in temperature.
- Has a temperature of 84–88°F (29–31°C)
- Has a pH of 4.8–4.9
- Has a total titratable acidity (TTA) of 4.5–4.6

The sponge and dough system is still popular in small bakeries but has been gradually replaced in commercial bakeries by faster production systems such as the straight or no-time dough.

d) Pizza : Pizza is a savoury dish made with a form of flat bread and usually topped with tomato sauce and cheese. The word "pizza" is thought to have come from the Latin word pinsa, meaning flat bread.

Pizza doughs do not require strong bread flour. This is because it creates an elastic dough that is difficult to stretch. Therefore, all-purpose flour, or flour with a lower protein quantity (<12%), is better suited for making pizza. This would ensure that the dough is easy to pull and stretch without breaking.

Notes

e) Pie: A pie uses pastry dough and is filled with sweet or savoury fillings. Pies can either be baked or fried.

Pie making always begins with the crust. The pastry dough used for pie making is mainly made with flour, fat and salt. Most commonly, pies are made using shortcrust pastry dough. This is the most durable type of dough for pie making due to its extensibility and cohesiveness. Most recipes for shortcrust pastry dough use two parts flour to one part fat.

4.2.3. Processes of baking:

a) Shortening

Shortening is an edible fat that is solid at room temperature. It shortens the gluten strands in wheat, which provides three textural attributes in baked goods:

1. A short bite
2. A lubricative moist texture
3. The crunchy or crispy auditory sounds

When used in a product, or a the medium to be cooked in, these three textural characteristics are heightened. It's main use is to shorten baked goods like pastries and pie crusts to create a tender and flaky final product. It's also a good vehicle for delivering flavour as well as richness to bread and cakes.

Notes

Types/Variations

- **Solid:** Recommended for use in pastries, pie crusts and bread.
- **Liquid:** Mainly used in recipes that call for melted shortening, such as cake and bread formulas.
- **All-purpose:** Non-emulsified hydrogenated shortening. Used successfully in hi-ratio cakes with the addition of emulsifiers.
- **Cake or icing shortening:** All-purpose hydrogenated shortening with one or two combinations of emulsifiers added by manufacturer. Emulsifiers blended into a shortening assist in forming an emulsion allowing the baker to add more water to the cakes. In this way, it improves the eating qualities of the finished cake by retaining more moisture.

b) Creaming:

Notes

When a recipe calls for the butter and sugar to be creamed together, it means that the method of baking is 'the creaming method'. The creaming method is usually the initial and most important step in the recipe and involves beating fat/s and sugar together until the mixture is light in colour and his increased in volume. It is important for creating air, needed for leavening and thus helps to produce light and fluffy cakes.

c) Leavening

Leavening refers to the gasses that are trapped in a baked good when it is baked. There are numerous ways baked goods are leavened. At times certain ingredients, like baking soda and baking powder, are used to cause chemical reactions in the baked goods which leavens it. Other times, the mixing method forces air into the baked goods to leaven it. Whatever the method, leavening is an essential part of baking.

There are 3 main categories of leavening:

- **Chemical** Leavening (Baking Powder & Baking Soda)
- **Biological** Leavening (Yeast)
- **Physical** Leavening (Air & Steam)

Baking soda & baking powder : Baking soda and baking powder are both forms of chemical leavening. This means that that when they are added to a baked good, a chemical reaction begins to occur producing carbon dioxide. This gas gets trapped in the structure of the baked good, leavening it.

Baking soda, also known as sodium bicarbonate or bicarbonate of soda, is alkaline in nature on the ph scale. This means that it needs an acidic ingredient to react with in order to leaven the baked good. Common baking ingredients that are acidic include:

Notes

buttermilk, brown sugar, chocolate, molasses, lemon juice, and natural cocoa powder (Dutch processed cocoa powder is not acidic).

While **baking soda** must be used in a recipe that contains an acidic ingredient in order to be effective, **baking powder** can be used in any recipe to leaven it. Baking powder contains baking soda combined with an acid. This means that when baking powder is hydrated it will immediately begin reacting because the acidic component is already present.

Yeast : Yeast is a type of biological leavening because it is a living organism- a fungus! Yeast eats sugars and starches present in dough and produces carbon dioxide and alcohol. This process is called fermentation and is what makes yeast dough rise. 95°F (35°C) is the temperature at which yeast most actively grows. Temperatures cooler than this will cause the yeast growth to slow down, and yeast cells will start to die at 135°F (57°C) and higher. Yeast that is used for baking is in three forms: natural yeast, fresh yeast, and dry yeast.

Natural yeast (also known as a wild yeast starter) is a cultivated form of yeast. Grain, typically wheat flour or rye flour, is mixed with water and left out to naturally ferment and cultivate a thriving community of natural yeasts. This is used to create naturally leavened bread.

Fresh yeast is a commercial product that is a moist cake form of yeast cells that are in an active state (as opposed to a dormant state as dry yeast cells are). The product must be refrigerated and is highly perishable.

Notes

Dry yeast are yeast cells that have been dried out to put them in a dormant state. Because the yeast cells are not active, they do not need to be refrigerated and they can be stored at room temperature for months. Dry yeast is sold in two main forms: active dry yeast and rapid rise (or instant rise) yeast. Rapid rise yeast is a smaller cell yeast that activates and produces carbon dioxide more quickly than active dry yeast.

Air : Air is a type of physical leavening that is used frequently in baking. The most common instance of air leavening our baked goods is by creaming together butter and sugar. This process of beating solid fat and sugar together forces air to get trapped in a web of sugar and fat adding volume to the baked good.

Air is also used when whipping egg whites or cream. This process also traps little pockets of air in the substance which lighten and leavens.

Steam : Steam is another powerful type of physical leavening. Certain ingredients such as butter, eggs, and milk contain water which will evaporate in the oven, creating steam. While this may not sound as exciting as the chemical and biological reactions of other leavening agents, when water evaporates it increases in volume by 1500 times. Steam can create a great deal of volume in a baked goods. One of the most evident examples of steam leavening a baked good is with puff pastry.

d) Fermentation : Fermentation is an anaerobic biological process that converts sugars and starches into simpler substances. In baking, it causes yeast and bacteria to convert sugars into carbon dioxide, among other things. This is what causes the dough to rise.

Notes

A shorter fermentation process leads to less taste, texture and quality. On the other hand, longer fermentation times will improve flavour and texture. With several careful steps and stages, the artisan bread process can take up to 48 hours, but the shorter mix times and slow fermentation add up to flavourful bread rich in aroma and texture.

In general, three stages comprise the fermentation process:

Pre-ferment: An optional step, pre-ferment is the preparation made and fermented from a portion of the final dough, prior to mixing. Used for many artisan breads, it introduces flour, water, yeast and sometimes salt to a longer fermentation period before incorporation. This step enhances flavour and shelf life.

First Fermentation: After adding the pre-ferment to the final dough, the first fermentation takes place; this can take as long as eight hours for artisan bread and as short as zero to 15 minutes for no-time dough.

Second Fermentation: After the first punch, this second round takes place. In the case of Ciabatta bread, this may involve three or more stages.

Mixed dough should be allowed for fermentation for a suitable length of time for obtaining light aerated loaf of bread. During this period, lot of changes both physical and chemical, take place in dough.

1) Physical changes

a) Increase in volume due to production of $C0_2$

b) Increase in temperature

c) Increase in the number of yeast cells

d) Loss of moisture

e) Changes in the consistency of dough. The dough becomes soft, elastic as well as extensible.

2) Chemical changes

a) Lowering of pH. The pH of dough comes down from 5.5 to 4.7 due to formation of acids like acetic acid from the bacterial as well as yeast activity.

b) Formation of maltose sugar by diastatic enzymes, present in the flour by acting on starch.

c) Development of dough due to the rupture of SS bonds and formation in new position which improve the gas retaining property of gluten.

Notes

d) Conversion of starch into Simple Sugar which is then converted into $C0_2$ and alcohol.

e) Production of acids by lactic acid bacteria by conversion of sugar.

f) Mellowing of gluten by proteolytic enzymes present in flour, yeast.

Fermentation time depends on:

i) Type of flour.

ii) Quantity of yeast.

iii) Temperature of the dough.

iv) Presence of yeast food.

Gas production and gas retention

Fermentation control is to have gas production capacity and gas retention capacity develop at a parallel as well as at even rate. When both the peaks are reached at the same time, bread will have largest loaf volume and good texture.

Gas production is controlled by the enzyme present in flour. yeast and any other added enzymes. Gas production is influenced by (i) yeast concentration (ii) amount of sugar and malt (iii) presence of yeast food; and (iv) temperature. Gas production is decreased by higher concentration of salt, sugars and excessively high temperature.

Gas retention is influenced by the quality of protein in the flour and its ability to form a continuous extensible film or the

Notes

rheological characteristics of dough which is influenced by the combination of proteolytic activity, fermentation by-product and H-ion concentration.

Dough make-up

The function of dough make-up is to transform the fermented bulk dough into properly sealed and moulded dough piece when baked after proofing yield the desired finished product. Dough make-up includes (a) scaling (b) rounding, intermediary proof and moulding.

A) Scaling (dividing)

The dough is divided into individual pieces of predetermined uniform weight and size. The weight of the dough to be taken depends on the final weight of the bread required. Generally, 12% extra dough weight is taken to compensate for the bake loss. Dividing should be done within the shortest time in order to ensure the uniform weight as the dough are scaled on a volumetric basis, longer times change the density of the dough due to production of carbon dioxide by yeast thereby changing the weight of the divided dough.

B) Rounding:

When the dough piece leaves the divider, it is irregular in shape with sticky cut surfaces from which the gas can readily diffuse. The function of the rounder is to impart a new continuous surface skin that will retain the gas as well as reduce the stickiness thereby increasing its handling umbrella type and bowl type.

C) Intermediate proof

When the dough piece leaves the rounder, it is rather well degassed as a result of the punishment, it received in that machines

Notes

and in the divider. The dough lacks extensibility and tears easily. It is rubbery and will not mold easily. To restore more flexible, pliable structure which will respond well to the manipulation of molder, it is necessary to let the dough piece rest while fermentation proceeds. lntermediate proofer contains a number of trays which are chain driven. The dough piece is deposited in the tray which completed number of laps at pre-determined rate. Average time: 5 to 20 min.

D) Moulding

The moulder receives pieces of dough from the inter- mediate proofer and shape them into cylinders ready to be placed in the pans. Moulding involves three separate steps; (i) sheeting (ii) curling; and (iii) sealing.

Sheeter degasses the dough and sheeted dough can be easily manipulated in the later stages of moulding. Sheeting is accomplished by passing the dough through 2 or 3 sets of closely spaced rolls that progressively flatten and degas the dough. The first pair of rolls are spaced about 0.25" apart where the degassing takes place. The successive two rollers are spaced 0.125" and 0.06" apart for optimum grain and texture development in the finished products.

Notes

The sheeted dough piece next enters the curling section. The sheeted dough is carried by a belt conveyor under a flexible woven mesh chain that rolls into a cylindrical form. The rolling operation should produce a relatively tight curl that will avoid air entrapment.

The curled dough piece finally passes under a pressure board to eliminate any gas pockets within and to seal the same.

Panning

The moulded dough pieces are immediately placed in the baking pans. Panning should be carried out so that the seam of the dough is placed on the bottom of the pan. This will prevent subsequent opening of the seam during proofing and baking. Optimum pan temperature: 30° C.

Final proof

Purpose:

i) To relax the dough from the stress received during moulding operation

ii) To facilitate production of gas in order to give volume to the bread; and

iii) To change tough bulky gluten to good mellow extensible character.

Proofing is influenced by temperature humidity and time. Normal conditions are temperature 35°C and RH 85% and proof time of 55 to 65 min. However, many bakeries proof at 35-40°C particularly for continuous mixed dough. Proof temperature depends on the variety of factors such as flour strength dough formulation with respect to oxidants, dough conditioners, type of shortening, degree of fermentation, make up treatment, type of product desired.

Notes

Baking

Coming out of the final proofer, the bread dough is well aerated with a typical internal temperature close to that of the proof box, around 35°C (95°F). As the dough pieces enter the oven, their surface temperature begins to increase and heat transfers slowly towards the core of the product. The oven temperature can be set, according to the type of product being processed, at any point between 200–300°C (390–570°F).

In general, there are three major stages in the baking process: expansion of the dough, drying of the surface, and crust browning. These can be subdivided into the following stages (in the order of temperature increase)

1. **Formation and expansion of gases (oven spring):** A rapid rise in volume takes place at the beginning of baking at a core temperature of 35–70°C (95–158°F). This rise creates the oven spring. Five events occur simultaneously to produce the oven spring in the first 5–8 minutes of baking:

- Yeast reaches its maximum fermentation rate and generates carbon dioxide, CO_2 gas (CO_2 is also produced by chemical leavening).
- Release of carbon dioxide gas from the saturated liquid dough phase into the surrounding gas cells.
- Expansion of the gasses trapped in cells (nitrogen from air and CO_2) and generated during mixing, makeup, and proofing.
- Evaporation of water/ethanol mixture.

2. **Killing of yeast and other microorganisms.** This usually occurs at an internal temperature of 60–70°C (140–160°F) where the cells can no longer contribute to the gas production or volume increase.

3. **Gelatinization of starch.** At 76°C (170°F), starch begins to gelatinize as granulesbecome fully swollen with local free water. Thanks to starch gelatinization and protein denaturation, the dough is converted into bread and a structure is set.
4. **Coagulation/denaturation of gluten (egg or other) proteins** that make up the continuous phase. From 60 to 70°C (140 to 160°F), the proteins begin to denature. As a consequence, gluten becomes increasingly tough and stiff as it irreversibly forms a gel. Moisture loss also imparts rigidity to the product being baked.
5. **Inactivation of enzymes** in the dough (naturally-occurring or added) at 80–95°C (176–203°F).
6. **Crust formation and browning** (non-enzymatic browning reactions and caramelization).Maillard browning takes place above 105°C (220°F) and requires the presence of a reducing sugar together with an amino acid. Sugars caramelize at 160°C (320°F).

The main parameters involved in the baking process include: time, temperature, humidity, air flow (convection systems) and heat flux. These process variables are a function of the size, unit weight, formulation, water absorption, type and target characteristics of the finished product. Baking times may range from 2–60 minutes, depending on the type of oven and heating pattern.

Bread cooling

After baking two processes take place:- perspiration - consists of cooling and complete drying of the product after baking; at the end of baking, in any baked product, some moisture remains in the crumb, which then comes out sooner or later, depending on the size of the product; - bread aging, characterized by:- retro gradation of starch – the water previously absorbed by starch is released, being absorbed by either gluten or migrated to the crust.

- water passing from the crumb to the crust, and from here to the environment.
- part of the water remains in the crust, so that the crumb becomes more and more dry and the crumb softens.
- the increased percentage of water left on the crumb is a factor that favours mould growth.

Notes

4.3. Preparation of common bakery products using different types of dough.

a) Bread

Ingredients

i. 3 cups 100% whole wheat flour (chapatti Atta) - 360 grams.

ii. 1 to 1.25 cups water - 250 ml to 312 ml.

iii. 1 teaspoon instant yeast or ½ tablespoon dry active yeast.

iv. 1 teaspoon regular salt or rock salt (sendha namak) .

v. 1 tablespoon regular sugar or unrefined cane sugar.

vi. 2 tablespoon ghee or oil or butter.

vii. 2 tablespoons curd or 1 to 1.5 tablespoon vinegar or 1 tablespoon lemon juice.

viii. some milk for brushing the top of the bread (dairy or vegan) - optional.

Instructions

Preparing bread dough with instant yeast.

1. Sieve the flour with salt or just mix the flour with the salt.
2. Add the 1 tsp instant yeast and just lightly mix. You can even mix the instant yeast granules with ½ cup water and sugar in a separate bowl as shown in the video. Then add this mixture to the wheat flour. Sometimes instant yeast granules do not dissolve completely in the dough and thus you can dissolve them separately in water.
3. Then add sugar, oil (or oil or butter) and curd.
4. First just mix everything lightly and then slowly adding water in intervals knead to a smooth, soft dough.
5. Add more water if required. The dough should be slightly sticky.
6. Brush some water all over the dough and keep in a deep wide bowl covered with a lid or kitchen towel for 30-35 minutes.
7. Remove and then lightly punch & knead the dough again.
8. Make a log of the dough and seam the edges.

Baking wheat bread

1. Place it in a greased loaf pan for 40-45 minutes.
2. Cover and let it rise.
3. Preheat the oven at 220°C for at least 20 minutes.

4. Once the bread has risen in the loaf pan, keep in the oven and bake at 220°C for 22 to 25 minutes or until the bread sounds hollow when tapped.
5. If the wheat bread begins to brown from the top, then cover with butter paper or aluminium foil.
6. When whole wheat bread is still lightly hot, remove from the loaf pan and keep it on a wired tray to cool.

b) Nankhatai

i. 1 cup all purpose flour or 125 grams maida.

ii. ¼ cup gram flour (besan) or 40 grams gram flour.

iii. ½ teaspoon baking soda.

iv. 1 teaspoon baking powder.

v. 2 tablespoon sooji (fine rava or cream of wheat) or 20 grams sooji

vi. 2 to 3 pinches nutmeg powder or grated nutmeg or ⅛ teaspoon nutmeg powder (jaiphal powder).

vii. ½ teaspoon cardamom powder.

viii. ½ cup ghee (semi solid) or butter at room temperature, 80 grams.

ix. ½ cup sugar, 100 to 110 grams sugar or ⅔ cup powdered sugar or icing sugar or add as per taste.

x. ½ tablespoon dahi (yogurt).

xi. 1 to 2 tablespoon milk.

xii. few almonds or chironji (charoli).

Notes

Instructions

Making nankhatai mixture

1. Powder the sugar finely in a grinder.
2. Then cream the ghee and powdered sugar with a electric mixer or blender. You can also cream in a food processor.
3. The mixture should become smooth, light and creamy.
4. Sift the following dry ingredients - all-purpose flour, besan (gram flour), baking powder and baking soda. Keep the sifted dry ingredients aside.
5. Add curd (yogurt) to the creamed ghee+sugar mixture. Mix very well.
6. Now add the sifted dry ingredients. Also add the sooji (rava or cream of wheat), cardamom powder and nutmeg powder.
7. Gently mix everything. Do not knead.

Making nankhatai

1. Just mix and gather to a smooth dough. If the mixture is too crumbly and you cannot bring together to a dough, then add 1 to 3 tbsp of milk. Mix lightly and bring the mixture to a dough.
2. Pinch medium sized balls from the dough.
3. Roll them evenly in your palms. Slightly flatten them. Press chironji or almonds on the top lightly.
4. You can also make some criss cross designs on the nankhatai with a fork or toothpick

Baking nankhatai

1. Place the nankhatai in a baking tray.
2. Keep some space between them as they expand while baking.
3. Bake the nankhatai in a pre heated oven at 180°C for 20-25 mins till light golden.
4. Remove and place them on wire racks, so that they cool down.
5. When cooled, store the nankhatai in an air tight container.

c) Butter cookies.

Ingredients

i. 2 cups whole wheat flour or 240 grams

ii. 4 to 5 green cardamoms - seeds kept and husks removed

iii. 100 grams chilled cold unsalted butter - about 7 to 8 tablespoon butter

iv. ½ teaspoon baking powder or ½ teaspoon baking soda

v. ¼ teaspoon nutmeg powder

vi. 2 to 3 tablespoon milk - add more milk if required

vii. 3 tablespoon curd (yogurt)

viii. ½ cup organic unrefined cane sugar or regular sugar or ¾ cup powdered sugar or 125 grams of powdered sugar

Instructions

Making cookies dough

1. In a blender or grinder, add 1/2 cup sugar and seeds of 4 to 5 green cardamoms.
2. Grind to a fine powder. Keep aside. You can also use 3/4 cup powdered sugar instead of grinding the sugar.
3. In a mixing bowl, take 2 cups whole wheat flour (240 grams) and ½ tsp baking soda or ½ tsp baking powder.
4. With a spoon or spatula mix everything well.
5. Add 100 grams chilled butter. With your fingertips break the butter and mix with the flour. You can cut the butter with two knives too. This can also be achieved with a food processor or a stand mixer. If the butter melts while mixing with your hands, keep the mixture in the fridge for some minutes and then start again..
6. Mix till you get a bread crumb like texture in the mixture.
7. Add powdered sugar and 1/4 tsp nutmeg powder. Mix well with a spoon or spatula.

Notes

Notes

8. Add 3 tbsp yogurt. Lightly mix and then add 2 to 3 tbsp milk.
9. Mix and gather the entire mixture together to a dough. Don't knead.
10. Keep the cookie dough covered in a bowl, in the fridge for 30 minutes

Making butter cookies

1. Before baking and cutting the cookies, pre heat the oven at 180°C/356°F. Remove the dough and spread some flour on the work surface as well as on the dough.
2. With a rolling pin, roll the dough. This rolling takes quite an effort. Roll the dough to a thickness of 0.50 to 0.75 cms.
3. With cookie cutters, cut the dough. Gather the remaining dough and again roll. Cut with the cookie cutters and repeat the process.

Baking butter cookies

1. Then place the cookies in a baking tray with an inch gap between them.
2. Bake the cookies in a preheated oven at 180°C/356°F for 15 to 25 minutes or more till the cookies are light golden or golden.
3. Once baked, remove when still hot and place them on a wired tray or rack. So that the cookies cool down.
4. Once they cool down at room temperature, place them immediately in an airtight jar or box.
5. Serve butter cookies plain or with milk or tea.

d) Shortcrust pastry

Notes

Ingredients

125g of butter.

250g of flour.

1/4 tsp salt/a pinch.

2-3 tbsp of cold water.

Instructions

1. Sift the flour and salt into a dish or food processor. Cut the butter into cubes and add to the bowl or food processor
2. If using a food processor, pulse the butter and flour together until the mix resembles fine breadcrumbs
3. If using your hands, use a knife to lightly cut the butter into the pastry, then use your fingertips to 'rub in' the butter. Lift it up from the mixing bowl and let the crumbs drop back into the bowl from a height to incorporate air and keep the pastry light
4. Add a tablespoon of ice cold water to the food processor and lightly pulse. Repeat this until a dough just starts to come together. If using your hands, add a tablespoon of cold water to the mix and slowly bring the dough together with your fingers. Once the dough has just started to form a ball, turn out onto a work surface and knead lightly to form a dough. Do not add too much water during this process – extra liquid will make the pastry easier to work with, but will result in hard, tough pastry.

5. Use your hands to squeeze the pastry together and roughly shape into a small, thick pancake-shape. Don't over-knead the pastry, as this encourages the development of gluten, giving the pastry a hard texture.

6. Wrap in cling film and refrigerate for at least 30 minutes before using to allow the pastry to rest – this causes the gluten to relax, which helps to stop shrinkage when cooking. The pastry can now be kept in the fridge for up to a week. Fresh pastry also freezes well, and can be safely defrosted at room temperature overnight. When the pastry is slightly cooler than room temperature, it is ready to roll. Be sure to lightly flour your work surface and rolling pin before working with the pastry.
7. Always put pastry into a preheated, hot oven (425°F / 220°C / Gas 7). If the oven is too cool the pastry will melt rather than cook.

4.3.1. Bread faults, their causes and remedy .

TYPES OF BREAD

French Bread / Baguette

White Bread

Wheat Bread

Rye Bread

Whole Grain Bread

Pita

Ciabatta

Pretzel

Croissant

Bagel

Rolls

Donut

Notes

The following gives some of the more prominent faults in white bread production:

Baking temperatures and times

Oven temperatures that are too high will tend to burn your product externally while leaving the interior raw or under-baked. This can result in gumminess or collapsing of the finished product. Oven temperatures that are too low will cause the product to dry out, resulting in a shorter shelf life of the finished based product

Ingredient weight

Weighing all ingredients, including water, is the most accurate method of producing consistent finished baked products on a daily basis. No matter if you use pounds and ounces or kilos and grams, weighing your ingredients will always be more accurate than using measuring cups and teaspoons.

Batter Temperature

Warm batters will activate the leavening too early in the production process. This early activation will result in cakes with insufficient volume and a coarse grain. These cakes will also have a tendency to be very fragile and will crumble easily when handled. Conversely, cool batters will delay the leavening action resulting in peaked and broken tops with a tough crumb.

Mixing Time

Under-mixing could result in lower volume and a tighter grain in the finished cake due to inadequate batter aeration. Over-mixing could create a weakened structure due to over aeration leading to a collapsed cake.

In checking these faults an analysis of the various causes will show inferior ingredients, unbalanced formula, improper mixing, incorrect fermentation time, poor control of temperature, time and humidity throughout the production process, poor makeup procedures, poor oven conditions as well as improper handling in cooling, wrapping and shipping account for most of bread faults.

A process of elimination must be instituted, the possible cause or causes determined and the proper remedy applied.

Sliced bread is a loaf of bread that has been sliced with a machine and packaged for convenience. It was first sold in 1928, advertised as "the greatest forward step in the baking industry since bread was wrapped"

The soft inner part of bread is called the **Crumb**, not to be confused with crumbs.

The **colour and taste of the bread** depend on the kind of flour used and the style of baking. Flour made from the whole grain gives darker bread. Flour made just from the polished wheat grain gives a very white bread. Rye and barley flour give darker types of bread.

The **yeast** most commonly used for leavening bread is , Saccharomyces cerevisiae the same species used for brewing alcoholic beverages.

Commercial bakers often leaven their dough with commercially produced baker's yeast. **Baker's yeast** has the advantage of producing uniform, quick, and reliable results, because it is obtained from a pure culture.

Practical Activity

Activity 1

Aim - 1. Baking product with and without pre heating and at different temperatures.

Materials Required -

1. Dough.
2. Baking Oven .
3. Baking Trays.

Procedure - 1

1. Pre heat the oven to a temperature between 200 – 220°C.
2. Transfer the dough received to a baking tray with a wide metal spatula.
3. Bake at specified temperature and time as per the SOP.
4. Remove the baked product from oven and test whether it has been baked as per the required specifications.

Procedure - 2

1. Do not pre heat the oven.
2. Transfer the dough received to a baking tray with a wide metal spatula.
3. Bake at specified temperature and time as per the SOP.

4. Remove the baked product from oven and test whether it has been baked as per the required specifications.

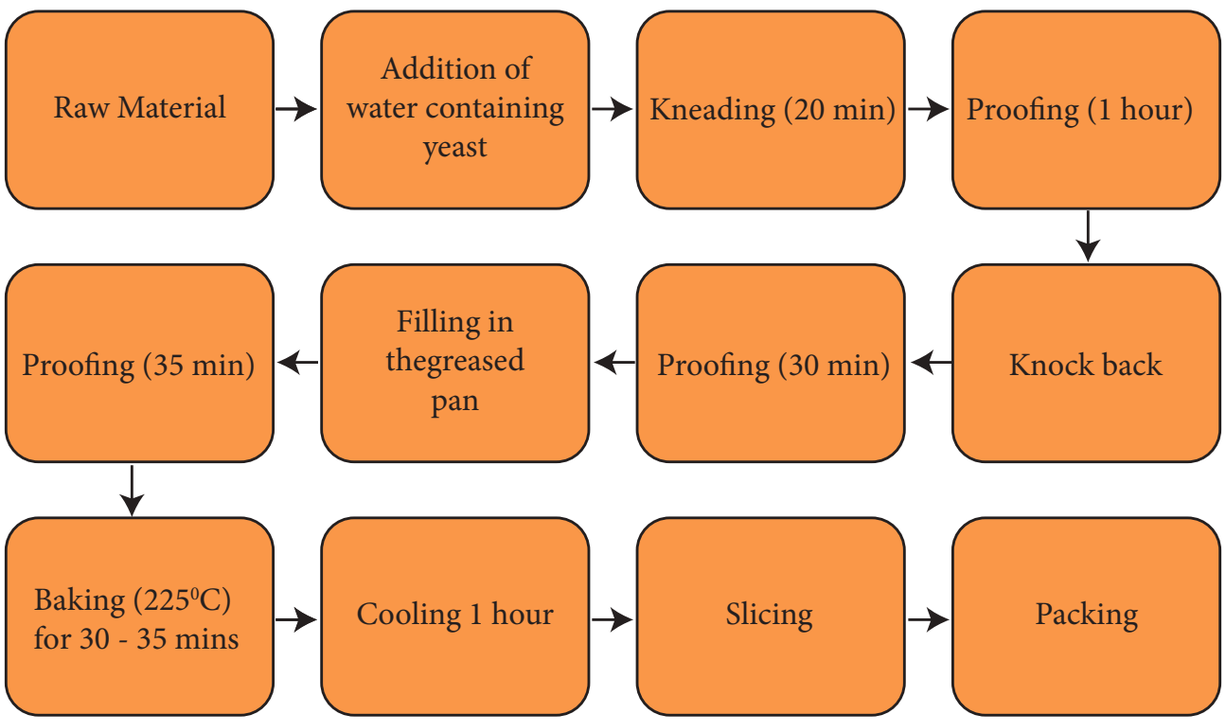
Test for baking	Baked completely	Not baked completely
Insert a cake tester/ skewer into the centre of the baked bread/ cake/ muffins.	No batter to cling to the tester/ skewer.	If batter clings to the tester or skewer, the baked good needs more time in the oven.
If batter clings to the tester or skewer, the baked good needs more time in the oven.	The baked cake/ muffin or bread will feel springy and resilient and spring back to position without leaving any impression.	Leaves an impression on the surface.

Results and Discussion

Activity 2

Aim

Depict the flow chart of process of baking.



Materials required

1. Chart
2. Pictures of various process of baking.
3. glue.
4. Scissors.

Notes

Procedure

Stick pictures accordingly to explain the process of baking.

Activity 3

Aim

Demonstrate the process of - shortening, creaming, leavening, fermentation, mixing,

Proving/proofing techniques.

Materials Required:

1. Note book, pen.

2. Camera/ mobile phone with camera.

Procedure:

Visit a nearby bakery industry/unit /shop/local distributor with your teacher.

Observe the following. (a). shortening, (b) creaming, (c)leavening, (d) fermentation, (e) mixing, (f) Proving techniques.

Prepare a report of the field visit.

Activity 4

Aim

To prepare different types of breads.

Materials Required:

Baking oven.

Hand blender cum mixer.

Mixer and grinder 5 lt.

Weighing scale.

Serrated Bread Knife.

Bread tin/ mould.

Cooling racks .

Dough scrappers.

Flour sifter/ sieves.

Measuring spoon.

Mixing bowl/vessels.

Spatula and pastry brush.

Spoon(big and small).

Notes

Pizza cutter.

Dough sheeter.

Procedure:

a) Brown bread.

Ingredients:

i. 2.25 cups all purpose flour.

ii. 3/4 cup whole wheat flour.

iii. 1 cup water.

iv. 1/2 tablespoon dry active yeast or 1 teaspoon instant yeast.

v. 2 Tbsp organic cold pressed Sunflower oil or melted butter.

vi. 1 tablespoon regular sugar or unrefined organic cane sugar.

vii. 1 Teaspoon rock salt or regular salt.

Instructions

proofing yeast

1. Warm 1 cup of water.
2. Add 1 tbsp sugar and dry active yeast.
3. Stir and let the yeast activate.
4. This usually takes about 10 minutes.

kneading brown bread dough in a bowl

1. Sieve both the flours with salt in a large wide bowl or a large plate with a rim/par at.
2. Add the proofed yeast and oil.
3. Mix all the ingredients.
4. Then begin to knead the dough.
5. If the dough feels sticky, then add some flour.
6. If it feels dry, then add some water.
7. Continue to knead, till you get a smooth dough which when stretched doesn't tear.

kneading brown bread dough in a stand mixer

1. Add the flour and salt in the bowl.
2. On speed 1 mix the flour & salt for some seconds.
3. Add the yeast mixture and oil and on speed 2 knead the dough.

Notes

4. Continue kneading for 2 minutes and check the dough.
5. If it feels dry, add some warm water.
6. If it feels sticky, add some flour.
7. Continue kneading for a further 2-3 minutes on speed 2 till you get a smooth andpliable dough.

leavening brown bread dough

1. Rub oil or water all over the dough and keep in a covered bowl to leaven for 2-3 hours.
2. After 2-3 hours, remove the dough and punch and deflate it lightly.
3. Roll a single log of the dough.
4. Tuck the edges down on both sides of the bread loaf.
5. Place the bread in a greased loaf pan (9x5 inches) with the tucked edges facing downwards.
6. Cover the loaf pan and let the dough leaven for 40 minutes or 1 hour.
7. Preheat oven to 180°C /350°F Bake the loaf for 35-40 minutes or until the bread sounds hollow when tapped.
8. Place the bread on a wire rack or tray.
9. Serve warm or refrigerate the brown bread.

b) Banana bread.

Ingredients:

i. 4 medium sized ripe Bananas or 300 grams ripe Bananas.

ii. 1.5 cups whole wheat flour or 180 grams whole wheat flour.

iii. 1/2 cup coconut oil or Sunflower oil or 125 ml coconut oil.

iv. 1/2 cup brown sugar or unrefined Cane sugar.

v. 1/2 teaspoon Vanilla powder or 1 teaspoon Vanilla extract.

vi. 1/2 teaspoon cinnamon powder (optional).

vii. 2-3 pinches nutmeg powder (optional).

viii. 1-2 tablespoon sunflower seeds (optional).

ix. 1.5 teaspoon baking powder.

x. 1/2 teaspoon baking soda.

xi. 1 pinch salt (optional).

Notes

preparation

1. Preheat the oven to 180°C.
2. Grease a bread tin or a rectangular cake pan with some coconut oil. You can use the

rectangular cake pan of size (7.5 x 4 x 2.5 inches) or round cake pan (7.5 x 2 inches).

Making banana bread batter

1. Take sliced bananas and sugar in a mixing bowl.
2. Mash the bananas well or puree them with a hand blender.
3. Now add the oil, vanilla, cinnamon powder, nutmeg powder to the banana and mix well.
4. Sieve the flour with the baking soda, baking powder, salt directly in the bowl containing the mashed bananas.
5. Fold the sieved flour really well.
6. This folding step is important as you want the whole bread mixture to be one and mixed evenly.
7. Lastly add the sunflower seeds and fold these.
8. Pour the bread mixture into the loaf pan.

Baking banana bread

1. Bake at 180°C for 30-40 minutes or till a toothpick inserted in the bread comes out clean.
2. The timing varies from oven to oven depending on the temperature in your oven and the size of your pan, the cake might take less or more time than mentioned here.
3. So take your call and keep an eye on the bread. However don't open the oven until the bread is ¾th done.
4. The benchmark is that a tooth pick inserted in the bread should come out clean.
5. When the bread cools down, remove the banana bread from the pan.
6. Slice and serve banana bread warm.
7. The remaining banana loaf, you can wrap in a cling film or keep in a box in the fridge.Warm the banana bread before serving.

Notes

- If coconut oil is added to the bread, it solidifies when refrigerated, hence the bread also becomes dense when you refrigerate it. So before serving just warm up the bread and the bread will have its natural texture back.

Notes

- Sweetness of the bread can be adjusted as per your preferences.
- You can skip adding sunflower seeds.

c) Pizza

Ingredients:

i. 3 cups whole wheat flour or 360 grams whole wheat flour.

ii. 1 teaspoon instant yeast or 3 grams of instant yeast.

iii. ½ teaspoon sugar.

iv. 1 teaspoon salt.

v. 1 tablespoon lemon juice.

vi. 3 tablespoons olive oil.

vii. 1 cup water - you can also add 1.25 cups water or add as required depending upon the quality of wheat flour.

Instructions

1. Take 1 teaspoon instant yeast (3 grams) in a mixing bowl or in the stand mixer bowl.
2. Add ½ teaspoon sugar and 1 cup water. mix well.
3. Next add 3 cups whole wheat flour, 1 teaspoon salt, 3 tablespoons olive oil and 1 tablespoon lemon juice.
4. If you do not have olive oil, use any neutral flavored oil.
5. Attach the bowl to a stand mixer with the hook attachment. On a medium-high speed knead the dough. If kneading with hands, then mix everything very well and then knead for at least 8 to 10 minutes.
6. The dough should be smooth, pliable and soft. If the dough looks dry, then you can add some water while kneading. If the dough looks sticky, then you can sprinkle some flour.
7. Spread some water all over the dough.
8. Cover with a lid or a kitchen towel and allow to leaven for 45 minutes to 2 hours till the dough increases in volume and doubles up. If using dry active yeast, then keep for 2 hours to 3 hours or more. Timing varies with the temperature conditions in your city. The pizza dough will nicely increase in volume and double up.
9. Knead the dough lightly again and then you can directly make pizzas from these.

Notes

Assembling and making veg pizza

1. Flatten the dough to a disk. on a floured surface roll the dough.
2. Place the dough onto a greased and dusted pan.
3. Brush some olive oil on the pizza base. spread the tomato sauce on the pizza.
4. Top with the veggies. spread the grated cheese.
5. Bake in the oven for 10-15 minutes at 200°C till the base becomes golden brown and the cheese on top melts and gets browned.
6. Serve veggie pizza hot.

Results and conclusion:

Activity 5

Aim

To identify the steps to achieve the final baked bread, namely:

a) Dough Making

b) Resting

c) Shaping

d) Proofing

e) Baking.

Procedure

1. Dough Making:

Materials Required :

1. Flour.
2. Yeast.
3. Sugar & Salt.
4. Oil & Water.

Mix all the raw materials to make a dough.

Check the following and write your observations.

Notes

Dough Making Test Result	Dough Making Condition.
The dough doesn't spring back when pressed with a finger, or tears when you pull it.	needs more kneading.
The dough springs back immediately when lightly pressed, and doesn't tear when you pull it	kneaded enough

2) Resting :

Materials Required :

1. Dough.
2. Tray/bowl.

Rub oil or water all over the dough and keep in a covered bowl to leave for resting. After resting, Check the following and write your observations.

Resting Test Result	Resting Condition.
When you touch the dough, it will be soft and your finger will leave an indentation when lightly pressed against the dough	It is ready.
The dough will tend to slowly spring back. The tendency is to not let the dough rise enough.	It is not ready.
Dough will wind up collapsing	Over Resting.

3) Shaping

Materials Required :

1. Dough
2. Flour
3. Flat Tray

After resting, shape the dough. Check the following and write your observations.

Notes

Shaping Test	Shaping Condition.
If your divided dough feels a little loose or slack, you can give it a slightly tighter preshape.	Preshaping also gives us an extra chance to add strength to our dough.
The dough is especially weak, possibly from under mixing or over hydration.	Perform a second preshape step to bring more structure to the dough before shaping.
The dough over-rises after shaping	Knead the dough and reshape it

4) Proofing :

Materials Required :

1. Dough.
2. Proofing Pan.

Set the proof box to required temperature and humidity. Check proofing with a pointed stick dipping into the dough .Check the following and write your observations.

Proof Test Result.	Proofing Condition.
The dough springs back after poking.	Under proof.
A tunnel is seen.	Over proofing.
The dough has risen to the desired level.	Proofed.

5) Baking :

Materials Required -

1. Dough
2. Baking Oven
3. Baking

1. Pre heat the oven to a temperature between 200 – 220°C.
2. Transfer the dough received to a baking tray with a wide metal spatula.
3. Bake at specified temperature and time as per the SOP.
4. Remove the baked product from oven and test whether it has been baked as per the required specifications. Check the following and write your observations.

Test for baking	Baked completely	Not baked completely
Insert a tester/skewer into the centre of the baked bread.	No batter to cling to the tester/ skewer.	If batter clings to the tester or skewer, the baked good needs more time in the oven.
If batter clings to the tester or skewer, the baked good needs more time in the oven.	The baked bread will feel springy and resilient and spring back to position without leaving any impression.	Leaves an impression on the surface.

Glossary:

Combustion - Burning.

Radiation - Radiation is the emission or transmission of energy in the form of waves or particles through space or through a material medium.

Conduction - The transfer of energy, such as heat or an electric charge, through a substance.

Convection - The transfer of heat through a fluid (liquid or gas) caused by molecular motion.

Impregnation - Impregnation, refers to the sealing of porosity which occurs in manufacturing processes such as casting and sintering.

Refractory - A substance that is resistant to heat.

Impingement - To make an impression.

Parameters - An arbitrary constant whose value characterizes a member of a system.

Blending - The action of mixing or combining things together.

Gluten matrix - A protein consisting of a mixture of glutelin and gliadin, present in cereal grains, esp. wheat.

Notes

Flakier - breaking or separating easily into flakes.

Bleached - Made white or much lighter by a chemical process or by exposure to sunlight

Fermentation - It is a metabolic process that produces chemical changes in organic substrates through the action of enzymes.

Amylase - An enzyme, found chiefly in saliva and pancreatic fluid, that converts starch and glycogen into simple sugars.

Artisan breads - Bread made by skilled craftsman who makes things by hand./ refers to a style of short shelf-life bread that is usually offered unpackaged (in baskets) and consumed immediately after baking for maximum freshness.

Ciabatta bread - An Italian white bread made from wheat flour, water, salt, yeast and olive oil, created in 1982 by a baker in Verona, Veneto, Italy, in response to the popularity of French baguettes.

Mellowing - to have a calming or relaxing effect .

Proteolytic - Enzymes produced and secreted by the pancreas which aid in the proteolysis of proteins in the digestive tract.

Notes

Evaluation

Choose the correct answer. (1 Mark).

1. Unlike other cooking methods, baking does not alter the ---------- of the food item.

   a) nutritional value. b) structure.

   c) taste. d) colour.

2. This oven is suitable for retail operations due to its floor space economy, and medium to long baking cycle times.

   a) indirect fired oven b) direct fired oven.

   c) rack oven d) electric oven.

3. ---------- is a high temperature process applied to fermented pieces of dough, that transform the dough in the baked form, the bread.

   a) steaming. b) baking. c) roasting. d) boiling.

4. The optimum temperature for the yeast multiplication ---------.

   a) 25 - 30°C. b) 20 - 35°C c) 25 - 50°C. d) 22 - 32°C.

5. The term ---------- primarily refers to either savoury or sweet products wrapped in some form of pastry dough.

   a) bread. b) pizza. c) pastry. d) cake.

6. Proofing is influenced by temperature, ---------- and time.

   a) suga b) salt. c) humidity. d) acidity.

Answer the following. (2 marks)

1. Define baking

2. What is the use of an oven in bakery ?

3. Differentiate - Direct fired oven and indirect fired oven.

4. Write the disadvantages of reel oven.

5. What are the two major goals of oven maintenance.

6. List the common fuels used for baking.

7. What is meant by oven temperature ?

8. What is the use of sieving in bakery production ?

9. Write a note on short crust dough.

10. What is no time dough. List the types of bread prepared using no time dough method.

11. Differentiate between pizza and Pie.

12. what is meant by creaming?

Answer in detail (3 marks)

1. In the Bakery industry and oven is the most important processing step for several reasons. Discuss.

2. Write a note on electric oven and rack oven.

3. Find the conversion factor needed to change a recipe that produces 20 portions with each portion weighing 150 gram into a recipe that produces 40 potions with each portion containing 100 grams.

4. What are the problems that occur while using recipe conversion form.

5. Draw a flowchart for bread manufacturing process.

6. Explain the stages of dough mixing.

7. Differentiate between natural yeast and fresh yeast.

8. Write explain the terms preferment first fermentation second fermentation.

9. Explain the sponge dough process.

10. What is meant by panning?

Notes

Notes

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Notes

MODEL QUESTION Paper

Std: IX **Sub: Baking** **Total Marks: 60**

I. Choose the best answer **6 X 1 = 6**

1. A _____ is formed as water evaporates from the surface and leaves it dry.

   a. Gelatinization b. Coagulation

   c. Crust d. Starch

2. _____ protects hands from hot irritant foods such as chillies

   a. Gloves b. Disposable vinyl gloves

   c. Oven gloves d. freezer gloves

3. _____ ferments sugars to produce CO2, the gas that gives the porous structure of bakery products

   a. Saccharomyces cervisiae b. Lactobacillus

   c. Lacto coccus d. Bifido bacterium

4. _____, substances naturally present in food, are responsible for the ripening process in fruits and vegetables.

   a. Micro Organisms b. Air

   c. Light d. Enzymes

5. _____ refer to the gases that are trapped in a baked good when it is baked.

   a. Leavening b. Creaming

   c. fermentation d. Coagulation

6. _____ is a commercial product that is a moist cake form of yeast cells that are in an active state.

   a. Natural yeast b. Fresh yeast

   c. Dry yeast d. Rapid rise yeast

II. Answer any 12 Questions: **12 X 2 = 24**

7. Define: Bakery
8. Why is bread becoming the most important food item in the human diet?
9. Instead of butter which one is used in baking?
10. Which bakery product has high calorific value?
11. What is meant by personal hygiene and sanitation?

Notes

12. Define: Hygiene
13. Name two common sanitizers used in restaurants.
14. Give brief notes on warming oven
15. What is meant by chemical modification?
16. What is meant by Oxidation?
17. What are the probiotics?
18. Define: food spoilage
19. Differentiate – Direct fired oven and indirect fired oven.
20. List the common fuels used for baking.
21. Write a note on short crust dough.

III. Answer any 10 of the following: 10 X 3 = 30

22. Find the conversion factor needed to change a recipe that produces 20 portions with each portion weighing 150 gram into a recipe that produces 40 portions with each portion containing 100 grams.
23. Explain the stages of dough mixing.
24. Write a note on electric oven and rack oven.
25. What is the role of yeast in bakery products?
26. Explain the use of microorganisms in food production.
27. Microbial growth stops when temperatures are under the minimum value or above the maximum value Discuss.
28. Suresh wants to be the baking technician, tell him the rules and responsibilities of baking technician.
29. Biscuits are the important items of bakery industry – Explain it.
30. What are the advantages and disadvantages of the bakery sector?
31. Enumerate the personal hygiene habits?
32. What are the purpose of protective clothing? Explain any three.
33. Write any three working units and their functioning.

AVENUES AVAILABLE FOR VOCATIONAL ASPIRANTS…

Institutional Support for MSMEs

Ministry of Micro, Small and Medium Enterprises- A branch of the Government of India and the apex executive body for the formation and administration of rules, regulations and laws relating to micro, small and medium enterprises in India.

Micro enterprise:

A business operation on a very small scale, especially one in the developing world that is supported by microcredit. (Ex. i. Trading, merchandising and retail, ii.Food business, iii. Agriculture and aquatics, Rice farming, iv. Graphic and Design, v. Arts and Craft, Furniture making, vi, Licensed Professional services, etc).

Small enterprise:

A small enterprise is an enterprise where the investment in plant and machinery is more than Rs. 25 lakh but does not exceed Rs. 5 crore.

Medium enterprise:

A Medium enterprise is an enterprise where the investment in plant and machinery is more than ₹ 5.

1. Commissionerate of Industries & Commerce

Formulate policies for MSME sector in Tamil Nadu

2. MSME Trade & Investment Promotion Bureau

To promote export and Investment in MSME sector

3. District Industries Centre

Implement the state policies at district level

4. Indcoserve and Sagoserve

Industrial Cooperative Societies to improve the socioeconomic conditions by providing gainful employment to the economically weaker sections and in ensuring remunerative prices to the growers like small tea growers and tapioca cultivators

5. Entrepreneurship Development & Innovation Institute

Training and Support for startup ecosystem

6. TN Small Industries Development Corporation

Provide Infrastructure for MSMEs - developed plots/shed

7. Tamil Nadu Industrial Investment and Corporation(TIIC) and Tamil Nadu Industrial Co-operative Bank (TAICO)

Provides -Strong financial support to MSMEs for securing loans and working capital needs

8. Tamil Nadu Small Industries Corporation Limited

Manages small scale units set up by the Government. They manufacture wooden, steel and engineering products

Schemes for MSMEs

1. MSME Subsidy Schemes

The micro, small and medium enterprises (MSMEs) have been accepted as the engine of economic growth and for promoting equitable development. The labour intensity of this sector is much higher than that of the large enterprises. The MSMEs play a pivotal role in the overall industrial economy of the country. With

its agility and dynamism, the sector has shown admirable innovativeness and adaptability.

Taking cognizance of the contribution made by the micro, small and medium enterprises to the economy of the state, the Government of Tamil Nadu has introduced various incentives and concessions to catalyse the growth of this sector.

The following incentives and concessions are being extended to the MSMEs in the state:

A. Capital Subsidy

25% capital subsidy on the value of eligible plant and machinery, subject to a maximum of ₹ 50.00 lakhs.

Eligibility:

- All new micro manufacturing enterprises established anywhere in the state.
- All new small and medium enterprises under the following 15 thrust sectors established anywhere in the state excluding additional capital subsidy and employment generation subsidy:

Electrical and electronic industry	Pollution control equipments
Leather and leather goods	Sports goods and accessories
Auto Parts and Components	Cost effective building materials
Drugs and pharmaceuticals	Readymade garments
Solar energy equipment	Food processing
Gold and diamond jewellery for exports	Plastic (Except "One time use and throw away plastics")
Alternate products to one time use and throw away plastics	Rubber, Electric Vehicle Components, Charging infrastructure and its Components

- All new small and medium manufacturing enterprises established in the 251 industrially backward blocks.
- All new agro based small and medium manufacturing enterprises established in the 385 blocks of the state.
- Existing manufacturing enterprises of the above categories which have taken up substantial expansion/diversification of the existing activities.

Additional Capital Subsidy:

- Additional capital subsidy for enterprises set up by women/scheduled caste/scheduIed tribe/differentIy abled and transgender entrepreneurs at the rate of 5% on the value of eligible plant and machinery, subject to a maximum of ₹ 2 lakhs.
- Additional capital subsidy for promotion of cleaner and environment friendly technologies at the rate of 25% on the value of eligible plant and machinery / equipment meant for environment improvement or sustenance subject to a maximum of ₹ 3lakhs.
- Employment Intensive Subsidy at the rate of 5% on the value of eligible plant and machinery, subject to a maximum of ₹ 5 lakhs.

B. Low Tension Power Tariff Subsidy

Eligible MSME units are provided 20% low tension power tariff subsidy for 36 months from the date of commencement of production or from the date of power connection obtained, whichever is later.

Eligibility:

- All new micro manufacturing enterprises established anywhere in the state.
- All new agro based micro, small and medium manufacturing uring enterprises established in the 385 blocks of the state.

- All new small and medium manufacturing enterprises established in the 251 industrially backward blocks.
- Existing manufacturing enterprises of the above categories which have taken up substantial expansion/diversification of the existing activities.

C. Generator Subsidy

Micro, small and medium manufacturing enterprises established anywhere in the state are eligible for a subsidy of 25% on the cost of generator set purchased (upto 320 KVA capacity), subject to a maximum of ₹ 5 lakhs.

D. Back-Ended Interest Subsidy

Back-ended interest subsidy at the rate of 5 % subject to a maximum of ₹ 10 Iakhs for a period of 5 years is being provided to micro, small and medium manufacturing enterprises for term loans upto Rs.100.00 Iakhs obtained for technology upgradation/ modernization and Credit Guarantee Fund Trust Scheme(CGFTS).

2. Scheme for promotion of Energy Audit and Conservation of Energy

The Government have introduced Promotion of Energy Audit and Conservation of Energy (PEACE) scheme for promoting energy efficiency in MSME units. Under this scheme, the Government would reimburse 50% of the cost of conducting energy audit and 25% of the cost of machinery &equipments replaced, retrofitted and technology acquired for the purpose of improving energy efficiency, based on the recommendations of the energy audit.

Objectives of the Scheme:

i. Creating awareness & educating MSMEs about benefits / advantages of the new techniques/ technologies for saving energy.

ii. Undertaking in-depth studies of high energy consuming MSME clusters and identify gaps and potential barriers for energy conservation and promoting adoption of suitable techniques/ technologies to achieve energy efficiency.

iii. Encouraging MSMEs for adopting energy audits to improve energy efficiency and fuel substitution, and monitoring the impIementation of recommendations.

Incentive for Conducting Detailed Energy Audit:

a. Main objective is to identify the major sources of energy in use, identify the lapses in energy usage and areas to improve energy usage, determine the level of consumption of the energy sources and recommend measures that will enhance energy savings in the industry.

b. 50% of the energy audit cost subject to a maximum of ₹ 0.75 lakh per energy audit per unit.

c. Eligible MSMEs shall file their claims within one year from the date of completion of energy audit.

d. Incentive for Implementing Energy Audit Recommendations:

   a. The objective is to incentivise MSMEs to implement the recommendations of the Energy Audit Report and to optimize the energy consumption leading to energy saving and moneysaving in electricity bills.

   b. Eligibility - all manufacturing MSMEs in the state which have undertaken energy audit and have achieved at least 15% energy savings in terms of number of units of energy consumed per unit of product manufactured.

   c. 25% of the cost of the eligible components, subject to a maximum Iimit of ₹ 2,00,000.

3. Scheme for acquiring quality certification

To encourage MSMEs to acquire quality standard certifications for process and product

such as ISO 9000/ ISO 14001 / ISO 22000 / Hazard Analysis and critical point (HACCP) / Good Hygienic Practices (GHP) / Good Manufacturing Practice (GMP) certifications, BIS certification, Zero defect and Zero Effect (ZED), Rating etc., the Government is providing reimbursement subsidy at the rate of 100% on the charge incurred by the MSMEs for acquiring such quality certifications subject to a maximum of ₹ 1.00 lakh

4. Business Facilitation Act

Tamil Nadu Business Facilitation Act, 2018 was enacted to ensure single point receipt of applications for securing clearances that are required to establish or expand an enterprise and for clearances required during normal course of business including renewals in a time-bound manner. The Act also provides for an effective grievance redressal mechanism in case of failure of Competent Authorities to act within the time limit and for matters connected therewith or incidental thereto.

The Act covers 54 clearances covering pre-establishment, pre-operation, renewals, incentives, etc. District Industries Centres and Guidance Bureau are designated as Nodal Agencies for MSMEs and large industries respectively for operating the single window mechanism.

The Act provides for a 3 tier institutional structure:

1. MSME District Single Window Committee
2. MSME State Single Window Committee, and
3. MSME Investment Promotion and Monitoring Board to monitor and review the progress of the single window mechanism.

5. Single Window Facilitation for MSMEs

The MSME Department supports the entrepreneurs who come forward to set up an enterprise. The entrepreneurs can get all licenses/approvals from various departments under the single window mechanism.

The Government of Tamil Nadu takes cognizance of the need for continuously improving the ease of doing business in the state. In order to demonstrate the state's interest in creating an investor friendly climate, conducive to the domestic and global business community, the MSME Department has implemented the online Single Window Portal to deliver requisite services to the investors in a time-bound and transparent manner through online mechanism from 11 departments such as the Directorate of Town and Country Planning (DTCP), Tamil Nadu Pollution Control Board (TNPCB), Fire, Directorate of Industrial Safety and Health (DISH), etc. during the pre-establishment, pre-operation and renewal stages.

The Single Window Portal for MSMEs is available at https://www.easybusiness.tn.gov.in/msme.

6. Micro and Small Enterprises Facilitation council

In the MSMED Act 2000, one of the objectives is to facilitate settlement of delayed payments to micro and small enterprises for the goods supplied by them to major industrial undertakings. Accordingly, the Government has constituted four regional Micro and Small Enterprises Facilitation Councils at Chennai, Tiruchirappalli, Madurai and Coimbatore. Applicants, who intend to file applications under this, can file applications online at https://samadhaan.msme.gov.in.

7. New Entrepreneur cum Enterprise Development Scheme

"New Entrepreneur—cum-Enterprise Development Scheme (NEEDS)" has been introduced by the Government to assist educated youth to become first generation entrepreneurs.

Objective:

To assist first generation entrepreneurs to set up their manufacturing / service enterprises with financial assistance for a maximum project cost of Rs 5 crores from banks or state financial agency.

Eligibility:

Age should be between 21 years to 35 years for General Category and not exceeding 45 years for Special Category (SC / ST / BC / MBC / Minority / Women / Ex-Servicemen / Differently Abled / Transgender).

Should possess educational qualification of any degree / diploma / ITI / vocational training from a recognized institution.

Highlights of the Scheme:

Promoter's contribution is 10% of the project cost for General Category and 5% for Special Category of entrepreneurs.

Individual based subsidy @25% of project cost (not exceeding ₹ 30 lakhs).

3% interest subvention for the entire term loan period.

50%earmarked for women beneficiaries.

15 days training on entrepreneurship by EDll-Chennai.

No income ceiling.

Selection of beneficiaries by district level Task Force chaired by the District Collector.

Subject to availability, reservation upto 25% for allotment of plots/sheds in SIDCO Industrial Estates.

8. AMMA Skill Training and Employment Scheme

The Amma Skill Training and Employment Scheme aims at promotion of the MSME sector by providing them with necessary skilled human resources. The scheme aims to train unemployed youth in enhancing their skill for employment with 30% reservation for women. The MSME units providing training to the candidates selected by them will have to pay a stipend of 5000/- per month/candidate upto six months. Out of this, 2,000/- per month will be reimbursed by the Government of Tamil Nadu to the MSMEs after completion of the training programme. The trained candidates will be issued with a certificate by the Tamil Nadu Skill Development Corporation(TNSDC).

The objective of the scheme is to fuIfiII the requirement of skilled human resources in the manufacturing sector through on the job training of candidates fulfilling the norms of NSDC / NSDA / Sector Skill Council / MES / other agencies and possessing required educational qualification and age limit (18 years to 45 years) prescribed for each trade. Disbursement of stipend is done by the TNSDC.

9. UYGEP

The Unemployed Youth Employment Generation Programme (UYEGP) has been introduced to create employment opportunities for the marginalized sections of the society.

Objective:

To create employment opportunities to for the marginalized sections of the society with financial assistance for a maximum project cost of Rs. 10 lakhs for manufacturing activities, Rs. 5 lakhs for service and business activities.

Eligibility:

Age should be between 18 years to 35 years for General Category and upto 45 years for Special Category comprising SC/ ST/ BC/ MBC/ Minority/ Women / Ex-Servicemen / Differently Abled / Transgender.

Pass in VIII Standard.

Family income not exceeding Rs. 5 lakhs per annum.

Highlights of the Scheme:

Promoter's contribution is 10% of the project cost for General Category and 5% for Special Category of entrepreneurs.

Subsidy @ 25 % of project cost (not exceeding ₹ 1.25 lakhs).

7 days EDP training.

Selection of beneficiaries by district level Task Force chaired by the General Manager, District Industries Centre.

10. PMEGP

The **Prime Minister's Employment Generation** have been accepted as the engine of economic Programme (PMEGP) is being implemented with effect from 2008-09.

Objective:

Creation of self employment opportunities in both rural and urban areas with financial assistance for a maximum project cost of ₹ 25 lakhs for manufacturing sector and ₹ 10 Iakhs under service sector.

Eligibility:

Age should be minimum of 18 years.

Beneficiaries should have passed minimum 8th Std. to avail loan above ₹ 10 lakhs in manufacturing sector and above Rs. 5 lakhs in service sector.

No income ceiling.

Highlights of the Scheme:

Promoter's contribution is 10% for General Category and 5% for Special Category (SC/ST/OBC/ Minorities/Women/ Ex-Servicemen/DA).

Subsidiaries from 15% to 35% as detailed below:

Category of Beneficiary	Rate of Subsidy	
	Urban	Rural
General Category	15% of the Project Cost	25% of the Project Cost
Special Category	25% of the Project Cost	35% of the Project Cost

Secondary – Class IX – Food Processing

(Vocational Skills)

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