Draft Study Material

Craft Baker

(QUALIFICATION PACK: Ref. Id. FIC/Q5002)

SECTOR: Food Processing

Grades 11

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NCERT

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Preface

Vocational Education is a dynamic and evolving field, and ensuring that every student has access to quality learning materials is of paramount importance. The journey of the PSS Central Institute of Vocational Education (PSSCIVE) toward producing comprehensive and inclusive study material is rigorous and time-consuming, requiring thorough research, expert consultation, and publication by the National Council of Educational Research and Training (NCERT). However, the absence of finalized study material should not impede the educational progress of our students. In response to this necessity, we present the draft study material, a provisional yet comprehensive guide, designed to bridge the gap between teaching and learning, until the official version of the study material is made available by the NCERT. The draft study material provides a structured and accessible set of materials for teachers and students to utilize in the interim period. The content is aligned with the prescribed curriculum to ensure that students remain on track with their learning objectives. The contents of the modules are curated to provide continuity in education and maintain the momentum of teaching-learning in vocational education. It encompasses essential concepts and skills aligned with the curriculum and educational standards. We extend our gratitude to the academicians, vocational educators, subject matter experts, industry experts, academic consultants, and all other people who contributed their expertise and insights to the creation of the draft study material. Teachers are encouraged to use the draft modules of the study material as a guide and supplement their teaching with additional resources and activities that cater to their students' unique learning styles and needs. Collaboration and feedback are vital; therefore, we welcome suggestions for improvement, especially by the teachers, in improving upon the content of the study material. This material is copyrighted and should not be printed without the permission of the NCERT-PSSCIVE.

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Module 1
Artisan Bakery and Patisserie

Module Overview

In this Module, we will discuss about the artisan bakery and patisseries, different categories of bakery and pastry products along with tools and equipment used in artisan bakery and patisseries. The various types of ingredients and raw material used for preparing artisan bakery and pastry products are also discussed.

Artisan bakery products are made using traditional methods of production. It is different from commercial bakeries in that artisan bakery products are mainly handcrafted with the end product reflecting innovation and creativity of the craft baker.

Learning Outcomes

After completing this module, you will be able to:

- Describe the characteristics, techniques, and varieties of breads and buns in an artisan bakery, including sourdough, baguettes, and specialty rolls.
- Explain the methods for making cakes and pastries in an artisan bakery, highlighting different styles, decoration techniques, and quality attributes.
- Identify and describe the tools and equipment used in an artisan bakery, and their specific uses in the baking process.
- Discuss the key ingredients used in artisan baking, and their roles in achieving desired textures and flavors in baked goods.

Module Structure

- Session-1 Breads and Buns of Artisan Bakery
- Session-2 Cakes and Pastries of Artisan Bakery
- Session-3 Tools and Equipment
- Session-4 Ingredients

A Craft Baker is a person who prepares variety of baked products in artisan bakeries and patisseries. The job of a craft baker is outlined in Fig.1.1.

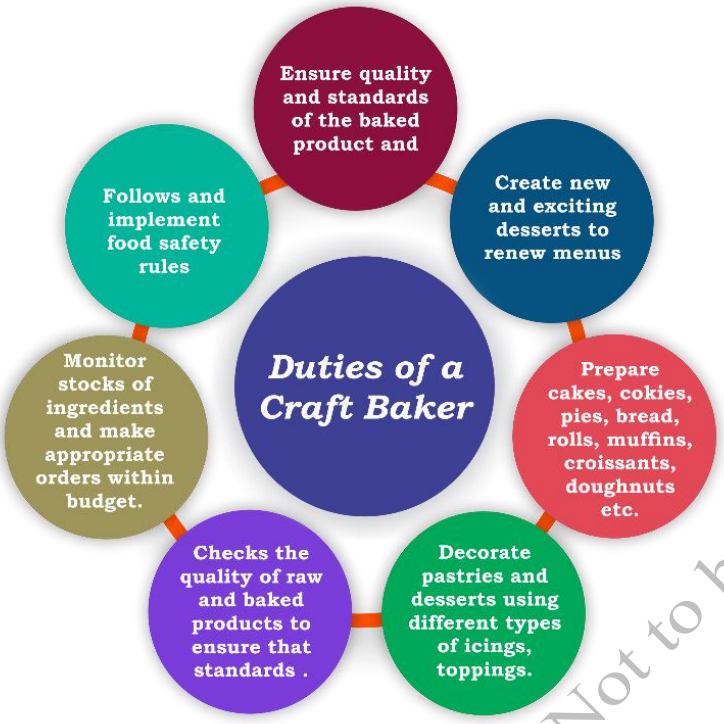


Fig. 1.1: Job profile of Craft Baker

SESSION 1: BREADS AND BUNS OF ARTISAN BAKERY

1. Artisan Bakery

Artisan bakery products include handcrafted bread, buns, pies and cookies. Depending upon the demands of the customers, color, texture and flavors of the different bakery products are customized. Various raw ingredients such as dates, walnut, garlic, carrot, mushrooms, green olives, herbs etc. are added in artisan bakery products to impart distinct appearance, flavour and taste.

1.1 Sections of artisan bakery

The artisan bakery is divided into two broad sections namely bakery and pastry. The various sections in an artisan bakery depend upon the kind of products and level of sales. For example, if the bakery is not producing chocolates there is no justification for a chocolate section.

Bread and buns are the main item for baking in an oven in the bakeries. This is the responsibility of the bread section. The pastry section deals with eggs, dairy products, chocolates, and other high risk food items that need to be protected from bacterial contamination. Therefore, the ambient temperature in pastry, dessert and chocolate section is controlled. Thus, the artisan bakery may have sections of breads, pastry, dessert, puff and chocolates.

Let us discuss the some of the most popular bakery products falling under the category of artisan bakery such as bread and buns in detail:

1.2 Bread

Bread of various types are the staple food for people around the world. White breads are the most basic and popular type of bread consumed in India. But you will be surprised to know that other than the white bread there is a large variety of artisan breads are prepared and consumed around the world. Artisan breads are claimed to be superior in terms of taste, flavor, crumb, crust texture and health benefits. However, all the breads are usually prepared using flour, yeast, water and salt.

These days artisan bread have also come into vogue. Artisan breads are different from regular breads in technique of preparation, presence of only natural ingredients and with visual appeal. However, few clearly defined differences exist between regular breads and artisan breads. Artisan bread is generally used in marketing and advertising to describe handcrafted bread. Therefore, the term "artisan bread" is somewhat vague and more of a marketing effort by bakers and tell customers why their bread is better than regular breads.

Some examples of artisan breads are given in Table 1.1.

Table 1.1: Types of artisan breads

Brioche A French bread made using flour, eggs, yeast, butter and glazed with an egg wash.  *Fig. 1.2: Brioche*
French bread The bread has crispy crust and a chewy crumb and baked in long lean loaves or baguettes.  *Fig. 1.3: Baguettes*
Calzone An Italian bread made from pizza dough and stuffed with vegetables, meat and cheeses. 

Fig. 1.4: Calzone

Ciabatta

An Italian white bread with a porous crumb. It is baked in a slipper shape and used for sandwiches.

Fig. 1.5: Ciabatta

Focaccia

A flavoured Italian flat bread, brushed with olive oil and topped with fresh herbs, vegetables and cheese.

Fig. 1.6: Focaccia

Pumpernickel

A German bread which is dark, dense and slightly sweet. It is made from coarsely ground wholemeal rye. It is also popular as rye bread.

Fig. 1.7: Pumpernickel

Stollen

The traditional Christmas bread of Germany, Stollen is a sweet and loaf shaped yeast bread filled with dried fruits and topped with icing and cherries.

Fig. 1.8: Stollen

English muffin

Yeast bread cooked in a round shape on a griddle and very popular as breakfast among Americans and Australians.

Fig. 1.9: English muffin

Challah

Challah is braided shaped and sweetened egg bread. It is popular among Jews.

Fig. 1.10: Challah

Bagel

Polish bread which is dense, chewy, round and made by boiling or steaming the proofed dough in water prior to baking.

Fig. 1.11: Bagel

1.3 Buns

A bun is usually made from dough that has been enriched with sugar, butter, milk and egg. Without the addition of any one of these ingredients, the dough will be termed as 'bread dough' and not a 'bun dough'. Buns are generally smaller in size and round in shape. Some popular buns are given in Table 1.2.

Table 1.2: Types of buns

Cinnamon buns

They are made with enriched dough filled with a mixture of ground cinnamon, brown sugar and butter and have a soft and tender crumb. They are drizzled with butter and icing sugar and served warm.

Fig. 1.12: Cinnamon buns

Hot cross buns

These buns originated in England and are served on Good Friday. It is a flavoured sweet bun usually made with fruit and marked with a cross on the top with butter and icing sugar.

Fig. 1.13: Hot cross buns

Pav

A bun widely consumed in India with *bhaji*, butter or *vada*.

Fig. 1.14: Buns

Fruit bun

A sweetened bun made with fruit, fruit peel, spices and nuts.

Fig. 1.15: Fruit bun

Burger bun

A round shaped bun made specifically to hold a patty.

Fig. 1.16: Burger bun

Conclusion

The session explains how a craft baker is concerned with artisan bakery and patisserie. Breads and buns have been discussed together in this session along with their different types. They have been discussed together because their manufacturing processes are similar. Cakes and pastry will be covered in the next session.

What have you learned?

After completing this Session, you are able to:

- Describe artisan bakery and patisseries
- Categorize bread and buns
- Discuss job profile of a Craft Baker

ACTIVITY

1. Visit a nearby bakery shop
   a) Identify the types of artisan breads and buns available there.
   b) Note down the recipe being followed.
   c) Discuss in the class what other types of breads and buns are consumed around the world.
2. Compare the characteristics of white bread with the artisan bread discussed in the session and discuss the noticeable difference in your class.

CHECK YOUR PROGRESS

I. Multiple choice Questions

1. Brioche is a bread of …….origin

a. Italian b. French

c. Danish d. German

2. An Italian bread made from pizza dough and stuffed with vegetables, meat and cheeses is called

a. cibatta b. calzone

c. foccaccia d. stollen

3. Which of the following is a dark, dense and slightly sweet and made using rye:

a. Stollen b. Bagel

c. Cibatta d. Pumpernickel

4. Which of the following is a braided shaped and sweetened egg bread:

a. brioche b. calzone

c. challah d. foccaccia

II. Mark the statement True or False

1. Bun and breads have same ingredients.
2. Pav is originated in England and usually served on Good Friday.
3. Bagel is a German bread and is very porous.
4. English muffins are popular breakfast item among Americans and Australians.
5. Baguettes is an Italian bread.

III. Fill in the blanks

1. _____is baked in a slipper shape and used for sandwiches.
2. Proofed dough of _____ bread is boiled or steamed in water prior to baking.
3. Drizzling with butter and icing sugar is done in _____.
4. A type of bun widely consumed in India is with *bhaji* and *vada* is called _____.
5. _____has sugar, fruit or fruit peel, spices and nuts in addition to flour and yeast.

VI. Very short answer type questions

1. What is Artisan Bread?
2. Enlist the types of bread and countries where they are popularly consumed?

3. How buns are different from bread?
4. What would you like to prepare among the products discussed in the session?
5. What are the different sections of an artisan bakery and how they are different with each other?

SESSION 2: CAKES AND PASTRIES OF ARTISAN BAKERY

Cakes

Cakes are a form of dessert usually made with flour, butter, sugar, eggs and cream. The final texture and colour of the baked cake depend upon how the batter is prepared. A typical cake is composed of a sponge, filling, icing and garnishing (Fig.1.16). The cake sponges can be broadly divided into two categories based on the ingredients used in making them and the mixing method employed.

Classification based on ingredients:

Based upon ingredients, cakes are classified into shortened, un-shortened cake and chiffon cake.

a. Shortened cake: These are made with shortening such as margarine and butter e.g. pound cake, butter cream cakes, red velvet cake, cheese cakes, banana cake, chocolate brownies. The method of mixing used for these cakes can be either creaming or whipping.

b. Un-shortened cake or Foam/Sponge cake: They are made without the addition of shortening and usually aerated with eggs. Examples of un-shortened cakes includes angel cake, genoise, sponge cake etc. The method of mixing in such cakes can be whipping and cutting and folding.

c. Chiffon cake: It is a combination of shortened and un-shortened cakes. This uses liquid shortening such as hydrogenated vegetable oil and egg whites. Examples of chiffon cake include orange chiffon cake, vanilla chiffon cake , butter cake etc. Whipping and cutting and folding are the method of mixing used to prepare such cakes.

Classification based on method of mixing:

The mixing methods used for cake making are creaming and whisking. In the creaming method, fat and sugar are creamed together and afterwards eggs and flour are added into the mixture. In the whisking method, eggs and sugar are whisked together until fluffy and then flour is folded into the whisked mixture.

We can also categorize cake sponges by the flavoring used in them i.e., chocolate cakes, vanilla cake, butterscotch cake, fruit cakes etc. It is emphasized that the two systems of classification presented above can be simultaneously employed in the categorization of cakes as given in Table 1.3

which rather gives a category of cakes based on popularity among consumers. The recipes and method of preparation of the cakes mentioned below will be discussed in detail in the succeeding class 12th textbook.

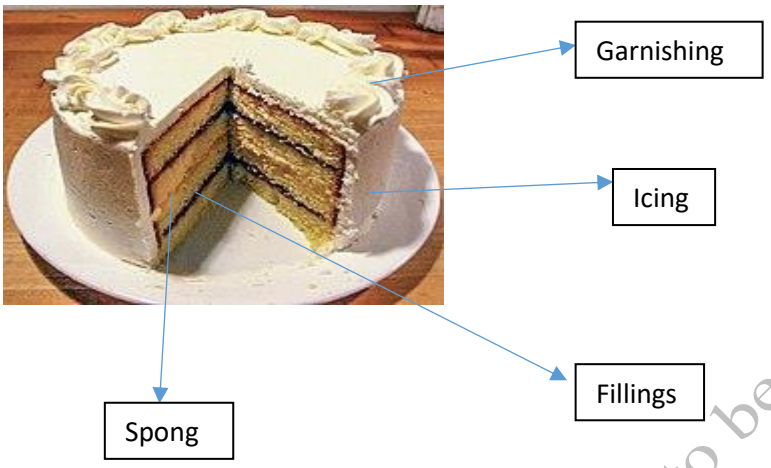


Fig. 1.17: Components of a typical cake

Table 1.3: Popular type of cakes

Sponge

A sponge has no artificial leaveners like baking powder or baking soda. They are prepared by whipping eggs and sugar together to form air pockets until the volume rises at least three times of the actual volume. After whipping, dry ingredients like flour and salt are sifted and folded-in gently. Sponge cakes are light, spongy, somewhat dry and suitable for icing.

Fig. 1.18: Sponge

Genoise

It is a kind of sponge cake made with whole eggs. Here, eggs and sugar are combined and whipped in a pan kept over simmering water to make it light and fluffy. Dry ingredients flour, salt and baking powder are folded in the whipped mixture. The batter is transferred into the baking moulds and baked in oven. Baked cake is sliced into thin horizontal layers and stacked with alternate layers of cream/frosting to create layered cake e.g. swiss roll, vanilla genoise.

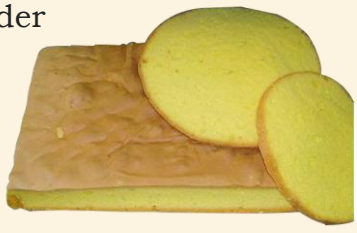


Fig. 1.19 Genoise

Butter cakes

Butter cakes are prepared through creaming method in which butter and sugar are creamed together. When the sugar dissolves partially, other ingredients such as flour, baking powder, salt, vanilla essence are added respectively into the creamed mixture. Butter cakes variation includes pound cake, red velvet cake and carrot cakes.

Fig. 1.20: Butter cakes

Flourless Baked Cake

As the name suggest, it does not contain flour and prepared using cream cheese, cocoa powder, melted chocolate, butter, eggs and sugar. Sometimes biscuit powder or cake crumbs are also used to form the base. Chocolate and butter is melted over double boiler and then whipped egg mixture is added along with other ingredients is mixed well. The mixture is then poured in a pre-greased mould and baked in oven. Example: cheese cakes, mousse cake etc.

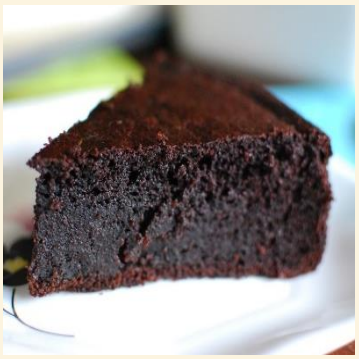


Fig. 1.21: Flourless baked cakes

Flourless Unbaked Cake

These cakes are made with cocoa powder, melted chocolate, butter and sugar These types of cakes are typically moulded in a dessert ring or spring form pan and chilled before unmoulding. Examples include unbaked cheesecakes, mousse cakes, chocolate mousse, strawberry mousse etc.

Fig. 1.22: Flourless unbaked cakes

Patisserie

Patisserie is originally a French word with widely different meanings such as cake shop, cake making, confectionary, confectioner's shop, confectionary shop and pastry making as well as a pastry chef who has completed a lengthy training process as an apprentice and passed a written examination.

Earlier bakeries were involved in only the production of breads and biscuits. With the progress of technology and use of ingredients such as dairy products, chocolate, essences, leavening agents, flavours etc. numerous new sweet products were made with baking. The hotel department making these products came to be known as pastry kitchen or patisserie in French.

As you know by now, cake is baked product made with leaveners, flour, fat and sugar, whereas pastry is a baked product made primarily with flour and fat. You will agree that the different cakes are baked products and that the pastry

includes all the baked products. Therefore, we can safely say that all of the cakes come under pastry. This leads us to believe that the art and craft of patisserie revolves around the pastries.

Pastry is a baked food which contains item made from flour and fat paste such as pie crust and tarts. Patisserie is a particular style of baking usually with small designer cakes, pastries and tarts etc. The various types of patisserie have originated from France, Belgium and other European countries. Generally, patisseries are set up within the bakery shop.

Patisserie Products

The patisserie products like cakes, tarts, custards, palmier, macarons, profiterole, chocolates, confectionery, desserts, are prepared by using refined flour, sugar, cream, butter, eggs, milk etc. and are generally sold in patisserie shops. These patisserie items are exquisitely decorated and delicious.

Pastry

The dominant component of patisserie products is pastry. The higher fat content in pastry contributes to their flaky or crumbly texture. A good pastry is light, airy, rich and firm enough to hold its shape. Pastries are generally used as base to create variety of preparations such as eclairs, profiteroles, choux crust pastry, patties etc. *Balushahi, Chatti pathiri, Samosa* etc. can be considered as example of popular pastries in India. Some of the popular pastries are given in Table 1.4.

Table 1.4: Types of Pastry

Puff pastry

The proportion of fat and flour is equal in puff pastry. The pastry is made with flour, salt, and lemon juice. After allowing the dough to rest, it is rolled out into squares and creamed fat is spread evenly on the dough sheet. The sheet is folded and rested at 4 to 5 ℃ for at least an hour. The examples of puff pastry are palmier, turnovers, vegetable puffs etc.

Fig. 1.23: Puff pastry

Flaky pastry

It is also known as blitz pastry and is similar to puff pastry with the difference of ratio of fat to flour which is 1:1.5 as compared to 1:1 for puff pastry. The examples of flaky pastries are vol-au-vent, jam puff, sausages rolls etc.

Fig. 1.24: Flaky pastry

Filo pastry

Filo is unleavened dough used for making pastries. The dough is rolled in many thin sheets and these sheets are then piled forming multiple layers using oil before baking.

Fig. 1.25: Filo pastry

Danish pastry

It is a multi-layered, laminated sweet pastry made with flour, yeast, sugar, eggs and milk. The dough is folded and rolled several times, creating minimum 27 layers. After baking, the pastry is brushed with sugar syrup. Croissants and windmills, are popular examples of Danish pastry.

Fig. 1.26: Danish pastry

Short crust pastry

This is the simplest and common pastry made with flour, fat, salt and water. It is mainly used in preparation of tarts, pie and quiche. Pate Sucre (sweet pastry) is a sweet version of this pastry where sugar is creamed with butter before adding flour and the water. Various sweet and savoury products are made with short crust pastry such as honey apple pie, pears pies.

Fig. 1.27: Short crust pastry

Choux pastry

This pastry is made by boiling together water, butter and salt and then the flour is added to form a paste. The paste is mixed vigorously with a spoon and then cooked again till the mixture has a shiny appearance. Beaten eggs are added gradually to the cooked paste with continuous beating to form a smooth and pliable mass of piping consistency. It is then piped into the desired shapes like rosettes, fingers or balls and baked. Éclairs, Cream Puffs, Duchesses, profiteroles and cream puffs are examples of choux pastry.

Fig. 1.28: Choux pastry

Chatti pathiri

It is popular in Kerala state. It is prepared in both sweet and savoury versions. The sweet version has sugar, beaten eggs, nuts, raisins and seasoned with cardamom. Once layered, it is baked at 180 ℃ for about 20 minutes.

Fig. 1.29: Chatti pathiri

Samosa

It is a fried or baked pastry prepared with dough of refined flour. The dough is rolled into triangular shapes and stuffed with a filling of mashed boiled potatoes, onions, green peas, lentils, and spices etc.

Fig. 1.30: Samosa

Balushahi

It is similar to glazed doughnut in terms of ingredients and appearance. The dough is made with flour, ghee and baking powder. Then it is shaped into round discs by hand, deep fried in ghee and dipped into thick sugar syrup.

Fig. 1.31: Balushahi

Conclusion

The different types of cakes are classified either on the basis of ingredients or on the basis of method of mixing of ingredient. In popular parlance, cakes are also categorized into sponge cake, genoise cake, butter cakes, flourless baked

cake and flourless unbaked cake. The concept of patisserie has been elaborately explained along with description of important types of pastry of Indian and foreign origin.

What have you learned?

After completing this Session, you are able to:

- Describe patisserie
- Categorize pastries
- Discuss example of Indian pastries.

ACTIVITY

1. Visit a nearby sweets shop
   a) Observe preparation of *samosa* or *balushahi*.
   b) Note down the recipe being followed.
   c) Discuss in the class how these items can be considered as examples of pastries.
2. Prepare a list of different types of cakes and pastries available in your locality.
3. Search and note down the recipe and method of preparing puff pastry, short crust pastry and choux pastry. Observe the difference in ingredients of each recipe carefully and discuss whether they are different or same.

CHECK YOUR PROGRESS

I. Multiple choice Questions

1. Margarine and butter is used to prepare which of the following type of cake
   a. sponge cake b. chiffon cake
   c. shortened cake d. foam cake
2. combination of shortened and un-shortened cakes produces
   a. sponge cake b. chiffon cake
   c. shortened cake d. foam cake
3. Sponge cake are aerated using
   a. eggs b. oil
   c. baking powder d. baking soda
4. Artificial leaveners are generally not used for preparing
   a. genoise cake b. butter cake
   c. sponge cake d. unbaked cake

5. Which one of the following is sweet version of short crust pastry

a. pate sucre b. flaky pastry

c. puff pastry d. Danish pastry

II. Mark the statement True or False

1. In creaming method fat is creamed with eggs.
2. Cakes are made generally using creaming or whisking method.
3. Flaky texture in pastries is due to low fat or oil content.
4. The proportion of fat and flour is equal in puff pastry.
5. The proportion of fat to flour in flaky pastry is 1:1.5.

III. Fill in the blanks

1. Patisserie is a _____ origin word specializes in pastries cold sweets and frozen desserts.
2. Tarts, pie and quiche are prepared using _____pastry.
3. Palmier, turnovers, vegetable puffs are prepared using _____pastry _____.
4. Another name of blitz pastry is _____pastry.
5. _____ pastry is laminated sweet pastry has at least 27 layers.

VI. Very short answer type questions

1. What is a patisserie?
2. What products comes under patisserie category?
3. List down the types of pastry?
4. What is the difference between puff and flaky pastry?
5. How choux pastry is made?

SESSION 3: TOOLS AND EQUIPMENT

Most of the artisan bakery products can be made by using simple tools. However large equipment like mixers, ovens and dough-handling equipment like kneaders and sheeters are also required. This session outlines of the important equipment used by bakers and pastry chefs.

Categories of Tools and Equipment

The major categories of tools and equipment in artisan bakeries and patisseries are:

1. Measuring tools
2. Preparatory tools

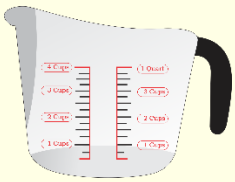
3. Mixing tools
4. Baking pans and moulds
5. Equipment

These categories are discussed in detail as follows:

Measuring tools

Baking is an art as well as a science and if even one of the ingredients is incorrectly measured, the entire recipe will be jeopardized. Therefore, accurate measurements are important in bakery. The essential baking tools for accurate measurements are given in Table 1.5.

Table: 1.5: List of essential measuring tools

S. No	Name of tool		Function
1.	Measuring cups		They come in different sizes and are used to measure the required dry and liquid ingredients.
2.	Measuring spoons		These are available in different sizes for measuring the required small quantities of liquid or dry ingredients.
3.	Liquid measuring cup		It is used to measure the required liquid ingredients like milk, oil, water etc.
4.	Weighing scale		They are used to weigh accurate quantities of ingredients.

Preparatory tools

These tools help in carrying out particular stages of preparation of the product. Using the correct preparatory tools helps in preparation of the desired product. Some of the preparatory tools employed in baking along with their functions are given in Table. 1.6.

Table: 1.6: List of some preparatory tools

S. No	Name of tool	Functions
1.	**Flour sieve**	Used for separating husk and undesirable materials from the flour. Also used for mixing of dry ingredients as well as aerating them. 
2.	**Cake Turntable**	Used for rotating the cake sponges while decorating and icing them. 
3.	**Cake stand**	Used by patisserie shop for displaying their cakes. 
4.	**Cake pillars**	Usually a four or six-legged plastic pipe like structure for providing support against collapse to multi- layered cakes. 
5.	**Piping bags**	Used for icing and decoration of cakes and cupcakes. 
6.	**Decorating Nozzles**	Used for preparing the desired designs over the cakes and pastry. 
7.	**Pastry or biscuit cutters**	Used for shaping, cutting and decorating the cookies, biscuits and cake. 
8.	**Rolling pin**	Used to roll the dough. 
9.	**Pastry wheel**	Used to cut the pastry dough and pizza into slices. 
10.	**Rubber scrapper**	

	Used to gather every bit of dough or batter from a work surface or a bowl.
11.	**Palette knife** Used for spreading cream, icing, fillings and smoothening of toppings on cakes etc. 
12.	**Scrappers** Used to scrape the dough from surfaces and cut the dough into equal pieces. 
13.	**Pastry brushes** Used for greasing pans, cake tins, or surfaces of bakery utensils. 
14.	**Sauce pan** Used for boiling sugar syrup etc. and making of sauces. 
15.	**Chopping board** Used for cutting and chopping vegetables, fruits, dry fruits etc.
17.	**Double boiler** Used for tampering chocolates, melting butter etc. 
18.	**Timer** Used to keep track of time for bakery processes such as proving, baking etc. 
19.	**Cooling rack** Used for cooling of baked products such as cakes, biscuits, cookies etc. 

Mixing tools

Mixing tools are used for mixing, whipping, aeration and creaming of ingredients. Some of the commonly used tools are given in Table 1.7.

Table: 1.7: List of some mixing tools

S. No	Name of tools	Function

1.	**Wooden Spoon/ mixing spoon** Used for mixing, blending different types of ingredients. 
2.	**Whisker** Used in beating eggs and whipping cream. 
3.	**Mixing bowl** Used for mixing flour, sugar, butter and other ingredients. 
4.	**Hand mixer (Electric)** Used for beating eggs, mixing batters and preparation of icing creams. 
5.	**Blender (Electric)** Used for mixing liquid ingredients, preparing smoothies, and dips, chopping nuts and pureeing fruits and vegetables. 

Moulds and pans

Baking pan is made from different materials such as aluminum, carbon coated iron, tin and silicone. These materials affect the baking time of the recipe. The baker has to have a good idea about how each material responds to heat so that the baking temperatures and duration is adjusted. Aluminum is a good heat conductor therefore quite popular in the industry. The right size and shape of the baking pan is equally important because it affects the baking time. Some of the commonly used baking mould and pan are given in Table 1.8.

Table: 1.8: Popular moulds and pans

S. No	Name of tool	Function
1.	**Circular cake mould** Used for baking the round shaped cakes. 	
2.	**Pie mould** Used for baking pie dishes. 	

3.	**Tart mould** Used to bake tart shells and muffins. 
4.	**Muffin pan** Used for baking muffins and cupcakes. 
5.	**Bread loaf pan** Used to bake bread dough. 
6.	**Bundt pan** Used for baking specialty cakes such as angel cake. 
7.	**Baking tray** Used for baking bread rolls, pastries, cookies, sheet cakes, swiss rolls etc. 
8.	**Cake rings** Used for making moulded desserts as well shaping and holding desserts made up of layers of cake, pastry and fillings. 

Equipment

The different equipment save labor and enable the craft baker to make bulk quantities of bakery products in less time. Without the use of these equipment, the bakery operations can hardly be economically viable. Some of the essential equipment are given in Table 1.9.

Table: 1.9: Some of the Essential equipment

S. No	Name of Equipment	Function
1.	**Planetary mixer** Used for mixing of the ingredients, kneading the dough and whipping of eggs and creams. The three attachments of planetary mixer dough hook, flat beater and a wire whisker are also shown in the Figure. 	

2.	**Dough Sheeter** Used for rolling the dough into sheets of desired thickness.	
3.	**Proving Chamber** Used for keeping dough of bread, rolls, buns, etc. for proofing.	
4.	**Oven** Used to bake cake, bread, biscuits, tarts and other bakery products	
5.	**Blow gun** Used for applying heat to caramelize sugars in custards, pies etc.	
6.	**Freezer** Used to store the bakery items to extend their shelf life.	

Conclusion

A good craft baker heavily depends on various tools and equipment. The essential measuring tool, preparatory tools, mixing tools, moulds and pans and equipment are discussed in this session along with the different purposes that are served by these tools and equipment.

ACTIVITY

1. Enlist the five tools and five equipment available in your laboratory and write down their function.
2. Prepare a list of equipment along with their functions used in large scale industries other than those discussed in the session.

CHECK YOUR PROGRESS

I. Multiple choice Questions

1. Accurate measurement of ingredients is possible by using which of the following tools

a. mixing b. preparatory

c. measuring d. all of the above

2. Very small quantities of ingredients are measured using

a. measuring cups b. Weighing scale

c. measuring glass d. Liquid measuring cups

3. In addition to removal of undesirable material from flour, aeration and mixing of ingredients is also achieved using which of the following tool:

a. Sieve b. scrapper

c. Spatula d. pastry brushes

4. For tempering of chocolates and melting butter, which of the following is used

a. sauce pan b. blender

c. double boiler d. oven

5. Caramelization of sugar in finished bakery products is achieved by which of the following:

a. Blow gun b. heating in oven

c. proving chamber d. mixer

II. Mark the statement True or False

1. Cake turn table is used for turning the cake during baking.
2. Planetary mixer is equipment used for preparing sauces.
3. Electric hand mixer is used for creaming, beating egg whites, mixing cake batters and icing cream.
4. Prooving chambers are used for proving the cake dough.
5. Cooling racks are used cooling cakes.

III. Fill in the blanks

1. _____ is used to store the bakery items to extend the shelf life of the products.
2. _____ is used for scraping surfaces and cut dough into equal pieces
3. is saucepan with a detachable upper compartment heated by boiling water in the lower chamber.
4. Three attachment of planetary mixer are dough hook, flat beater and _____ . **wire whisker** .

5. For preparing special type of cake such as angel cake, _____pan is used.

IV. Very short answer type questions

1. Explain about oven and its uses.
2. List down the measuring tools used in the bakery section?
3. What are preparatory tools?

SESSION 4: INGREDIENTS

Consumers can easily detect the quality of the ingredients used in bakery and patisserie products after tasting it. Therefore, success of any artisan bakery and patisserie heavily depends on the quality of the ingredients used in preparing them. Use of optimum amount of ingredients is essential for producing good quality bakery product. Use of either low or high amount has an adverse effect on the quality of baked product. In this session you will learn about the basics of ingredients used to prepare various bakery and pastry products. A variety of ingredients such as flour, leavening agents, fats and oil, sugar, eggs, creams, flavouring agents, milk, chocolates, fruits, nuts, salt etc. are used in the artisan bakery and pastry products. Let us discuss these ingredients in detail:

Flour

Flour is a key component of bread, cakes, pastries and other bakery product. It forms the structure, texture and taste of the products. Different types of flours are used depending upon the product to be prepared. The strength of the flour is associated with the amount of gluten protein present in the flour. The gluten content of different flour varies greatly and serves as the basis for choosing the most suitable type of flour for the desired bakery product. For example, a flour having 10-14 % protein is suitable for making breads, buns, and patties whereas a flour having 6-8 % protein is suitable for producing cakes and biscuits. The various types of flours used in bakeries are discussed below:

a) **Bread flour:** This flour is obtained by milling hard wheat and has about 12 % protein. It is used in preparation of bread, buns, *pav* and rolls.

b) **Cake flour:** It is obtained by milling soft wheat and has about 6- 8 % protein. This flour is used for products where crumb structure is desired such as cakes, cookies and biscuits.

c) **All- purpose flour:** As the name suggests, this flour can be used for most of the bakery product as it has about 10-11 % protein which level of protein can be used for most of the bakery products.

d) **Whole wheat flour:** This flour is obtained by milling the whole wheat kernel. However, the disadvantage of using whole wheat flour is that the bran particles present in it cut through the gluten threads during mixing and kneading, resulting in smaller and heavier bread dough and thus making the bread quite dense. Therefore, this flour is generally used in combination with bread flour or all-purpose flour.

Nowadays multigrain breads are gaining popularity in which a variety of flours such as oats, corn, rye, amaranth and millets are used in combination with all-purpose flour.

Leavening Agents

Leavening agents produce the desired volume in bread, cakes, muffins and other bakery products. The following leavening agents are used for different bakery products depending upon the aeration and volume required in the product.

a. Yeast: Yeast i.e. *Saccharomyces Cerevisiae* is a unicellular microorganism found on plant leaves, flowers, and fruits as well as soil. Yeast needs air, moisture, warmth and sugar to multiply. Availability of optimum conditions helps the yeast to multiply to produce carbon dioxide which raises the dough. The various types of yeast are given in Fig.1.7

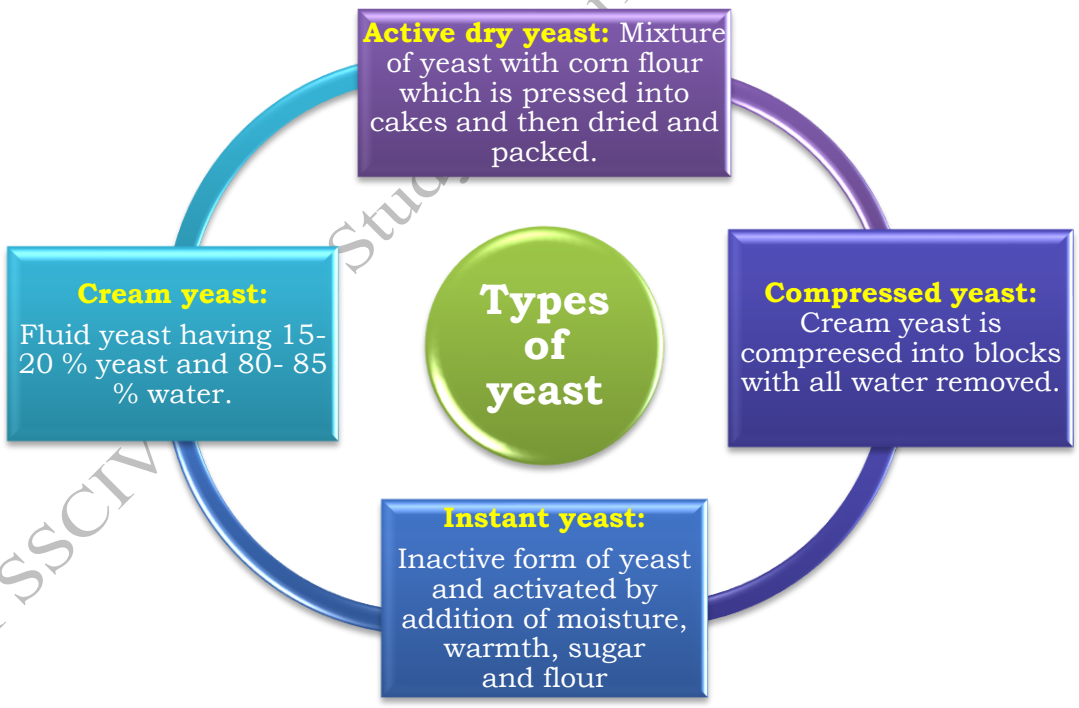


Fig. 1.32: Types of Yeast

b. Baking Powder: It is a chemical leavening agent and a mixture of sodium bi-carbonate, cream of tartar (tartaric acid) and a separator usually rice flour

or corn starch. Under optimum air, moisture and temperature the sodium bicarbonate produces carbon dioxide which raises the volume of the dough or batter.

c. Ammonium bicarbonate: Ammonium bicarbonate also releases carbon dioxide under optimum moisture, air and temperature. It is used in precisely measured quantity because even a slight excess can produces undesirable taste in biscuit or cookies.

d. Baking Soda: Sodium-bicarbonate is popularly called as baking soda. It breaks into sodium carbonate, carbon dioxide and water on heating during baking process. Sodium bicarbonate, when heated, releases only 50 per cent of the total carbon dioxide. Addition of acidic ingredient such as lemon, vinegar or curd to the sodium bicarbonate (which is alkaline salt) causes release of up to 100 per cent carbon dioxide. The acid present neutralises the leftover soda so that no after taste is left in the product.

Fats and Oil

The amount and type of fats used in a bakery product largely contributes to the final texture of the product. The fats and oils used retain moisture, impart flavor and glaze to the product. Different types of fats and oils used in bakery are discussed below:

Butter: Butter imparts distinct flavour and mostly used in cookies, cakes, pastries etc. It is obtained by churning the cream of milk. White butter and processed butter are two variants of butter. White butter is fresh with higher moisture content and natural flavour whereas processed butter is pasteurized, pressed, and salted.

Oils: These are extracted from oilseeds and used for shortening, frying and glazing in bakery products.

Margarine: It is a cheaper substitute for butter and some bakers claim that its use gives comparable results. It is of non-dairy origin and obtained from hydrogenated vegetable oils and fats.

Sugar

Sugar is an integral part of most of the bakery and pastry products. It acts as a sweetener and plays a role in the development of taste, texture, flavour and appearance of baked products. The sugar in dough provides the substrate for the yeast to grow and multiply. It contributes to the golden-brown outer crust of the bread. Sugar tenderizes a cake by preventing the gluten from forming. The various types of sugars used for different functions include granular sugar, castor sugar, icing sugar, brown sugar, golden syrup, honey, treacle and liquid glucose.

Eggs

Eggs are added to give nutritional value, tenderness, texture, moisture, flavor and color to the bakery products. The egg yolks act as an emulsifier because it has some amino acids that repel water and some amino acids that attract water. When the egg yolk is thoroughly mixed with oil and water, some protein will stick to water and some proteins will stick to oil resulting in an emulsion. this emulsification property is used in cakes, rolls and pastries. Egg white works as a leavening agent contributing to the structure of the baked product.

Water

Various parameters of water such as hardness and its pH play an important role in preparation of various bakery products. Water is required for development of viscoelastic properties in dough. The consistency of the dough is dependent on its hydration level as shown in Table 1.10.

Table 1.10: Hydration level for different types of dough

Type	Hydration level	Products
Batter	100-130%	*Jalebi*, Waffles, Pancakes
Soft dough	55 -70 %	Bread and biscuits
Moderately stiff	50 to 55 %	Crusty, malty and rye bread
Very stiff	30 -40 %	Fancy bread decoration

Milk

Milk enhances the nutritional value and acts as a moistening agent in the bakery products.Milk is used in various forms such as skimmed milk, condensed milk, dried milk powder and milk solids.

Creams

Dairy creams and non-dairy creams are used for decoration, filling and icing of bakery products. Dairy cream is separated from milk whereas non-dairy cream is prepared from vegetable oils. Dairy cream is delicate and perishable in nature whereas non-dairy cream are easy to use and store with longer shelf life.

Flavouring agents

A large variety of natural extracts from various sources such as vanilla bean and cocoa are used as flavouring agents. The artificial essences such as strawberry, pineapple and vanilla, rose are also used to impart desirable flavor to bakery and patisserie products.

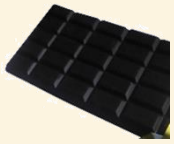
Cocoa

Cocoa pods are obtained from the seeds of the cocoa tree called Theobroma cacao. Cocoa powder is low in fat and has no sugar. Different formulation of cocoa such as cocoa butter and cocoa powder are used in bakery production to provide unique colours and flavours.

Chocolates

Chocolates are primarily made from cocoa powder, cocoa butter and sugar. It is available in liquid, paste or in a block form and is used for decorating and flavoring purposes in desserts, cakes, pudding, mousse, chocolate brownies, and chocolate chip cookies. The detailed use of cocoa and chocolates in patisserie is discussed in detail in class 12th textbook on "Craft Baker". The three major types of chocolates used in bakery are discussed in Table 1.11.

Table 1.11: Types of chocolates

Dark Chocolate Dark chocolate is made up of 50-90% cocoa solids and cocoa butter and do not have added sugar and therefore taste bitter.	
Milk Chocolate Milk chocolates are made up of cocoa, milk solids, vanilla, sugar, emulsifiers and cocoa butter. Milk chocolates have 10 to 20 percent cocoa solids.	
White Chocolate White chocolate is made up of cocoa butter, milk solids, sugar and does not contain cocoa powder. It imparts ivory colour with slight chocolaty taste.	

Salt

Salt i.e. sodium chloride strengthen gluten strands, enhances flavours and retains moisture. Salt controls the speed of fermentation in dough or batter.

Nuts and Dried Fruits

Almonds, cashews, hazelnuts, peanuts, pine nuts, pistachios and walnuts are referred as nuts. Fresh fruits such as apricots, berries, grapes, blueberries, cranberries, cherries and strawberries are dried by various techniques and used as dry fruits for cakes, pastries and dessert in bakery.

Fresh Fruits and vegetable

Fresh fruits like apple, peach, pear, kiwi, watermelon, mango, banana, oranges, jack fruit, pomegranate, grapes, pineapple, etc. and vegetables such as carrots, beets, peas, potato, tomato, olives are used for specific purposes, effect and craftmanship in various bakery and patisserie products.

Conclusion

Most of the ingredients widely used for preparation of bakery and patisserie products have been described in this session. Function and usage of flour, leavening agents, fats and oils, sugar, eggs, milk, creams, flavouring agents, cocoa chocolates, salts, nuts and dried fruits, fresh fruits and vegetable and water have been discussed in the session.

ACTIVITY

1. Weigh 2 g, 4 g and 6 g of instant yeast in three bowls separately and add 5 g of sugar in each bowl. Dissolve yeast and sugar in 10 ml of water and let it rest for 10 minutes. Now take 200 g of flour in triplicate and name them as A, B and C. Add yeast suspension of 2 g in A sample, 4 g in B sample and 6 g in C sample. Knead the dough well and keep it into a greased bowl and let it ferment in the proving chamber maintained at 30°C, 75% RH for 90 min. It can be kept at room temperature in case of non -availability of proving chamber. Knock back the fermented dough for 1 min and keep it again for second proofing for 25 min. After second proofing keep the dough into pre greased bread pan and allow the final proofing for 30 min at 30°C. Now bake at 220°C for 25 min. Remove from the pans and cool on the rack. Observe and note the following:
   a. Volume and weight of the breads
   b. Appearance of the breads
   c. Crust and crumb colour of the breads
   d. Texture of the breads
2. What are the differences you observed in the above prepared breads and discuss the reason behind it?

CHECK YOUR PROGRESS

I. Multiple choice Questions

1. Which of the following determines the strength of flour
   a. moisture content b. gluten content
   c. Starch content d. all of the above
2. How much protein content is desirable for producing good quality of breads?
   a. 8 % b. 12 %

c. 18 % d. 6%

3. Which of the following flour has 10-11 % of protein and considered suitable for most of the bakery product is:

   a. cake flour b. All purpose flour

   c. whole wheat flour d. multigrain flour

4. Which of the following gas is responsible for raising the bread dough during fermentation:

   a. Oxygen b. carbon dioxide

   c. sodium bi-carbonate d. ammonia

5. Sodium bicarbonate is popularly known as:

   a. baking soda b. baking powder

   c. shortening agent d. all of the above

II. Mark the statement True or False

1. Weak flour contains higher protein content and suitable for producing bread.
2. Compressed yeast is obtained from cream yeast. True
3. Cocoa is obtained from the seeds of the cocoa tree, Theobroma cacao.
4. Oil and butters are used as shortening agents in bakery products. True
5. Baking soda is a mixture of sodium bi-carbonate, cream of tartar and a separator. False

III. Fill in the blanks

1. Flour gives the _____ for the product.
2. _____ is a unicellular micro-organism of plant origin.
3. _____ produces a pungent in flavor in the products.
4. Salt has 40% of _____ and 60% of _____.
5. Margarine is non-dairy butter obtained from _____vegetable oil and fat.

IV. Very short answer type questions

1. Name the types flour used in the bakery.
2. What is chemical leavening agent?
3. Explain shortening agent?
4. What is fermentation?
5. Describe functions of eggs?

Module 2
Elements of Baking

Module Overview

The major elements which affect any baking activity are prior preparation of work area, raw materials, required equipment, processes involved in manufacturing of the bakery product and manpower etc.

Before actual baking, certain prior preparations like cleaning the workplace, measuring ingredients, preheating oven etc. are carried out. The preparation activities undertaken before, during, and after the production stage are termed the "Work Plan". A work plan includes the specific product to be made, its recipe, ingredients, tools and equipment and arrangement of the work space. You will also learn about the preparation of dough and procedure for cooling, packaging and storing the bakery product and the necessary mathematics involved in baking.

Learning Outcomes

After completing this module, you will be able to:

- Describe the process of production planning for baking, including scheduling, resource allocation, and selecting appropriate ovens for different types of baked goods.
- Explain the principles of baker's math, and adjusting measurements to ensure consistency and quality in baking.
- Understand the properties and handling of dough, including mixing, kneading, fermentation, and shaping techniques to achieve desired textures and structures in baked products.

Module Structure

- Session 1 Production Planning and Ovens for Baking
- Session 2 Baker's Math
- Session-3 Dough

SESSION 1: PRODUCTION PLANNING AND OVENS FOR BAKING

Planning is required at all stages of production to fulfill quantity and quality standards of products within given timeframe. Production planning in terms of resources including material, time and manpower is an essential for achieving target production.

1. Aspects of Planning Production

Pre-production planning is as important as actual production planning. Planning for production starts just after receiving the production order. Once the production order is received, requirement for raw material, duration for production and timeline to deliver the order is decided and recorded. Exact estimation of required raw material, skilled manpower and projections to meet the market demand reduces the cost of production.

Various aspects related to planning for bakery production are discussed below:

1.1 Raw Material and Manpower Requirement

After deciding the total volume of the production as per the order, the baker calculates the quantity of ingredients required to prepare that volume. For this purpose, s/he has to refer to the recipe and determine possible wastages and losses during the production process. The number of skilled manpower needed to perform the production process is also decided at this stage.

1.2 Equipment

Before execution of any production order, a baker has to ensure that the required equipment is in working order. Process time calculation is done to ensure optimum utilization of machines and equipment and to avoid financial losses during production.

1.3 Production Processes

Two types of production processes used in bakery are batch production and continuous production.

i. Batch production

Here, one batch is fully completed before starting a new batch. In a small-scale bakery most of the products are made in batches. Batch production is used for manufacturing smaller amounts of bakery at a time to ensure specific quality standard.

ii. Continuous production

In continuous production the product or process does not need to be checked or changed as frequently. It is a production process which runs till the production is complete. In a continuous process, material flows into and out of the process during the entire duration.

1.4 Packaging material

Packaging influences the shelf life of the products as well as their aesthetic value. The requirement of packaging materials is calculated on the basis of production quantity and sizes of packets required as per the order. Packaging material must be airtight and rigid enough to protect the products from

becoming soggy and breaking. Opaque packaging materials are recommended for packaging of bakery products. The packaging material are of food grade material. Three layers of packaging is generally done for ease of handling and transportation as shown in Fig. 2.1:

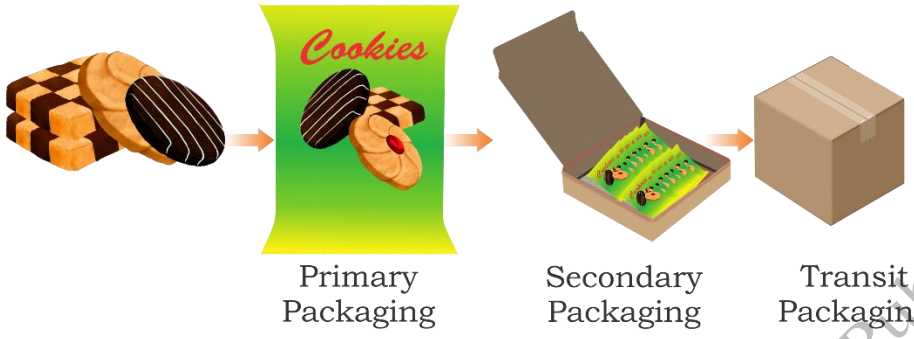


Fig. 2.1: Three layers of packaging of bakery products

1.5 Post production activities

The post production activities include checking and ensuring the availability of raw material, checking and ensuring the working of equipment and proper cleaning and sanitation of the equipment and work area.

2. Ovens for Craft Baking

The hot environment within oven is created by three methods of heat transfer viz. convection, conduction and radiation. The heat transfer through these methods within the oven chamber is depicted in Fig. 2.2.

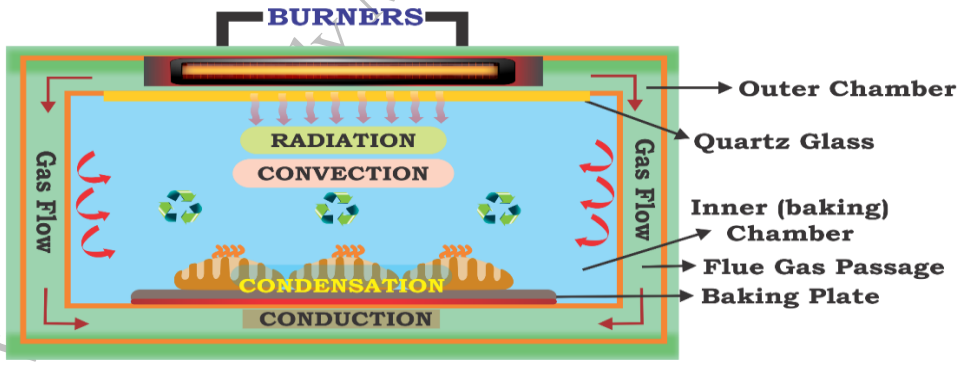


Fig. 2.2: Heat transfer within an oven

2.1 Changes in dough during baking

The main parameters involved in the baking process include time, temperature, humidity, air flow and heat. Baking gives the final structure to baked products. The heat travels from the surrounding air and heated surface to the core of the dough or batter. Chemical leaveners and yeast present in dough or batter enhance the volume of the finished products. Cakes, cookies, muffins, biscuits are prepared using chemically leavened dough whereas bread and buns are prepared using yeast leavened dough. Preheating of the oven is a must before

keeping the dough for baking. Preheating allows the oven to reach the desired temperature for baking. If the oven has lower temperature than the desired it will result in dense and undercooked finished product. When dough is placed inside the oven for baking, following changes sequentially take place as shown in Fig. 2.3.

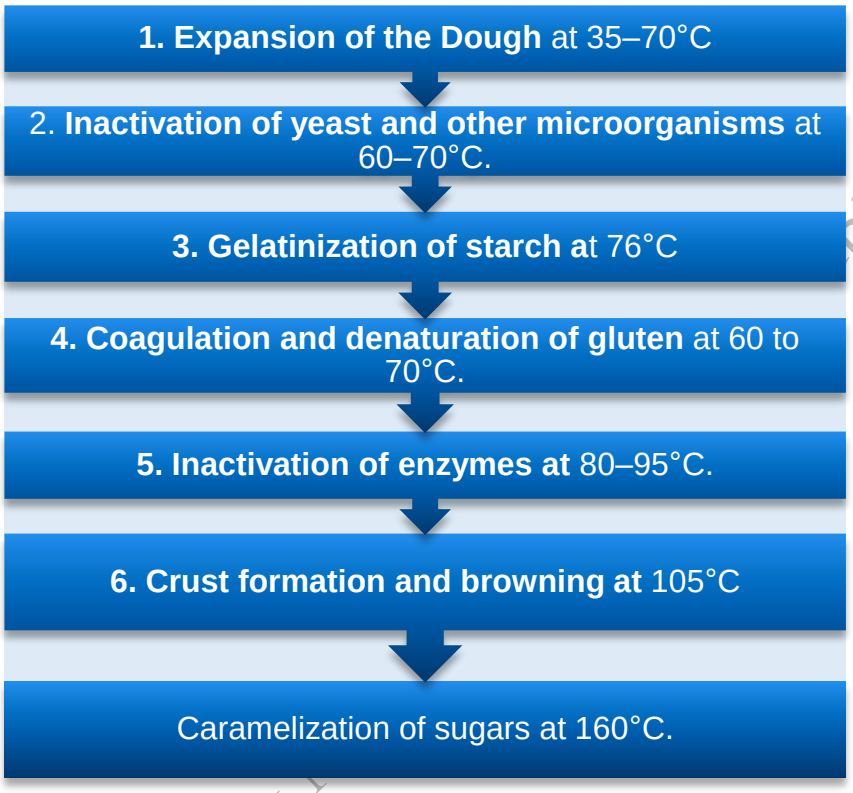


Fig. 2.3: Changes during the baking of dough

The baking process causes weight loss in the dough and batter due to loss of moisture (8–12%) and volatile organic compounds, especially in pan breads and buns. Chemically-leavened products generally have higher baking losses. Following four types of ovens are generally used for craft baking purposes:

Deck Oven

These ovens are designed to heat the baking chamber from top and bottom (Fig. 2.4). Deck ovens use conduction heat to bake products in which heat travels directly from a hot stone or deck, to the loaf of bread or sheet pan being baked. Deck ovens also utilize radiant heat, in which infrared heat waves penetrates into the dough, heating it throughout.

Fig. 2.4: Deck Oven

The products to be baked are placed directly in the different deck of the oven. There are no racks for holding pans in deck ovens. Deck ovens are equipped with steam injectors for baking bread. Deck Surfaces can be made up of stainless steel or stone. Stainless steel decks surfaces are economical, easy to clean, durable and less prone to cracking than stone. A stone surface holds heat better than stainless steel, conserves energy, distributes heat evenly and ensure crispy crusts.

a. Rotary or Revolving Oven

In a rotary oven, the bakery trolleys are in rotating motion (Fig. 2.5). This mechanical action eliminates the possibilities of hot spots or uneven baking. These ovens are very big in size and used in high volume commercial baking operations. Provision of steam injector in the oven helps in the appropriate retention moisture and high quality end product.

Fig. 2.5 Rotary Ovens

b. Rack Oven

A rack oven (Fig. 2.6) is a large oven into which entire racks is loaded for baking. These ovens use electricity or LPG as fuel sources. Fans are installed inside the baking chamber to speed up baking times and to develop special features in the products. The fully automatic rack ovens usually have programmable (saved) recipes which can be modified by the baker.

Fig. 2.6: Rack Oven

c. Brick oven

Brick ovens are traditional version of the deck ovens which are generally used by the artisan baker to impart a distinct earthen flavor to the product. The oven is heated by wood fire inside the wood fired chamber. A brick oven accumulates the heat that comes from the fire, keeps it and releases it gradually to give long lasting and evenly distributed heat. The oven has a dome and a cooking base that is constructed of fire bricks (Fig. 3.7).

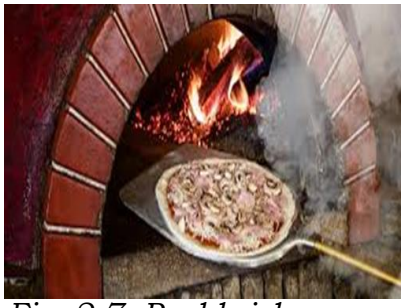


Fig. 2.7: Peel brick oven

Gas-fired brick ovens are similar, but the heat is more easily controlled. Dishes like pizza, bread, lasagna, meats and vegetables are cooked in the same chamber as the fire and consequently get a smoky flavour from the wood. The ovens are operated manually and require special skills from the baker. It is the most common, convenient and cost effective fuel for bakery ovens.

2.4 Temperature Conversion

Temperature is usually measured in degrees Celsius (°C) or in Fahrenheit (°F). Both Celsius (°C) and Fahrenheit (°F) are widely used in bakery. Some recipes mention Degree Fahrenheit and some mention Degree Centigrade. In India most common temperature scale is Degree Centigrade. In order to convert Fahrenheit into Degree centigrade you need to use following formula:

(32°F – 32) × 5/9 = 0°C.

So, if the Fahrenheit is 300 then (300° F – 32) X 5/9 = 148.889° C Or 149° C.

In order to convert Degree centigrade into Fahrenheit you need to use following formula:

(32°C × 9/5) + 32 = 89.6°F

So if the Celsius is 110 then (50°C × 9/5) + 32 = 122°F.

The oven temperature and time at which a bakery products is to be baked varies over a considerable range, depending on factors such as richness of the formula, size of pan, and moisture content of the dough and batter. Bread depending on their type is generally baked at temperature ranging from 175 to 220 ºC. Biscuits and cookies are baked at temperature range of 175-200ºC whereas nankhatai is baked at a low temperature ranging from 155-175 ºC. Cake batters having high sugar content require low baking temperatures in the range of 160-175ºC, while thinner mixtures are usually baked at a temperature range of 175-200ºC.

Conclusion

In this session, we have deliberated on functional aspects of planning for the production of any bakery item. Selection of right type of oven for a particular baking activity is discussed along with the changes that occur in dough during various stages of baking. An explanation for conversion of temperatures from Fahrenheit to Celsius and vice versa is also discussed.

What have you learned?

After completing this Session, you are able to:

- Plan production for baking products.
- Describe methods of heat transfer and types of oven.
- Discuss changes occurring in dough during baking in oven.

ACTIVITY

1. Bake any product with and without pre heating of oven at different temperatures and record the difference in product outcome.
2. Convert 36 Degree Fahrenheit into Degree centigrade.
3. Prepare a diagram covering the change occurring during the baking of yeast leavened dough.

CHECK YOUR PROGRESS

I. Multiple choice Questions

1. Which of the following is considered suitable for packaging of bakery product?

   a. airtight, rigid and opaque b. food grade material

   c. moisture resistant d. all of the above

2. Third layer of packaging is provided for ease of handling and …

   a. packaging b. transportation

   c. production d. cost saving

3. Which of the following is not a method of heat transfer in oven

   a. convection b. condensation

   c. conduction d. radiation

4. Which of the following leavener is used for raising the volume of the cakes, cookies and biscuits during baking:

   a. baking powder b. Instant yeast

   c. Cream of tartar d. ammonia

5. Gelatinization of starches present in the dough starts at :

   a. 76 °C b. 50 °C

   c. 40 °C d. 98 °C

II. Mark the statement True or False

1. Yeast and other microorganisms are inactivated at 50 ° C.
2. A rotary oven is a large oven into which entire racks is loaded for baking.
3. In a rack oven, the bakery trolleys are in rotating motion.
4. Conveyor ovens used for large production volume.
5. Brick ovens are traditional version of the deck ovens.

III. Fill in the blanks

1. Caramelization of sugars takes place at _____ .
2. Temperature is usually measured in degrees Celsius or in_____.
3. Enzymes present in the dough gets deactivated during baking at _____°C.
4. Denaturation of protein takes place at _____°C.
5. Two types of production processes used in bakery are batch and _____ production.

IV. Very short answer type questions

1. Enlist the three methods of heat transfer in oven.
2. List down types of ovens employed in craft baking.
3. What are the types of convection oven?
4. Enlist the aspect related to planning for bakery production.
5. Write the formula for converting Degree centigrade into Fahrenheit?

SESSION 2: BAKER'S MATH

A craft baker has to deal with different Modules of measurements to measure different ingredients accurately. Both liquid and solid type of ingredients is used in bakery and has to be measured using specific Modules appropriately such as liter, milliliter, teaspoon, cup, gram etc. There are different ingredients used in bakery operations and each ingredient is indented as per the prescribed Module. The costing and recipe formation is also done as per the Module use so a baker must have complete knowledge of Modules of measurement and their conversion into other Module systems.

Systems of Measurement

Measurements of ingredients in a recipe are often expressed in imperial units or metric units. A craft baker must be acquainted well with both the imperial system and metric systems. Imperial system is a traditional system used in American recipes whereas metric system is used internationally. Various units of measurement used in metric system and imperial system are given in Table 2.1.

Table 2.2: Units of measurement in metric and imperial system

Parameter	Metric System	Imperial System
Weight	Gram (g)	Ounce (oz), pound (Lb)
Volume (liquid)	Liter (L)	Gallon (gal.), pint (pt.), quart (qt.)
Volume (dry)	Liter (L)	Peck, pint (pt.), quart (qt.)
Long length	Meter (M)	Mile, yard
Short length	Centimeter	Foot, inch

Imperial and metric unit's conversion chart for weight, liquid, dimension and temperature etc. is given below in Fig. 2.8.

Weights

Imperial	Metric
½OZ	10g
¾OZ	20g
1OZ	25g
1½OZ	40g
2OZ	50g
2½OZ	60g
3OZ	75g
4OZ	110g
4½OZ	125g
5OZ	150g
6OZ	175g
7OZ	200g
8OZ	225g
9OZ	250g
10OZ	275g
12OZ	350g
1lb	450g
1 lb 8 OZ	700g
2lb	

Liquids

Cup	Metric	Imperial
	30ml	1 fl OZ
1/4	60ml	2 fl OZ
1/3	80ml	3½ fl OZ
	100ml	2¾ fl OZ
1/2	125ml	4 fl OZ
	150ml	5 fl OZ
3/4	180ml	6 fl OZ
	200ml	7 fl OZ
1	250ml	8¾ fl OZ
1¼	310ml	10½ fl OZ
1½	375ml	13 fl OZ
1¾	430ml	15 fl OZ
	475ml	16 fl OZ
2	500ml	17 fl OZ
2½	625ml	21½ fl OZ
3	750ml	26 fl OZ
4	1L	35 fl OZ
5	1.25 L	44 fl OZ
6	1.5L	52 fl OZ
8	2L	70 fl OZ

Dimensions

Imperial	Metric
1 inch	2.5 cm
1¼ inch	3 cm
1½ inch	4 cm
1¾ inch	4.5 cm
2 inch	5 cm
2½ inch	6 cm
3 inch	7.5 cm
3½ inch	9 cm
4 inch	10 cm
5 inch	13 cm
5¼ inch	13.5 cm
6 inch	15 cm
6½ inch	16 cm
7 inch	18 cm
7½ inch	19 cm
8 inch	20 cm
9 inch	23 cm
9½ inch	24 cm
10 inch	25.5 cm
	28 cm
	30 cm

Cup and Spoons

Cup	Metric
1/4	60ml
1/3	80ml
1/2	125ml
1	250ml
Spoon	**Metric**
1/4 Teaspoon	1.25ml
1/2 Teaspoon	2.5ml
1 Teaspoon	5ml
2 Teaspoon	10ml
1 Tablespoon	20ml

Oven Temperature

No Fan	Fan Forced	Fahrenheit
120ºC	100ºC	250ºF
150ºC	130ºC	300º F
160ºC	140ºC	325º F
180ºC	160ºC	350º F
190ºC	170ºC	375º F
200ºC	180ºC	400º F
230ºC	210ºC	450º F

Fig. 2.8: Imperial and Metric units' conversion chart

Basic Mathematics

Bakery products are prepared using a calculated and quantified amount of ingredients. Craft bakers use formula to prepare baker products. The quality of all bakery products is depending on the accurate measurement and proportion of the ingredients to be used. A craft baker must have the skills to perform the basic mathematics such as addition, subtraction, ratio, proportion, baker's percentage etc. They are used widely in bakery production to scale up and scale down a recipe as and when required. Mathematics used in bakery by a baker often referred as baker's math. Baker's math deals with calculating ratio of ingredients and formula for given recipes. Various calculations under baker's math are discussed below:

Conversion Factor

The baker often needs to apply baker's math for standard recipes. A standard recipe prepares the product for a specific number of portions. When the number of portion changes, the conversion formula is applied to the recipe to increase or decrease the number of portions. For example, suppose a standard recipe is written to prepare 25 portions. The recipe can be modified to prepare 50 portions. We can do it simply by doubling the quantity of the raw ingredients or by multiplying. Bakers use the term conversion factor for this purpose. The conversion factor comes handy in adjusting ingredients of the recipes when either portion sizes or batch size needs to be changed.

Conversion factor can be easily obtained by dividing the required portion/yield by the old portions/ yield.

$$Conversion\ factor = \frac{\text{Required recipe yield}}{\text{Standard recipe yield}}$$

For example, to find the conversion factor needed to change a recipe that produces 25 portions with each portion weighing 40 g into a recipe that produces 200 portions with each portion containing 10 g, these are the steps you would take:

1. *Old yield of recipe = 25 portions x 40 g per portion = 1000 g*
2. *Required yield of recipe = 200 portions x 10 g per portion = 2000 g*
3. *Conversion factor = required yield/ old yield = 2000/ 1000 = 2*

Now that you have the conversion factor, you can use it to adjust all the ingredients in the new recipe. The procedure is to multiply the amount of each ingredient in the original recipe by the conversion factor.

Table 2.2: Ingredients of a recipe using a conversion factor of 2

Ingredient	Standard recipe	Conversion Factor	Ingredients required for the new recipe
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 kg	2	2 kg

Baker's Percentage

Baker's percentage is widely used in baking to calculate the amounts of ingredients. In baking, formulas are primarily based on flour; each ingredient's weight is measured as a percentage of the total flour weight (100%). Percentage is denoted by (%) sign.

The equation for obtaining baker's percentage is:

$$Baker's\ \% = \frac{(Total\ weight\ of\ the\ ingredient\ )}{(Total\ weight\ of\ the\ flour)} x\ 100$$

Let us understand by following example: Consider a bread recipe where 1000 g of flour is used. Then all the other ingredients are calculated in relation to the total weight of the flour.

Ingredient	Weight of the ingredients (g)	Formula	Baker's percentage (%)
Flour	1000	1000/1000x100	100.0
Water	600	600/1000x100	60.0
Salt	20	20/1000x100	2.0
Sugar	30	30/1000x100	3.0
Shortening	15	15/1000x100	1.5
Yeast	25	25/1000x100	2.5

Milk powder	20	20/1000x100	2.0

Baker's Percentage for liquids

Baker's percentage for water or other liquid ingredients, like milk, alcohol, juice, etc. is known as hydration'. Hydration is an important factor in mixing and the final appearance of a product. This can help a baker predict the texture of the crumb. However, it is important to note that different types of flour absorb water differently because of their gluten protein percent. A baker is required to adjust the dough consistency accordingly. The hydration percent of dough can also be calculated in the same way as the baker's percentage. Hydration levels in bakery products range from low to higher. Table 2.3 shows the hydration level for different bakery products and their characteristics.

Table 2.3 Hydration level of bakery products

Hydration Level	Consistency	Product
Low (50-57%)	Stiff, firm and dry	Bagels and pretzels
Medium (58-65%**)**	Not sticky	Sandwich bread and rolls
Higher (above 65%**)**	Wet and sticky	Ciabatta and focaccia

Ratio of Ingredients

In baking recipes, an ingredient has relationship with other ingredients present in recipe. Even a minute change in one ingredient or its quantity will affect the other ingredient's role in the recipe. It is because of chemical reactions occurring due to the interaction of ingredients in baking.

This relationship between ingredients is called ratio in bakery science. Over or under estimation of ingredients can spoil the product, especially when it comes to cakes, bread and biscuits. Therefore, ingredients need to be in exact proportions to interact properly. For example, if a recipe needs 3 cups of flour and 2 cups of sugar, the relationship between the two is 3 to 2. This is written as 3/2 or 3:2.

Conclusion

The various ingredients used in preparation of bakery items have to be added in precisely measured quantities. For this baker use the idea of 'conversion factor' and 'baker's percentage', which have explained in the session along with the concept of 'ratio of ingredients'. The units of measurement for weight, volume, temperature etc. are also discussed in metric and imperial system.

What have you learned?

After completing this Session, you are able to:

- Perform basic mathematical calculations related to bakery operations.
- Perform prerequisite tasks required to prepare the bakery products.
- Perform the important steps involved before baking the final product in the oven.

ACTIVITY

1. Scale the raw material as per the recipe provided.

2. Draw the flow chart of process of baking of bread.

CHECK YOUR PROGRESS

I. Multiple choice Questions

1. Which of the following is used to increase or decrease the number of portions of a recipe?

   a. Baker's percentage b. conversion factor

   c. ratio d. all of the above

2. Baker's percentage calculate the amounts of each ingredient on the basis of

   a. flour b. recipe

   c. Sugar d. production

3. Ciabatta has higher hydration level which is above

   a. 50 % b. 65%

   c. 45 % d. 55 %

4. Low hydration level product are

   a. non sticky b. firm and dry

   c. wet d. sticky

II. Mark the statement True or False

1. Imperial system is used mostly in American recipes.
2. Weight in Metric system is measured as ounce.
3. In imperial system long length is measured using meter.
4. Conversion factor is calculated by dividing required yield by standard recipe yield.
5. Baker's % is obtained dividing total weight of the ingredient by total weight of the flour.

III. Fill in the blanks

1. The two systems for units of measurement are metric and _____ system.

2. Baker's percentage calculates the amounts of ingredients in relation to _____.
3. Baker's percentage for water or other liquid ingredients is known as _____.
4. Sandwich bread and rolls has_____ hydration level.
5. Relationship between two ingredients is called _____.

IV. Very short answer type questions

1. Describe hydration level for different bakery products.
2. Explain ratio and conversion factor.
3. What is baker's percentage?
4. Explain imperial and metric systems of unit measurements.

SESSION 3: DOUGH

In this session you will learn about the different types of dough and their method of preparation. The types of products made from the different dough are also discussed. Perfect dough is mandatory to achieve desired baked product. Dough is prepared by mixing flour with small amount of water and sometimes yeast, oil, leavening and flavoring agents. Doughs vary widely depending on ingredients, the kind of product being produced, the type of leavening agent, method of dough mixing, and cooking or baking technique. Doughs with higher fat content develop less gluten, due to their lower water content and may be less elastic; these doughs are often called "short" by bakers, and include many cookies and pie crust doughs, such as short-crust pastry. Quick breads dough uses leavening agents other than yeast, and include most cookies, cakes, biscuits, and more; these may be based on a batter or a dough. Following types of dough are used to prepare different bakery products:

Types of Dough

Yeast Dough

Yeast dough is used for preparing breads, pao, buns and pizza. This dough is a combination of flour, sugar, yeast, fat, salt, egg or milk and water. Different types of yeast dough are made using all or few of these ingredients and are discussed in detail in Unit 4 of the textbook. Example includes bread dough, pizza dough, brioche dough etc.

Pastry Dough

Pastry dough are categorized on the basis whether they are laminated or nonlaminated. Lamination is the technique where fat is rolled and folded into

dough alternatively several times to produce thin layers. Dough for pastry preparation are categorized into following types as shown in Fig. 3.22.

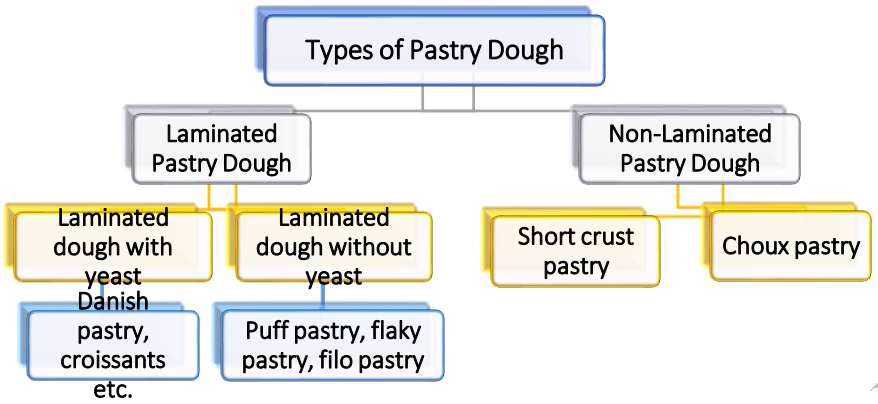


Fig. 2.9: Types of Pastry dough and their products

Let us discuss above mentioned pastry dough in detail:

Laminated Pastry Dough

Laminated pastry dough can be made with or without yeast. Danish pastry, croissants, etc., are made from yeast leavened laminated dough. Laminated dough without yeast is called puff pastry and used to prepare patties, cream horns, etc. Flaky pastry is a variation of puff pastry.

a. Laminated Dough with Yeast

This type of dough is a combination of flour, water, salt, sugar, yeast, butter or margarine. The dough is further laminated with butter or margarine. Flour having high gluten content preferred for building up the laminated structure. Butter is the preferred fat because of its flavour and melt in the mouth quality. A weak acid solution such as lemon juice or cream of tartar is added to the dough, as it will confer greater extensibility to the gluten. It is commonly used to prepare Danish pastry, croissants, cinnamon roll etc.

Fig. 2.10: Laminated dough with yeast dough and their products

b. Laminated Dough Without Yeast

Puff Pastries

This type of dough is a combination of flour, water, salt, vinegar or lemon juice and butter/ margarine and does not contain any leavening agent. It generally has equal amounts of fat and flour. It consists of over 1000 layers. After allowing it to rest, the dough is rolled out into a square and the creamed block of fat is placed in the center. The dough is then folded around the fat and it is refrigerated for a while. The dough is then rolled in to a rectangle about ½ — thick. The two ends are folded to the center and then into half (book fold). The dough is refrigerated or rested to relax the gluten. Rectangles of dough and fat are rolled and folded together in such a way that the result is a number of uniform sheets of pastry. Puff pastry dough is used for making palmier, turnover, vegetable puff, khari, fan, patties, etc.

Fig. 2.11: Puff pastries dough

Flaky Pastry

It is also known as blitz pastry and rough puff pastry. The dough is prepared in similar way as of puff pastry but the amount of fat is only 2/3 that of the flour. The fat is creamed into a homogenous mass and divided into three parts. The dough is rolled out into a rectangle about ½‖ thick. One third of the fat is then spread onto 2/3rd of the dough surface. The dough is then folded into three so that there are alternate layers of fat and dough are created. The dough is then rested/ refrigerated to relax the gluten. The process is repeated twice more to use up all the fat and then once again without fat. The dough is rested between each rolling. The pastry is now ready for the final make up. Flaky pastry relies on large lumps of shortening (approximately 1in. /2½ cm. across) mixed into the dough, as opposed to the large rectangle of shortening in puff pastry. The chunks of shortening keep the rolled particles of dough in the flaky pastry separate from each other, so that when the dough is baked they become flakes. Flaky pastry is used for preparing vol-au-vent, jam puff, sausages rolls etc.

Phyllo (Filo) Pastry

Phyllo dough is made using flour, water, salt, and oil. Phyllo dough has relatively lower fat content than puff pastry dough. Such doughs are easy to fold, roll and can be given any shape. The products made with phyllo dough include baklava and spanakopita have several soft flaky layers.

Preparation of Laminated Pastry Dough

Laminated dough can be made either by hand or by machine. In manual method, rolling pin is used to flatten the dough for making laminated pastry dough. The dough pieces are sheeted with a rolling pin to uniform thickness and a size of approximately 16 x 36 inches (less for smaller dough pieces). The roll-in fat is evenly distributed over 2/3 of this area (16 x 24 inches). The uncovered portion is then folded over the center third followed by the remaining third that has been covered with fat. This now gives three layers of dough separated by two layers of roll in fat. The dough pieces then turn 90, and sheeted to a uniform thickness with square corners measuring approximately 20 x 48 inches. After brushing the excess dusting flour, the two end sections of the dough sheet are folded again over the center section so that the final dough pieces consist of seven dough layers separated by six fat layers. This is the first threefold which is also called "half turn" by bakers. The dough is then placed on a flour dusted sheet pad for 20-30 minutes' rest time in refrigerator. Now the pastry is ready for final makeup into various products. The Fig. 2.12 and 2.13 below illustrates the steps for preparation of laminated pastry dough manually and using a laminator:

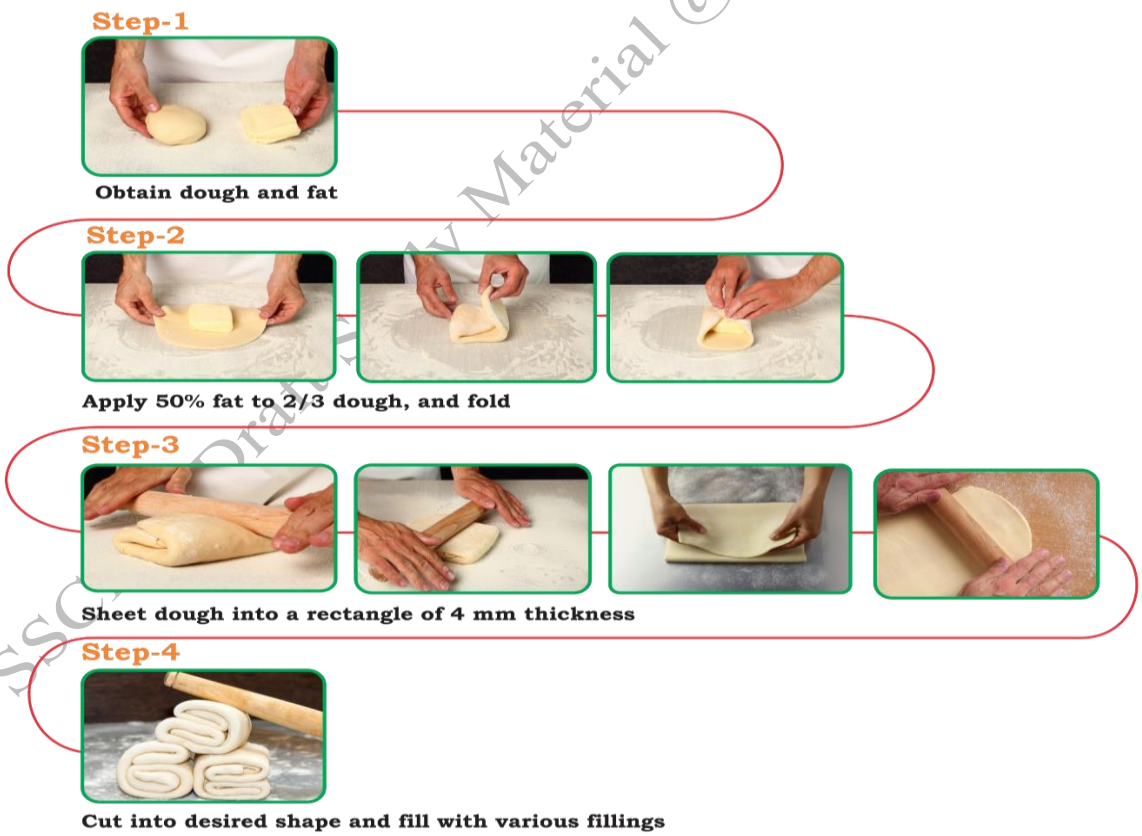


Fig. 2.12 Preparing laminated pastry dough manually

Fig. 2.13 Preparing laminated pastry dough

Non-Laminated Pastry Dough

Non-laminated dough is when the fat, normally butter, shortening or lard is "cut-in" or sometimes rubbed into the flour. Non-laminated pastry dough includes short crust pastry, choux pastry and pie dough (normal and sweetened).

a. Short Crust Pastry Dough

Short crust pastry dough is a combination of flour, butter, sugar and eggs and is made by employing either the creaming or rubbing-in (Fig.3.27) technique. To prepare short crust dough, flou r is sifted and fat is added in it. The fat is then mixed using rub in or cut shortening method to get bread crumb like texture of the mixture. At the same time salt and sugar are dissolved in water and mixed to the fat–flour mixture. The dough is formed using the salt sugar mixture and placed in refrigerator for at least 4 hours. The dough is now ready to prepare the other products like apple pie and fruit tart.

Fig.2.14: Rubbing-in method

b. Choux Pastries Dough

Choux pastries dough is twice cooked dough as seen in Fig. 2.15. Choux paste is made by boiling water, butter and salt together and then the flour is added to form a partly gelatinized paste. The paste is mixed vigorously with a wooden spoon and then cooked once more till the mixture has a shiny appearance. Beaten eggs are added gradually to the paste, beating continuously to form a smooth pliable and piping consistency mass. It is then piped into the desired shapes, rosettes, fingers or balls. Eclairs, cream puffs, Duchesses, profiteroles and cream puffs are all choux pastry-based items.

Fig.2.15: Choux paste

Conclusion

Preparation of the required qualitative dough is the first step in bakery production. There are subtle differences in dough preparation for a variety of pastry products. The methods of preparation of various types of dough are discussed in this session.

What have you learned?

After completing this Session, you are able to:

- Describe the types of dough used in baking.
- Describe the usage of different types of dough.
- Prepare and identify different types of pastry dough.

ACTIVITY

1. Prepare laminated pastry dough.
2. Prepare yeast leavened dough.

CHECK YOUR PROGRESS

I. Multiple choice Questions

1. High fat content in dough results in low……. development

   a. gluten b. elasticity

   c. starch d. gas

2. Quick breads dough is leavened using

   a. baking powder b. fat

   c. yeast d. fermentation

3. Technique of folding fat into dough alternatively several times to produce thin layers is called

   a. shortening b. lamination

   c. fermentation d. non-lamination

4. Which of these is a yeast leavened laminated dough?

   a. Danish b. Puff

   c. Flaky d. Phyllo

5. Which of these following has relatively lower fat content than puff pastry dough

   a. Danish b. Puff

   c. Flaky d. Phyllo

II. Mark the statement True or False

1. Puff pastries has equal amounts of fat and flour.
2. Amount of fat in flaky pastry is 1:1.
3. Short crust pastry dough is type of laminated pastry dough.
4. Flaky pastry is used for preparing vol-au-vent, jam puff.
5. Choux pastries dough is twice cooked dough.

III. Fill in the blanks

1. Multiple layering of dough and fat with butter or margarine is done in _____ of dough.
2. A _____, consists of over 1000 layers.
3. Flaky pastry also known as _____.
4. Fat is "cut-in" or rubbed- in into the flour in to prepare a _____.
5. Eclairs and cream puffs are example of _____ dough.

IV. Very short answer type questions

1. Enlist the different types of dough prepared in bakery for preparing different bakery products.
2. List down the type of pastry dough.
3. What are the products made from laminated pastry dough?
4. Mention types of non-laminated pastry dough.
5. Give few examples of choux pastry-based products.

Module 3
Fundamentals of Bread Making

Module Overview

Bread is one of the most familiar products among all bakery products. You can find bread at every bakery shop and general stores. Bread has become secondary staple food after chapatti and puri due to its popularity and ease of consumption. Bread making requires understanding of the science behind the usage of ingredients, temperature, time duration and the processes involved. In this Module you will learn about the role of each ingredient in bread preparation, various methods of bread dough preparation, different types of bread, steps involved in bread preparation and bread faults.

Learning Outcomes

After completing this module, you will be able to:

- Identify the key ingredients used in bread making, and explain their specific roles and interactions in the bread-making process.
- Describe the steps involved in bread dough preparation, and understand how each step contributes to the development of texture and flavor in the final product.

Module Structure

- Session-1 Ingredients and their role in bread making
- Session-2 Bread Dough Preparation

SESSION 1: INGREDIENTS AND THEIR ROLE IN BREAD MAKING

Bread

Bread, is prepared by dough of wheat flour and water, seasoned with salt and raised by the action of yeast and then baked in an oven. Many variations to this basic bread can be made using different types of flours, e.g., whole meal flour, barley flour etc., techniques and shapes. Bread is highly perishable and dough is an important stage in the making of the bread. Breads are made by a fermentation process in which yeast consume the sugar and converts it into carbon dioxide gas, water and alcohol.

The sugar required for the action of yeast comes from flour itself which contains 1% sugar, and any sugar added during preparation. The fermentation process requires sugar and proper conditions of temperature and humidity. It then results in gradual expansion of dough and finally its doubling in volume. In addition to yeast multiplication and activity, the gluten of flour must be developed. It is the gluten which gives dough elasticity or stretch ability which is necessary for rising in volume. During the kneading process gluten is formed from the proteins present in flour, on addition of water and salt. As bread rises during the fermentation process, the gluten stretches to form the cellular structure of the dough which should be light and porous.

Role of Ingredients in bread making

Each ingredient in the bread formula performs a specific function in producing a loaf of bread with desired quality attributes. Let us discuss the various ingredients of bread and their functions in detail:

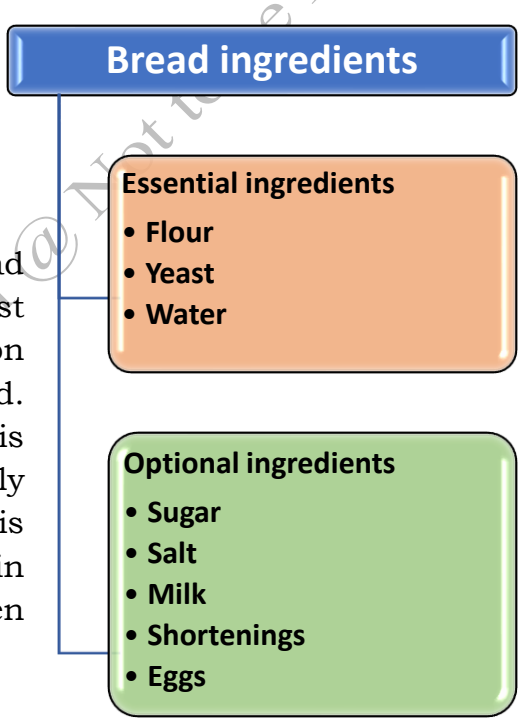


Fig. 3.1: Bread ingredients

Flour

Flour is the main ingredient in bread preparation. Wheat flour is the most commonly used flour in a bread formulation and is responsible for the structure of bread. Wheat flour contains gluten protein which is made up of mainly two components namely gliadin and the glutenin. When the water is added to the flour, the gliadin and glutenin interact with each other to from the gluten proteins.

This property of the wheat flour helps in formation of the elastic dough which retains the gas released during fermentation due to the action of yeast and proofing stages. The elastic property of the wheat flour dough facilitates the retention of the carbon dioxide gas produced during the bread-making process and develop a honey comb structure inside the baked loaf. Whole wheat flour is not recommended for bread preparation as they have higher bran and lower gluten content resulting in weaker structure of gluten fiber network, lesser gas retention and thus a loaf with smaller crumb.

On the basis of their suitability for the manufacture of yeast-leavened bread, common flours milled from wheat are classified broadly into two groups:

strong and weak. Strong and weak denotes the strength of wheat protein relating to its baking quality.

Table 3.1: Difference between strong flour and weak flour

Strong Flour	Weak Flour
Contains relatively high percentage of gluten forming proteins.	Has relatively low protein content.
Form tenacious, elastic gluten with sufficient retention of gas produced during fermentation.	Forms a weak and more extensible gluten with lower gas retention capacity.
Gives high yield of bread.	Gives relatively lower bread yield.
Bread baked from strong flours has a well-risen loaf, good crumb grain and softer texture.	Weak flour produces bread with poor loaf volume, crumb grain and poor texture.

So now you must have understood that gluten content of the flour is of the prime importance and that is why strong flour is more suitable for bread making.

Water

Water is needed in the formation of dough having viscoelastic properties. The consistency of the dough is related to its water content. Quality of water namely, hardness and pH of water, plays an important role in bread making. A water of hardness not exceeding (100 ppm) is suitable for use in baking. Excessively hard water is undesirable because it retards fermentation by tightening the gluten structure too much. Temperature of water also affect the rate of fermentation. Use of lukewarm water for yeast fermentation is recommended. The other major functions of water in bread preparation are shown in Fig. 2.17.

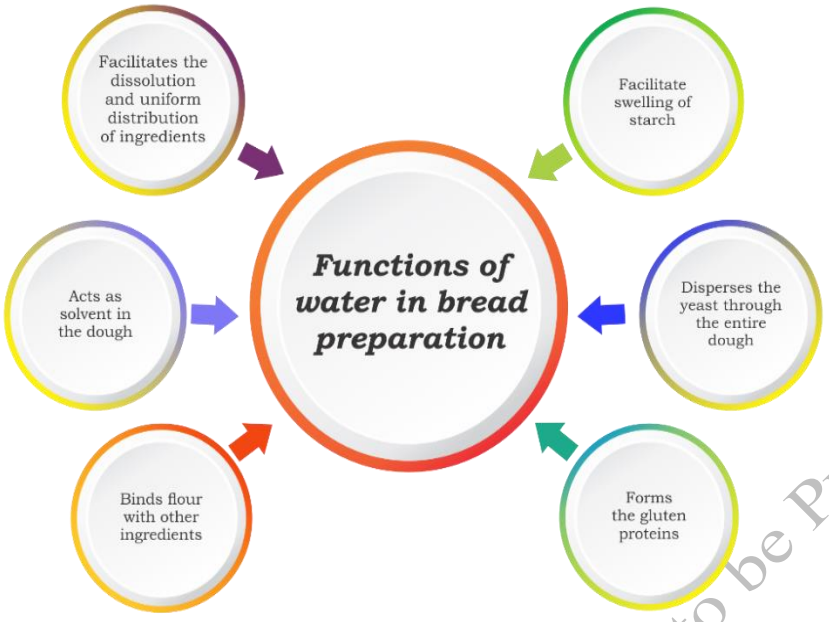


Fig. 3.2: Functions of water in bread preparation

Yeast

Yeast converts the natural sugar present in the flour into tiny bubbles of carbon-di-oxide that are trapped in the dough through a process called fermentation. During baking process these tiny bubbles expand and provide the desirable texture and lightness in the bread. The three major functions of yeast in dough fermentation are leavening, dough maturation and flavour development.

Sugar

The main function of sugar in bread making is to act as primary food for yeast which in turn produces carbon dioxide gas that raises the dough. Apart from the sugar added in the formula, flour naturally contains about 3 % of sugar in the form of sucrose and maltose, which provides food for yeast during the initial stage of fermentation. The important functions of sugar are illustrated in Fig.3.3:

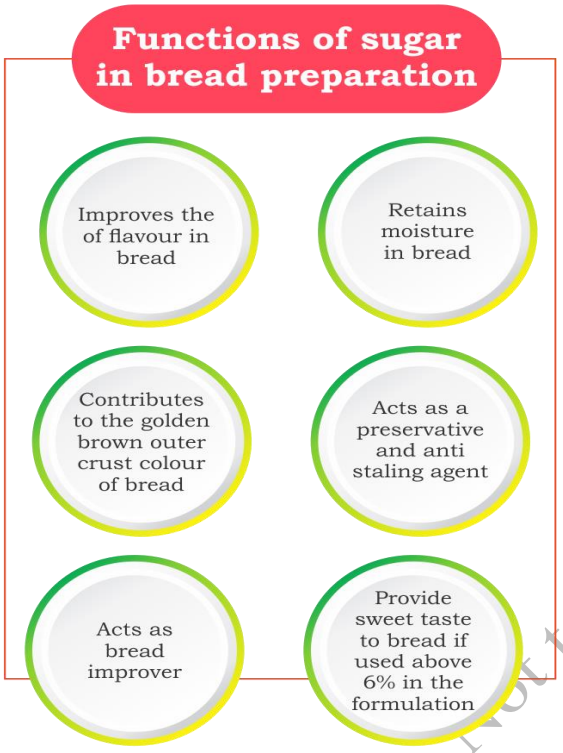


Fig. 3.3: Functions of sugar in bread preparation

Salt

Salt controls the rate of fermentation, strengthen the gluten network and add crust and crumb color formation in bread. The quantity of salt used in dough affects the characteristics of the final product. High salt content produces dense structure of gluten with low gas production and dark crust color. Little amount of salt is used where large volume, lighter crust color and a weak crumb structure is desirable.

Milk

In regular white bread 1 to 2% milk (solids) is added for improving the quality of bread which will also improve its nutritional content. Milk in any form i.e. fresh liquid, evaporated, condensed or powder form is used for bread making. Milk adds moisture and makes the bread whiter and softer with a distinct flavor. The casein protein of milk has tightening effect on gluten. The lactose sugar of milk is not fermentable by the yeast. Therefore, it remains in the bread and produces desirable crust color.

Shortenings (fats and oil)

Shortenings are used in a very small quantity i.e.,1 to 2%. Higher percentage of shortenings decreases the rate of the fermentation. However, in small quantities it has a lubricating effect on gluten strands, thus improving their extensibility which enables the bread to acquire good volume.

Eggs

Egg contains proteins, fat and lecithin which keeps the bread moist and soft. Protein of egg has strengthening action on gluten which improves volume and crumb structure of bread. Eggs are sometimes used as the bread improver at the rate of 4 to 6% based on flour.

Conclusion

Most of the ingredients widely used for preparation of bread such as flour, yeast, water sugar, salt, milk shortenings and eggs are discussed categorically. The session also gives insight that every ingredient has specific role to perform in bread making.

What have you learned?

After completing this Session, you are able to:

- Discuss the ingredients used for bread making.
- Describe functions of ingredients in bread making.

ACTIVITY

1. Identify and label the specific functions of different ingredients used in bread preparation.

CHECK YOUR PROGRESS

I. Multiple choice Questions

1. Which of the following is responsible for elasticity of the dough?
   a. Choux pastries b. starch
   c. fat d. Carbon di oxide
2. Which of the following is an essential ingredient for bread making?
   a. yeast b. sugar
   c. milk d. salt
3. Strong flour is recommended for bread preparation due to its
   a. low protein content b. high protein content
   c. ease of handling d. low starch content
4. Hardness of water must not exceed which of the following value?
   a. 100 ppm b. 200 ppm
   c. 300 ppm d. 400 ppm
5. Which of the following promotes yeast multiplication?
   a. hot water b. cold water

c. lukewarm water d. None of the above

II. Mark the statement True or False

1. Breads are made by a fermentation process.
2. Gluten is developed during baking of the dough.
3. White bread has 5 to 12% milk solids.
4. Hardness of water affects the bread quality.
5. Yeast is the multiple cell micro-organisms

III. Fill in the blanks

1. During fermentation yeast consume the sugar and converts it into water, _____ and alcohol.
2. Naturally present sugars of the flour are sucrose and _____.
3. Gluten protein is made up of gliadin and the _____.
4. Hardness and _____ of water plays an important role in bread making.
5. Eggs can be used as the bread improver at the rate of _____.

IV. Very short answer type questions

1. Enlist the essential and optional ingredients for bread preparation.
2. List down types of yeast and difference among them.
3. How sugar affects the texture and color of the bread?
4. How water affects the quality of bread?
5. What will happen if you add higher quantity of salt while dough preparation?

SESSION 2: BREAD DOUGH PREPARATION

In previous session, you have read about the ingredients along with their specific functions in bread making. The ingredients are combined together to form a bread dough. Different types of breads are produced using different method of combining various ingredients. In this session we will learn about the popular methods of bread dough preparation.

Methods of bread dough preparation

Five different methods employed for bread dough preparation are discussed below:

Straight dough method

Straight dough method is the simplest and most popular method used in production of bread. As the name suggests, in this method all the ingredients are mixed together, and the dough is fermented for a predetermined period. The fermentation time of straight dough depends on the strength of flour. Strong flours high in gluten content will require long fermentation time to help in softening of the gluten. However, weak flour like whole wheat bread will require a shorter fermentation time. Therefore, strong flour is not recommended for using straight dough method. Most of the dough are fermented for 3 to 4 hours in controlled environment.

The temperature in this method is critically important and must be maintained below the 40°C. The yeast will not grow and multiply above this temperature. The temperature of the dough increases because of the fermentation process, softening of the gluten, decreased moisture and increased salt content in dough leading to the release of the heat energy.

No-Time Dough Method

This process is the shortest process and uses higher amount of yeast (2.5 %) and water (4 %). In this method, dough is not fermented in the usual manner instead directly made, scaled, moulded, allowed to rest for a brief period about 30 minutes to recover from the strains of mixing and baked. Flour, yeast, salt and water with the improver are kneaded into a loose dough. Kneading is done till the sufficient gluten is developed. The production of gas and conditioning of gluten is achieved using higher quantities of yeast i.e. 2 to 3 times of original quantity used in other methods of dough making. Further the dough is kneaded loosely and kept warmer. Such bread sometimes has a strong yeasty flavour also.

Salt–delayed method

Salt is helpful in controlling the pace of fermentation by the yeast and hence, when the salt is omitted in the first stage, the activity of the yeast increases. The gluten present in the flour ripens or softens well due to the rapid action gases released. This is a slight variation of straight dough method, where all the ingredients are mixed except salt and fat. As the salt has a controlling effect on action of yeast, the speed of fermentation of dough without salt will be faster, and a reduction in total fermentation time is affected. The salt is added at the knock-back stage. Only three-fourth (of the actual mixing time) mixing should be given initially and then salt and fat is added and remaining one-fourth mixing is done. This method is utilized when strong flours are used for bread-making. Due to absence of salt, the fermentation speed is enhanced and gluten is matured in a reasonably shorter time.

Ferment and dough method

When a bread formulation have ingredients such as milk, eggs, substantial quantity of fat or sugar which has retarding effect on yeast activity. The ferment and dough method is considered suitable for bread production. Ferment is an equal proportion of water, flour and tiny quantity of yeast to make a thin batter. The yeast rapidly disperses in the water and begins assimilating the food dissolved in the water. It begins multiplying and fermenting immediately and becomes active and vigorous. Ferment is made and kept until it shows a sign of collapse. This is when it is considered to be at its optimum condition for bread preparation. Usually 30 minutes to 1 hour for fermentation is sufficient.

The ideal concentration of sugar for yeast to work is 10% sugar. In the first stage, the ferment yeast is blended into a thin batter and fermented with about 20% of the flour and with all the water. Fermentation depends on the yeast content. It is best fermented in a prover or in similar conditions. The first ferment is then blended with the rest of the flour, salt, fat and perhaps milk powder to form a dough. This is the second or the dough stage and is bulk fermented for roughly the same time as the ferment. The dough can then be scaled. This method is used for making enriched breads, buns, Danish pastry, sweet dough, doughnuts etc.

Sponge and dough method

In this method, as a first step, a part of flour, proportionate amount of water, all the formula yeast and yeast food are mixed together. Longer fermenting sponges may contain some amount of salt also. Mixing operation is carried out just sufficiently to incorporate all the ingredients evenly. This sponge is fermented for predetermined time. Sponge fermentation time depends on the amount of flour in the sponge and flour quality. The quantity of flour in sponge depends on the strength of flour. When the sponge is ready, it is be broken down properly with formula water, so that its even mixing in the dough is assured. Broken down sponge is mixed with the remaining flour, sugar, salt, fat etc. After the dough is mixed, it is rested for 30 to 45 minutes during which time it relaxes from the stress of mixing operation. Example: sour dough bread.

Production sequence in bread making

There are various stages involved in bread making and has to be carefully followed to get the best bread. Let us now discuss each of the steps in detail.

Collecting the mise en place

The mise en place for bread making include:

1. Scaling: Weighing all the ingredients as per the recipe and making sure all the ingredients are at the required temperature. Weigh using digital scale as accuracy of ingredients is very crucial in bread preparation. Measure all wet and dry ingredients by weight. Use a formula that is expressed in "baker's math" or "baker's percentages." This step concludes when all

ingredients are accurately measured and lined up in order of use, as well as all tools and equipment are ready for the second step in the bread-making process

2. Selecting and preparing the bread tin or mould. Grease the bread mould or tin with oil properly to avoid sticking of the baked bread.
3. Getting ready all the required utensils, tools, and equipments.
4. Preheating and setting the temperature of the baking oven at the required degree as temperature plays a critical role.

Mixing and fermentation

In this step, all the ingredients are combined into a smooth, uniform dough using methods of mixing; such as straight dough method, salt delayed method, no time dough method, ferment and dough method or sponge and dough method (refer methods of dough preparation used in baking). Mixing and kneading enables even distribution of the yeast and other ingredients through the dough, development of the gluten, and initiation of fermentation. Kneading or working the dough by hand or by machine further disperses the ingredients and develops the gluten in the dough.

Proving

Proving involves allowing the dough to rise and double its size through fermentation. Rising takes place due to the primary fermentation process in which the yeast acts on the sugar and starches to produce carbon dioxide and alcohol. The dough when kept at an optimum temperature (32 °C) will rise to double its original volume. Proving is done in three stages: first is just after kneading the dough called as “first proving” and second is after knock back step and called “intermediate proving” and the “final proving” is done after shaping the bread. Place the dough in lightly oiled bowl to avoid sticking and cover with a moist duster. Duster should not be too wet. It should be squeezed well before using for covering the dough. The dough should be placed in a temperature and humidity-controlled environment to allow the bread to rise to the desired volume before baking.

Knock back

The fermented dough is punched down to knock off the air bubbles that had developed during the first proving. This is done to redistribute the yeast and the other ingredients evenly all through the dough. Knock back equalize the temperature in the dough. After knocking the dough is again kept for resting and to rise. This is also known as intermediate proving. At this stage, over kneading should be avoided to maintain the gluten structure.

Dividing and scaling

Dividing is done to portion the dough into pieces of required weight after the resting period. Scaling is the process of cutting and weighing individual pieces of dough, which will become the actual loaves of bread. Scaling of dough is done according to the shape and size of the mould.

Shaping/ panning

The portioned dough is loosely shaped into smooth, round balls. This organizes the dough into consistent pieces and makes the final shaping easier and more efficient. It also stretches the gluten on the outside of the dough and forms a skin that helps it retain the gases produced by the yeast. The dough is rested for 20 minutes before final shaping to allow shaping without pressure. After the final shaping of the dough, the ready dough is transferred into the bread pan for final proving and this process is known as panning.

Final proofing

In this step the dough is placed in a temperature and humidity-controlled environment to allow the bread to rise to the desired volume before baking. The final proving is usually done in a proving chamber or proving cabinet (Refer Module-1). Proving chamber have temperature of 30 °C and are maintained at humidity levels of 90% which is the ideal condition for the yeast action and fermentation process. Final proof can also be performed without the proving cabinet or chamber. The dough should be placed in a warm place covered with water sprinkled cloth to avoid scale formation on the surface of dough.

Scoring

It is an optional process of bread making in which marking on the top of the dough with a sharp knife. This process enables the bread to expand during baking without cracking.

Baking

After the final proving and scoring the dough is now ready to be baked. The dough after panning is then kept in pre heated oven for baking. Some of the important changes that occur during the baking process are:

a. Oven spring: The initial, rapid expansion of loaf volume that is caused when the trapped gasses in the dough expand as a result of the high heat of the oven. The yeast remains active in this final fermentation process until it is killed at a temperature of about 63°C.

b. Coagulation of proteins and gelatinization of starches: This contributes to the formation of the crumb and sets the structure of the loaf. This begins at approximately 60°C and continues until the temperature reaches between 82°C and 90°C.

c. Formation and browning of the crust: This begins when the surface of the dough reaches 100°C. It occurs in baked goods in the presence of heat, moisture, proteins, and sugars and continues until the surface temperature reaches 175°C. Further crust color and flavor develop with caramelization that occurs between temperatures of 149°C and 204°C. When the bread reaches a maximum internal temperature of 99°C the bread is considered as properly baked. The baking process is now complete and the bread is ready to be cooled and stored.

Cooling

The loaves are cooled on racks that allow the air to circulate around them and prevent the crusts from becoming soggy. The bread should be cooled at least two hours to allow the crumb structure to stabilize and develop full flavour. Baked breads will stale most quickly at temperatures between 0°C and 10°C and therefore should never be placed in the refrigerator.

Wrapping/ Packaging

In this step the cooled bread is packed with the grease and perspiration proof packaging material for enhancing the shelf life, minimizing the risk of contamination and microbial growth.

Types of Bread

There are different types of breads and can be classified either on the basis of their ingredients or on the basis of dough used to prepare them. We have already discussed popular breads around the world in Module-1. Here we discuss the three types of breads on the basis of doughs as below:

Soft dough bread

Soft dough also called rich doughs have higher fat, sugar and sometimes have eggs. These doughs are used for preparing breads and rolls, including rich dinner rolls and brioche. Brioche dough is made with a high proportion of butter and eggs. However, sweet rolls, including coffee cakes and tea rolls have high fat and sugar content and usually contain eggs. They generally have a sweet filling or topping.

Hard dough bread

Hard dough also called lean dough has low fat and sugar content. Products made from lean doughs include the following:

1. Hard-crusted breads and rolls, including French and Italian breads, Kaiser rolls and other hard rolls, and pizza. These are the leanest of all bread products.

2. Other white and whole wheat breads and dinner rolls. These have a higher fat and sugar content and sometimes also contain eggs and milk solids. Because they are slightly richer, they generally have soft crusts.
3. Breads made with other grains. Rye breads are the most common. Many varieties of rye bread are produced, with light or dark flours or with pumpernickel flour, and with various flavorings, especially molasses and caraway seeds.

Flaky bread or rolled in yeast dough bread

Rolled-in doughs or laminated doughs are those in which a fat is incorporated into the dough in many layers using a rolling and folding procedure. The alternating layers of fat and dough give the baked product a flaky texture.

Laminated doughs vary in sugar content from about 4% for some croissant doughs to 15% or more for some Danish dough. However, most of the sweetness of laminated yeast dough products comes from the fillings and toppings. Croissant and Danish doughs are the main laminated yeast dough products

Bread Faults

During bread preparation, faults may occur due to many reasons such as incorrect baking temperature, fluctuation in temperature, sedimentation of yeast in dough, sugar, salt, incorrect handling of the dough, poor ingredient quality, incorrect recipe formulation etc. The faults in bread on the basis of various factors are comprehensively given in Table 3.2.

Table 3.2: Faults in bread and their causes

Bread Fault	Indicators	Causes
1. Flying Tops also known as an exaggerated break, wild break or flaked crust	The top crust burst due to the pressure of expanding gas.	1. Inadequately conditioned gluten 2. Under proofing 3. Excessive heat in the oven 4. Use of weak flour 5. Lack of humidity in proofing chamber 6. Skin formation during proofing or fermentation

2. Lack of colour on crust/ dull appearance	Lack of shine and pale crust	1. Over proofing and fermentation 2. Under-kneaded dough 3. Excessive resting 4. Insufficient sugar 5. Insufficient salt 6. Low baking temperature
3. Condensation marks	Condensation marks	1. If the bread is not cooled properly before packing some of the water vapours will deposit in the crumb. 2. Very soft dough 3. Excessive steam injected during baking
4. Uneven texture	Uneven texture	1. Over fermented dough 2. Under fermented dough 3. Improper mixing 4. Uneven baking temperature of the oven
5. Dries rapidly	Rapidly drying of the crumbs	1. Low baking temperature of oven 2. Prolonged baking time 3. Too high dough temperature 4. Over fermented dough 5. Too tight dough 6. Under fermentation time
6. Moist crumb	Sticky, too moist crumb	1. Higher carbohydrate content of flour 2. Excessive humid proofing chamber

7. Dense crumb	Tight and dense crumb	1. Excessive milk 2. Excessive fat 3. Over kneading/ knocking 4. Under proofed dough 5. Tight dough 6. Too high oven temperature
8. Crumbliness of crumb	This bread will not slice neatly and may break into fragments by the pressure of slicer blades	1. Over or under fermentation 2. Too tight dough 3. Excessive amount of fat 4. Low salt content 5. Poor quality of flour 6. Under mixed dough
9. Too thick crust	Thick crust on bread	1. High sugar content 2. Lack of moisture 3. Too strong flour 4. Over fermented dough 5. Low baking temperature
10. Low volume	Low volume of the bread	1. Too tight dough 2. Too little yeast/ weak yeast/ dead yeast 3. Under fermentation 4. Crusting of dough 5. Excessive salt 6. Under proving 7. Too strong flour
11. Excessive volume		1. Too loose dough 2. Lack of oven temperature 3. Lack of salt 4. Excessive yeast 5. Loose moulding

		6. Excessive sugar
12. Holes and tunnels	Elongated holes or tunnels in crumb	1. Too soft flour 2. Too strong flour 3. Concentration of yeast 4. Improper mixing 5. High oven temperature 6. Improper knockback 7. Using combination of strong and weak flour 8. Excess flour dusting 9. Excessive fat
13. Sourness	Acidic fragrance in bread	1. Over fermentation 2. Excess yeast 3. Less amount of salt 4. High room or proving chamber temperature.

Conclusion

The session discusses preparation of dough by different methods for the production of different types of bread. The sequential steps involved in production of bread are also discussed along with various types of bread and the common defects found in the prepared bread and their corresponding causes.

ACTIVITY

1. Prepare dough using different methods of bread dough preparation.
2. Prepare bread following all the steps of bread preparation discussed in the session.

CHECK YOUR PROGRESS

I. Multiple choice Questions

1. Which of the following is simplest method of bread dough preparation?

a. Straight dough b. No-Time Dough

c. Salt–delayed method d. Sponge and dough

2. When salt is added in dough, multiplication of yeast and speed of fermentation is

   a. increased b. stopped

   c. decreased d. none of the above

3. Equal proportion of water, flour and tiny quantity of yeast is called

   a. batter b. ferment

   c. paste d. dough

4. Which of these methods uses higher quantity of yeast?

   a. Straight dough b. No-Time Dough

   c. Salt–delayed method d. Sponge and dough

5. At what temperature generally the dough will rise to double its original volume?

   a. 52 °C b. 22 °C

   c. 32 °C d. 18 °C

II. Mark the statement True or False

1. Breads are made by a whipping process.
2. Gluten is developed during baking of the dough.
3. White bread has 5 to 12% milk solids.
4. Combination of strong and weak flour can cause holes and tunnels in breads
5. Excessive heat in the oven can lead to flying tops on bread.

III. Fill in the blanks

1. Coagulation of proteins starts at _____.
2. Caramelization starts at 149°C and _____.
3. Yeast is killed at a temperature _____.
4. Process of cutting and weighing individual pieces of dough is called _____.
5. Release of developed air bubbles and redistribution of yeast in dough is achieved through _____.

IV. Very short answer type questions

1. What are the methods of bread dough preparation?
2. Enlist the steps involved in bread preparation.
3. Describe bread faults and their causes?

Module 4
Pastry and Cakes

Module Overview

In Module-1 of the textbook you have been introduced to pastry and cakes. In this Module you will learn about the types and methods of preparing various types of pastry and cakes. You will also learn about the faults arising in preparation of pastry and cake and their causes.

Learning Outcomes

After completing this module, you will be able to:

- Describe the different types of pastries, and understand the techniques and ingredients required for their preparation.
- Explain the methods for making various types of cakes, and discuss the importance of ingredients, mixing techniques, and baking conditions in achieving desired textures and flavors.

Module Structure

- Session-1 Pastry
- Session-2 Cakes

SESSION 1: PASTRY

The term pastry generally refers to a mixture of flour, liquid, sugar and fat. Pastry refers both pastes such as choux pastry and doughs such as puff pastry as base to prepare several products. You have read types of pastry dough in Module-2 of the textbook. You will recall that laminated and non-laminated are two types of pastry dough and various products are made using them. Let us discus various pastry products in detail:

Pastry Products

The noticeable feature of the pastry is that they are usually made with butter, flour, and water and sometimes eggs are added too. Creativity and innovation in this area has no end and based on combination of only these four ingredients, innumerable pastry products already exist. However, it is beyond the scope of the textbook, therefore we will cover only the basic pastry products. Various types of pastries and their sweet and savoury preparation are as follows:

S. N.	Types of Pastries	Sweet and Savoury
1	Puff pastry	Proportion fat to flour is 1:1 folding three times with fat, once without used for preparing palmier, turnover, vegetable puff
2	Flaky pastry	Proportion fat to flour is 3:4 folding once with fat, three times without used for preparing vol-au-vent, jam puff, sausages rolls
3	Danish pastry	Proportion fat to flour is 1:2 folding once with fat used for preparing croissants, windmills etc.
4	Filo pastry	Used for preparing baklava, spanakopita etc.
5.	Short crust pastry	Proportion of fat to flour is 1:2. Used for preparing tarts, sweet pastries, almond cookies, pie, quiche, apple pie etc.
6.	Choux pastry	Proportion of fat to flour to water 1:1:2. Used for preparing eclairs, creams, puffs, duchesses, profiteroles and cream puffs

Let us discuss the recipe and method of preparation for some of these pastries and products made with them.

Puff Pastry Dough

The ratio of fat and flour is 1:1 in puff pastry which contain multiple layers and has very flaky texture.

Table 4.1: Puff pastry dough preparation	
Ingredients	**Quantity**
Refined flour	200g
Fat	20g for the dough
	180g for rolling
Powdered sugar	10g
Salt	5g

Lemon juice	Optional
Water	100-120 ml (as per the strength of the flour)

Method:

1. Sieve thrice all the dry ingredients together to remove the husk, impurities and aeration of the flour.
2. Add 10 % creamed or melted fat to the flour.
3. Rub-in fat with the flour.
4. Make a bay in the flour and add water for kneading.
5. Make a soft dough by kneading.
6. Rest the dough for 1 hour.
7. In the meantime cream the fat and divide it in three even portions.
8. Keep aside the dough for further processes.
9. Sheet the dough to the desired thickness.
10. Spread the one portion of fat evenly on sheeted dough and three fold the sheet.
11. Keep the dough for resting in a refrigerator for at least 30 minutes.
12. Repeat the step 9, 10 and 11 for with other 2 remaining fat portions.
13. Now puff pastry dough is ready.
14. This dough must be properly wrapped and stored at 1-5 °C for further usage.
15. The dough products are baked at 200 – 220 °C for 30 to 45 minutes depending upon the product.
16. This dough is used as base for preparation of patties, vol-au-vent, cream horns, turnovers etc.

Preparing patties using Puff pastry dough

Table 4.2: Patties (Puff) preparation using puff pastry dough	
Ingredients	Quantity
Refined flour	200 g
Fat	20 g for the dough
	180 g for rolling
Powdered sugar	10 g
Salt	5 g
Lemon juice	Optional
Water	100-120 ml (as per the strength of the flour)
Puff Filling	
Potato	500 g
Turmeric powder	10
Red chilli powder	10
Coriander powder	20
Garam Masala powder	10
Dried mango powder	10
Salt	To taste
Oil	20 ml for tempering

Method:

For fillings:

1. Boil, peel and mash potatoes.
2. Heat oil in a frying pan, add all the powdered spices and mashed potatoes.

3. Mix well, cook for few minutes and remove from heat. Allow it to cool.
4. Filling is ready for puff pastry.

For pastry:

1. Make puff pastry dough as mentioned above in Table.
2. Roll the dough into sheets.
3. Cut the sheet into desired rectangular shape.
4. Put the fillings in the centre of the sheet.
5. Apply water on the edges of the sheet.
6. Turnover the sheet to match the edges.
7. Egg wash/ milk wash is given for shine on the top.
8. Bake at 200 -220 degree for 20 minutes

Danish Pastry

Danish pastry is made up of soft fermented yeast dough, using flour, fat, sugar, yeast, salt, eggs and milk. The dough is folded and rolled several times for desired layer, creating minimum 27 layers. The pastry is brushed with sugar syrup after baking. Croissants, windmills, are examples of Danish pastry.

Preparation of Danish pastry dough

Table 4.3: Preparation of Danish pastry

Ingredients	Quantity
Refined flour	225 g
Powdered sugar	30 g
Fat	170 g
Milk	50 ml
Salt	5 g
Yeast	10 g
Egg	1 no.

1. Sieve all the dry ingredients.
2. Mix yeast in lukewarm milk with a pinch of sugar.
3. Cream 30 g of fat and rub in the flour.
4. Make a bay, add milk and yeast, egg and knead soft dough and ferment the dough for at least 30 minutes.
5. Punched down the dough and place in a refrigerator for 1 hour.
6. In the meantime cream the remaining fat and divide it in three even portions.
7. After resting, roll the dough in to the thick sheet.
8. Spread the one portion of fat evenly on sheeted dough and three fold the sheet.
9. Keep the dough for resting in a refrigerator for at least 30 minutes.
10. Repeat the step 7, 8 and 9 with other 2 remaining fat portions.
11. Roll the dough cut and give the shape.
12. Keep this for proving for at least 30 minutes.
13. Glaze it with the egg wash.
14. Bake the proofed dough at 210 °C for 30 to 40 minutes.

Note: With this dough different products can be made. Example croissant.

Short Crust Pastry

Short crust or short pastry is the simplest and most common pastry. It is made with flour, fat, salt, and water. This dough is used as base for preparation of tarts, pie and quiche. For short crust pastry the standard ratio of 1:2 for fat and flour respectively, whose recipe is given below:

Table 4.4: Recipe for short crust pastry	
Ingredients	**Quantity**
Refined flour	200 g
Fat	100 g
Powdered sugar	10 g
Salt	5 g
Iced water	for sprinkling

Method:

1. Sieve thrice all the dry ingredients together to remove the husk, impurities and aeration of the flour.
2. Add fat to the flour.
3. Cut in fat with the flour.
4. Make the dough by sprinkling iced water using rubbing-in method. (With the help of finger)
5. Store prepared dough in refrigerator for resting.
6. Now, short crust dough is ready for making base for the different products like pie, tarts etc.
7. Short crust dough can be baked at temperature between 180 – 200-°C.
8. Let us prepare Jam tart using short crust pastry dough.

Table 4.5: Jam tart preparation using short crust pastry dough	
Ingredients	**Quantity**
Refined flour	200 g
Fat	100 g
Powdered sugar	30 g
Jam	100 g

Salt	3 g

Method:

1. Make short crust pastry dough as mentioned above in Table 1.
2. Roll out pastry sheet into approximately 4 mm thickness.
3. Cut the dough sheet using tart cutter.
4. Place in the tart mould and thumb press for even moulding.
5. Bake the tart shells at 190 °C for 15 minutes.
6. When the tart shells are cooled, pipe creamed jam into the tart shell.
7. Bake again jam filled tart shells for five minute
8. After cooling of the baked tart, sprinkle icing sugar for garnish.

Note: The same process is used for preparation of pie, tarts and flan.

Sweet pastry

The standard ratio of 1:2:3 for sugar fat and flour respectively. This dough is used as base for preparing variety of cookies.

Table 4.6: Sweet pastry dough preparation

Ingredients	Quantity
Refined flour	150g
Fat	100 g
Powdered sugar	50 g
Salt	2 g
Iced water	Optional

Method:

1. Sieve thrice all the dry ingredients together to remove the husk, impurities and aeration of the flour.
2. Add fat to the flour.
3. Cut in fat with the flour.
4. Make the dough by using rubbing-in method with the help of fingers. (sprinkle iced water if required)
5. Store prepared dough in refrigerator for resting.
6. Now, sweet dough is ready for making various types of cookies such as almond cookies, choco chip cookies etc.
7. Sweet dough can be baked at temperature between 180 – 200 °C.

Preparation of almond cookies using sweet pastry dough

Table 4.7: Almond Cookies preparation

Ingredients	Quantity
Refined flour	150g
Fat	100 g
Powdered sugar	50 g
Salt	2 g
Almond powder	25 g
Almond flakes for garnish	20 g
Milk	for coating
Iced water	Optional

Method:

1. Sieve thrice all the dry ingredients except almond powder and flake together.
2. Add almond powder and fat to the flour.
3. Cut in fat with the flour.
4. Make the dough by using rubbing-in method with the help of fingers. (sprinkle iced water if required)
5. Store prepared dough in refrigerator for resting.
6. Now, divide the dough in to 20 even sized balls.
7. Press the balls using cookie stencils and place them in a baking tray by keeping gap of 1 inch between them.
8. Give milk wash and garnish with almond flakes.
9. Bake at 180 °C for 20 minutes.

Choux Paste

Choux paste is made by boiling water, butter and salt together and then the flour is added in to form a partly gelatinized paste. It is then piped into the desired shapes, then deep fried and baked.

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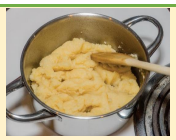
Table 4.8: Preparation of Choux paste



Ingredients	**Quantity**
Refined flour	375 g
Butter	250 g
Milk	250 ml
Salt	5 g
Sugar	15 g
Water	250 ml
Egg	625 g (approx 14 no.)

1. Mix water, milk, butter and boil.
2. Remove the boiled mixture from heat.
3. Add flour into the liquid mixture, mix vigorously and then cook on low flame.
4. Stir with a wooden spoon until a firm smooth paste formed.
5. Cool till a temperature of the paste is reached about 60 °C.
6. Mix the beaten eggs one at a time until it is absorbed.
7. The choux paste is ready for preparation of éclairs and profiteroles.

Preparing éclair using Choux paste

Table 4.9: Preparing éclair using Choux paste			
Ingredients			
Choux paste			
Melted chocolate			
1. Line baking tray with parchment paper. 2. Fit a large pastry bag with a plain tube. Fill the bag with éclair paste. 3. Pipe out dough into strips about 2 cm wide and 8-10 cm long. 4. Lower heat and bake at 190 °C until crisp and brown 5. Remove from oven and cool slowly in a warm place. 6. Fill baked éclairs with pastry cream by making a small hole at one end and using a piping bag to fill in the cream. 7. Dip the tops of éclairs in chocolate fondant.			
			

Common Faults in Pastries and Their Causes

The common pastry faults and their causes are shown in Table 4.10.

S. No.	Common faults of pastry	Causes
1.	Pastry is pale	1. Under baking 2. Low oven temperature
2.	Pastry shrinks while cooking	3. Excessive stretching of the dough
3.	Blisters on pastry	1. Insufficient rubbing of fat 2. Excessive amount of water in dough
4.	Pastry is too dark	1. High oven temperature 2. Over baked
5.	Pastry is soft and too crumbly	1. Excessive baking powder is used 2. Excessive fat is used 3. Insufficient amount of water is used while dough preparation
6.	Pastry is dry and too crumbly	1. Overhandling of the dough 2. Excessive water is added 3. Soft fat is used
7.	Pastry is hard	1. Insufficient fat is used 2. Over-rolling of pastry dough 3. Overhandling of the pastry dough

Conclusion

The two steps involved in preparation of various types of basic pastry products are preparation of the right dough and using it to prepare the desired pastry product. Four basic types of pastry are discussed in this session with their detailed recipes and the methods of preparation. The likely faults which can arise in their preparation along with causes of such faults are also covered in this session.

What have you learned?

After completing this Session, you are able to:

- Describe and prepare the pastry products
- Categorize pastry dough
- Discuss pastry faults and their causes.

ACTIVITY

1. Prepare basic Pie or Tart.
2. Prepare choux pastry, Éclair and profiterole.
3. Prepare Puff pastry.

CHECK YOUR PROGRESS

I. Multiple choice Questions

1. Proportion fat to flour is 1:1 in which of the following pastry?
   a. flaky pastry b. Puff pastry
   c. Danish pastry d. Filo pastry
2. Eclairs is made using which of the following pastry?
   a. flaky pastry b. Puff pastry
   c. Choux pastry d. Filo pastry
3. Baklava is an example of which pastry?
   a. flaky pastry b. Puff pastry
   c. Danish pastry d. Filo pastry
4. Flaky pastry is used to prepare which of the following product?
   a. croissants b. vol-au-vent
   c. palmier d. turnover
5. In short crust pastry, proportion of fat to flour is
   a. 1:4 b. 1:2
   c. 4:1 d. 1:5

II. Mark the statement True or False

1. Pastry refers to paste and dough both.
2. Weak flour is preferred for pastries preparation.
3. Short crust is the simplest pastry.

4. Water, butter and salt is boiled together and then the flour is added to make short crust pastry. False
5. Jam tart is prepared using short crust pastry dough.

III. Fill in the blanks

1. _____ is used to prepare tart, pie, and flan.
2. _____ dough is used to prepare, flaky and Danish pastry.
3. The ratio of fat and flour is 1:1 in _____.
4. _____ used for preparation of patties, cream horns, turnovers etc.
5. Pastry shrinks while cooking due to excessive _____ of the dough.

IV. Very short answer type questions

1. What is puff pastry?
2. How many layers are created in Danish pastry?
3. How a Choux paste is prepared?
4. Enlist four pastry faults and their causes.

SESSION 2: CAKES

Cakes are a form of dessert usually made with flour, butter, sugar, eggs and cream. The final texture and colour of the baked cake depend upon how the batter is prepared. A typical cake is composed of a sponge, filling, icing and garnishing

Cakes are made by creaming or whisking method. In creaming method, fat and sugar are creamed together and adding eggs and flour afterwards. In whipping method, eggs and sugar are whipped together and flour is folded-in into whipped mixture. Cakes are usually made up of following three types of ingredients:

1. Structural ingredients: These ingredients include flour and eggs and their core function is to provide structure to the cakes.
2. Shortening agents: Shortening agents include fat, butter, oil, sugar and chemical leaveners.
3. Moistening agents: Liquids which adds moisture in cakes and these includes water, milk, syrups, eggs etc.

Types of Cakes

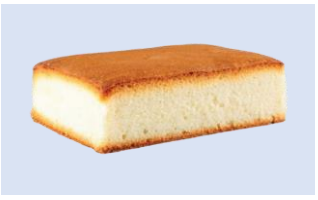
Different types of cakes are discussed below:

Sponge Cakes

Sponges are made from three main ingredients egg, sugar and flour, with some containing small amount of butter as well. Sponges are always a component of assemble temporized cakes. Various types of sponges include Genoese cake, fatless sponge, Swiss roll sponge, eggless sponge etc.

Sponge Cake			
Ingredients	**Fatless sponge**	**Genoese sponge**	**Swiss roll sponge**
Flour	500 g	500 g	500 g
Sugar	500 g	575 g	500 g
Butter			
Eggs	20 no.	17 no.	15 no.
Baking powder	15	20 g	10 g
Essence	7.5 ml	7.5 ml	10 ml
Melted fat		150 ml	
Salt			5 g
Gel			25 g
Water			100 ml
Refined oil			75 ml

Genoese Cake



1. Beat eggs while adding sugar gradually till light and foamy
2. Add vanilla essence mix well.
3. Fold in flour in three parts gently and thoroughly in to the egg mixture (don't over mix).
4. Fold in the melted fat.
5. Pour it in a greased and butter paper lined cake tin.
6. Bake it at 180 °C for 15 to 20 minutes or till done.

7. Baked cake is sliced into thin horizontal layers and stacked with alternate layers of cream/frosting to create layered cake such as Swiss roll, Vanilla genoise etc.

Fatless Sponge

1. Sieve the flour with baking powder and mix salt.
2. Beat the egg till it gets foam.
3. Add sugar gradually and keep on beating the eggs till the mixture forms a peak.
4. Add desired essence and fold the flour.
5. Careful handling is must to maintain the foamy texture and to avoid any lumps in the mixture.
6. Pour the mixture into the prepared tray and bake it at 190 degree C for about 15-20 minutes.

Swiss Roll

1. Beat eggs while adding sugar gradually till light and foamy
2. Add vanilla essence mix well.
3. Fold in flour in three parts gently and thoroughly in to the egg mixture (don't over mix).
4. Pour it in a greased and butter paper lined cake tin.
5. Bake it at 190 °C for 15 to 20 minutes or till done.
6. When it is hot demould, spread melted jam, roll it tight using dry cloth or butter paper, & set in the refrigerator for 10 minutes.
7. Slice into 1/2″ thick round pieces.

Cream Cakes

Ingredients	Quantity
Flour	200 g
Sugar	100 g
Eggs	2 no.
Cream	100 g
Baking powder	5 g

Salt	5 g
Vanilla essence	5 ml

Method:

1. Beat eggs, sugar, vanilla essence and mix well.
2. Sieve and combined all the dry ingredients.
3. Add the flour mixture in three stages alternating with whipping cream.
4. Combined well till smooth batter of ribbon consistency is obtained.
5. Pour the batter in cake pan.
6. Bake at 175 °C for 30 to 40 minutes.
7. Once baking is done, remove the pan from the oven and let it cool.

Tea Cake/ Pound Cake

Recipes of some commonly consumed tea a cake is given in Table 4.11.

Recipe Of Pound Cake, Fruit Cake, Cupcake And Chocolate Muffins					
S. N.	**Ingredients**	**Pound cake** 	**Fruit cake** 	**Cup cake** 	**Chocolate muffins** 
1.	Flour	1000 g	1000 g	1000 g	1000 g
2.	Sugar	1000 g	1000 g	1000 g	1000 g
3	Fat	1000 g	1000 g	1000 g	1000 g
4.	Egg	20 nos.	20 nos.	20 nos.	20 nos.
5.	Milk powder	20 g	20 g	20 g	10 g
6.	Cake gel (optional)	50 g	50 g	50 g	50 g

7.	Baking powder	20 g	20 g	20 g	20 g
8.	Calcium propionate	4 g	4 g	4 g	4 g
9.	Vanilla essence	20 ml	20 ml	20 ml	20 ml
10.	Orange essence	10 ml	10 ml	10 ml	-
11.	Lemon essence	10 ml	10 ml	10 ml	-
12.	Choco chips	-	-	400 g	
13.	Cocoa powder	-	-		175 g
14.	Walnut	-	-		-
15.	Dry fruits	-	250 g		-
16.	Chocolate essence	-	-		10 l

Preparation Required Before Baking the Cakes

1. Mould/ cake tin must be greased with oil and dusted with flour.
2. Excessive greasing must be avoided as it may cause frying effect on the bottom of the cake.
3. Turn the mould upside down and tap gently to remove excess flour.
4. Pour the prepared batter in moulds avoiding creation of air pockets which upon baking causes holes in cakes.
5. Fill only 2/3rd part of the moulds ensuring enough space for the expansion of the cake batter while baking.

6. Always pre-heat the oven before baking the product. Pre-heating the oven ensures that the product is exposed to the right temperature for the right time duration.
7. Never open the ovens till the structure of the cake is set, as doing this at earlier stage cause collapsing of the cake.
8. Baking must be performed at right temperature. Too high temperature will set the cake before it is raised well and also darken the color of the cake. Whereas too low temperature will result in poor volume and texture of the cake

Common Cake Faults and Their Causes

Fault	Causes
Volume and Shape	
Poor volume	Insufficient flour
	Excessive liquid
	Insufficient leavening
	Oven too hot
Uneven shape	Improper mixing
	Batter spread unevenly
	Uneven oven heat
CRUST	
Too dark	Excessive sugar
	High oven temperature
Too light	Insufficient sugar
	Oven not hot enough
Burst or cracked strong	Too much flour or flour too
	Insufficient liquid
	Improper mixing

	High oven temperature
Soggy	Underbaked
	Cooling in pans without enough ventilation
	Wrapping before cooling
TEXTURE	
Dense or heavy	Insufficient leavening
	Excessive liquid
	Excessive sugar
	Excessive shortening
	Low oven temperature
Coarse or irregular	Excessive leavening
	Insufficient egg
	Improper mixing
Crumbly	Excessive leavening
	Excessive shortening
	Excessive sugar
	Wrong kind of flour
	Improper mixing
Tough	Flour too strong
	Excessive flour
	Insufficient sugar or shortening
	Overmixing
Poor Flavour	Poor-quality ingredients

	Poor storage or sanitation
	Inaccurate measurement of ingredients

Conclusion

Cakes are integral to patisserie. The various types of cakes detailed recipes and prior preparation required to be made are given in this session. The various types of faults that can arise in cakes along with their corresponding causes are also covered in this Module.

What have you learned?

After completing this Session, you are able to:

- Describe and prepare basic cakes
- Discuss cake faults and their causes.

ACTIVITY

1. Preparation of basic cakes sponge cake, Genoese cake, tea cake, pound cake, fruit cake, muffins and cupcakes.
2. Identify cake faults and causes during preparation of the cakes.

CHECK YOUR PROGRESS

I. Multiple choice Questions

1. Which of the following is considered structural ingredients for cake?
   a. egg b. baking powder
   c. fat d. milk
2. Genoese cake is an example of which of the following?
   a. cream cakes b. sponge cake
   c. pound cake d. none of the above
3. Frying effect on the bottom of the cake is caused by
   a. excessive dusting b. excessive greasing
   c. excessive heating d. low temperature of oven
4. Which of the following is responsible for too dark crust colour of the cake?
   a. uneven oven heat b. excessive sugar
   c. improper mixing d. excessive liquid

5. Poor volume of cake is caused by which of the following?

a. Insufficient sugar b. Insufficient leavening

c. Too much flour d. Low oven temperature

II. Mark the statement True or False

1. Cakes are made using creaming or whisking.
2. Flour gives structure to the cake.
3. In creaming method egg is whipped with sugar till it forms firm peaks.
4. Outer layer or paste on cake which is used for decoration is known is icing.
5. Quick breads are leavened with a biological leavening agent.

III. Fill in the blanks

1. _____ provide structure to the cakes.
2. Water and milk add _____.
3. _____ are always a component of assemble temporized cakes.
4. _____ is used for preparing swiss roll, Vanilla genoise.
5. Excessive sugar causes darkening of the _____.

IV. Very short answer type questions

1. What are basic types of cakes?
2. What are the various methods of mixing cake batters?
3. What are the preparations required before baking the cakes?
4. Enlist the causes of poor volume in cake.
5. Enlist the causes burst or cracked strong?

Module 5
Food Safety Management Systems

Module Overview

The main sources of contamination in a bakery are food handler, surfaces, air, water, and pests. The risk of contamination from such sources is minimized using food safety management systems. In this Module, we will discuss the food safety management systems and how it is affected by the layout of the bakery unit, personnel hygiene and hygiene and sanitation of the workplace. We will also learn about the various types of cleaning agents, cleaning tools and methods of cleaning and maintaining heavy equipment.

Learning Outcomes

After completing this module, you will be able to:

- Describe the importance of pulse crops in agriculture, including their nutritional benefits, role in crop rotation, and contribution to soil fertility through nitrogen fixation.
- Explain the economic and social significance of pulse crop cultivation, highlighting their impact on food security, farmer livelihoods, and market demand.

Module Structure

- Session-1 Food Safety Management System -I
- Session-2 Food Safety Management System -II
- Session-3 Food Safety Management System -III

SESSION 1: FOOD SAFETY MANAGEMENT SYSTEM - I

Food Safety Management System (FSMS) by Food Safety Standards Authority of India (FSSAI) provides mandatory guidelines for maintaining food safety in a bakery establishment. A craft baker must be acquainted with the working elements of FSMS to ensure food safety during various bakery operations as follows:

1. Hazard analysis critical control point (HACCP)
2. Good manufacturing practices
3. Good Handling Practices (GHP)
4. Interactive Communications
5. Management System
6. Statutory and regulatory requirements

7. Layout of the bakery unit
8. Equipment
9. Personal Hygiene
10. Cleaning Agents and Tools

All the above elements have been thoroughly discussed in class 10th textbook on "Baking Technician". A recapitulation of the ideas is as follows:

Hazard Analysis and Critical Control Point (HACCP)

HACCP is an internationally recognized system for the reduction of food safety hazards and ensures food safety. Several biological, physical or chemicals hazards can occur during the process of production. The potential hazards are identified and controlled at a specific point by the quality control procedures described in HACCP through following measures:

1. Conduct hazard analysis to identify types of hazard
2. Identify the critical control points (CCP)
3. Analyse the CCP for each step-in production
4. Refer to the critical limits from safety manual.
5. Establish the critical limits for the product.
6. Monitoring system for the critical limits.
7. Apply corrective measures to control the critical limits.
8. Enter the observation records in the log book.

Good Manufacturing Practices (GMP)

Production of food in a manner to ensure hazard-free food in a manufacturing unit are covered under Good Manufacturing Practices. GMP minimizes the possible hazards involved in production that cannot be eliminated by testing the final product. Thus, GMP covers all aspects of production like raw materials, premise, equipment, training and personal hygiene of staff. GMP is based on five key elements, viz., people, procedure, products, premises and equipment and processes. These elements are often referred to as the 5 Ps of GMP.

Good Handling Practices (GHP)

It is a comprehensive approach followed from the farm to the store or consumer to ensure that all persons handling the food follow good hygiene practices. The identification of potential sources of food safety hazards and procedures taken to minimize the risk of contamination are covered under GHP.

Communication

Communication is a two-way flow of information. It covers both "internal communication" and "external communication". Internal communication establishes and maintains effective communications with personnel on issues that have an impact on food safety such as new products development, changes in process control, ingredients quality, change in formulations etc.

External communications establish and maintain an effective communication with suppliers, customers, food authorities and other organizations outside the bakery that may have an impact on the FSMS.

Management system

Managerial system implements and controls the food safety hazards for ultimate consumption at the consumer level. It is applicable to all organizations, regardless of size which are involved in any aspect of the food chain and want to implement food safety systems that consistently provide safe products.

Statutory requirements

The guidelines of FSMS for bakery and bakery products supplement the various relevant provisions of Food Safety and Standard Act, 2006. The FSMS guidelines cover the following major activities of the bakery industry:

a) Receiving and storing of raw material.

b) Manufacturing and packing of bakery products.

c) Storage, warehousing and transportation of bakery products

All the above activities may or may not be carried by the same bakery unit. In such cases where the manufacturing, warehousing and transportation are being carried by different units, all the different unit will have the diligently follow the respective FSMS guidelines in their individual operational area. FSMS guidelines apply on biscuits, bread as well as cakes and pies.

Other notable features contained in the FSMS guidelines are:

1. A full treatment on GMP and GHP relevant for bakery products.
2. The language of the FSMS guidelines is directive in nature. For compliance of most of the businesses of food and bakery sector, the directory word “shall” is used.
3. The FSMS guidelines have provisions for implementation of Hazard Analysis and Critical Control Point (HACCP) system by the food businesses. The tables of Hazard Analysis in the document definitely help the industry to identify the food safety risks related to each processing step

and identify the Critical Control Points (CCPs) along with recommended corrective action.

4. Sample HACCP plans have been taken from established bakery industries. These plans could be used as reference by the industry and modified by a bakery unit based on their operations.
5. The FSMS guidelines provide inspection checklist for bakery units to audit their facilities and operations. The bakery unit can evaluate themselves based on their scores.
6. The FSMS guidelines provide valuable templates and forms required by any bakery unit to maintain their records. Various mandatory forms as prescribed by FSSAI along with other templates for maintaining records of HACCP are also given in the FSMS guidelines.

Conclusion

The FSMS is an umbrella system which has 10 different elements as discussed in this session. The HACCP, GMP, GHP, communication, management system and statutory requirements are discussed in this session and the aspects of layout of bakery unit, equipment, personal hygiene and cleaning agents and tools will be discussed in subsequent sessions.

What have you learned?

After completing this Session, you are able to:

- Discuss food safety management system.
- Describe HACCP, GMP and GHP

ACTIVITY

1. Visit a nearby bakery and observe the following:
   - The area where bakery products are prepared and served
   - How is the food prepared and stored?
   - How is the food served?
2. Comment if the outlet is following in some ways the approaches of HACCP, GMP and GHP or not.
3. Identify the critical control points in the outlet and give suggestions for improvement in this area.
4. Visit https://www.fssai.gov.in/cms/guidance-document.php and read the FSMS guidance document for bakery sector

CHECK YOUR PROGRESS

I. Multiple choice Questions

1. Which among the following system, identifies hazards and sets critical limits for food safety?

   a. GMP b. HACCP

   c. GHP d. Management system

2. Various aspects of food production are covered under which of the following

   a. FSMS b. HACCP

   c. GMP d. GHP

3. GMP consist of which of these?

   a. 5 P's b. 5 C's

   c. 5 D's d. 4 G's

4. CCP is

   a. critical care point b. care and control point

   c. critical control points d. crucial care point

5. Safe food handling from the farm to the consumer is concerned with?

   a. Crucial control point b. Communication

   c. GHP d. Management system

II. Mark the statement True or False

1. Poor hygiene and sanitation do not impact food safety in bakery industry.
2. HACCP is based on five principles.
3. People, procedure, product, premises and publicity are the 5 P's of GMP.
4. The Food Safety and Standards Act (FSSA) was passed by the Indian Parliament in 2002.
5. In GMP potential hazards are identified and controlled at a specific point.

III. Fill in the blanks

1. The main sources of contamination in a bakery are _____, surfaces, air, water, and pests.
2. FSSA stands for _____.
3. FSMS stands for _____.

4. Communications is a _____ flow of information.
5. Communication covers both internal and _____ communication.

IV. Very short answer type questions

1. List down the key elements of FSMS.
2. Write 4 features of FSMS guidelines.
3. Comment on effectiveness of HACCP

SESSION 2: FOOD SAFETY MANAGEMENT SYSTEM -II

Another important limb of FSMS is the proper layout of the bakery unit and personal hygiene and sanitation so that instances of hazards and contaminants are minimized. In this session you will learn some of the salient features of layout of a bakery unit and maintenance of personal hygiene and sanitation.

Layout of bakery unit

Layout for bakery setup requires several considerations for safe and hazard free operations. Designing of plant layout includes, work area, floor, windows, doors, cleaning area and other facilities. The layout should facilitate optimum utilization of various bakery facilities and minimization of potential hazards. Some of the important considerations in bakery layout are given below:

Floors and Walls

1. Floors must be strong enough to resist heavy equipment, trolley movement and cleaning materials.
2. Floors should have an appropriate slope to allow drainage.
3. Floors should be non-slippery and easy to clean.
4. The surface of walls should not have any flaking paint or plaster. Non-porous tiles are preferred which are also easy to clean.

Fig. 5.1: Smooth floor

Windows

1. Sufficient windows, roof vents and exhaust fans are provided to facilitate optimum ventilation and remove excessive humidity and steam formed during bakery operations. It should be easier to clean the windows etc. at periodic interval.

2. Wood as a construction material is avoided as it promotes mold growth and termites.
3. Adequate natural or artificial light is provided. Lights in production area are always covered.

Doors

1. Self-closing doors with no gap between doors and floors are preferred.
2. Doors shall have a smooth and non-absorbent surface
3. Doors are fitted with strip curtain, air curtain, wire mesh etc. to ensure that pest and other contaminants do not enter food handling area.

Working surfaces

1. Working surfaces must be made of non- reactive materials such as stainless steel, marble etc.
2. It must be free from cracks, crevices etc. and in good working condition.
3. It must be free from sharp internal angles or corners, protruding rivets, nuts and bolts etc.

Water Supply

1. Water supply must be from a reliable source.
2. Provision of adequate water storage facilities
3. Sufficient number of water supply taps with appropriate placement
4. Ease of access to water storage tanks for periodic cleaning.

Waste disposal

1. Appropriate waste disposal facilities are provided to avoid risk of contamination of food or potable water supply.
2. Provision is provided for separate collection of biodegradable and non-biodegradable wastes.

Drainage and other facilities

1. Drainage is designed for smooth outflow.
2. Drainage and sewage system are equipped with traps and vents.
3. Drainage pipes must be covered and corrosion resistant.
4. Facilities are provided for personal hygiene, cleaning food, utensils, equipment, dressing and washrooms.
5. Sufficient number of toilets with proper flushing facilities are provided.

Personal Hygiene and Sanitation

Products prepared under hygienic conditions always attract the consumers. Therefore, in a bakery unit the focus is on preventive measures rather than on corrective measures. The main objective of hygiene and sanitation is observation of food safety rules and meet the obligations towards the consumers. Hygiene and sanitation in the bakery conceptually refer to its adoption by the personnel and its implementation in the work area. Hygiene means clean and contamination-free environment for the staff and the working area. Bakery worker can eliminate the possibilities of infection which they may carry on their body, hair or clothes by following hygiene and sanitation standards.

Aspect of maintaining personal hygiene and sanitation include hands, hair, cloths and personal habits as discussed below:

Hands Hygiene

Hands are the most likely source and carrier of contamination in food industry. Therefore, they must be washed with soap solution and water at least for 20 seconds followed by rinsing in running water.

1. Wash hands before and after handling of food material.
2. Use protective hand gloves while working. Gloves must be cleaned and sanitized after every work cycle.
3. Baker should not wear hand jewelry, wristwatch or bangles.
4. Person suffering from any kind of skin diseases or open wound are not allowed to work in bakery.
5. Wash basins are provided near the working area. The proper method of washing hands is shown in Fig. 5.2.

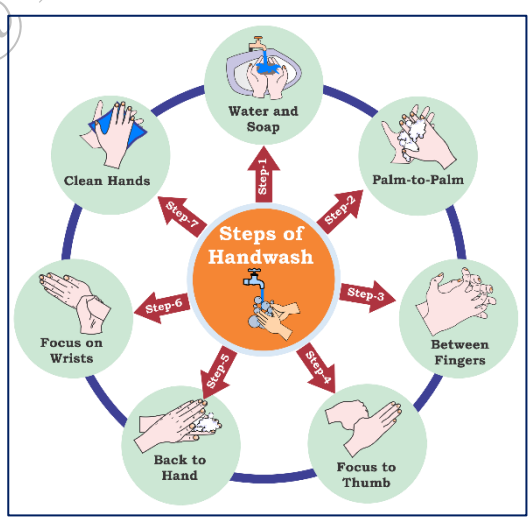


Fig. 5.2: Proper method of handwashing

Hair hygiene

1. Hair to be kept short and clean.
2. Combing of hair is avoided in working area.
3. Hair is covered using hairnet, chef cap or head scarf.

Cloth hygiene

1. A light colour protective cotton uniform preferably white is worn while working in bakery.

2. The uniform should allow smooth movement and comfortable to wear.
3. The uniform needs to be regularly washed.
4. Adequate changing rooms, rest rooms and cabinets for clothes and personal belongings are provided while developing the layout of the bakery unit.

Prohibited activities

1. Touching nose, eye, ear, mouth and hair while working is strictly prohibited as it carries a lot of bacteria which immediately contaminates the bakery food.
2. Coughing or sneezing without covering the mouth and nose with cloth.
3. Eating, drinking, consumption of tobacco products or chewing gum is strictly prohibited in work area.

Conclusion

As discussed in the previous session personal hygiene and sanitation along with proper layout of the bakery unit are ingredients of FSMS. In this session a description of layout of bakery unit including its floors and walls, windows, doors, working surfaces, water supply, waste disposal, drainage etc. is given. The session gives salient point of personal hygiene and sanitation with do's and don'ts for hygiene of hands, hair, clothes and other activities.

What have you learned?

After completing this Session, you are able to:

- Describe the FSMS components for bakery layout.
- Describe the importance of personal hygiene and sanitation.
- Describe the importance of workplace hygiene and sanitation.

ACTIVITY

1. Visit to a nearby bakery unit/ plant to understand following:
   a. Hygiene and sanitation standards practiced in unit
   b. Layout of the unit and placement of the equipment
   c. Discuss the good and bad hygiene practices observed during visit in your classroom.
2. Demonstrate how to wear uniform, including chef coat, apron, gloves, hair caps, socks, shoes properly in your classroom.

CHECK YOUR PROGRESS

I. Multiple choice Questions

1. Hygiene means maintaining the staff and bakery unit in clean and …… free conditions

   a. pest b. dust

   c. contamination d. moisture

2. …… are the most likely source and carrier of contamination in food industry.

   a. Hands b. rodents

   c. Equipment d. None of the above

3. Which of the following helps in ventilation and remove humidity?

   a. exhaust fans b. drainage facility

   c. door d. strip curtain

4. Hygiene or sanitary conditions of an individual refers to ……

   a. Personal hygiene b. food hygiene

   c. bakery unit hygiene d. food safety

5. Hands are washed at least for……seconds

   a. 20 b. 10

   c. 5 d. 100

II. Mark the statement True or False

1. Work area preparation facilitates optimum utilization of the bakery facilities.
2. Non-porous tiles are considered good for cleaning.
3. Wooden doors and windows are prone to mould growth, and termites with ageing.
4. Stainless steel and marble tops are preferred work surfaces.
5. Storage of biodegradable and non-biodegradable wastes separately is a good practice.

III. Fill in the blanks

1. Working surfaces must be made of _____ materials.
2. Strip curtain, air curtain and wire mesh prohibit the entry of _____ and contaminants in food handling area.
3. Lights in production area must be _____.

4. Floors must be_____ and facilitate cleaning.
5. Appropriate slope of floor facilitates proper _____.

IV. Very short answer type questions

1. Enlist the three important considerations for ensuring hygienic supply of water.
2. Mention three practices to keep the workplace organized and hygienic.
3. How do you maintain hygiene and sanitation at your home?
4. What practices are prohibited in food production area?

SESSION 3: FOOD SAFETY MANAGEMENT SYSTEM – III

Now we will discuss how equipment is related with the concept of FSMS. Hygienic equipment avoids any possibility of contamination and microbial growth. Food preparation equipment must be of hygienic design and easy to maintain. The session also discusses cleaning and maintenance of various bakery equipment.

Cleanliness of equipment

Generally, equipment manufactured from food grade material like stainless steel, plastic, iron, silicone etc. are used in bakeries. Proper cleaning and maintenance not only ensure hygienic production but also extend the life of the equipment. Clean in place (CIP) and clean out of place (COP) are the two approaches employed for cleaning of the equipment. CIP is adopted for cleaning heavy equipment which are fixed and cannot be moved from place to another. COP approach is practiced where equipment can be dismantled easily such as dough kneader attachments.

Equipment are installed in a manner which facilitates their cleaning and maintenance. Generally, a gap of minimum 1 foot from wall is maintained while installing the equipment. Self-draining equipment are properly connected to the drain lines. All equipment is routinely cleaned and sanitized to remove dirt and bacteria. Established cleaning procedures are followed at all times with regular review. Cleaners, detergents and soaps used to clean food contact surfaces are not allowed to come in contact with food. The equipment is rinsed properly to remove any residues of cleaning agents. Cleaning procedure of some heavy equipment is given in Table 5.1

Table 5.1: Cleaning procedure for some heavy equipment

Equipment	Requirements	Cleaning procedure
Proving chamber	Hot soapy water Clean towels Scrubbing pads or brush Sanitizer Degreaser	Drain the chamber. Scrub and wipe the inside of chamber. Drain scrubbed water and rinse with clean water. Scrub outside and wipe outside. Use degreaser if necessary. Sanitize the internal chamber with approved sanitizer. Air dry.
Ovens	Long handled brush, Dust pan, Hot soapy water, Clean towels, Oven cleaner liquid/spray	Wipe off top and outside of oven with hot soapy water. Brush the crumbs out of oven chamber. Replace the used tray with clean tray. Deep cleaning of oven is done once in a week during off hours.
Walk-in Cooler/ Freezer	Broom, Dustpan, Mop, Bucket, Floor cleaner, Glass cleaner and Paper towel	Sweep floor of the cooler. Using hot water with floor cleaner, dry mop the floor. Allow to air dry. Wipe doors inside and outside, paying special attention to handle and gaskets. In case of glass door reach-in freezer, clean and wipe glass door with glass cleaner. Clean handles and gaskets of glass reach in door with hot soapy water.

Microwaves	Hot soapy water, Clean towels, Bleach solution in spray bottle	Wipe off top and outside of the chamber with hot soapy water (65 ℃). Wipe with dry clean towel and allow it to air dry.
Deep Fryer	Hot water, Degreaser, Scrapper and Duster	Strain out leftover oil from the deep fryer container. Remove debris and scrap sedimentation using scrapper. Degrease the frying chamber with the help of degreaser. Clean with hot soapy water. Rinse, wipe and air dry.
Hoods	Disposable gloves, Oven and grill cleaner, Duster, Degreaser	Degrease and Wash screen of hoods. Clean inner chamber and outer surface with hot soapy water and degreaser. Clean top of hood with hot soapy water and degreaser.

Maintenance for clean equipment

Maintenance refers to regular or methodological processes to keep the equipment in working condition. Regular maintenance of the machineries and equipment is required to optimize their performance. Regular inspection and adjustment of equipment gives consistent quality bakery product.

Types of maintenance

The various types of maintenance activities can be considered under two broad categories as follows:

Planned Maintenance

The maintenance activities planned and scheduled in advance are covered under planned maintenance. Such activities can be preventive or corrective. Preventive activities are carried out at fixed time intervals before a fault happens. The corrective maintenance is required when the equipment is being

used. The maintenance personnel inspect the equipment and do the repair work to run the machine in the shortest time.

Unplanned maintenance

Some of the maintenance problems occurs unexpectedly. Unplanned maintenance is generally the result of equipment breakdown. Breakdown maintenance incudes repairs, replacement of parts or even a complete overhaul to ensure that the equipment is back in operating condition. Breakdown maintenance is generally applicable to sophisticated equipment.

Cleaning agents and tools

All equipment, utensils and food contact surfaces are cleaned and sanitized thoroughly before starting the baking work. Bakery ingredients such as fats, flour, sugar, syrups, dough etc. are sticky in nature and deposit on equipment and its grease. Therefore, cleaning and sanitization of equipment is done to remove such food residues and dirt. Appropriate cleaning agent and tools are used for maintaining cleanliness of equipment. To achieve this the following cleaning sequence shown in Fig. 5.3 is adopted:

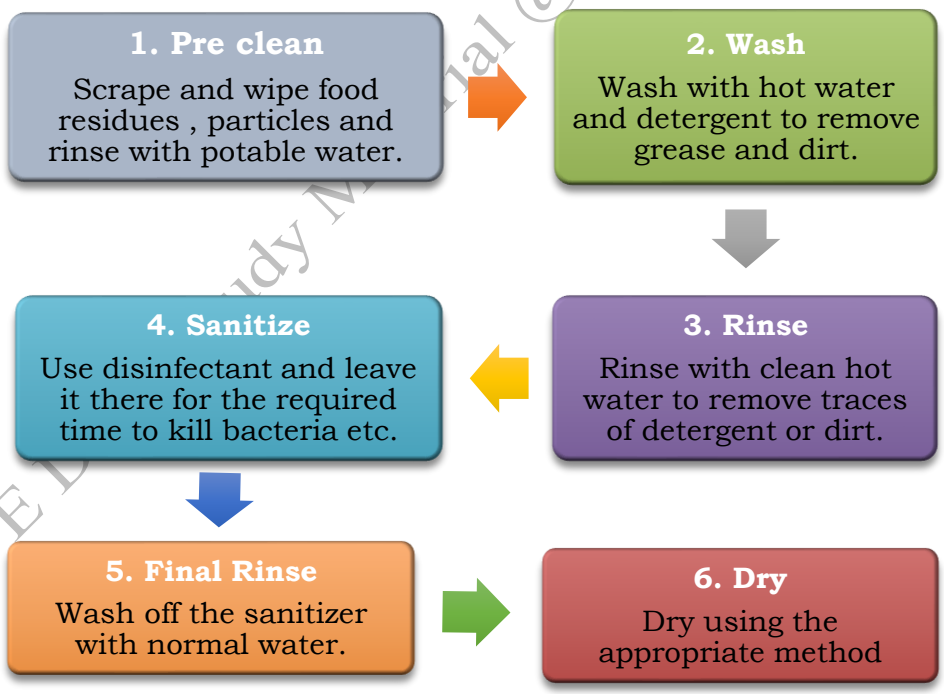


Fig. 5.3: Cleaning sequence of equipment

Selection of cleaning agents

Detergents, disinfectants and sanitizers are generally used to clean the equipment. Detergents include alkalis (caustic soda), acids (hydrochloric), and oxidants (hypochlorite, peroxide). Inappropriate use of cleaning agent on food contact surfaces may cause contamination. The nature of the cleaning agent depends on soiled surface, hardness and temperature of water for cleaning and safety precautions. While dealing with chemical detergents, protective clothing and safety precautions are followed. Table 5.2 shows some of the cleaning agents used for cleaning in bakery unit:

Table 5.2: Cleaning agents used in bakery

S. N.	Cleaning Agent	Where used
1	Detergents (soap, washing-up liquid, washing powder etc.)	To remove dirt, grease, oil and food particles.
2	Foaming cleaner and Degreaser	To remove grease deposited on the equipment
3	Dish washing solution	To clean the utensils and metallic surfaces
4	Anti-microbial hand wash/ hand sanitizer	To disinfect the hands of the staff to prevent any contamination
5	Disinfectant (Chlorine, Quaternary ammonium-based disinfectant, Iodine solution etc.)	To disinfect the food preparation areas. Prior to disinfection, detergent is used.
6	Sanitizers	Sanitizers are combined detergent and disinfectant, used to sanitize and remove micro-organisms from the work surfaces.
7	Glass cleaner Plastic cleaner CRT cleaner	To remove dirt, dust and grease from glass, plastic or any other delicate surface.

8	Stainless Steel Cleaner, Polish (Aerosol)	To maintain the mirror finish of display counters of the bakery.

Cleaning Tools

The cleaning work is achieved by a variety of tools for specific purposes such as scrapping the drippings, removing deposition of various types, sedimentation and grease on equipment and work surfaces and cleaning of floors. Some of the tools used for these purposes include rubber gloves, counter scraper, floor scraper, stiff broom, mop, paper towel, kitchen duster, wiper, scrub brush, scrub pads. A cleaning inspection checklist is maintained on regular basis in bakeries as shown in Table 5.3.

Table 5.3: Cleaning inspection checklist of bakery

S. No.	CHECKLIST	DATE AND TIME	EMPLOYEE NAME AND SIGN
1	Clean and sanitize work surfaces and preparation tables		
2	Clean burners and ovens		
3	Clean inside and outside of ovens		
4	Clean all baking racks and trays		
5	Clean grills, stoves, steam tables and all cooking equipment with a degreaser		
6	Clean inside and outside of large equipment		
7	Clean shelves, counters, and preparation tables		
8	Clean inside and outside of all display cabinets		
9	Clean inside and outside of refrigerators, freezers and other appliances		
10	Clean inside and outside of hoods and vents		

11	Inspect bakery supplies for detection of pests		
12	Clean inside and outside of sinks		
13	Clean all chairs and tables		
14	Clean floors and floor mats		
16	Sweep and mop floors		
17	Clean and disinfect floor drains		

Conclusion

Clean equipment is a fundamental requirement of bakeries under FSMS. In this session the various aspects of clean equipment, cleaning procedures, maintenance requirements for clean equipment, cleaning agents, cleaning tools and cleaning checklist have been discussed. With this session the present unit of FSMS is completed.

What have you learned?

After completing this Session, you are able to:

- Discuss the basic approaches of cleaning
- Enlist the tools and cleaning agents used for cleaning and sanitization of bakery equipment.
- Describe the cleaning sequence of equipment

ACTIVITY

Visit to a bakery unit and observe and make note on following aspects:

- How the cleaning of tools and equipment takes place?
- Frequency of cleaning of tools and equipment
- Placement order of the tools and equipment
- Preparation of work area and equipment before actual production

CHECK YOUR PROGRESS

I. Multiple choice Questions

1. Equipment used in food production are made with which of the following material?

   a. reactive material b. food grade material

   c. strong material d. heat resistant material

2. Recommended gap between equipment and wall is at least

   a. 1 foot b. 5 cm

   c. 2 meter d. None of the above

3. Regular or methodological processes to keep the equipment in working condition is called

   a. maintenance b. cleaning

   c. sanitizing d. repairing

4. Which of these maintenance activities is preventive in nature?

   a. replacing an old gasket b. repairing a broken gasket

   c. changing a broken electric wire d. none of the above

5. Which of the following will you use to remove grease deposited on the equipment

   a. dish washing solution b. sanitizer

   c. foaming cleaner d. Disinfectant

II. Mark the statement True or False

1. Caustic soda is an acid-based cleaning agent.
2. Clean in place (CIP) is processes involve dismantling of the equipment.
3. Clean out of place is used for movable equipment.
4. Pre clean involves use of disinfectant for cleaning of the equipment.
5. Hardness and temperature of water affect cleaning of the equipment.

III. Fill in the blanks

1. _____ requires dismantling, disassembling, washing, checking, inspecting, validating, and reassembling.
2. _____ is an example of oxidants for cleaning.
3. Protective clothing is a must while handling with _____ detergent.
4. _____ is used remove micro-organisms from the equipment.
5. _____is used to mainatain shine and mirror finish of display counters.

IV. Very short answer type questions

1. What is the cleaning sequence used for bakery equipment?
2. List down the basic cleaning agents.
3. Describe the basic approaches of cleaning practiced in bakery.

4. Categorize tools and equipment available in your laboratory on the basis of CIP and COP approaches.

GLOSSARY

Batter	Batter is thin dough that can be easily poured into a pan. Batter is used mainly for pancakes, light cakes, and as a coating for fried food
Condiments	They are different from flavors and are typically served along or on top of a dish or baked product which complements the actual taste and aroma of the main dish.
Conduction	The transfer of thermal energy through direct contact.
Contamination	Incorporation of any impurity or some other undesirable element that spoils, corrupts, infects, makes unfit
Convection	The transfer of thermal energy through the movement of air.
Deep freezer	a refrigerator in which food can be quickly frozen and kept for long periods at a very low temperature of -18 degree Celsius
Enamelled	Coated or decorated (a metallic or hard object) with enamel
Fermentation	This is a process in which yeasts or bacteria convert carbohydrates to alcohol or organic acids.
Flavourings	Additives that are added in baked goods to enhance taste.
FSSAI	Food Safety and Standards Act of India
Gluten	This is a type of protein found in grains specially wheat
GMP	Good Manufacturing Practices
HACCP	Hazard Analysis and Critical Control Point
Hazard	Dangerous or risky
Hygiene	Keeping one self and things clean to prevent diseases and infection.

Leavening	Any substances used in doughs and batters that cause a foaming action which lightens and softens the mixture
Proofing	dough is allowed to rest and rise a before baking
Radiation	is the transfer of thermal energy through thermal emission
Refrigerator	Refrigerator is a kitchen appliance where we can store your perishable food at a cool temperature
Rodents	Warm-blooded mammals with oversized front teeth causing great damage in and around. Example mice.
Sanitation	The process of handling food cleanly, healthily and safely
Shelf life	The length of time or duration for which commodity may be stored safe for human consumption
Shortening	Shortening is any fat that is a solid at room temperature and used to make crumbly pastry and other bakery food products
SOP	Standard operating procedure
Sourdough	Sourdough means the dough of bread is made by the fermentation of dough using naturally occurring lactobacilli and yeast
Spoilage	Deterioration of food and other perishable goods
Profiterole	A small puff made of éclair paste. Often filled with ice cream and served with chocolate sauce.
Puff Pastry	A very light, flaky pastry made from a rolled-in dough and leavened by steam.
Pumpernickel Flour	A coarse, flaky meal made from whole rye grains.
Retarding	Refrigerating a yeast dough to slow the fermentation.
Rich Dough	A dough high in fat, sugar, and/or eggs

Rolled-in Dough	Dough in which a fat has been incorporated in many layers by using a rolling and folding procedur
Sponge	A batter or dough of yeast, flour and water that is allowed to ferment and is then mixed with more flour and other ingredients to make a dough.
Sponge cake	A type of cake made by whipping eggs and sugar to a foam, then folding in flour
Sponge method	A cake mixing method based on whipped eggs and sugar.
Stollen	A type of sweet yeast bread made with fruit.
Wash	1) A liquid brushed onto the surface of a product, usually before baking.
Weak Flour	Flour with a low protein content.
Oven Spring	The rapid rise of yeast goods in the oven due to the production and expansion of trapped gases caused by the oven heat.
No-Time Dough	A bread dough made with a large quantity of yeast and given no fermentation time expect for a short rest after mixing.
Lean Dough	A dough that is low in fat and sugar.
Genoise	A sponge cake made with a batter containing melted butter.
Gelatinization	The process by which starch granules absorb water and swell in size.
Ganache	A rich cream made of sweet chocolate and heavy cream.
Croissant	A flaky, buttery, yeast roll shaped like a crescent and made from a rolled in dough.
Creaming	The process of beating fat and sugar to blend them uniformly and to incorporate air.
Compote	Fruit cooked in sugar syrup.

Chiffon Cake	A light cake made by the chiffon method.
Chiffon Method	A cake mixing method involving the folding of egg whites into a batter made of flour, egg yolks and oil.
Brioche	Rich yeast dough containing large amounts of eggs and butter, or a product made from this dough.
Baklava	A Greek or Middle Eastern dessert made of nuts and phyllo dough and soaked in syrup
Spanakopita	Greek Spinach Pie, made from layers of dough with a spinach and cheese filling

ANSWER KEY

Unit	Session	MCQ	True or false	Fill in the blanks
Module 1	Session 1	1. French 2. calzone 3. pumpernickel 4. challah 5. False	1. False 2. False 3. False 4. True 5. False	1. Ciabatta 2. Bagel 3. cinnamon buns 4. Pav 5. Fruit bun
	Session 2	1. shortened cake 2. chiffon cake 3. eggs 4. sponge cake 5. pate sucre	1. False 2. True 3. False 4. True 5. True	1. French 2. short crust 3. puff 4. flaky 5. Danish
	Session 3	1. measuring 2. Weighing scale 3. Sieve 4. double boiler 5. Blow gun	1. False 2. False 3. True 4. False 5. True	1. Freezer 2. Scrapper 3. Double boiler 4. Wire whisker 5. Bundt
	Session 4	1. gluten content 2. 12 % 3.All-purpose flour 4. carbon dioxide 5. baking soda	1. False 2. True 3. True 4. True 5. False	1. Structure 2. Yeast 3. Ammonium bicarbonate 4. Sodium and chlorine 5. Hydrogenated

Module 2	Session 1	1. all of the above 2. transportation 3. condensation 4. baking powder 5. 76 °C	1. False 2. False 3. False 4. True 5. True	1. 160°C. 2. Fahrenheit 3. 80–95 4. 60–75 5. continuous
	Session 2	1. conversion factor 2. flour 3. 65% 4. firm and dry	1. True 2. False 3. False 4. True 5. True	1. imperial 2. Flour 3. Hydration 4. medium 5. ratio
	Session 3	1. gluten 2. baking powder 3. lamination 4. Danish 5. Phyllo	1. True 2. False 3. False 4. True 5. True	1. Lamination 2. Puff pastry 3. blitz pastry 4. Non-laminated dough 5. Choux pastries
Module 3	Session 1	1. Choux pastries 2. Yeast 3. high protein content 4. 100 ppm 5. lukewarm water	1. True 2. False 3. False 4. True 5. False	1. Carbon dioxide gas 2. maltose 3. Glutenin 4. pH 5. 4 to 6%
	Session 2	1. Straight dough 2. Decreased 3. ferment	1. False 2. False 3. False 4. True	1. 60°C 2. 204°C 3. 63°C 4. Scaling

		4. No-Time Dough 5. 32 °C	5. True	5. Knock-back
Module 4	Session 1	1. Puff pastry 2. Choux pastry 3. Filo pastry 4. vol-au-vent 5. 1:2	1. True 2. True 3. True 4. False 5. False	1. Short crust pastry 2. Laminated pastry 3. Puff pastry 4. Puff pastry dough 5. Stretching
	Session 2	1. Egg 2. sponge cake 3. excessive greasing 4. excessive sugar 5. Insufficient leavening	1. True 2. True 3. False 4. True 5. False	1.Structural ingredients 2. Moisture 3. Sponges cakes 4. Genoese 5. Crust
Module 5	Session 1	1. HACCP 2. GMP 3. 5 P's 4. critical control points 5. GHP	1. False 2. False 3. False 4. True 5. False	1. Food handler 2. Food Safety and Standards Act 3. Food Safety Management System 4. two-way 5. external

	Session 2	1. Contamination 2. Hands 3. exhaust fans 4. Personal hygiene 5. 20	1. True 2. True 3. True 4. True 5. True	1. non- reactive 2. pest 3. covered 4. non slippery 5. drainage
	Session 3	1. food grade material 2. 1 foot 3. Maintenance 4. replacing an old gasket 5. foaming cleaner	1. False 2. False 3. False 4. False 5. True	1. COP 2. hypochlorite 3. chemical 4. Sanitizer 5. Aerosol

List of Credits

1 **Module 1**

Fig. 1.6: https://tinyurl.com/3fgvssbp

Fig. 1.7: https://tinyurl.com/aueyyyvt

Fig. 1.9: https://tinyurl.com/1nyhvmte

Fig. 1.10: https://tinyurl.com/5amj4yjn

Fig. 1.11: https://tinyurl.com/rojwzj3m

Fig. 1.12: https://tinyurl.com/2w287nau

Fig. 1.13: https://tinyurl.com/dn9csz1k

Fig. 1.14: https://tinyurl.com/xjptiz31

Fig. 1.15: https://tinyurl.com/ytl7h62z

Fig. 1.16 : https://tinyurl.com/yb8fhfo8

Fig. 1.17: https://tinyurl.com/t4oqzhju

Fig. 1.18: https://tinyurl.com/366amo3l

Fig. 1.19: https://tinyurl.com/1i54k448

Fig. 1.20: https://tinyurl.com/7gmsmcr8

Fig. 1.21: https://tinyurl.com/8dq8um4o

Fig. 1.22: https://tinyurl.com/2d2cjhpc

Fig. 1.23 https://tinyurl.com/3nxxrv5o

Fig. 1.24: https://tinyurl.com/6e6gi21w

Fig. 1.25: https://tinyurl.com/1eql4h9m

Fig. 1.26: https://tinyurl.com/yju28xj7

Fig. 1.27: https://tinyurl.com/ko4zvrb3

Fig. 1.30: https://tinyurl.com/mmr173y6

Fig. 1.31: https://tinyurl.com/1473rlzm

Fig. 1.32: https://tinyurl.com/3am8jb76

Fig. 1.36: https://tinyurl.com/flsgu2b6

Fig. 1.39 https://tinyurl.com/1gpi0ird

Fig. 1.40 By Donovan Govan. - https://tinyurl.com/4r9zkl3x

Fig. 1.41: https://tinyurl.com/b5qwjwin

Fig. 1.42: https://tinyurl.com/1proyeeq

Fig. 1.43 By Dr. Preeti Dixit, PSSCIVE, Bhopal

Fig. 1.44 https://tinyurl.com/fhyjvxbe

Fig. 1.45: https://tinyurl.com/1iy555ha

Fig. 1.46 https://tinyurl.com/2ihjduwa

Fig. 1.47: https://tinyurl.com/3h5urjb6

Fig. 1.48: https://tinyurl.com/gbrvrlqq

Fig. 1.49: https://tinyurl.com/4dcl83bx

Fig. 1.50: https://tinyurl.com/46y93x9l

Fig. 1.51: https://tinyurl.com/1cqoxipi

Fig. 1.52: https://tinyurl.com/yw4sr938

Fig. 1.53: https://tinyurl.com/3cdqkcye

Fig. 1.58: https://tinyurl.com/lapc7aaj

Module 2

Fig. 2.3 : Bhopal Baking Company (BBC), Bhopal

Module 3

Fig. 3.1: https://tinyurl.com/ylw46n6k

Fig. 3.4: https://tinyurl.com/cf2fg6nu

Fig. 3.7: https://tinyurl.com/1r6knvbb

Fig. 3.8: https://tinyurl.com/54kap9p9

Fig. 3.11: https://tinyurl.com/ms4h6fwf

Fig. 3.12: https://tinyurl.com/1sw2i79r

Module 4

Fig. 4.2: Bhopal Baking Company (BBC), Bhopal

Fig. 4.4: Bhopal Baking Company (BBC), Bhopal

Fig. 4.5: Bhopal Baking Company (BBC), Bhopal

Fig. 4.6: Bhopal Baking Company (BBC), Bhopal

Fig. 4.7: https://tinyurl.com/yqyb3cuq

Fig. 4.8: https://tinyurl.com/gjwe7bdz

Fig. 4.9: https://tinyurl.com/y56mjdy9

Figures on cover page:

Fig. 1 and 2: Bhopal Baking Company (BBC), Bhopal

Fig. 2-6: By Dr. Preeti Dixit, PSSCIVE, Bhopal

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