Unit-2

Bakery and Confectionery Technology

Objectives

- To understand bakery and confectionery industry.
- To study the role of different types of major and minor ingredients.
- To provide the information about the different types of equipments and tools used for bakery and confectionery products.
- To learn process for manufacturing bakery and confectionery products.

Manufacturing of bakery and confectionery products are considered both as an art and science.

The agriculture processing sector especially food processing industry is gaining importance in trade by contributing in industrial production and employment generation. Among different sectors of food processing industry, bakery and confectionery industry is largely considered as an entry level business by many of the aspirant entrepreneurs.

Bakery and confectionery products have become essential food items for majority of the population. Consumer needs are always changing with respect to novelty in the form of food, aesthetic properties, nutritional value and convenience. These needs are primarily satisfied by bakery and confectionery industry by providing range of quality products in the market like bread, cake, pastries, cookies, crackers, candies, chocolates, etc.

For this a baker or confectioner should have a basic knowledge about how to select and use different ingredients, their roles in particular product, specific characteristics and processing aspects of each product, etc. Hence, this unit is basically designed to acquire the knowledge of bakery and confectionery.

4 Bakery Technology

Contents

Bakery holds an important place in food processing industry and is a traditional activity.

A bakery is a facility that produces and sell flour based baked food items such as bread, cake, pastries, biscuits, cookies, etc. They are also referred as baker's shop or bake shop. The process of making bakery product is called baking.

Fig. 4.1 Bakery products

Fig. 4.2 Traditional baking oven

4.1 WHAT IS BAKERY TECHNOLOGY ?

Technically baking is a science of cooking where flour based food is cooked under prolonged heating condition using dry heat. The equipment used for baking is called as baking oven. The basic ingredients are either formed into a dough or batter and then baked in oven.

Dough:

Dough is a thick, semisolid, malleable and sometimes elastic kneaded ball of flour and water mixture with minor ingredients. The water used is sufficiently enough to hydrate each flour particle.

Batter:

Batter is a semi-liquid mixture of flour and other ingredients with pourable consistency.

4.2 INGREDIENTS IN BAKERY

To make bakery products with outstanding flavour and texture, quality ingredients are needed. Each ingredient in the recipe has a specific purpose and plays an important role in the success or failure of the baked goods.

The selection of the ingredients, their proportions and processing techniques with oven temperature are very important to attain the quality of finished bakery items.

The below image (fig 4.3) shows the ingredients used in bakery.

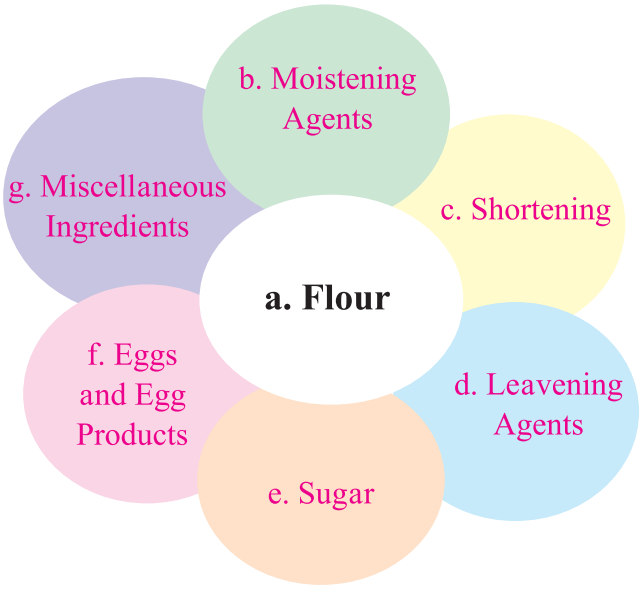


Fig. 4.3 Ingredients used in bakery

a. Flour: Cereal flours are most commonly used basic ingredient of baked goods. Among various cereals wheat is widely used because of its unique protein i.e. gluten.

The second component of flour which is equally important for giving characteristic quality in product is starch. The hydrated starch gets cooked and forms gel like structure during baking by the process called gelatinization. These gelatinized starches upon cooling gets harden enough to give structure to the product.

Fig. 4.4 Wheat flour

Can you recall ?

In wheat flour gluten occurs in the form of two fractions gliadin and glutenin. When water gets added into flour these two fractions combine and develops a protein network called gluten network.

Gluten network gives elasticity and extensibility to the product and helps in trapping the gas formed by leavening agents.

Types of wheat flour:

Depending upon the protein content, wheat flour is classified into two types.

i. Hard Wheat Flour:

Hard wheat flour contains more that 10% protein and are used for preparation of bread, pies and pizza base where elasticity and sponginess are required.

ii. Soft Wheat Flour:

Soft wheat flour contains less than 10% protein and are used for preparation of cake, pastries, cookies, biscuits, etc.

b. Moistening agents:

Material which provides moistness to the product is known as moistening agent. Water, milk and buttermilk are used as moistening agent. Proper amount of moistening agent is necessary to form dough or batter of desired consistency.

i. Water:

It hydrates the flour and acts as a distribution medium for other small ingredients. It helps in gluten development and gelatinizing the starch. In the case of leavened bread, water acts as an activator, as the yeast will have its optimal growth when it is being supplied with sufficient amount of water. Dry yeast gets activated first by pouring it into luke warm water whereas, chemical leavening agents (carbonates) liberates carbon dioxide gas when in contact with water.

ii. Milk:

Milk helps in improving the nutritional value of bakery product. It tightens flour proteins, which improves the gas retention power of the dough. It improves the flavour, colour and taste of the product. The lactose in milk helps to give crust colour to the product.

iii. Buttermilk:

Buttermilk contains approximately 90% water and 10% milk solids. It also contains lactic acid, which softens the gluten and gives softness to the dough.

c. Shortening:

Fats and oils shorten the process of gluten network formation. Therefore, they are called as shortening agent. Most commonly used shortenings are; hydrogenated vegetable oil, butter and margarine.

Functions:

1. Reduces the stickiness of dough.
2. Increases nutritional value and glossiness of products.
3. To incorporate air during creaming which helps to increase the final volume of products.
4. Acts as heat transfer media.
5. It improves the taste and shelf life of baked products.

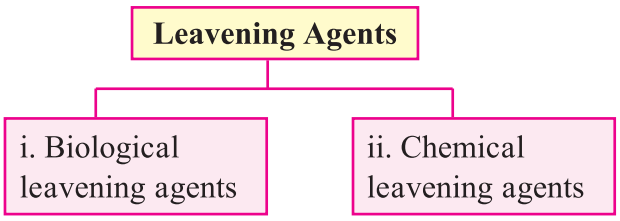
d. Leavening agents:

A leavening agent is also known as a raising agent. It is a substance used in dough and batter that causes CO_2 gas formation that lightens and softens the product.

Functions:

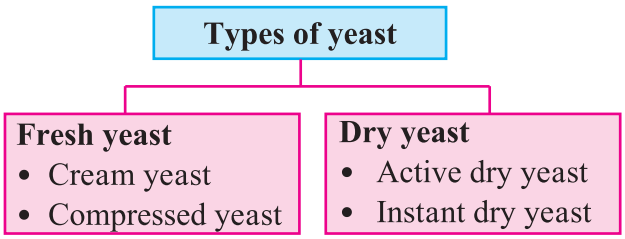
1. Increases the volume of the products.
2. Improves the product by making it tender, softer and lighter.
3. Enhances flavour (taste and smell).
4. Increases the digestibility.

Leavening agents used in bakery products are basically of two types;



i. Biological Leavening Agent:

It is basically single-celled organism (a type of yeast). Baker's yeast (*Saccharomyces cerevisiae*) is the common name for the strains of yeast widely used as a leavening agent in bread and bakery products. It converts the fermentable sugars present in the dough into carbon dioxide and ethanol. The yeast can be divided into two main categories i.e. fresh and dry. Both of these can again be divided into following subcategories:



Fresh yeast:

- Bakers prefer fresh yeast because it is cheaper and more active.
- The cream yeast is available in the suspension form.
- Compressed yeast is generally available in blocks of 500 g.

Dry yeast:

- Dry yeast is preferred in ships and household baking as it can be preserved for a longer time.
- It is generally available in granular form in small packets (10 and 25 g), medium pack (500g) and big pack (10 kg and 25 kg).

ii. Chemical leavening agent:

Most commonly used chemical leavening agent are as follows:

- Ammonium carbonate or bicarbonate.
- Sodium bicarbonate.
- Baking powder.

When using these chemicals following points should be kept in mind.

- The chemicals must comply with provision of the Food and Drugs Act.
- After reaction, the residual substances remaining in the product must be harmless.
- It should not be unpleasant in taste and aroma.
- The chemical should be reasonably cheap and easily available in market.
- They should not react together in dry state.
- They should not readily react together when moistened in the cold state.
- If used in excess quantity, the end product (biscuits/cookies) will spread during baking and it will spoil the appearance.

Ammonium carbonate or bicarbonate:

It decomposes into ammonia gas, carbon dioxide and water. The advantage of this type of leavening agent is that it decomposes in two gases and does not leave a solid residue which make problem in case of sodium bicarbonate. Ammonium bicarbonate is used in biscuit, cookies, crackers and similar products.

Sodium bicarbonate:

Sodium bicarbonate is popularly known as baking soda, which produces CO_2 gas for aeration, when moistened and heated, makes the product more porous. Baking soda is used in cake, cookies and similar products.

Baking powder:

It is a combination of sodium bicarbonate and an edible acid salt (cream of tarter) with or without fillers like starch or flour.

It is available in two forms:

Single acting baking powder: Which acts instantly and the product has to be baked immediately as soon as it is mixed.

Double acting baking powder: In this, some of the gas is released when it is mixed to the batter at room temperature and the final gas is released in the oven during baking.

Do you know ?

Too much baking powder results in a bitter tasting product, while too little results in a tough cake with little volume.

e. Sugar:

Sugar contributes to the flavour and texture of the product. Most commonly table sugar or cane sugar (Sucrose) is used in bakery products. It is also used as a source of energy for yeast during activation. Sugar, being hygroscopic in nature, absorbs and retains the moisture hence the products remain moistened for a longer time thereby it improves the shelf life. Sugar caramelizes when heated, which provides dark brown colour and pleasant flavour to the product.Sugar is used in granulated, grind or fine form (powdered).

Granulated sugar: It is larger in particle size (regular sugar) which is used in homes. It is used in products where it is firstly dissolved in water or milk or where the granular appearance is desirable in mouth feel.

Grind Sugar: This is basically grounded sugar and is used nearly for all purposes like creaming, whisking etc. It is free in grain and has no dust.

Fine Sugar: It is also called icing sugar. It is used for cake decoration and in butter creams, gum pastes, various types of dessert, biscuits, dusting biscuits dough, etc.

f. Eggs and egg products:

Eggs and egg products are the most important raw material for different bakery products. They are used as principal ingredients for the production of cakes, cookies, crackers, biscuits, doughnuts, sweet rolls, icing and meringues, etc. In fact, many of the bakery goods could not be made without eggs.

Functions:

Moistening agent: Moisture present in the egg makes product moist.

Aerating or foaming agent: It incorporates and entraps air properly when whisked, and thereby form stable foams and other aerated structure.

Emulsifying agent: Egg contains lecithin (an emulsifier) which gives homogeneous nature.

Structure building agent: Protein present in the egg when heated gives definite structure.

Enriching agent: Egg contains high quality protein and enriches nutritional value.

Flavouring and colouring agent : Egg possesses a delicious flavour and the yolk gives yellow colour.

g. Miscellaneous ingredients:

The ingredients used in small quantity but which have remarkable effects on the acceptability of the food are called as miscellaneous ingredients.

Salt: Salt (Sodium Chloride) imparts salty taste to the bakery products. Hence product becomes appetizing and palatable. It enhances the natural flavour of the other ingredients. It lowers the caramelization temperature of the cake batter and thereby improves the crust colour.

Flavour additives: They improve the flavour of bakery products and can be divided into two categories:

i. **Natural:** It includes basic ingredients added in the formula like sugar and syrups, fruit pulp/juice, cardamom, nutmeg, cocoa, chocolate, and the essential oils of citrus fruits (lemon and orange) and vanilla, etc.

ii. **Synthetic:** It is the only practical means of flavouring in the bakery industry. Synthetic flavour will have more taste appeal than the natural flavours alone. E.g. vanilla.

Colour additives: The use of colour is as important as the use of flavour. They are used in specialty breads, cakes, and cookies, as well as fillings, icings and coatings. It can be divided into two groups:

i. **Natural colour:** They are obtained from different natural sources i.e. Curcumin from Turmeric (Yellow colour), Chlorophyll from leaves (Green colour), Safranin from Saffron (Orange colour), cocoabeans (Brown colour), etc.

ii. **Artificial colour:** They are dyes. It posses more accuracy, clarity and glossiness than natural colour hence it is widely accepted by all bakers. Some FDA certified synthetic colours are Sunset yellow (Yellow colour) and Brilliant blue (Blue colour), etc.

Fruit and nuts: A variety of dried and preserved fruits and nuts can be used in baked products to produce different types of flavours and colours. Normally raisins, dates, cherry, tutty fruity, pineapple, banana, apple, etc. fruits are used. In addition to fruits, cashew nut, coconut, groundnut, walnut, pistachio nut, almonds, etc. are also used.

Spices: The spices are used comparatively in small quantities in the baked products even though they improve the eating qualities as well as the physical characteristics of the products. Hence they are quite important. A baker can add variety of tastes to the baked products by choosing fresh and high quality spices. E.g. cinnamon, nutmeg and cardamom.

4.3 EQUIPMENTS USED IN BAKERY

Various types of equipments are needed and are used to facilitate the process of baking. Depending upon the use, equipments may be as light or heavy equipments. The light equipments are sometimes called as baking tools.

Always Remember

Baking can be a lot of fun, but without the right equipment, it will only cause a lot of headaches.

a. Weighing balance and measuring utensils:

Weighing balance and measuring tools like measuring cups, measuring spoons, measuring cylinders, pipettes are used to measure dry as well as liquid ingredients.

Weighing balance or generally it is called as weighing scale is a device to measure weight or mass. They are widely used because, they can get calibrated and works with minimum error. Also, a very small quantity of ingredient can be measured with an accuracy of 0.0001g.

Fig. 4.5 Digital weighing balance

Fig. 4.6 Measuring spoons and pan balance

b. Dough and batter mixer:

Mixing is a general term that includes stirring, beating, blending, binding, creaming, whipping and folding. In **mixing**, two or more ingredients are evenly distributed in one another until they become one homogenous product. Each mixing method gives a different texture and character to the baked goods.

Commercially in bakery industry stand mixers are used. Stand mixers are composed of large bowl to contain the material to be mixed and an agitator attached to rotating shaft. The agitators are of different type namely dough hook (bread dough), paddle attachment (batter and icing) and whisk attachment (egg whisking).

Stand mixers are of two type that is spiral mixer and planetary mixer.

In spiral mixer the bowl rotates while the agitator remains steady. It can be used in bread and pizza dough.

In planetary mixer the agitator rotates and bowl remains steady. It can be used for all types of dough, cake batter, whipped cream, fondant icing, etc.

Hook Paddle Whisk

Fig. 4.7 Dough mixer and attachments

c. Baking wares:

Baking wares are food preparation containers, used in various techniques of food preparation to contain and shape the finished product while baking. They are also called as pan or mould. A bread pan is also called as loaf pan. Its function is to shape bread while it is proofing (rising) during baking. The most common shape of the bread pan is the loaf. Cake mould varies in their dimensions, and they are called as cake pan, bundt pan, muffin tins, etc. For biscuits, cookies and other bakery products baking trays and moulds are used.

They are made from a conductive material such as metal which might be treated with a non-stick coating. Generally, aluminum is used as a construction medium because of its high heat transfer capacity. In some cases galvanized tins are used for making baking wares.

Bake wares

Bread pan

Cake pan

Bundt pan

Muffin tray and tin

Fig. 4.8 Different types of bake wares used for bakery products

d. Baking oven:

An oven is a thermally insulated chamber used for the heating, baking, or drying of a substance. The air inside the chamber gets heated by use of coil and by the convection mode of heat transfer it gets transferred to the food material (dough or batter).

Ovens are of two types i.e. batch type oven and continuous band oven.

➢ **Batch oven:**

- They are called as retailer oven
- They are used in small as well as large bakeries.
- Commonly used batch type ovens are deck oven and rotary rack ovens.
- In this oven the trays which contain the food material revolves in baking chamber. The baking chamber is an insulated cubic compartment with a door at front.

a. Deck ovens:

Deck ovens transfer heat to the baked goods by the means of conduction in a static baking atmosphere. Conduction heating is a process in which heat travels directly from a hot stone or deck to the loaf of bread or sheet pan being baked.

Fig. 4.9 Deck oven

b. Rotary rack or fixed rack ovens:

They are convection ovens with forced air circulation. They consist of a chamber that can receive one or more racks with 12-18 trays. The rack of tray rotates during baking. Here, baking is by means of hot air circulating in the chamber. The oven is suitable for the baking of different kinds of bread and pastry products, both of small or medium size. These ovens are not recommended for large loaves.

Fig. 4.10 Rotary rack oven

➢ **Continuous band oven:**

- They are known as wholesaler oven.
- Continuous band ovens are used in the industry where production works for 24 hours.

Fig. 4.11 : Continuous band oven

4.4 BAKERY PRODUCTS

Some of the bakery products with their formulations are discussed below.

a. Bread:

Bread is baked dough that may be leavened or unleavened (*roti, bhakri,* etc.). The bread that we get from bakery shop is leavened bread. The bread dough is leavened by natural leavening agent, i.e. yeast. The yeast acts on carbohydrates of wheat flour and produces CO_2 gas. These gas bubbles get retain by gluten network and get evolved during baking. Upon baking, gas bubbles expand and increase the volume of bread. This gives us cooked, light, aerated and porous product called bread.

b. Cake:

Cake is a mixture of flour, eggs, sugar, butter, and liquid that is baked in the oven in a variety of forms and distinguished by a tender texture and sweet flavour. Cake is categorized as sponge cake and butter cake.

Sponge cakes (or foam cakes) are made from whipped eggs, sugar, and flour. They rely primarily on trapped air in a protein matrix (generally of beaten eggs) to provide leavening, with baking powder.

Butter cakes are made from creamed butter, sugar, eggs, and flour. They rely on the combination of butter and sugar beaten for an extended time to incorporate air into the batter.

c. Biscuits and cookies:

The name biscuit comes from the French word bis, which means twice and cuit which means baked. It is a sweet or savoury dry flat cake with a high calorie content. The raw materials used for biscuit manufacture is flour, sweeteners, shortening, milk, leavening agents and other miscellaneous products.

Cookies were at one time referred to as small cakes or sweet biscuits. The Dutch have provided bakers and confectioners with the word kocke which means small cake. There are

more varieties of cookies than any other baked product, because of the possibility of creating so many different shapes, sizes, textures and flavours.

Activity-1

Formulation for bread:

Ingredients	Amount (g)
Wheat flour	100
Wet yeast	2-4
Salt	2
Sugar	6
Fat	2
Water	60 ml

i. Weigh all the ingredients as per the recipe formula.

ii. Sieve flour with salt.

iii. While using dry yeast dissolve yeast in a solution containing sugar, flour and luke warm water to activate it for about 10-15 minutes.

iv. In case of wet yeast add it directly into dough mixer. Knead the dough into soft and pliable dough.

v. Cover the dough with a wet cloth and leave in a warm place for first profing for about 20 minutes (fermentation).

vi. Knock back (knead lightly) the dough and divide the dough into equal pieces, round each piece and pan it.

vii. Allow to rise upto 3/4th height of pan in a proofing chamber.

viii. Bake at 210°-230°C for 10-12 minutes till get golden brown colour.

ix. Remove from oven, cool and de-pan.

Bread Dough

Proofed Dough

Baked bread

Activity-2

Formulation for sponge cake:

Ingredients	Amount (g)
Wheat flour	100
Fat	100
Sugar powder	100
Baking powder	5
Salt	0.85
Whole egg	100 (2 eggs)
Vanila Essence	2-3 ml

i. Sieve refined wheat flour and baking powder for 3 to 4 times for uniform distribution and air incorporation.

ii. Beat egg with vanilla essence using hand beater or using stand mixer with whisk attachment.

iii. Take fat in a bowl, add powdered sugar in it and beat till it become creamy. Add beaten egg and flour mixture and whisk it to get a light and fluffy batter.

iv. Preheat the oven at 170°C.

vi. Pour the batter into greased and dusted pan and tap the pan on table for 2 times to spread batter evenly.

vii. Bake it at 170°C for 25-30 minutes.

viii. Check for baking with knife (stick test). Cool and de-mould.

ix. Remove from oven, cool and de-mould.

Cake batter

Moulding

Baked cake

Activity-3

Formulation for Cookies:

Ingredients	Amount (g)
Flour	180
Butter	100
Sugar	85
Milk	35 ml
Baking Powder	3.5
Salt	1
Vanilla	1 ml

i. Weigh all the ingredients.

ii. Sieve refined wheat flour and baking powder for 3 to 4 times for uniform distribution.

iii. Take butter and cream it, till it become soft. Add grind sugar and cream it.

iv. Add essence and flour mixture gradually and knead it to get soft dough.

v. Divide the dough and convert them into small balls or of desired shape.

vi. Preheat the oven at 170°C.

vii. Place the dough pieces into greased and dusted baking tray and inch apart.

viii. Bake it at 170°C for 15-20 minutes till light brown colour.

ix. Remove, cool and pack it.

Biscuits

Cookies

Points to remember

- A bakery is a facility that produces and sell flour based baked food items such as bread, cake, pastries, biscuits, cookies, etc.
- Cereal flours are most commonly used basic ingredient of baked goods.
- Depending upon the protein content, wheat flour is classified into two types, hard wheat flour (> 10% protein) and soft wheat flour (< 10% protein).
- Leavening agents are used for formation of CO_2 gas, they are of two type biological leavening agent and chemical leavening agent.
- For baking of products baking oven is used.
- Bread and biscuit are made from dough whereas cake is made from batter.
- In biscuit high amount of fat is used which retards gluten formation that results in hard and crispy texture.

Exercise

Q. 1 a. Select the correct option from given choices.

i. _____ is a protein present in wheat.

a. Casein b. Gluten

c. Leutin d. Zein

ii. Moistening agent includes_____.

a. Water b. Milk

c. Both a and b

d. None of the above

iii. Yeast is a _____ leavening agent.

a. Biological b. Chemical

c. Mechanical

d. None of the above

iv. Cake is baked at _____ temperature

a. 100°C b. 120°C

c. 170°C d. None of the above

v. Paddle attachment is used for,

a. Bread Dough b. Cake Batter

c. Both a and b d. All of the above

b. Match the correct pair.

	A		B
i.	Soft flour	a.	Sodium bicarbonate
ii.	Lecithin	b.	Fresh Yeast
iii.	Baking soda	c.	> 10% Protein
iv.	Cream yeast	d.	Baking
v.	Oven	e.	Emulsifier
		f.	< 10% Protein

c. Do as directed.

i. Select the odd word

Cake, Biscuit, Bread, Paneer

ii. Complete the word

W			S				G

Clue: Beating egg to incorporate air

iii. Unscramble the word?

leinengva

Clue: I am used for carbon dioxide gas formation

Q. 2 Answer the following questions.

i. What is dough and batter?

ii. Define baking.

Q. 3 Write Short notes on the following.

i. Baking oven

ii. Moistening agent

iii. Shortening

Q. 4. Long answer question.

i. Enlist and explain ingredients used in bakery

iii. Give details about equipment's used in bakery

Project :

Prepare a project report after visiting a bakery unit at your place.