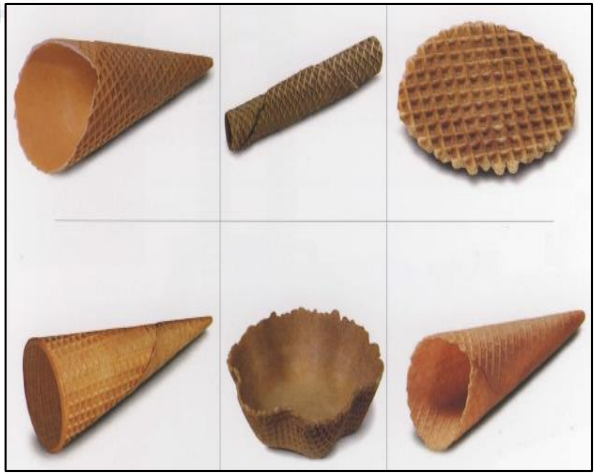
Paper No.: 09

Paper Title: BAKERY AND CONFECTIONERY TECHNOLOGY

Module – 14: Technology of Wafer Biscuits

Technology of Wafers Biscuits



Introduction

- Wafers are low-moisture-baked-foods.
- The primary textural attributes of products are crunchiness or crispness
- Wafers represent a specialized type of light-textured biscuit, generally made from cereals.
- The thin, crisp, precisely shaped wafers are available in variety of shapes including flat, hollow, cones, sticks etc.
- Wafers usually serve as the edible carriers of an added food.
- In wafers starch gelatinization in wafer is quite high.

The characteristics of wafer

1. Wafers are very thin biscuits: thickness lies between 1 and 5 mm
2. The wafer surfaces are smooth and precisely formed with the dimensions, engravings, logos etc.
3. Wafers are cereal based low fat products
4. The product density of wafer ranges from 0.10 to 0.25 g/cm^3 : wafer matrix highly aerated and composed of gelatinized starch
5. Wafers for delicate crisp texture combine well with different types of coatings and fillings like cream, ice cream, foam etc

The classification of wafer

Wafers may be classified in two basic types:

- **No-or low-sugar wafers**
- **High-sugar wafers**

Wafer may be following three types:

- **Plain**
- **Sandwiched**
- **Coated**

Compositional requirement of wafers

Table 1: Compositional requirements of wafers (BIS, 1988)

Characteristics	Wafer types	
	Plain	Sandwhich/ Coated
Moisture, percent by mass, Max	4.5	6.0
Acid insoluble ash (on dry basis), percent by mass, Max	0.05	0.05
Acidity of extracted fat (as oleic acid), percent by mass, Max	1.0	1.0

Ingredients of wafer biscuits

According to BIS (1988) the ingredients of wafer biscuit can be classified in two types: ***Essential ingredients, Optional ingredients***

Essential ingredients: **Flour and Water**

Optional ingredients:

- ✓Baking powder and other leavening agents
- ✓ Chocolate, cocoa powder, coffee extract
- ✓Citric, malic, lactic, tartaric, acetic acid
- ✓Food colours, flavouring essences, flavour improvers and fixers
- ✓Fruit and fruit products
- ✓ Salt, dextrose, liquid glucose and sugar products (gur, jiggery etc.)
- ✓Emulsifying and stabilizing agents agents
- ✓Preservatives and antioxidents, fat and shortenings
- ✓ Milk products and egg products
- ✓Nutrients- vitamins, minerals etc., etc.

Ingredients of wafer biscuits

Table2. Specification for using dough improvers and conditioners

Ingredients	Name	Quantity (g/ kg of flour)
Dough improves	Ammonium persulphate	Max 2.5 g
	Potassium bromate/ Potassium iodate	Max 50
Dough conditioners	Calcium or sodium salt of stearoyl-2-lactylate	Max 2.0
	Polysorbates	Max 2.0

(BIS, 1988)

Wafer oven

- The oven is the heart of the process
- Oven consists of pair of strong metal plates which is latched, immediately after the placing of batter between them
- The flat wafer sheets have thickness of maximum than 2-5 mm
- The baking plates can carry special figures
- The plate pairs are fixed to heavy carriers to support the plates and to keep them rigid
- Wafer baking ovens can contain up to 120 plate pairs with 41-61 plates are most common

Wafer oven

- The plates are heated either directly by gas or by electric heaters and operate at temperatures between 160°C and 190°C
- Deposits of charred oils and sugars build up, blackening the surfaces and causing wafer release problems, regular cleaning is necessary
- cleaning may be needed after about 1000 hours of running, Plate cleaning is best achieved with caustic soda solution
- Modern wafer- baking plates often are surface plated, e.g. with chromium for easier release and reduction of cleaning stops

Role of Wafer Ingredients

Flour

- Gluten strength of flour is a key to finished wafer quality, medium gluten strength is suitable
- Soft wheat flour for biscuit production is preferred
- Flour with protein content between 8.1% and 10.9% gives acceptable wafer sheet, whereas increased protein content (12.8-13.2%) lead to an unacceptable product
- Flour with smaller particle size gives less dense, soft and friable sheet; course flour gives unacceptable and incomplete sheets.
- The water absorption of flour is important, variation in this property affect the batter consistency for any given solids content.

Water

- Water is one of the important parameter of wafer sheet preparation
- Water helps in the distribution of ingredients
- Water also functions as a leavening agent
- Water produce a convenient consistency to flow over cover plates
- The quantity of water added to wafer batter is roughly 150% of flour weight.
- Less water results in thick, heavy and unbaked sheets occur
- Water temperature should be around 20°C to prevent gluten strand formation

Fat and lecithin

- Fat and lecithin are used as release agent
- wafer surface is smoother when fats are present in the recipe
- For convenience, liquid vegetable oils are favoured over solid fats
- Lecithin is a useful addition, it is better to include a fluidized soya lecithin with the fat or oil rather than use powdered lecithin to save cost
- Though, the fat content of wafers is low, the inclusion of antioxidant in the oil is necessary to retard rancidity
- Eggs can serve as a source of both fat and emulsifier (lecithin)

Sugar and milk powder

- Sugar and milk powder added in small quantities to improve quality
- They promote wafer colouring and sticking to the plates
- staling is retarded by incorporation of sugar and crispiness is maintained for longer
- Sugar, when used in ice cream cones, it is necessary to employ specially designed equipments
- Salt is added as a flavour enhancer at a level of 0.25 units per 100 units of flour

Aeration

- Aeration is most important in wafer preparation
- Leavening agents help in development of porous texture of wafers by increasing the number of gas cells in batter
- Sodium bicarbonate and ammonium bicarbonate or a mixture of two can work to create chemical aeration
- Combination of batter consistency and ammonium bicarbonate level is the best way to control batter spread and wafer weight
- Sodium bicarbonate and ammonium-bi-carbonate also affects the final pH and influence the colour development during baking
- High pH of batter retards gluten strands formation which is undesirable

Aeration

- Yeast is added as a means of aeration
- Yeast cells form the nuclei for water vapour production which is important for the formation of a good wafer texture.
- Yeast is now rarely used in batter preparation as batter standing times and multiplication temperatures of yeast are not usually very practical

Other ingredients

- The information about flavouring ingredients of wafer is scanty
- Most synthetic flavours and essential oils are lost in wafer production
- Protein hydrolysates are fairy heat stable and they may be used, although they are prone to colour development

Role of different processing parameter in wafers weight and thickness

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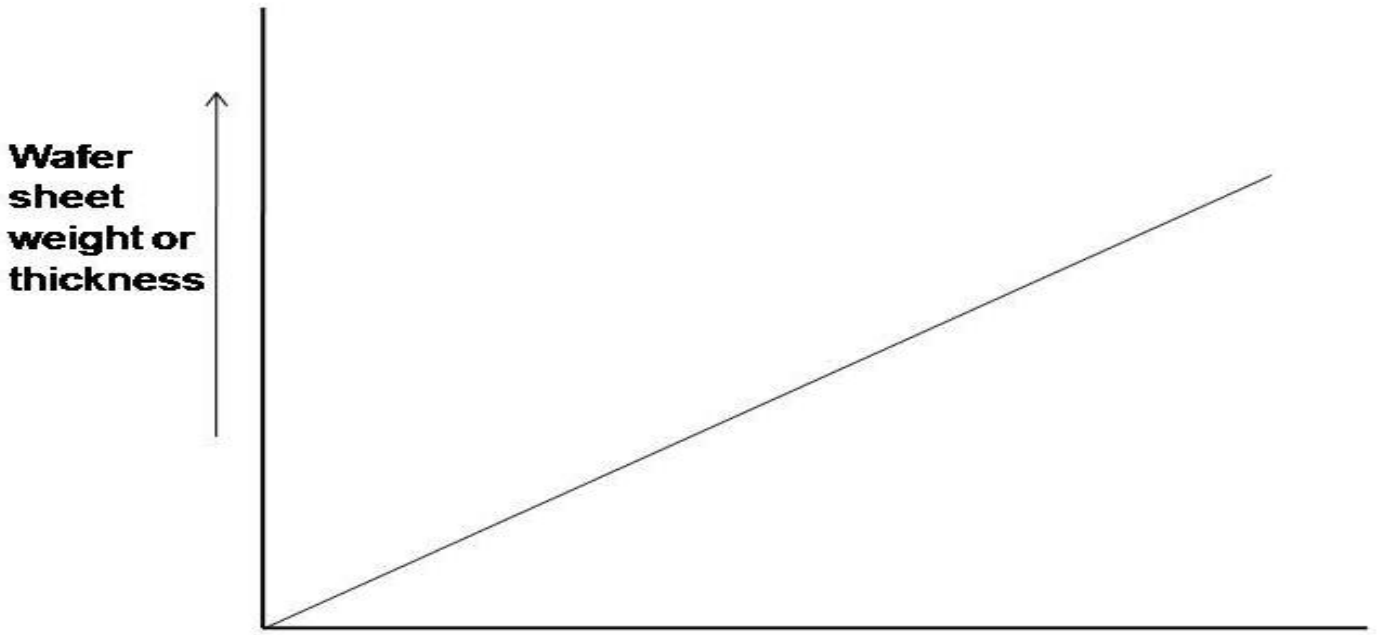


Plate gap setting →

Volume of batter deposit →

Batter viscosity Thin → Thick

Plate closure speed →

Baking speed → (Faster baker implies high temp.)

Role of different processing parameter in wafers weight and thickness

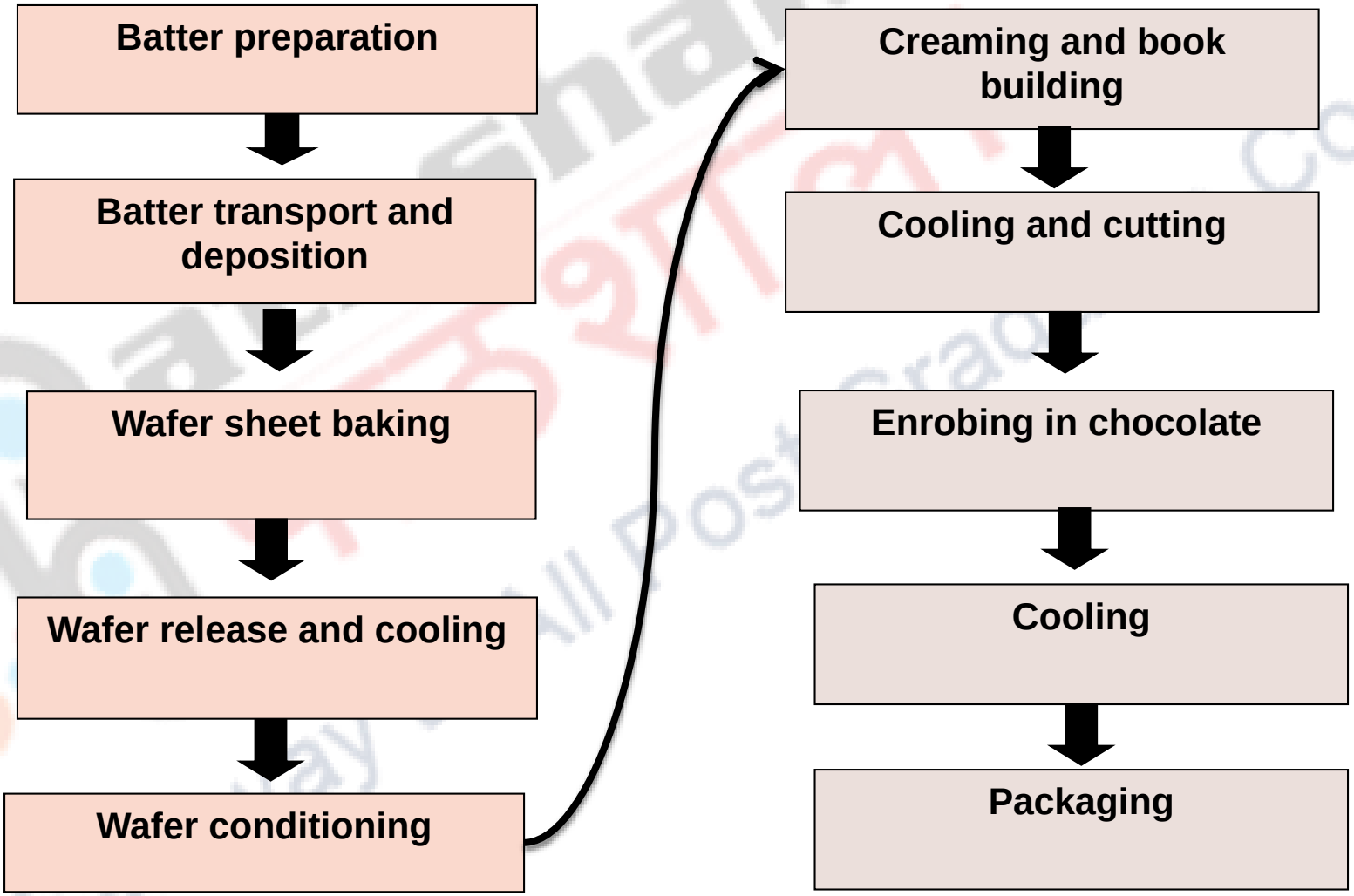
- The increased gaps between the plates increases the thickness
- Higher volume of deposit gave increased sheet weight with excessive waste
- Thick batter gives a heavier, more dense and harder wafer.
- Faster closure gives lower weights and thinner wafers
- Fast baking speeds require high plate temperatures resulting to ‘shelling’ (wafers with extremely fragile centre texture)
- If the drying is more surface burning and sticking may happen
- If heat disposition across a plate is uneven some cracks may occur

Manufacture Technology of wafer biscuits

Wafer batter ingredients (weight parts, flour=100)

Ingredients	Low-sugar wafer	Higher-sugar wafer
Wheat flour	100	100
Water	120-160	100-140
Starch	0-12	0-5
Sucrose	0-4	25-75
Oil/ fat	0.5-2.0	1-6
Milk powder	0-2	0-2
Soy lecithin	0.2-1.0	0.2-1.5
Salt	0-0.6	0-0.6
Sodium bicarbonate	0.1-0.5	0-0.3

Flow diagram of wafer biscuits preparation



Batter preparation

- Wafer batter is prepared by mixing the water-soluble components followed by addition of farinaceous ingredients.
- The batter should be of homogenous nature containing about 35-40% dry matter.
- Appropriate mixing is necessary for to achieve a homogenous suspension, 4 min time is required
- The viscosity of batter should be low enough to flow over and cover the oven plate.
- The high viscosity results in undesirable quality of wafer.
- The desirable quality wafers are made from a fluid batter with a viscosity in the range of 300-2000 mPs.

Wafer preparation

- The batter is transferred after preparation into intermediate tank, from where it is pumped to the oven and spread on to baking plates.
- The baking of wafer sheets is done in wafer oven at 160-190°C. The baking times ranges between 1.5 and 2.5 min.
- At the end of the baking operation the baked sheets are released and cooled.
- Wafers are passed to a conditioning unit, where the moisture content of the sheets is increased to achieve some stability in texture and size of the wafer.

Wafer preparation

- The wafer sheets are passed to the creaming station, where creaming is done at temperatures of 30-40°C.
- Coated sheets are built up into piles to create 'book'.
- The wafer books pass into a cooling tunnel to set the cream.
- The cooled books are cut into desired sizes by application of taut wires, blades or circular saws.
- Laminated or specially coated films are used for wafer packaging in flow packs, boxes and bags.
- The wafer biscuits have be to protect against humidity, oxygen and light to insure a shelf life of 6-9 months.

Molded Wafer Cones

- The molded wafer cones are ‘hollow’ wafers in shape of cups and fancy shapes
- They are mainly of two types, a) No-or low-sugar cones, generally known as ‘cake cones’ b) molded sugar cones
- Low-sugar cones are generally similar to those for sheets and contain an intermediate sugar content, below 20 parts of sucrose for 100 parts of flour
- ‘Rolled sugar cones’ are the product containing more than 20% concentration of sucrose or other sugars in finished product
- Rolled wafer sticks are hollow tubes with walls consisting of very thin multiple layers, the layers do not carry a wafer pattern and are ~0.5 mm thick.

Innovations in Wafer-manufacturing equipment

Vertically stacked oven

- The oven with vertically stacked baking plates, requiring less floor area is innovated. The weight of the stacks eliminates the need for hinges as compared to traditional oven.

Low-emission oven

- Ovens with “low-emission” heating concept together with a 60% reduction in energy consumption has come into operation. Application of induction heating and use of ring is the main key of the instrument. Reduction in energy consumption with consistent product is the main output.

Further reading

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