



FOOD CHEMISTRY

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Type of flours

for bread making and confectionaries
and
influence of additives

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- The term **baking** is usually applied => **flour-based** foods => wheat, oats, maize and sorghum => have a relatively long shelf life.
- **purpose** of baking :
 - change **eating quality** of the staple ,
 - add **variety** to the diet,
 - a means of **preservation** => extending shelf life => removing **moisture** and inhibiting **enzymes and bacteria**.
- **bread and pastries** => a shelf life of **2 to 5 days** and
- **biscuits and some cakes** have a shelf life => **several months** => correctly packaged.

- During baking => food => heated by the hot air in the oven.
- Moisture at the surface => evaporated by the heat and a dry crust forms. Biscuit production => slower heating => moisture is also lost from the inside of the product.
- Baked goods are produced => either doughs or batters => a mixture of flour and water made by => mixing / beating / kneading / folding.
- processing method depends => ingredients being used, and the product being made.
- All baking => wheat flour and many other ingredients are used => each of which => different effects on the final product.

Flour

- **flour** refers => powder obtained => grinding a cereal grain.
- Flours => different wheat varieties => vary in **protein** content.
- Flours => good for bread making (**good loaf volume**) => obtained from wheat => **high protein** contents (12-14%).
- **Good bread making** wheat => described as '**hard**'.
- Hardness is related => **degree of adhesion** b/w starch and protein.
- Hardness and softness refer => the **way** in which the endosperm **breaks down** on milling.
- In **hard wheat** => fragmentation of **endosperm** tends to occur **along the lines** of the cell boundaries, whereas
- endosperm of **soft wheat** fractures in a **random way**.

- **Hard wheat** yields => coarse, gritty flour
- **Soft wheat** give => very fine flour
- strength of wheat relates to => its **baking** quality.
- **Hard wheat** produces => large loaf volume and good crumb structure
- **Hard flour** dough => more elastic and more resistant to stretching than **soft** flour dough.
- **Bread flour** should form => **good gluten** when mixed with water => bread with a **good volume** when baked.
- **Soft wheat flour** (protein < 10%) => good for **biscuits and cakes**.
- **Biscuit flour** => dough having **more extensibility**, but less resistance than bread dough.
- They form => only a **small loaf** with **coarse crumb** structure.

Characteristics of good cake flour

- medium-strength flour => from **soft low-protein** wheat of **low α -amylase activity** and **very fine** in structure.
- purpose of flour => allow **an aerated structure** to be retained after the cake has been built up.
- **stability** of the final cake depends => on presence of uniformly **swollen starch granules** => hence => starch granules => **undamaged** during milling, be free from **adherent protein**, and be **un attacked** by **amylolytic enzymes**.
- **low-protein** flour (7-9%) => **soft and tender** cakes.
- flour must be **chlorinated** => cakes with **higher sugar**
- Good milling => achieve these characteristics, but wheat => **appropriate quality**.

Characteristic and general quality of flour depends on:

- **variety** and **conditions** under which the wheat has grown.
- affects => quality and quantity of **gluten** in the grain.
- **milling processes**
- determines => **degree of separation** of the bran & endosperm and **particle size** of the flour => important factor in cake flour.
- **additives** and **special treatments** used => produce flour mixes with **special characteristics**.

Yeast

- *Saccharomyces cerevisiae* => strain used in baked products
- After addition => to dough (pH 4-6 and temperature 30°C) => yeast begins to feed on the starch in the mixture => forming **sugar, alcohol** and **carbon dioxide** {dough to expand ("rise")}
- dough must be "kneaded" **thoroughly** => to **distribute bubbles evenly** and then => left to rise again => usually to about double its original volume
- If mixture is left => **too long** => **acid produced** by the oxidation of the alcohol => product to taste sour.

Chemical Leavening Agent

- most important chemical agent => **1. baking powder**
- a mixture of **NaHCO₃** and a **weak solid acid** or acid salt
- when mixture dissolves in water and the temperature is raised:
- $NaHCO_3 + H + (\text{from the acid}) \rightarrow Na^+ + H_2O + CO_2$
- most common acids used are **potassium hydrogen tartrate**, **tartaric acid**, **acid calcium phosphate**.

- When **baking powder** is used rather than baking soda alone => by-products => **less alkaline** than Na_2CO_3 and => have no undesirable effects on => **taste** of the product.
- **type of acid** used in the baking powder => affects the rate of CO_2 production => affects the product.
- In baking => **rate** at which CO_2 is produced and **continuity** of CO_2 production => both important.

- **Baking powder** is a very widely used ingredient in cooking and baking.
- **Self-raising flour** has also become popular in recent years
- is merely **high-grade flour** => to which baking soda and a suitable acid (such as cream of tartar) have already been added.
- **2. Baking soda** (sodium bicarbonate) is also used as leavening agent. It has the property of releasing CO₂ when it is heated:



- When used on its own => **only half** the available **CO₂** is released
=> **sodium carbonate** produced => **strongly alkaline** => baked product => **bitter, "soapy"** taste and **yellow** colour.
- During **digestion** of such products => **Na₂CO₃** reacts with **HCl** in stomach => **produce the other half of the available CO₂**.
- Sodium bicarbonate => **very rarely** used on its own => mixed with some acidic material.
- To **avoid** an **imbalance** between the **acidic and basic** materials, i.e. an incorrect pH => **baking powder** => more commonly used.

Fat

- number of functions in baking.
- weakens or 'shortens' a dough by weakening its **gluten network** => resulting in the baked product => being **softer**, **breaking easily** and having a more **tender mouthfeel**.
- can **trap air** during beating and mixing => batter that consists of **masses of tiny air bubbles** trapped within droplets of fat => these air bubbles expand during baking => forming a **light, airy structure**.

- In puff pastry => fats => which are **soft over a wide temperature range** are used => spread between pastry layers and will separate them during cooking giving a layered pastry.
- fats should have => bland flavour => to prevent them from changing the flavour of the finished product
- occasionally fats are chosen => on the basis of their flavour => **butter** for particular baked goods and **lard** for meat pie pastry.
- fat => able to form an **emulsion** with the other ingredients in the batter or dough.

Sugar

- undergoes a series of **complex browning reactions** above 160°C => products of these => form the brown crust of many baked goods.
- reactions => are essentially amino acid - catalysed caramelization reactions => in which a sugar aldehyde or ketone is converted => to **unsaturated aldehyde or ketone**.
- 0.5 - 0.75% w/w of sugar => **increases rate of fermentation** for **fermented goods** (breads) => by giving yeast more sugar to work on.
- large quantities of sugar can be added => **non-fermented goods** => biscuits => **improve the keeping quality** of the biscuits as well as sweetening them.

Ascorbic acid (vitamin C)

- Addition => small amount (up to 100ppm) => **shortens** the time needed for dough to mature.
- ascorbic acid catalyses => gluten cross linking reactions => to form a **more extensible, elastic, strong network**.

Egg

- important ingredients => wide range of bakery products.
- improve => **physical and organoleptic** properties of products
- Beaten egg white => give the dough a **light, airy texture**
- can be used as **emulsifiers, moisteners** and a **source of fat** and all the **essential amino acids**
- improve => **cell structure** of the product => maintain it during baking process and **reduce** the moisture loss from the baked product

Salt

- enhance flavour of cakes and breads
- "toughen up" the soft mixture of fat and sugar
- has retarding effect on yeast fermentation.
- In its absence => fermentation takes place very rapidly and the dough is too sticky to knead properly => resulting in the coarse texture of the baked bread.

THANKS