

Knowledge Organiser

Food & Nutrition

Topic: Food Science Functions & Faults in Cooking



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Protein

Proteins denature = bonds holding them break down and unravel. This is usually irreversible. **3 ways of denaturing: physical, heat & acid.** After denaturation, coagulation can occur.

1. **Physical** – Whisking & Kneading
*Whisking – foam – proteins stretch, air gets trapped (aeration). (i.e. meringue) Over whisking = foam collapses.
*Kneading – gluten (a protein) is formed when flour is mixed with water. Gluten are coils, which can stretch and bend = elasticity (stretchiness)



2. **Temperature** – cooking/heat denatures protein

3. **Acid** – i.e. Marinate in lemon juice to denature protein and tenderise



Coagulation – Water traps within i.e. egg, steak
Over cook = tightens the strands and water squeezes out.

Maillard Reaction – Reaction between protein and sugar in heat (dry) = colour & flavour e.g. roast meat



Faults

To know the fault, you need to consider the function of the ingredient

Flour

Function: Bulk & volume in baking and thickens
Too much – Stodgy & dry
Too little – Lacks bulk, volume, soft & runny mixtures



Fat

Function: Favour, moisture, colour, traps air
Too much – Greasy, rubbery doughs/mixtures
Too little – Dry, lack flavour



Sugar

Function: Flavour, colour, texture (crisp)
Too much – Too brown, over sweet, crisp and brittle
Too little – Poor flavour, may lack volume and be dry



Egg

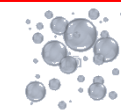
Function: Colour, flavour, sets & aerates
Too much – Eggy flavour, dense texture
Too little – No coagulation so doesn't set enough, mixture too dry.



Liquid – Too much or little affects consistency – too runny or too dry

Raising agent

Baking powder, yeast
Too much – Cakes can crack, or rise too much then collapse, or spill over tin
Too little – Dense texture, flat and not very well risen.



Common Cooking Mistakes

Cooking temperatures incorrect

- Opening oven door or not preheating – cakes can sink
- Placing pasta/rice in the pan of cold water – start in boiling
- Frying in cold oil – the food absorbs the oil



Inaccurate Measuring

-Vital when baking – it is like an experiment. Ratios are important i.e. adding too much water to a pastry – affects ratio of flour to fat.



When using pans

Overcrowding in pans leads to uneven cooking & affect on textures
Not using lids can dry out a food as water evaporates.
Sauces need to be constantly stirred to avoid lumps or sticking to pan.



Overworked pastry

Shortcrust pastry should not be overworked as it can develop the gluten – it should be a short texture.

Carbohydrates

Starch

Gelatinisation – thickening of sauces i.e. béchamel
Starch in a liquid (i.e. Flour in milk)
At room temperature, starch is suspended – sinks unless stirred
When heated, bonds of the starch molecule break, water enters & swells
At around 60-80C, the molecule swell so much that they burst & starch strands are released = thickens
Cools and solidifies into a gel – useful for set desserts/custard
Also happens to pasta and rice – starch released into water



Dextrinisation
Starch breaks down into smaller molecules (dextrins) (Bread, biscuits)
Cooked with dry heat i.e. toasting/baking = brown, crisp & adds flavour



Sugar

Caramelisation
Sugar breaks down at high temperature – turns brown & adds flavour
Goes runny, then to caramel, eventually to hard /candy.
Adds sweetness to desserts (crème brulee, apple crumble etc)
Occurs in savoury food as well – i.e. Sugars in onions break down



Maillard Reaction –
Reaction between protein & sugar in heat (dry) = colour & flavour
e.g. roast meat

Raising Agents

Chemical

Bicarbonate of soda – co2, rise
- alkaline and soapy – needs a strong flavour
Baking powder
Mixture of bicarbonate of soda (alkaline) & cream of tartare (acid)
Neutralises & makes less soapy
Self raising flour – Combination of baking powder & plain flour



Biological

Yeast (microorganism) – used in bread
Fermentation: Yeast produces alcohol + CO2 gas
Bread is left to 'prove' where this occurs and co2 is trapped in gluten.
Process stops in oven as yeast is killed & alcohol is evaporated



Steam

High liquid content is needed, steam raises the mixture then it is turned into a solid (Batter, puff and choux pastry)



Mechanic – by physically adding

Folding (folding a liquid over itself in a bowl) & folding pastry layers
Beating – spoon or fork (eggs & sugar in bowl)
Whisk – Sieve - Creaming Method

What might be asked in an exam?

Grade 1-3: Explain the basic function of ingredients, with no key terms
Grade 4-6: Explain all functions of ingredients, with key terms
Grade 7+: Rectify cooking mistakes by explain functions of ingredients. Explain the effects of changing ingredients and conditions such as pH and oxygen.



Useful sites

Enter the URLs into your browser or scan the QR code.

Coagulation: tinyurl.com/y9txocfa
Caramelisation: tinyurl.com/y7oyhd4y
Gelatinisation: tinyurl.com/yc3zcsqw
Emulsification: tinyurl.com/yd4noyek
GCSEPod: tinyurl.com/yaucs54u



Fats & Oils

Aeration – incorporating air
When fat is beaten with sugar (i.e. cakes)
In creaming method, air is trapped in the fat and sugar = fluffy & light



Plasticity – ability to spread and be moulded (hardness at room temp)
Fats contain triglyceride (3 fatty acids & one glycerol)
Different triglycerols melt at different temperatures.
Higher plasticity = easier to spread.
Unsaturated = high (liquid), Saturated = low (solid)
Useful: i.e. Solid – buttercream, rubbing in, spreading butter



Shortening
Rub fat into flour, give flour a waterproof coating
Prevents long gluten molecules forming – 'shortening' = can't become stretchy = SHORT texture (firm and crumbly)



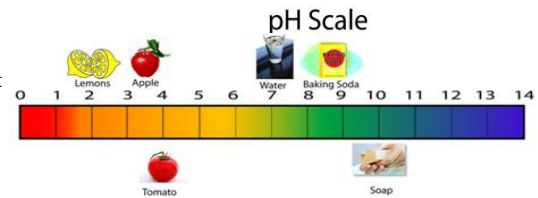
Emulsification
An emulsion – oily & watery liquids
Mixes when stirred then separates out – known as 'unstable'
Some foods we need them to be mixed – to be 'stable'
Add an emulsifier for this (lecithin in egg yolk – mayonnaise, Hollandaise)
Hydrophilic and hydrophobic ends mean they do not separate.



Effect of pH & Oxygen

pH

Acid. Uses:
Marinates foods & tough meat
Softens meringues
Used in production of cheese
Preserves food
Cooks fish i.e. ceviche
Stops enzymic browning



Alkali. Uses:

Raising agent (bicarbonate of soda)
*Needs neutralising with cream of tartar - stops soapy flavour

Oxygen

Fruit & Veg: Causes enzymic browning (oxidisation)
Meat & poultry: Red colour in meat (myoglobin) reacts & turns brown
Fats & oils: In oxygen, turns rancid, unpleasant colour, smell & flavour
Need to reduce oxygen contact with these foods by wrapping foods.



Key Words

Denature - a process where proteins lose the structure, by application of heat, acid or external stress
Elasticity – 'stretchiness' - the ability to resume its normal shape after being stretched /compressed;
Marinate - to put meat/fish in a sauce for a period of time - add flavour & makes the protein more tender
Coagulation – when denatured proteins join together, changing from a liquid to a solid
Maillard reaction - chemical reaction between protein & sugar that gives browned food its distinctive flavour.
Gelatinisation – when starch molecules swell and burst to thicken a sauce
Suspension - is when a solid is held in a liquid. The solid may sink if the mixture is not stirred
Gel – when a gelatinised sauce sets on cooling useful in desserts such as custard.
Dextrinisation - the browning of starch foods by dry heat - the breakdown of starch into dextrin's
Caramelisation - the browning of sugar, resulting in a sweet nutty flavour and brown colour.
Plasticity – how easily a fat can be spread. i.e. Butter compared to oil.
Emulsion – mixture of oil and water which do not mix.
Emulsifier – an addition to an emulsion which enables the oil and liquid to be mixed.
Aeration – air added to a mixture to make it lighter i.e. Meringue, cake sponge, yeast in bread
Shortening – adding fat to flour, coating the flour to make it crumbly.
pH – how acidic or alkali a food is.
Enzymic browning - chemical process (browning) which occurs in fruits & vegetables by an enzyme in oxygen.
Raising agent – something added to a food to create gas bubbles which makes a food rise. i.e. Baking powder.
Fermentation – process where yeast converts sugar, present in the flour, into carbon dioxide & alcohol. Bread rising.