

Food spoilage and contamination. Micro-organisms and enzymes 3.1.1 Signs of food spoilage 3.1.2

Key words:

Catalyst: a substance that speeds up a chemical reaction

Contaminate: making food unsafe to eat by allowing it to come into contact with micro-organisms that will grow and multiply

Enzymes: Natural substances in living things that speed up chemical reactions.

Food poisoning: an illness caused by eating food contaminated with micro-organisms

Food spoilage: food made unfit + unsafe to eat

High risk food

Perishable): Foods containing protein, moisture, requiring refrigeration. These easily support the growth of micro-organisms e.g. pathogenic bacteria. E.g. meat, fish, milk, cream, eggs)

Micro-organisms: tiny forms of life **only** visible with a microscope

Micro-organisms are found in many places. They **spoil** food as they make it unsafe to eat because it is contaminated with their **waste products**; the **toxins (poisons)** they produce and their physical presence. 3 groups spoil food and cause **food poisoning**: **yeasts, moulds, bacteria.**

To grow and multiply they need:

- The right **temperature**: 37°C is ideal. At 0 – 5°C they multiply and grow **BUT** slowly. If **too hot** they will be destroyed.

- **Food.** Nutrients are needed for growth.

- **Moisture** i.e. water is needed for all biological processes. If there is **no** water/moisture they cannot grow/multiply. If water is removed e.g. drying; adding high concentrations of sugar or salt (where the water from the cells is removed by osmosis).

- Time. Bacteria multiply every 10 – 20 minutes (in the right conditions) by **binary fission**.

- The right amount of acidity/alkalinity (pH). If too **acidic** or **alkaline** micro-organisms cannot grow. Preserving food in vinegar is a method of preventing micro-organisms from multiplying.

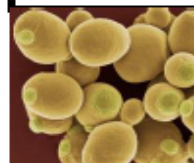
- Micro-organisms (especially bacteria) grow easily in **high risk** (or perishable foods). These will spoil quickly and are most likely to cause food poisoning because bacteria and other micro-organisms can grow and multiply very easily and quickly in them.

- They have the right conditions for their growth: nutrients (especially protein) and water/moisture.

- These types of foods spoil very quickly and must be refrigerated, cooked thoroughly and eaten within a few days.

Signs of food spoilage include:

- mould growing on the food
- bruising of fruit
- change in the colour of the food
- loss of water/shrinkage
- sprouting in potatoes
- change in texture e.g. slime, hardening, graininess and development of an unpleasant taste
- food curdling
- milk that has separated.



There are a number of ways in which food can spoil.

Enzymes are natural substances (mostly proteins) found in foods and all living things. They are biological catalysts, which means they have the ability to speed up chemical reactions.

Ripening caused by enzymes: Enzymes cause foods such as fruits to ripen. Fruit ripens because the enzymes in the fruits have caused chemical reactions changing the texture, flavour and aroma of the fruits. The sugar content increases.

Browning caused by enzymic action: Plant cells contain storage vacuoles (spaces) in the centre, which contain a variety of natural substances. Around the outside of the vacuole is cytoplasm which contains substances called **enzymes**. When broken open, the enzymes in the cytoplasm and O₂ from the air mix with the substances in the vacuole = **oxidation** which results in colour change e.g. brown apples; black bananas.

Mould growth on foods: Moulds are a type of micro-organism which contaminate food by growing and multiplying on it (if the conditions are right). They are air borne spores. Lots of types exist. Moulds send out tiny spores that land on food and germinate. The germinated spores send down roots into the food (the roots are called **mycelium**), which will send up thousands of shoots with a fruiting body on each. These are small, blue-green lumps in a softened area with a white appearance like lace. The waste products from the mould can cause food poisoning. They may be harmful (toxic), so even if the visible mould is scraped off, there may still be waste products present

Yeasts: Spoil foods that contain sugar e.g. fresh and dried fruits (e.g. grapes, apples, strawberries). They settle on food multiply and grow by 'budding' then ferment the sugar to produce CO₂ gas and alcohol. This shows as pale brown, spots on the skin of the fruit, which becomes brown and mushy as the yeast continues to grow. Needs sugar (in food), right temp. (25-37C), moisture + time

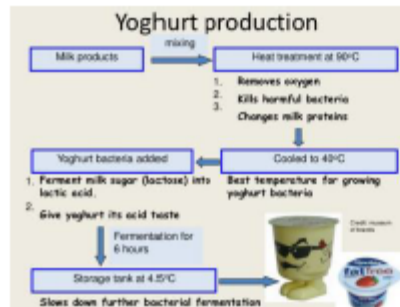
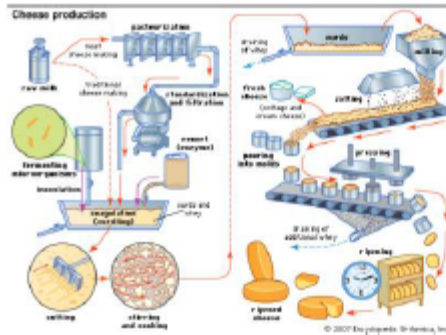
Micro-organisms used in food production. 3.1.3

Key words:

Homogenisation: Prevents the fat in the milk separating out forming a layer of cream on the surface. The fat droplets are forced through fine sieves to break them up. **Pasteurisation:** Heating raw milk to 72°C for 15 seconds to kill pathogenic micro-organisms.

Pathogenic: Harmful micro-organisms, e.g. bacteria/moulds causing food poisoning.

Non-pathogenic: micro-organisms that do not cause food poisoning.



Micro-organisms used in cheese production

1. Milk is **pasteurised**. Because it is a perfect food for bacteria to grow in. Pasteurisation destroys the pathogenic bacteria .
2. **Bacteria culture** is added. This turns the **milk sugar (lactose)** into **lactic acid**. This **coagulates milk protein**; adds flavour, **texture** and acts as a **preservative**.
3. An **enzyme** (rennet) is added. This **clots (coagulates)** the milk proteins. = **curds** and **whey**.
4. The curds are cut to release the watery whey
5. The whey is collected and drained. It is used to manufacture baked products as 'whey protein'
5. The **curd** is piled up to release more whey.
6. The **curd** is heated and cut to develop texture.
7. The cheese is then salted (as a preservative and flavouring) and pressed. It is then ripened. This **matures** the cheese. The **longer** it is ripened, the **stronger** and more **mature** the cheese. **In blue veined cheese e.g. Stilton** the spores of special moulds are added at stage 2. These germinate (stage 7) as the cheese ripens which adds blue veins and a particular flavour.

Micro-organisms used in bread production

A special non pathogenic baker's yeast is used. Given the right conditions of warmth, moisture, food (sugar or starch) + time, it breaks down the starch in the flour, adds flavour and produces CO₂ gas bubbles, which make the dough rise. (**Fermentation**). It also produces alcohol, which adds flavour and escapes in the oven.

There are 3 types of yeast: fresh, dried and fast acting. Fast acting contains ascorbic acid which speeds up the process of bread making.

Micro-organisms used in yogurt production

- Yogurt is made from milk that has been heat treated (to destroy pathogenic bacteria). Whole, semi and skimmed are used.
- The milk is homogenised to give a smoother texture. It is then **pasteurised** 85°C to 95°C to destroy micro-organisms.
- It is cooled to 42°C = the right temperature for bacteria to grow and ferment the lactose in the milk. (Two types of non-pathogenic bacteria are used as a **culture**).
- The mixture is **incubated** (held at a temperature of 37°C to 44°C) for 4 – 6 hours.
- The bacteria ferment the lactose sugar in the milk and produce lactic acid. (The lactic acid denatures and coagulates the milk proteins, which makes the milk become semi-solid in texture). 0.8 to 1.8% of the bacteria become inactive but are still alive.
- The pH is measured = 4.5°C.
- The lactic acid and other natural substances that are produced give the yogurt its distinct, traditional flavour.
- The milk is cooled to 4.5°C to stop the bacteria growing = natural 'live' yogurt. This is **not** pasteurised.
- Other yogurts are then pasteurised to kill any bacteria.
- Fruit and/or other flavours are added.
- It is then packed, sealed and transported to the consumer.