Edexcel International AS Biology

Your notes

Plants & Conservation

Contents

Your notes

Substituting Oil-Based Products

- **Sustainability** refers to the use of resources in such a way that the requirements of the **current generation** are met **without depleting** these resources for future generations
- This requires the use of **renewable resources** - which can be used without the resource running out
  - An example would be **solar energy** - it will not run out in our lifetime as the sun will continue to shine every day for several billion more years
- **Fossil fuels** are an example of a **non-renewable** resource, as they could potentially run out if we use them too fast (since it takes millions of years for fossil fuels to form)
- **Sustainable practices** are those that minimise the damage done to the environment and its resources, to ensure that there will be something left for the next generation
  - An example would be **replanting trees** after logging
- **Unsustainable practices** are limited by a finite supply of resources
  - An example is the use of fossil fuels to make **oil-based plastics**

Plant fibres and sustainability

- Using **plant fibres** to make products such as ropes and fabric is **more sustainable** than using oil-based plastics
- **Less fossil fuels** are used and plants can be **replanted** for the next generation
- Plant fibres are **biodegradable**, unlike most oil-based plastics, which means the products made from these fibres can be **broken down by microbes** to minimise environmental pollution
- Extracting and processing oil is an expensive and difficult procedure compared to growing and processing plants, making plant-based products **easier** and **cheaper** to produce in developing countries
- However, the ropes made from plant fibres are typically not as strong as plastic ones

Starch and sustainability

- Plants store excess sugars as **starch** in their cells
- Starch can be used to make **bioplastics** which is **more sustainable** than making oil-based plastics
- It does **not require as much fossil fuels** to be burned to produce them and the crop plants can be **replanted** (renewable resource)
- Starch can also be used to make **bioethanol**, which can be used as a fuel for vehicles
- Using starch to produce biofuels is **more sustainable** than producing them from oil

Bioplastics

Your notes

- Bioplastics are made from **biological polymers** e.g. starch and cellulose
- There are multiple benefits to using bioplastics as a suitable replacement of traditional plastics
  - **Sustainability**: starch and cellulose are plant based materials which can be replaced at a sustainable rate; unlike oil based plastics which are made from non-renewable fossil fuels
  - **Biodegradable**: since bioplastics are made from biological material, it can be broken down by microorganisms; unlike oil based plastics which is generally not biodegradable
    - This could potentially decrease the amount of plastic pollution that is currently having a detrimental effect on the environment
- Currently, there are several different types of bioplastics in use
  - **Cellulose-based plastics** are made from wood pulp and are mainly used as food wrappers (e.g. cellophane)
  - **Thermoplastic starch** which is a mixture of starch and other compounds, such as gelatine, to create a smooth and shiny plastic
    - This has been used with great success in the pharmaceutical industry to create easy to swallow capsules that contain drugs
  - **Polylactic acid** (PLA) produced from maize or sugar cane and have properties similar to polyethene
  - **Poly-3-hydroxybutyrate** (PHB) which is made from products of the sugar industry and used in ropes, bank notes and car parts
- Bioplastics can be **burned** once they are no longer used to avoid the production of methane during decomposition
  - Methane is a much **more potent** greenhouse gas than the carbon dioxide released during combustion
  - An added advantage to burning is that the energy released can be utilised to **generate electricity** and produce **more bioplastics**
- There are **several challenges** concerning the use of bioplastic
  - They **do not** always have the same **useful properties** as oil based plastics
  - Bioplastics are **more expensive** than oil based plastics
  - Using **limited food crops** to produce plastics (which do not feed the hungry) is a controversial subject in some parts of the world

Your notes

Roles of Water & Ions in Plants

- Plant cells perform a variety of different functions
- In order to perform these functions efficiently, the plant requires **water** and **inorganic ions** (minerals)
- They are absorbed through the **root hairs** on the root and travel up the stem in **xylem vessels**
- A plant will show certain **symptoms** (e.g. yellow leaves, stunted growth) when there is a **deficiency** in any one of these substances

Water

- Important component required for **photosynthesis**
- Provides a **transport medium** for minerals
- Maintains **turgidity** in plant cells though pressure in cell vacuoles
- **Regulates temperature** - to ensure that enzymes can function at their optimum rate

Magnesium ions

- Important requirement for the **production of chlorophyll**
- This provides the green colour of stems and leaves and is essential for photosynthesis

Nitrate ions

- Without nitrate ions, the plant would be unable to **synthesise DNA**, **proteins** and **chlorophyll**
  - **Enzymes** are important proteins for which nitrate ions are needed
- These molecules are essential for **plant growth**, as well as the production of **fruit** and **seeds**

Calcium ions

- These form important **cell wall components**
- Plants require calcium ions for proper **growth**

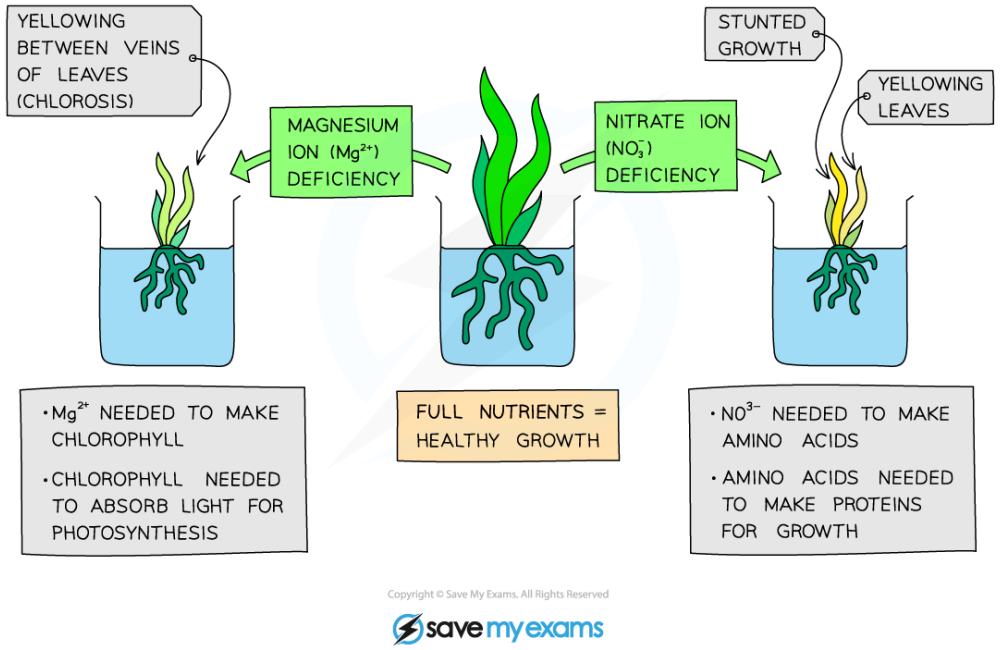

Diagram showing the importance of magnesium and nitrate ions for plants

Your notes

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Determining the Tensile Strength of Plant Fibres

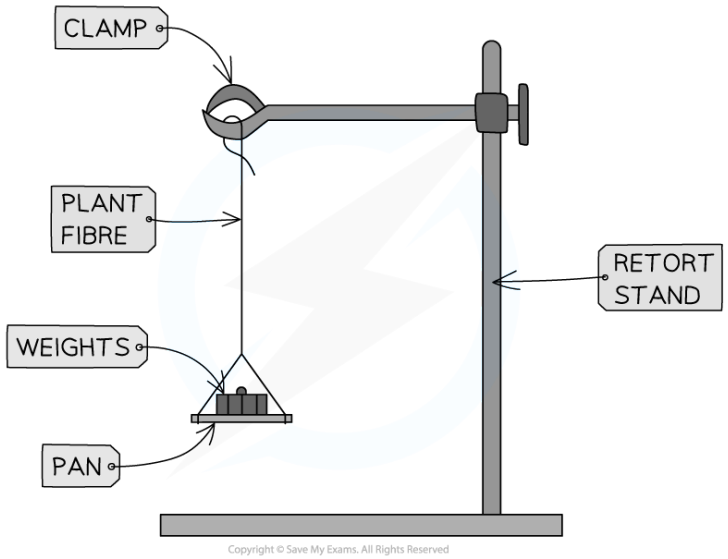
- The **tensile strength** of a fibre refers to the **maximum load** it can carry **before breaking**
  - For example, this information would be important when determining the strength of a rope made of plant fibres

Apparatus

- Plant fibres
- Retort stand (clamp stand)
- Clamp
- Weights

Method

1. The fibre should be attached to a **clamp stand**
2. Attach a **weight** on the other end of the plant fibre
3. Carefully continue to **add one weight** at a time until the **fibre breaks**
4. **Record the mass** at which the fibre **broke**
5. This represents the **tensile strength**
6. To increase the **accuracy** of your results, this process should be **repeated** with more samples of the same plant fibre
   - These values can be used to **calculate the mean** tensile strength for the fibre
   - It is important to ensure that the fibres are all of the **same length** and that all other **variables are kept constant**



Apparatus used to determine the tensile strength of plant fibres

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