Explore an Issue: Hemp (Hemp Fibre) in Canada

Teacher Resource

Course: Grade 11 University Biology

Ontario Curriculum Expectations

Overall Expectations

F1. evaluate the importance of sustainable use of plants to Canadian society and other cultures;

Specific Expectations

Relating Science to Technology, Society, and the Environment

F1.1 evaluate, on the basis of research, the importance of plants to the growth and development of Canadian society (e.g., as a source of food, pharmaceuticals, Aboriginal medicines, building materials, flood and erosion control; as a resource for recreation and ecotourism) [IP, PR, AI, C]

Developing Skills of Investigation and Communication

F2.1 use appropriate terminology related to plants, including, but not limited to: mesophyll, palisade, aerenchyma, epidermal tissue, stomata, root hair, pistil, stamen, venation, auxin, and gibberellin [C]

Activity Duration: Approximately 45 minutes

Teacher Notes

This activity should be completed at the end of the strand Plants: Anatomy, Growth, and Function. Students may not have an extensive background in carbohydrates so some background has been provided.

Hemp fibre has been use for thousands of years. In Canada it has had an interesting history. In recent years there has been resurgence in growing hemp in Canada. In this investigation we will explore the components of hemp, the history hemp in Canada and its uses.

Background

Carbohydrates are a class of chemicals that includes sugars, starch and cellulose. The simplest carbohydrates have the chemical formula $C_nH_{2n}O_n$. Where n is three or greater these are known as monosaccharides. Examples of monosaccharides include glucose and fructose. Disaccharides are made up of two monosaccharides. Examples of disaccharides include sucrose (table sugar) that is made up of two linked glucose molecules, and lactose (found in milk) made up of glucose and galactose. Mono and disaccharides that are small and water soluble are known as sugars.

Starch is a very large carbohydrate made up of many glucose molecules linked together. Starch is produced in all green plants, and used as a reserved supply of food. Foods high in starch include bread, rice and potatoes. Starch is broken down in by our bodies to generate energy.

To see diagrams illustrating these chemicals:

- http://www.ausetute.com.au/sugars.html
- http://chemwiki.ucdavis.edu/Biological_Chemistry/Carbohydrates/Carbohydrates_Fundamentals

Hemp is a natural fibre made up of cellulose (77.5%), hemi-cellulose (10.0%), lignin (6.8%), pectin (2.9%), fat and wax (0.9%) and water soluble materials (1.8%). Cellulose is a type of very large carbohydrate similar in size to starch. Cellulose cannot be broken down by our bodies to generate energy but it is still helpful for good digestion. Hemi-cellulose and pectin are other forms of complex carbohydrates.

Hemp fibre can be harvested from two locations. The phloem of the hemp plant is known as bast fibre. Linen, jute and ramie are also sourced from bast fibre. The core fibres of hemp come from the xylem of the plant. These fibres give hemp its distinctive qualities.

Use the following websites to help you with your research:

- Agriculture and Agri-Food Canada –search industrial hemp: http://www.agr.gc.ca/
- Agricultural Marketing Resource Center: http://www.agmrc.org/commodities__products/fiber/industrial-hemp/
- Alberta Farmer: https://www.albertafarmexpress.ca/crops/theres-a-reason-why-alberta-is-canadas-hemp-leader/
- History of Hemp, Massachusetts Institute of Technology (MIT): http://www.mit.edu/~thistle/v13/2/history.html
- Hemp: A New Crop with New Uses for North America - Purdue University: https://www.hort.purdue.edu/newcrop/ncnu02/v5-284.html

1. What are some of the historic products made from hemp?

fibre	Clothing, rope, paper
grain	Various foodstuffs
oil	Cosmetics, lighting, paints, varnishes, and medical products

2. Industrial hemp is sourced the plant species *Cannabis sativa*; so is marijuana. What regulations are in place to distinguish between industrial hemp and marijuana?

Both European and Canadian standards limit the amount of THC (tetrahydrocannabinol). THC is the active ingredient in marijuana. Industrial hemp can only have levels of THC that are less than 0.3% where marijuana has levels between 3-30%

3. *Cannabis sativa* was legal in Canada at one time. When was it banned? Why?

It was banned in 1938 under the Opium and Narcotic Drug Act. It was done to reduce the use of marijuana. There was some "relaxing" of this act during WW II, for fibre production and since 1961 there has been production allowed for research

4. Briefly explain how and when the ban on industrial hemp was lifted.

Research was completed to create commercial hemp distinct from marijuana crops. Through the research and initiatives of a few companies, some Canadian universities and provincial governments, the ban on industrial hemp was lifted in 1998.

5. Use the http://www.agr.gc.ca/ website for (a)-(h). According to Agriculture and Agri-Food Canada, hemp seed contains EFAs (essential fatty acids) and GLA (gamma linolenic acid).
    a. What conditions can occur or worsen if a person has low EFAs in their body?
    obesity, cardiovascular disease, osteoporosis and eczema

    b. What percent of hemp seed oil is EFAs-30%

    c. What are the diseases/conditions that hemp seed oil can help to treat?
    Can be beneficial to diabetes, cancer, lupus, asthma, depression and hypertension

    d. EFAs are used in body care. What is their function in these products?
    Lotions: They help to restore and soothe skin
    Lip balms, hair care products, soaps and shaving products: they are emollients (soften skin or hair) and provide a smooth feeling after use.

    e. What are the potential positive effects of GLA?
    It can have positive effects for inflammatory diseases, and depression, dyslexia and ADHD. About 1/3 of the population cannot produce this

compound because they lack an enzyme and need to produce GLA, hemp is a good source of this chemical.

f. Hemp fibre is considered very durable. There are two types of fibres in the stalk of hemp. Give the location of these fibres in the plant, their characteristics and uses.

Bast fibres- found in the outer portion of the stock. They are strong, long and thin. They give hemp strength. These fibres have high durability, absorbency and provide anti-mildew and anti-microbial properties. They are used in car panels.
Core fibre- the wood like stalk of the plant, inner portion of the stalk. This fibre also has anti-mildew and anti-microbial properties. These fibres are used for animal bedding, simulated cedar shakes, hemp and paper production.

g. One hectare of hemp can produce…800 kg of grain, 200 L of oil, and 6 tonnes of straw that produces 1.5 tonnes of fibre.

h. Summarize the "Conclusions" section
   - Hemp can be grown without fungicides, herbicides, and pesticides
   - It absorbs 5x the CO2 than the same acreage of forest
   - The crop matures in 3-4 months
   - It can be used to make a variety of products

6. Proceed to Industrial Hemp Statistics on the http://www.agr.gc.ca/. Use Table Canada: Industrial Hemp Total Imports and Exports
   a. Compare the amount of hemp fibre exported and its cash value from 1998 to 2007
      In 1998-17 tonnes were exported at a value $74 949. In 2007- 876 tonnes with a value of $3,454,149 in 2007

   b. Compare the amount of hemp fibre imported and its cash value from 1998 to 2007
      In 1998, 61 tonnes were imported with a value of $74 038. In 2007, 363 tonnes were imported with a value of $530,162.