

This activity is divided into multiple sections.

* **Planning: 1 period** 
  + Planning an evaluation protocol for plastic characteristics
* **Lab** – ***creation of two polymers***: **2 periods** 
  + Creation of 2 types of plastic in the lab

Note: the activity can be held over one period if half the class conducts lab 1: the creation of a starch polymer and the other half conducts lab 2: the creation of a milk polymer

* **Lab** – ***evaluation of plastic characteristics***: **1 period**
  + Evaluation of the plastic’s qualities

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| **Overall Expectations** | | **Specific Expectations** |
| A1. Demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analysing and interpreting, and communicating)  A2. Identify and describe careers related to the fields of science under study, and describe the contributions of scientists, including Canadians, to those fields  B1. Analyse social and economic issues related to an environmental challenge, and how societal needs influence scientific endeavours related to the environment  E3. Demonstrate an understanding of the nature and types of waste and strategies for its management  E2. Investigate the effectiveness of various waste management practices  E1. Analyse economic, political, and environmental considerations affecting waste management strategies | | A1.1 Formulate relevant scientific questions about observed relationships, ideas, problems, or issues, make informed predictions, and/or formulate educated hypotheses to focus inquiries or research  A1.5 conduct inquiries, controlling relevant variables, adapting or extending procedures as required, and using appropriate materials and equipment safely, accurately, and effectively, to collect observations and data  A1.12 Use appropriate numeric, symbolic, and graphic modes of representation, and appropriate units of measurements (e.g., SI units, imperial units)  A1.11 Communicate ideas, plans, procedures, results, and conclusions orally, in writing, and/or in electronic presentations, using appropriate language and a variety of formats (e.g., data tables, laboratory reports, presentations, debates, simulations, models)  A2.1 Identify and describe a variety of careers related to the fields of science under study and the education and training necessary for these careers  A2.2 Describe the contributions of scientists, including Canadians, to the fields under study  B3.1 Identify some major contemporary environmental challenges, and explain their causes and effects.  B3.5 Describe a variety of human activities that have led to environmental problems and/or contributed to their solution  E2.5 Investigate a local, regional, national or global waste management practice, and communicate their findings  E2.1 Use appropriate terminology related to waste management  E1.2 Evaluate the short- and long-term impact on the environment of a specific type of waste |
| **Concepts** | | |
| **Terminology** | | **Theory** |
| * Polymer * Temperature * Decaying * Management | * Organic molecules * Waste * Plastic | * Type and management of waste * Health and environmental decaying |
| **Material to prepare** | | |
| * Context * Copy of activity * Copy of assessment grid * Activity * Planning   + Computer * Laboratory section  |  |  | | --- | --- | | Material/Perishable | | | Part A | | | – Potato starch  – HCl 0.1 M  – NaOH 0.1 M  – 50% glycerol solution in water  – 1% solution of cochineal red  – Erlenmeyer flask 100 mL  – Magnetic heating plate + magnet bar | – Petri dish  – Test tube 25 mL  – Test tube 10 mL (2)  – Spatula  – Small beaker 50 mL (6)  – Temperature probe | | Part B | | | * 500 mL milk * 1 beaker of 1 L * 60 mL acetic acid * Graduated cylinder * Erlenmeyer flask 1000 mL   – Magnetic heating plate + magnet bar | * Filter * Filter paper * Funnel * Petri dish * Pliers | | Part C | | | Material to be determined according to the methods developed by the students  Example of material   * Flexibility: [malleability] burner, warm water bath * Resistance: universal holder, rope, weight, force table… * Impermeability: water bath, stopwatch, scale… * Lightness: overflow vessel, scale * Decaying rate (be sure to compare pieces of plastic of similar size) | |  * Pushing further * Computer for analysis and report * Same material as part B with different milks * Use different types of plastics | | |
| **Context**   * Present a video or an article on plastic production * **Du pétrole au plastique [**[**https://www.youtube.com/watch?v=P9UvzH02o-A**](https://www.youtube.com/watch?v=P9UvzH02o-A) **]** * **Comment c’est fait, Les sacs de plastique** [<https://www.youtube.com/watch?v=ofs2xm9omH8>] * Discuss the characteristics of plastics. [resistance, flexibility, lightness, impermeability] and how to evaluate these characteristics. * Presentation of lab work | | |
| **Activity — part 1 — Writing of evaluation methods for the characteristics of plastics**   * Flexibility, resistance, impermeability, lightness   **Activity — part 1 — Experiment**   * Group the students * Students complete the lab protocol.   **Activity — part 2 — Experiment**   * Group students according to the variables selected. * Ensure students follow approved directions.   **Activity — part 3 — Evaluation of the characteristics of plastics**   * Ensure student protocols have been validated * Obtain necessary materials according to established procedures | | |
| **Pushing further**  – Teams work with different types of milk [skim, 1%, 2 %, 3.25%, 5% cream…]  – Pool the results of the different teams to determine which type of milk offers the best bioplastic  – Research the composition of different milks to explain the different characteristics of the plastics | | |
| **Assessment**   * Summative: lab work — Evaluation method for characteristics — lab report | | |
| **Resources**   * Example of protocol — polymer lab * Lab report assessment grid * Lab work assessment grid * Material supplier * Internet * [Accros au plastique](https://plus.lapresse.ca/screens/1ea2e0ef-3ada-49f0-bd66-7c40cae394eb__7C___0.html) *[*[*https://plus.lapresse.ca/screens/1ea2e0ef-3ada-49f0-bd66-7c40cae394eb\_\_7C\_\_\_0.html*](https://plus.lapresse.ca/screens/1ea2e0ef-3ada-49f0-bd66-7c40cae394eb__7C___0.html)*]* * [Peut-on se passer des plastiques](https://synchronex.ca/nouvelles/peut-on-se-passer-des-plastiques-dans-lemballage%E2%80%89/) *[*[*https://synchronex.ca/nouvelles/peut-on-se-passer-des-plastiques-dans-lemballage%E2%80%89/*](https://synchronex.ca/nouvelles/peut-on-se-passer-des-plastiques-dans-lemballage%E2%80%89/) *]* * The 100% biodegradable packaging is coming soon *[*[*https://www.bpkpackaging.com/2018/09/05/the-100-biodegradable-packaging-is-coming-soon/*](https://www.bpkpackaging.com/2018/09/05/the-100-biodegradable-packaging-is-coming-soon/)*]* * [4 innovations de l’industrie agroalimentaire](https://www.cartoffset.com/4-innovations-de-lindustrie-agroalimentaire-pour-reduire-le-plastique-dans-nos-emballages/)  *[*[*https://www.cartoffset.com/4-innovations-de-lindustrie-agroalimentaire-pour-reduire-le-plastique-dans-nos-emballages/*](https://www.cartoffset.com/4-innovations-de-lindustrie-agroalimentaire-pour-reduire-le-plastique-dans-nos-emballages/)*]* * Innovating dairy packaging until the cows come home  [*[*](https://tctranscontinental.com/fr-ca/emballages/marches/fromages-et-produits-laitiers)[*https://tctranscontinental.com/en-ca/packaging/markets/cheese-dairy*](https://tctranscontinental.com/en-ca/packaging/markets/cheese-dairy)*]* * [Bioplastique et plastique fossile](https://fliphtml5.com/mjnth/edzm/basic) *[*[*https://fliphtml5.com/mjnth/edzm/basic*](https://fliphtml5.com/mjnth/edzm/basic)*]* * [Les résidus de filtration](https://www.laterre.ca/du-secteur/formation/les-residus-de-filtration-du-lait-valorises) *[*[*https://www.laterre.ca/du-secteur/formation/les-residus-de-filtration-du-lait-valorises*](https://www.laterre.ca/du-secteur/formation/les-residus-de-filtration-du-lait-valorises)*]* * [Bioplastique Lactips](https://www.agro-media.fr/tag/bioplastique) *[*[*https://www.agro-media.fr/tag/bioplastique*](https://www.agro-media.fr/tag/bioplastique)*]* * [Un plastique compostable fait de déchets](about:blank) *[*[*https://novae.ca/un-plastique-compostable-fait-de-dechets/*](https://novae.ca/un-plastique-compostable-fait-de-dechets/)*]* * Milk-based plastics to reduce environmental damage*[*[*https://cordis.europa.eu/article/id/254165-milkbased-plastics-plastics-to-reduce-environmental-damage*](https://cordis.europa.eu/article/id/254165-milkbased-plastics-plastics-to-reduce-environmental-damage)*]* * [Du bioplastique made in Québec](https://unpointcinq.ca/economie/bioplastique-compostable-quebec/) *[*[*https://unpointcinq.ca/economie/bioplastique-compostable-quebec/*](https://unpointcinq.ca/economie/bioplastique-compostable-quebec/)*]* * [Les bioplastiques biodégradables](https://www.emballagesmagazine.com/mediatheque/2/9/0/000035092.pdf) *[*[*https://www.emballagesmagazine.com/mediatheque/2/9/0/000035092.pdf*](https://www.emballagesmagazine.com/mediatheque/2/9/0/000035092.pdf)*]* * [Remplacer les agents de conservation chimiques par un biofilm fonctionnel aux propriétés antimicrobiennes, antioxydantes et bioréactives.](https://www.cbc.ca/news/canada/nova-scotia/cape-breton-researchers-looking-into-plastic-that-kills-covid-19-1.5633150) [[*https://www.cbc.ca/news/canada/nova-scotia/cape-breton-researchers-looking-into-plastic-that-kills-covid-19-1.5633150*](https://www.cbc.ca/news/canada/nova-scotia/cape-breton-researchers-looking-into-plastic-that-kills-covid-19-1.5633150)*]* * In search of a natural solution against spoilage bacteria and pathogens in poultry and frozen vegetable products [<https://canadianfoodinnovators.ca/project/in-search-of-a-natural-solution-against-spoilage-bacteria-and-pathogens-in-poultry-and-frozen-vegetable-products>] * [50 raisons de dire non au plastique](https://www.selection.ca/sante/vivre-sainement/50-raisons-de-dire-non-au-plastique/) *[*[*https://www.selection.ca/sante/vivre-sainement/50-raisons-de-dire-non-au-plastique/*](https://www.selection.ca/sante/vivre-sainement/50-raisons-de-dire-non-au-plastique/)*]* * Manufacturer of packaging made of wood, cardboard and plastic *[*[*https://www.groupe-lacroix.com/en/*](https://www.groupe-lacroix.com/en/)*]* | | |