

3D Educational Resources

MAKE YOUR OWN BUTTER

Butter has long been a popular spread and cooking fat around the world, particularly in northern European and North American culture. Making butter is not that difficult and can be done in just a few simple steps.

ONTARIO CURRICULUM LINKS

Through this activity, your students will learn about emulsions and how a physical change in matter can create butter. This activity can be connected to multiple aspects of the Ontario School Curriculum, our suggested links are:

- Grade 3: Social Studies (Heritage and Identity: Communities in Canada, 1780 – 1850)
- Grade 5 Science (Properties of and Change in Matter)

Note: The butter churn should only be used for demonstrational purposes only and any butter made from it should not be ingested. Currently there is no way to 3D print an object that is entirely food safe. If you wish to make butter without a churn, see the first “Try This” activity



Grades

1 – 6

Age Range

6 – 12 years

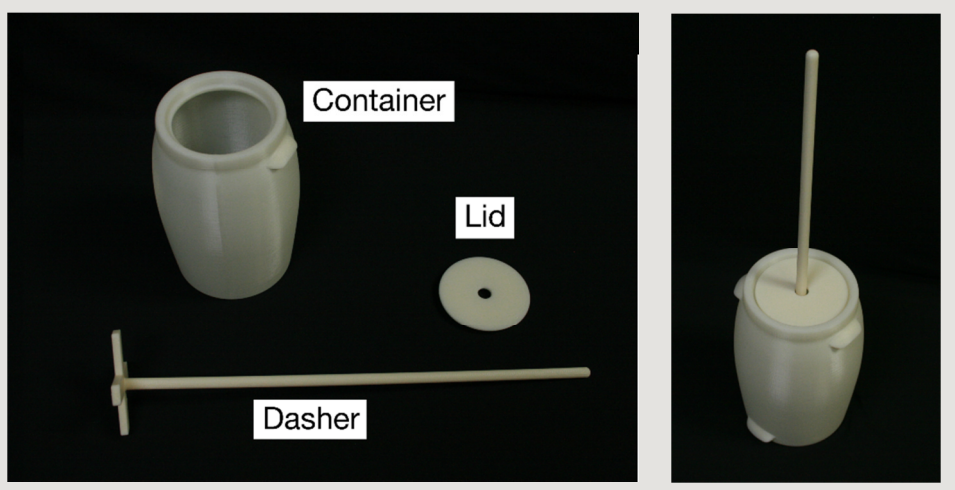
MATERIALS

| | |
|-------------------------------------|---------------|
| 1 – 3D printout of butter churn | 1 – Bowl |
| 1 – Spatula | 1 – Container |
| 500 mL – 35% cream (whipping cream) | Water |
| 1 – Dish brush | Dish soap |

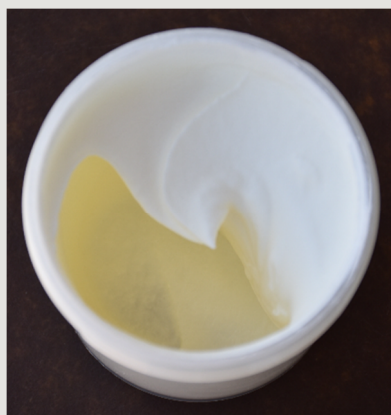


INSTRUCTIONS

1. Take the 35% cream out of the fridge and let it reach room temperature.
2. Fill about one third of the container of the butter churn with cream.
3. Put the lid on the container with the dasher (the pole) in the barrel and sticking out of the lid. To do you this you'll need to put the dasher in the container first before putting on the lid.



4. Use the dasher to agitate the cream by moving it up and down quickly. This can be a messy process and the container may leak, so it's best to do it in a sink.
5. At some point the cream will no longer easily move in the barrel and will have a foam-like appearance (this will likely take around 10 minutes). The cream has now formed whipped cream. Feel free to open the lid to see what this looks like.





6. Keep agitating the whipped cream until a substantial solid begins to separate from the liquid (this will likely take 10 minutes). You have now formed butter! The liquid part is buttermilk.



7. Pour out the buttermilk in a separate container.
8. Use the spatula to scoop out the butter into a bowl. Fill the bowl with cold water. The cold water will harden the butter. Gently knead the butter while it is still in the water to remove any remaining buttermilk
9. Drain the water from the bowl. Now your butter is ready!

Note: We recommend that you do not ingest any butter. Currently there is no way to 3D print an object that is entirely food safe. If you wish to make butter without a churn, see the “Try This” activity below.



10. Wash the churn with hot soapy water and a brush to remove the butter that may have gotten into the cracks. This is important as butter could get stuck in the cracks of the butter churn and cause bacteria to grow.

TRY THIS! You can also make butter using just a plastic bag or glass bottle (ingeniumcanada.org/agriculture/doc/education-programs/cafm/education-properties-of-and-changes-in-matter-bread-eak.pdf). Have a discussion with your class on what advantages and disadvantages each method has. One point that you can bring up is how using the butter churn makes mixing a large quantity of cream easier.



SCIENTIFIC EXPLANATION

As you saw in this activity, cream is used to make butter. Cream is obtained from the milk that comes directly from cows. It is mainly a mixture of fat particles and water (the cream used in this activity was 35% fat) along with some other substances like pigments (carotene) and milk solids (protein, lactose). More specifically it is an emulsion of water and fat; an emulsion is a mixture of two things that normally do not mix. One of the main reasons why the fat stays mixed in the water and does not clump together, or float to the surface, is because it is found in tiny membrane sacs. The fat clumps inside these membrane sacs are called “globules”.

During this activity, the agitation in the milk created by the dasher caused many of the membrane sacs to burst. The fat, now free, begins to clump together. As more of the membrane sacs burst, more of the fat clumps together, forming butter. The remaining liquid forms buttermilk. It is largely water, though some of the fat globules remain.

TRY THIS! Have your class determine the impact of the 35% cream’s temperature on the butter making process by using the cream right after you have taken it out of the fridge. It should be easier to make butter when the cream is at room temperature. A higher temperature means that the fat globules have more energy, making it easier for them to clump and create butter.

TRY THIS! Have your class determine the impact of using different liquids on the butter making process. Instead of 35% cream, try making butter using skim milk (0% milk fat), half and half cream (10% milk fat) and table cream (18% milk fat). Are your students able to make butter with anything but the 35% cream? 35% cream is the easiest because it has the highest content of milk fat, which is what the butter is made out of.

Ingenium – Canada’s Museums of Science and Innovation has more than 110 000 artifacts in its collection, including many different butter churns. You can explore other objects in the collection at: ingeniumcanada.org/ingenium/collection-research/collection.php.