

ARTIS MICROPIA

Making yoghurt

Put bacteria to work

Yoghurt is one of the most fun and delicious products you can make on your own with the help of microbes. Humans have been making yoghurt for about 7000 years. The actual work is done by two types of bacteria: *Streptococcus thermophilus* and *Lactobacillus delbrueckii bulgaricus*. If you look at these so called lactic acid bacteria through a microscope you will see vibrating spheres (*Streptococcus*) and rods (*Lactobacillus*). The way these bacteria make yoghurt is by converting lactose, the sugar found in milk, into lactic acid. It is this lactic acid that gives yoghurt its distinctly sour flavour. In addition, the acid causes the proteins in milk to solidify, making it thicker in substance. This process is called curdling. Below you can find a step-by-step guide to make your very own yoghurt with the use of these two microbes, good luck!

What do you need?

- 1 litre of whole milk
- 100 ml (about 5 tbsp) of full-fat yoghurt (preferably organic)
- Saucepan
- Thermometer
- An oven that can be set at a low temperature (below 50°C)
- In case you don't have an oven: a cast iron pan, a warm location or a thermos flask

BEFORE YOU START: Read the instructions carefully before starting, then you know beforehand which steps will take longer than others. At the end you will also find some alternatives if you don't have all the materials. Before starting, collect all ingredients and materials, as it is convenient to have everything at hand once started.

Getting to work!

Step 1: Heat up the milk

1. Empty the milk carton in the saucepan and place the thermometer in the milk.
2. Heat the milk to 90°C, try to keep it from boiling.
3. Remove the pan from the stove and let the milk cool to about 40°C.

Step 2: Mix the yoghurt and the milk

1. Add the yoghurt to the milk.
2. Slowly but thoroughly mix the two together.

Step 3: Keep the yoghurt nice and warm

1. Cover the saucepan with a lid and place it in the oven set at a temperature of 35-40°C.
2. Wait for 6 to 48 hours. Try waiting overnight for your first try.

Step 4: Admire your yoghurt!

1. Give your homemade yoghurt a good stir.
2. Pour a small amount of yoghurt into a bowl.
3. Move the bowl around in your hand so the yoghurt will glide through the bowl.
4. Is it thicker than milk? Then you have made yoghurt! Still as liquid as milk? Place the pan back into the oven and wait for another night.
5. Answer the questions on the next page.

Step 5: Storing your yoghurt

1. Store your homemade yoghurt in the refrigerator.
2. Eat the yoghurt within a few days.

I DON'T HAVE AN OVEN THAT CAN BE SET AT A LOW TEMPERATURE, NOW WHAT? The most important thing is that you keep your yoghurt at a constant temperature for a long time. You can also accomplish this by making the yoghurt in a heavy cast iron pan. Alternatively, you can pour your yoghurt into a thermos flask. If you don't have either of these, try keeping the pan as warm as possible by placing it in a warm spot in your home. In some ovens just the light of the oven can produce enough heat to keep it at temperature. In all cases using a few towels can help keep the yoghurt warm. If using any of these alternatives, wait for the yoghurt to develop for two nights to give the bacteria enough time to produce the yoghurt.

I DON'T HAVE A THERMOMETER, NOW WHAT? Instead of heating the milk to 90°C, let the milk boil for a very short amount of time. The milk will still have to cool down to approximately 40°C. You can estimate when it has reached this temperature by placing a clean metal spoon in the milk when cooling down. If you can hold the handle without it being too hot, the temperature should be right.

Questions

Question 1: Look at the thickness of the yoghurt. Is it different from the milk or the starting yoghurt?

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Question 2: How does your yoghurt smell? Does it smell different from the yoghurt you started with?

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Question 3: How does your yoghurt taste?

Circle the words that best describes it:

sweet strange sour bitter salty light creamy soft fresh heavy

Question 4: Does your homemade yoghurt taste different from the one you buy from the supermarket? What is the difference?

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Question 5: Why do you think the milk is heated to 90°C before adding the yoghurt?

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Question 6: What do you think will change in the yoghurt if you keep it warm for a longer time?

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Do you want to learn more about all the things bacteria can do? Or do you want to do more experiments of your own? Visit micropia.nl for more microbiological fun!