

Yoghurt:

You need:

- 3 litres of milk
- Different yoghurt germs or yoghurt with active germs in it
- metal pot and a hot plate for cooking the milk
- some jars to fill in the milk-germ-mixture
- a heating cabinet where we can heat the milk-germ-mixture

We made 3 different kinds of yoghurt.

We had yoghurt germs from Austria and France.

We mixed one litre of milk with the yoghurt germs from Austria, one litre of milk with the germs from France and one litre of milk with the double amount of the germs from Austria. After mixing together the milk with the different germs we filled the mixture into glasses and put them into a heating cabinet with a constant temperature of 30°C.

We want to show that as more germs we put into the milk as sourer the yoghurt gets. So, the first result was that the yoghurt with the double amount of germs was sourer than the two yoghurts with the single amount of germs. The second "result" was that the germs from Austria tasted different than the germs from France. We made a blind testing and the yoghurt with the Austrian germs (single amount) won.

Denaturation of Proteins

You need:

- a hot-plate
- two beaker glasses
- six test tubes
- one test tube rack
- one spoon or scoop
- one egg white
- 100ml of milk
- 50ml of vinegar (5%)
- 15 grams of Salt – NaCl
- 5 grams of copper sulphate solution
- water

What do you have to do?

First you need an egg white solution. Therefore, put 15g salt into 150ml water and stir it until it is solved. Now put the egg white into the solution and stir it again till everything is well mixed together.

Then you compare the egg white solution with the milk in three different kind of ways.

Comparison specimen:

Protein in egg white solution:

1. Fill 3 test tubes with the egg white solution until it reaches about 3cm.
2. Put some water into a beaker glass, heat it up and put one of the test tubes into it.
3. Put in one of the other test tubes five to ten drops of vinegar and shake carefully.
4. Put in the last test tube five to ten drops of copper sulphate solution and shake very carefully until it is solved.

In the second experimental arrangement do the same but use milk instead of the egg white solution.

What happens with the egg white solution?

During the denaturation of a protein, its structure changes, but the order of amino acids is usually not changed by denaturation.

When the structure of the protein changes, its function is automatically lost. An enzyme, for example, loses its enzymatic activity.

Denaturing by heat:

During heat denaturation, weak chemical bonds are broken. This is because the supply of heat causes the protein molecules to vibrate. The higher the temperature, the stronger the vibrations, until finally weak bonds, at higher temperature but also strong chemical bonds are broken. This can also be observed well in humans when we are sick and get fever. Living beings are damaged by heat.

At temperatures above 40°C, the proteins of the human body also begin to denature, some proteins a little earlier, some a little later. This also applies to the proteins of invaded pathogens. Therefore, the body increases its temperature (fever) when you are infected. The aim of the fever is to kill the pathogens by denaturing their proteins.

Denaturation by acids (vinegar):

Acids release protons, which can then settle on negatively charged carboxy groups in the side chains of the acidic amino acids. These side chains then lose their negative charges, and the cohesion of the tertiary structure in these places is then lost because the positively charged "opposite" amino acids no longer have a binding partner.

Denaturing by heavy metals:

Heavy metals such as copper (lead, cadmium, etc.) react with the sulphur residues in the side chains of cysteine to make soluble Cu-S compounds. In addition, the positively charged metal ions can also form complexes with the negatively charged carboxyl groups in the side chains of the acidic amino acids. Especially copper ions form very solid bonds to the protein, so that this type of denaturation is irreversible.

What happens with the milk?

Denaturation by acids (food vinegar, lemon juice):

By adding acid (food vinegar, lemon juice) by dropping, the protein can be made visible in the milk. This causes the pH to drop below 5 and leads to the denaturation of the milk protein: the milk clots. The structure of the protein is destroyed and the lumps separate from the whey (aqueous-cloudy solution). By filtration, the unusual cheese substance is separable from the whey (filtrate). By acidifying/filtering, milk can be separated into casein and whey.

