2.2 Drinking water produced through ultrafiltration

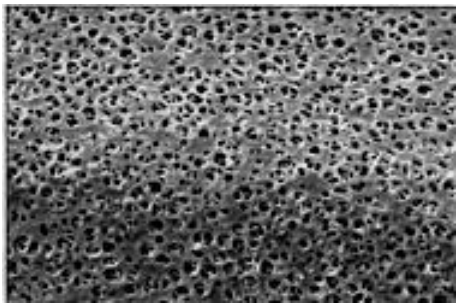
Basic information and collecting ideas 	Ultrafiltration: The pores of the plastic filter are between 10 and 100 nm (nanometres) in size. 1 nm is one millionth of a millimetre. Teaching method “think-pair-share”: Ask the students what they already know about unsafe water, related diseases and methods to produce safe water. **Examples:** ▪ Boiling the water (high energy consumption) ▪ Adding chlorine solutions (chlorine is a toxic chemical) ▪ Using filters whose pores are smaller than the germs but large enough to let water particles through. This method needs no energy supply and uses no toxic chemicals.
Setting up and conducting experiments 	Please make the students aware that germs in water are invisible to humans (the size is less than a thousandth of a millimetre). We use clay in the experiment to visualize the effect of the filter. You can also make a dirty solution for the experiment from river mud or other sediments. Make sure that the ultrafiltration membrane is wet for more flexibility. Use only light pressure on the syringe.
Observing and documenting 	
Analysing and reflecting 	Use the drawings on page 2 to explain the function of an ultrafiltration membrane: *> The students should realize that bacteria and most viruses are larger than the pores (20 nm), which allow only the small water molecules to pass through. Instead of pushing the dirty water through the membrane (from inside to outside) you can also suck the water through the membrane into the syringe (from outside to inside).*
Doing further research 	▪ How would you use a multimeter to check whether the ultrafiltration membrane also filters dissolved salts out of the water? Compare the conductivity of safe and unsafe water. *> Similar conductivity means that the salt ions are very small and are able to move through the pores.* ▪ How can you improve the system to get the daily requirement of 2 litres of safe water? *> You use many ultrafiltration membranes (bigger surface – more water).* ▪ People in Africa knew how to produce safe water from unsafe water with a piece of sugar cane. How can this work? *> Suck on a piece of sugar cane immersed in unsafe water. The cells of the sugar cane act as pores.*

© Siemens Stiftung 2022. Content licensed under CC BY-SA 4.0 international

Technical and vocational application 	▪ Talk to your students about the procedures which would be appropriate and what advantages and disadvantages they have. ▪ Water technician at the local water suppliers

Part of ultrafiltration membrane

The diameter of the pores of an ultrafiltration membrane is 20 nm.



Size of pores 10 nm

Size of other pathogens:

Bacteria	1100 nm
Poxvirus	300 nm
Herpesvirus	150 nm
Poliovirus	30 nm

© Siemens Stiftung 2022. Content licensed under CC BY-SA 4.0 international