

2.1 Plastic bottle for water purification



How would you produce clear water from turbid water with simple materials?



If you want to clean dirty water, you can let it seep through various layers of soil. In this experiment, you should fill different layers of earth – from fine to coarse material – in a bottle and demonstrate the natural cleaning effect.

As filtering material you can also use sand or charcoal.

Charcoal has a very large surface area and is able to absorb toxic materials and substances which smell or taste bad.

Set up:

- | | |
|----------------------------|------------------------------------|
| ▪ 2 PET bottles | ▪ gravel |
| ▪ scissors | ▪ piece of cloth |
| ▪ clean sand (or charcoal) | ▪ bottle with turbid surface water |



Use the following materials to turn murky water into clear water by filtering:

1. Use the scissors to cut off the bottom of the first PET bottle. Drill an approx. 3 mm hole in the cap of the bottle.
2. First place a cotton cloth in the neck of the bottle. Fill the bottle with cleaned sand and gravel on top.
3. Cut off the neck of the second PET bottle and place the first bottle in the second bottle (as pictured).
4. Now pour dirty water into the upper bottle and compare the result.



Observing and documenting:



Analysing and reflecting:



How can you explain that salt water cannot be converted to drinking water by this process?



In some African countries people use charcoal or even the ashes of burned bones instead of sand if the natural water is strongly contaminated with toxic fluoride salts. How does this cleaning process work?

Filtration methods with different pore sizes for different applications

Overview of membrane filters

Process	Microfiltration (MF)	Ultrafiltration (UF)	Nanofiltration (NF)	Reverse osmosis (UO)
Filter material	Organic material or ceramic	Polyamides, polysulfanes, cellulose acetates, PVdF (polyvinylidene fluoride)	Homogeneous polymer layers	Homogeneous polymer layers
Pore size	In the micrometer range 0,05 – 10 µm	Hundredths of micrometers 0.005 – 0.15 µm	In the nanometer range 0.7 – 10 nm	< 1 nm "No pores"
Separable substances	Plankton, algae, turbidity, bacteria, suspended particles, fibers, poss. proteins and large microorganisms (amoeba)	Macromolecules, viruses, colloids, bacteria	Organic compounds, ions (bivalent), dyes, pesticides and also herbicides	Molecules and ions: alkali and earth alkali salts but also heavy metal ions and alcohols as well as sugar
Required pressure difference	0.1 – 2 bar	0.1 – 5 bar	3 – 20 bar	10 – 100 bar
Example	Aftertreatment of purified wastewater	Drinking water treatment (e.g. SkyHydrant)	Pure water treatment, water softening	Ultra-pure water treatment, seawater desalination