Make a membrane model

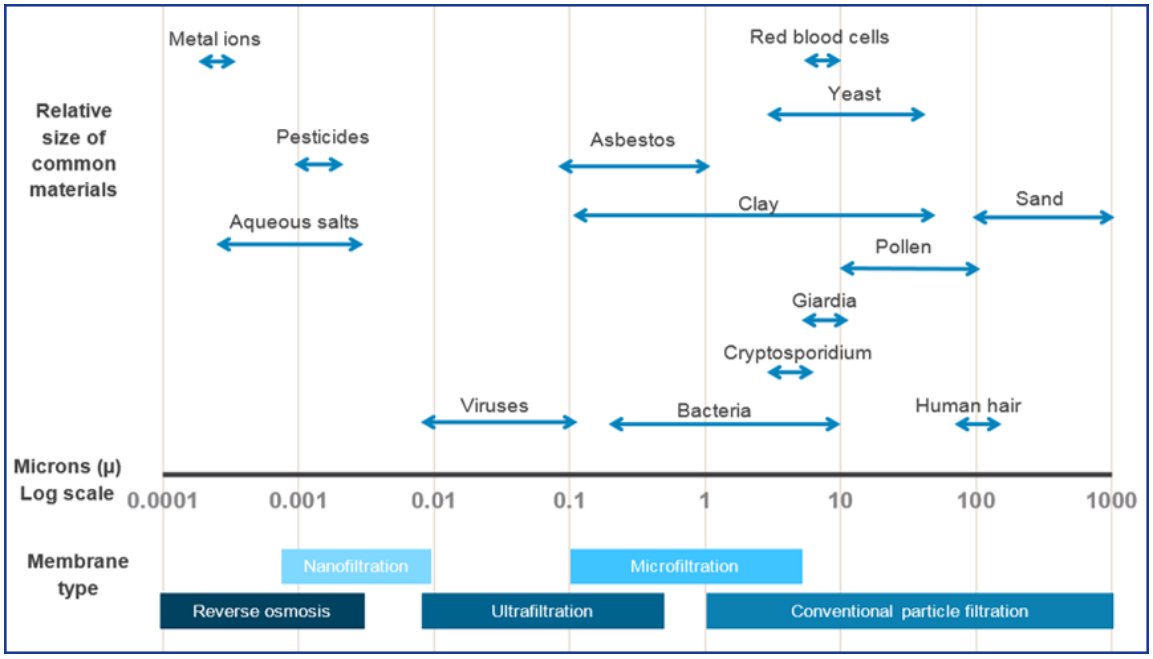
Learn about how reverse osmosis membranes are designed and then build your own model.

What are reverse osmosis membranes?

Reverse osmosis (RO) membranes are a semi-permeable barrier. Our membranes remove particles larger than 0.0005 µm. The membrane is a very large flat sheet. They're cleverly arranged in a spiral wound module (sometimes called an element) to save space, make them easy to handle and make them more efficient.

Did you know?

We use RO membranes at St Marys Advanced Water Recycling Plant to produce highly treated recycled water.

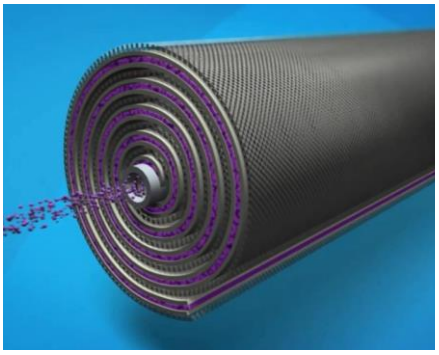


Membranes come in a range of pore sizes and designs to remove different common materials.

How are reverse osmosis modules designed?

RO membrane modules are designed with three layers wrapped around a central perforated tube.

1. **Membrane flat sheet** – this is the semi-permeable barrier layer. Water passes through (permeate), leaving behind the impurities in a solution (concentrate).
2. **Feed channel spacer** – this is a sheet of plastic netting that creates space between the membrane sheets, so they don't stick together.
3. **Permeate spacer**- this is a sheet that collects the permeate after it passes through the membrane layer and moves it to the perforated tube.



Spiral wound layers in a RO membrane module. The flow of water molecules is shown in purple.

How do I make a reverse osmosis module model?

What you'll need

You can get creative and find substitute recycled materials to scale the model up or down.

- glue
- tape
- scissors
- needle
- rubber band
- cardboard tube such as cling wrap, paper towel, toilet paper roll
- 4 x A4 sheets of clear plastic from plastic sleeves, bags or packaging
- 2 x A4 sized sheets of black plastic from garbage bags or plastic packaging
- 2 x A4 sized sheets of plastic mesh from orange or onion bag, net, curtain or bubble wrap.

Examples of materials you can use for your RO filter model.

Activity

1. Pierce holes in the clear plastic sheets with the needle (remember to watch your fingers!).
2. Place two clear plastic sheets together. Seal one of the short edges with tape, leaving three unsealed sides.
3. Insert a sheet of plastic mesh in between the two layers of clear plastic. Tape the mesh to the clear plastic within the fold.
4. Run glue on the top of the clear sheet, along the three unfolded edges.
5. Stick a sheet of black plastic over the glue.
6. Cut a lengthwise slit along the cardboard tube leaving a couple centimetres. Don't cut the entire length of the tube.
7. Insert the plastic sheet sandwich into the slit a couple centimetres, on the folded edge. Tape the edge to the inside of the tube.
8. Repeat 1-7 with the rest of the materials, making a slit on the opposite side of the cardboard tube.
9. Wrap sheets carefully around the cardboard core and secure with a rubber band.
10. Indicate the direction of flow and name each layer using sticky labels or marker.

Step 4

Step 7

Step 9

Research task

Complete the table using our website and your own independent research. Use the links below to start.

Learn more

- The osmosis principle video
- *Polymers in reverse osmosis membranes* fact sheet
- How does reverse osmosis work? video
- HSC Chemistry webpage

Items in the model	Identify what these items represent.	Identify the polymer(s) used in the RO module?	Identify properties of these polymers. Describe why these polymers were used in the RO module.
Clear plastic			
Plastic mesh		Polypropylene	
Black plastic		PET	
Cardboard tube	Permeate collection tube	PVC or Polypropylene	
Rubber band	Brine seal	Rubber	

Discussion

What are the benefits of this design?

- Why are there three separate layers?
- Why are these flat sheet layers wound in a spiral?
- Why have water flow across the surface of the membrane rather than at right angles?
- Could the RO module be made of different materials?

How has this activity helped your understanding?

- Why is building a model a useful tool?
- How could you improve this model?