# Activity: From the sewer to the glass (Years 9 and 10)

Cleaning up sewage

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| Victorian Curriculum F–10[[1]](#footnote-1) links:  **Levels 9 and 10**  **Geography**  **Geographical Knowledge**  **Environmental change and management**  Different types and distribution of environmental changes and the forms it takes in different places  Environmental, economic and technological factors that influence environmental change and human responses to its management |

The Western Treatment Plant treats some sewage to Class A standards, making it suitable for the irrigation of human food crops and cattle production. But it is not suitable for use as drinking water. To take this further and make water suitable for direct human consumption, further treatment is necessary.

Students investigate the processes necessary to treat water to a standard sufficient for human consumption, conduct an experiment to demonstrate osmosis and debate whether Melbourne should use suitably treated effluent to augment its domestic water supply.

### Duration

Two period sessions

### Activity steps

**Purifying effluent**

1. Students view the video of Singapore’s NEWater system at <https://www.youtube.com/watch?v=DWWU-8_4wu0> [3:28] to identify the steps used to purify their treated sewage effluent for human consumption. They then use the information gained to produce a flow chart describing the process.

**What is osmosis?**

1. Students conduct an experiment using potatoes to demonstrate osmosis. They extend this knowledge to explain the process of reverse osmosis and how it can be used to remove mineral and biological contaminants from treated effluent. Further information is available in **Student worksheet: Potato osmosis**.

**Debate**

1. Students form teams to research and debate the question: Should Victoria use recycled water to augment Melbourne’s domestic water supply?

## Student worksheet: Potato osmosis

### Introduction

Osmosis occurs when water molecules are allowed to pass through a semi-permeable membrane that stops solutes from passing through. Osmosis will happen when the concentration of the solutions is different on each side of the semi-permeable membrane and so water moves from the side of lower concentration to that of higher concentration, tending to dilute it, until equilibrium is reached. Reverse osmosis occurs when pressure is applied to the more concentrated solution forcing the water backwards through the membrane.

### Hypothesis

What changes do you think you may see over the period of observation?

### Controls

Consider factors that may affect the dissolved oxygen (DO) levels in the samples and how they will be controlled in your experiment. Record them in a table like the one below.

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| --- | --- | --- |
| **Control factor** | **Effect** | **Method of control** |
| Temperature | Increased temperature will increase the rate of evaporation of water | Keep both potatoes at the same temperature |
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|  |  |  |

### Materials

1 large potato

100 mL saturated sodium chloride solution

distilled water

2 petri dishes

sharp knife

### Procedure

1. Use the knife to cut the potato in half and cut about 1 cm from the bottom of each half so they have a flat base to stand on.
2. Carefully scoop out a well in the top of each half, being careful not to cut through the bottom of the potato.

Dish 1 – High concentration

Dish 2 – Low concentration

1. Pour saturated sodium chloride solution into Dish 1 until about 5 mm deep.
2. Two-thirds fill the well in the potato with distilled water. Mark the levels in the petri dish and on the potato.
3. Pour distilled water into Dish 2 until about 5 mm deep. Two-thirds fill the well in the potato with the saturated sodium chloride solution. Mark the levels in the petri dish and on the potato.
4. Over a number of days, let the dishes stand undisturbed and away from direct sunlight. Observe what happens to the liquid levels in the potato and the dish and any other changes that occur.

### Results and observations

Devise a suitable table to record your observations and record what you see over a number of days.

What did you notice about the movement of water in Dish 1?

What did you notice about the movement of water in Dish 2?

What was the trend in the movement of the water?

What would you expect to happen if the pressure on the salt solution was increased?

What would you expect to happen if the pressure on the distilled water was increased?

### Conclusions

Write a simple statement describing the movement of water and salt, and what could be causing it.

Explain the process of reverse osmosis and how it can be used to treat effluent to drinking water standards.

1. Creative Commons Licence Victorian Curriculum and Assessment Authority (VCAA) <<http://victoriancurriculum.vcaa.vic.edu.au/>> Accessed 14 August 2016. [↑](#footnote-ref-1)