**ACTIVITY: Testing water for nitrate**

**Activity idea**

In this activity, students test nitrate levels in various samples of water and draw possible informed conclusions about the results.

By the end of this activity, students should be able to:

* explain why excessive nitrate can be harmful
* demonstrate how to test water for nitrate
* make an informed decision about safe nitrate levels in drinking water.

[Introduction/background notes](#Introduction)

[What you need](#need)

[What to do](#Do)

[Discussion questions](#questions)

Student handout: [Water nitrate levels](#handout)

**Introduction/background**

Nitrate is a naturally occurring substance so there is always a possibility it may be present in groundwater and surface water. Nitrate also enters waterways through other means – the disposal of wastewater into rivers and from septic tank discharge, animal wastes and/or fertilisers.

The Drinking-water Standards for New Zealand allow a maximum of 50 mg/L (parts per million) of nitrate in drinking water.

Too much nitrate in drinking water can be harmful to young infants or young livestock. Excessive nitrate can result in restriction of oxygen transport in the bloodstream. Infants under the age of 4 months lack the enzyme necessary to correct this condition (blue baby syndrome). In parts of Eastern Europe where groundwater has a high nitrate content (over 50–100 mg/L), pregnant women and children under 1 year of age are supplied with bottled water.

Excess nitrogen in waterways can cause excessive growth of aquatic plants and algae, which can clog waterways, use up dissolved oxygen as they decompose and block light to deeper waters. Eutrophication may then occur – producing unsightly algal growth on the water surface and possibly killing other organisms in the water such as fish. At worst, a lake may be ‘killed’ by depriving it completely of oxygen. Generally, eutrophication leads to depletion in animal and plant diversity. It also affects our use of the water for boating, swimming and fishing.

It’s important for local government and other authorities to know the nitrate levels in water. In this activity, students gain experience with nitrate testing.

**What you need**

* Nitrate test kit (can be obtained from pet or aquarium stores)
* Water samples
* Clean containers to collect and store water
* Copies of the student handout: [Water nitrate levels](#handout)
* Access to the articles [Farming and environmental pollution](https://www.sciencelearn.org.nz/resources/920-farming-and-environmental-pollution) and [The nitrogen cycle](https://www.sciencelearn.org.nz/resources/960-the-nitrogen-cycle)

**What to do**

1. In groups or as a class, read and discuss the articles [Farming and environmental pollution](https://www.sciencelearn.org.nz/resources/920-farming-and-environmental-pollution) and [The nitrogen cycle](https://www.sciencelearn.org.nz/resources/960-the-nitrogen-cycle).
2. Collect water samples. This could be done in small groups. Each group should have a variety of samples from different sources, for example, streams, rivers, lakes, ponds, puddles, farmland streams and ponds, tap water, bore water, bottled water.

* Use clean containers – thoroughly washed and dried.
* Collect about half a cup in each container.
* Label each container with the water source.
* With older students, discuss the concept of replication – testing a number of samples from the same location or repeating the tests a number of times helps to ensure precision.

1. Follow the instructions on the nitrate test kit to conduct a test (or tests) on each sample.
2. Record results on the student handout [Water nitrate levels](#handout). (This document is in Word, so modify it as needed to include replications or other changes.)
3. With older students, consider repeating the activity in a month or 3 months’ time to see if the results are the same.

**Discussion questions**

* Are there any samples with over 50 mg/L (ppm) nitrate content? Why might this be the case? (Answers will vary, but proximity to farm animals, sceptic tanks, fertiliser application, and effluent treatment or irrigation are some of the contributors to nitrate in waterways.)
* Why do you think the samples measured as they did?
* What are some of the difficulties in obtaining an accurate test? (Accuracy of the person doing the test or even the accuracy of the test kit.)
* Would you receive the same results if you tested the same water sources in 12 months? Why? Why not? (Nitrate levels are subject to change depending on the land use. Stock numbers may be increased or reduced, fertiliser usage may change, sceptic tanks upgraded and so on. Nitrate is also highly mobile and moves readily in groundwater.)

**Student handout: Water nitrate levels**

* Gather water samples to be tested for nitrate. Possible sources are local streams and lakes, ponds on cropland or pastures, stormwater puddles in the street and so on.
* Collect the water in a clean container and label the container with the source of the water.
* Record the results of the nitrate testing in the water below.

|  |  |  |
| --- | --- | --- |
| **Source of water** | **Nitrate (ppm)** | **Comments** |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |