teachers guide

Redox reactions 4

Bioremediation

Components

	NAME	DESCRIPTION	AUDIENCE
	Bioremediation teachers guide	The guide shows how an investigation may be used to extend student understanding of redox reactions within the context of acid sulfate soils.	teachers
	Repairing with redox procedure sheet	This procedure uses organic matter to increase the pH of acid soils.	students
	Solving acid soil problems worksheet	Various methods of reducing the impact of acid soils are outlined in a case study, and questions posed about the effectiveness of these processes.	students

Purpose

To enable students to enrich their understanding of methods used to reduce the effects of acid sulfate soils.

Outcomes

Students:

- explain how organic materials can be used to reduce soil acidity through bioremediation processes that involve redox reactions;
- communicate the results of their investigations to others; and
- analyse procedures for dealing with acid soils, and comment on their effectiveness.

Activity summary

ACTIVITY	POSSIBLE STRATEGY
Student groups complete the procedure, *Repairing with redox*, by selecting an organic substance to investigate and appropriate materials from the equipment list.	students in small groups
When the results of the trials have been completed, findings may be collated and conclusions used to develop recommendations.	Students communicate their results and recommendations to the class.
Students study methods used to deal with acid soils and answer questions on the worksheet, Solving acid soil problems.	students in small groups or individually

Technical requirements

The teachers guide, procedure sheet and worksheet require Adobe Reader (version 5 or later), which is a free download from www.adobe.com. The procedure sheet and worksheet are also provided in Microsoft Word format.

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Teacher notes on procedure

Safety warning: Bioreactors may be made from a 250 mL beaker with a petri dish lid that is taped on during the 'fermentation'. The teacher can extract the sample for pH testing, using a Pasteur pipette, to reduce risks to students. Bioreactors may also be sterilised, by heating, before they are opened.

This activity requires seawater. If none is available, it may be prepared by dissolving 24 g of NaCl, 5 g of $MgCl_2$, 4 g of Na_2SO_4, 0.5 g of KCl and 0.7 g of $FeCl_3$ in 1 L of water. To acidify seawater, add HCl until the pH is about 4. Record the actual value as students will need to compare this pH with their results, after the experiment is completed.

Prepare glucose solution by dissolving 1.5 g of glucose in 1 L of water.

To compare the effectiveness of the various organic materials, allocate each group a different substance and report their results in a whole class discussion at the end of the activity. To allow for a fair comparison, use equal masses of organic materials and equal volumes of 'acid water'.

After a week the organic materials should slowly develop a black, slimy coating. This is a precipitate of metal sulfides (mostly FeS).

It may take longer than a week to observe any significant change in the pH of filtered solutions from the various bioreactors. If this is the case allow the experiment to run for an extended period. A class discussion about the effectiveness of each organic substance and recommendations for use may follow the reporting of results.

SPICE resources and copyright

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Associated SPICE resources

Redox reactions 4: Bioremediation may be used in conjunction with related SPICE resources to address the broader topic of redox.

DESCRIPTION	LEARNING PURPOSE
Redox reactions (overview) This learning pathway shows how a number of SPICE resources can be combined to teach the topic of redox reactions.	
Redox reactions 1: Acid soils A video shows scientists studying acid sulfate soils in two different environments and raises student awareness of the broader problem.	**Engage**
Redox reactions 2: Sulfide chemistry Students explore the chemistry of sulfides through laboratory-based activities.	**Explore**
Redox reactions 3: Acid soils and redox An interactive learning object explains the chemistry of redox processes that lead to the formation of acid sulfate soils.	**Explain**
Redox reactions 4: Bioremediation Students investigate how acid sulfate soil problems can be dealt with through a practical activity and a case study.	**Elaborate**