Filtering the Truth

To consider what water filtration systems have to achieve versus what different systems can achieve

Subject(s): Science, Design & Technology

Approx time: 60 – 90 mins (depending on how many activities are chosen)

Key words / Topics:
> clean water
> health
> disease
> water supply
> treatment systems
> engineers

Suggested Learning Outcomes

> Recall the different types of impurities that exist in water
> Describe how water filtration equipment acts in a number of different ways to produce potable (drinkable) water
> Explain why it is necessary to be able to test the claims of manufacturers in independent tests

Introduction

Water is crucial to human life, but it can also be a killer.

Water contaminated with micro-organisms or chemicals, which is then used for drinking or cooking, is a leading cause of disease and death across the world. Poor facilities for the disposal of sewage and other waste water can quickly lead to the spread of dangerous diseases.

In the UK clean, drinkable tap water is taken for granted; however, in other parts of the world supplies of water are often unsafe to drink unless properly treated. Filtering water is a huge enterprise and often big business. Water can be filtered to improve the quality and taste in safe tap water areas or as a necessity for those travelling and living in other countries. Many advertisers make claims about what their product can achieve some of which may be incorrect. Other claims may not be but, due to lack of knowledge on the part of the consumer, may not fulfil their need. In the case of drinking water this could be potentially dangerous.

These resources look at what is required to provide safe, clean drinking water and explore the claims of those selling filtration equipment.

Purpose

This activity gets students to design an experiment or experiments which will test the claims of companies producing various types of domestic water filtration equipment.

Activity

1.. Explain the following scenario to your class *(ca five minutes)*:

"You are a team of researchers working for a consumer TV programme. The producer is making plans for a one-hour special looking at water purification products. She has asked your team to come up with an experiment or experiments that can be used to test the claims of a particular product.

These tests must use scientific principles to prove or disprove the claims of the manufacturers."

2. Manage a brainstorm where students are asked for ideas about how they might tackle the problem. Record the students' ideas on the whiteboard and then arrange them into steps that broadly follow the approach below *(ca 20 minutes)*:

- Read the advertising material provided (**Product Adverts (Handout)**) and find out what the manufacturers are claiming about their products
- Do the claims have any basis in science?
- Are the claims written in such a way that they can be tested? For example, are there any figures to check?
- Think about what experiment(s) you could do to test these claims
- Will you need to repeat the same experiments or perhaps do different experiments to test the same claim more than once?

3. Give each team one of the adverts. All teams can be given the same advert or all four can be distributed for differentiation purposes. Run through the process they might want to follow and explain that they will have one minute to present their ideas back to the rest of the class. *(ca 10 minutes)*

4. Students present back to the rest of the class. Teacher and class give feedback on the effectiveness of their planned experiments. *(ca 10 minutes)*

Teacher notes

Students should work in small teams.

It must be explained to students that they don't have to understand the filtration processes, but they should think of ways to test the manufacturers' claims.

Note: In the advert for the 'Aquamatic Plus' a claim is made regarding copper contamination. The only method that students may be familiar with that could be used here would be to evaporate the water and conduct a flame test on the residue. This would be an acceptable response however this would not be practical in the real world, where the use of electronic testing kits is much more likely.

Testing for suspended solids could be done with manual 'before and after' counts using a powerful microscope.

Differentiation

Basic

Use only advert 3 which contains claims that are more easily tested.

- Students should have a basic understanding of the difference between mixtures and chemical compounds and the methods which can be used to separate mixtures
- It would be useful for students to have a broader idea about the relationship between clean water and human health and how scientists and engineers are involved in this process. The film 'Safe Drinking Water' provides a useful start to the lesson in this case.

Extension

Ask your students to think of ways of refuting advert 1.

Ask teams to create their own advertisements with claims which they know how to test. These could then be shuffled and redistributed to other teams in the class.

Challenge the teams to design experiments to test the claims of the advertisements created by their classmates.

Resources

Required files

DOC PDF PPT

DOC **Product Adverts (Handout)**

Additional websites

- Palintest® (www.palintest.com): a commercial site with a handy drop-down list of selectable water contaminants. When you select a contaminant the site brings up products which could be used for testing for that particular contaminant.
- RMS Water Treatment (www.rmprocesscontrol.co.uk/Ion.htm): contains plenty of background information on ion concentrations and water testing equipment. (This is a commercial site.)
- Wikipedia (http://en.wikipedia.org/wiki/Water_purification): gives a reasonable overview of water purification methods (search for 'water purification')
- Home water purifiers and filters (www.home-water-purifiers-and-filters.com/carbon-water-filter.php): a page from a commercial site which gives a good account of what activated carbon filters can and can't remove
- Wikipedia (http://en.wikipedia.org/wiki/Reverse_osmosis): a good explanation of reverse osmosis (search for 'reverse osmosis').

Related activities (to build a full lesson)

Starters (Options)
- FILM: Safe Drinking Water
- ACTIVITY: Engineers Can Save Lives
- ACTIVITY: Killer Water
- ACTIVITY: Spreading Disease

Main (Options)
- ACTIVITY: **Filtering the Truth**
- ACTIVITY: Filtering Water

Extension (Options)
- ACTIVITY: Tap Supply
- ACTIVITY: Water Treatment Systems

Plenary
- GAME: Outbreak
- QUIZ: World Water
- Opportunities within activity for presentations, peer/self assessment
- Reflection on Objectives and PLTS skills used

The Engineering Context

> **The story** Safe Drinking Water

Curriculum links

England: National Curriculum	Northern Ireland Curriculum
Science > KS3 1a, 1b, 2a, 2c, 3c, 3e, 17a, 17b, 17d, 17e > KS4 1.1b, 1.2a, 1.3a,c 1.4a, 2.1e Design & Technology > KS3 3d	Science Developing pupils' knowledge, Understanding and Skills > Organisms and health > Chemical and material behaviour (Objective 1) Developing pupils as Individuals > explore the physical, chemical and biological effects on personal health (Objective 3) Developing pupils as Contributors to the Economy and the Environment > investigate the effects of pollution e.g. water and specific measures to improve and protect the environment Technology & Design Developing pupils' knowledge, Understanding and Skills > design – identifying problems; investigating, generating, developing, modelling and evaluating design proposals; giving consideration to form, function and safety (Objective 1) Developing pupils as Individuals > mutual understanding (Objective 2) Developing pupils as Contributors to Society > ethical awareness (Objective 3) Developing pupils as Contributors to the Economy and the Environment > identify product needs and pursue sustainable harmonious design solutions in a local outdoor/indoor context. Learning Outcomes > research and manage information effectively to investigate design issues, using Mathematics and ICT where appropriate; > show deeper understanding by thinking critically and flexibly, solving problems and making informed decisions, using Mathematics and ICT where appropriate; > work effectively with others; > communicate effectively in oral, visual (including graphic), written, mathematical and ICT formats showing clear awareness of audience and purpose.
Scotland	**Wales**
Sciences Materials – Chemical Changes > SCN2-18a Topical Science > SCN2-20a Technologies > TCH 3-01a, TCH 3-02a	Science > KS3 Range (Interdependence of organisms 6 & 7)

Assessment opportunities

Assess the students while they are delivering their presentations. This could be made into a formative assessment if each other the team which are observing also assess the presentation and give feedback to the group.

Personal, learning & thinking skills (PLTS)

> Creative Thinker
> Team Worker