PARTICULATE MATTER TESTING

OBJECTIVE

Students define particulate matter and analyse it. They compare levels of particulate matter in test areas and discover the sources of pollution before suggesting ways to improve air quality.

OVERVIEW

Our atmosphere is made up of invisible gasses and aerosols. Most major air pollutants are also invisible, even though they can be present in high concentrations, particularly in urban areas. Sometimes this can be seen as smog.

One type of air pollution, particulate matter, can be seen. It appears on the surface of buildings as dark smudges and stains. Particulate matter can come from natural sources, like volcanic ash and pollen, but a lot comes from human activities, like the burning of diesel in vehicles, and coal in power plants. Fireplaces and wood-burning stoves also produce significant amounts.

Particulate matter is solid particles and liquid droplets found in the air. Some particles are large or dark enough to be seen with the naked eye, while others are so small that they can only be detected using an electron microscope. Some are known as primary particles, these are emitted directly from a source, such as a construction site or smokestack. Others, known as secondary particles, form when chemicals emitted by industry, react with each other in the atmosphere.

Particulate matter can be harmful to humans, plant life and animals.

The main way to improve particulate matter pollution is to reduce activities that produce particulates. Another solution is to use plants and trees to remove it from the air. Plants with hairy and rough leaves can capture a significant amount.

TIME NEEDED

One lesson to make and install monitors

One lesson to analyse results after one week

PARTICIPANTS

As individuals or in groups

RESOURCES NEEDED

- card
- scissors
- sellotape
- magnifying glasses or microscopes
- hole punch
- permanent markers
- string

LEARNING OUTCOMES

- carry out sampling techniques to measure particulate matter
- present observations and data using appropriate methods, including tables and graphs
- interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions
- present reasoned explanations, including explaining data in relation to predictions and hypotheses

INSTRUCTIONS

1. Introduce air pollution and particulate matter using the background information. Ask students for examples of natural and man-made particulate matter, and sources of particulate matter. Explain the harm it can cause to plant and animal species, as well as human health.
2. Explain the importance of measuring and monitoring particulate matter as the first step to improving pollution.
3. Students will measure and monitor particulate matter at various sites around the school. They need to create particulate matter monitors. Explain how these work and hand out the instructions.
4. The monitors need to be left for a week in various indoor and outdoor locations around the school. Discuss this with the class and decide on suitable test areas. Remember, you want to compare sites that are likely to have varying air quality. You also might want to focus on areas where a lot of people pass by, as they will be breathing in this air.
5. Hang the air strips, using tape to secure the string to a stable They should be able to move freely without bumping surfaces. All air strips should be labelled with the date, location and student's name. (During rain, bring outdoor air strips inside.)
6. After a week, collect the strips. Be careful not to touch the sticky side of the tape.
7. Visually compare control air strip with the air strips used to collect particulate matter.
8. Distribute magnifying glasses or microscopes and ask the students to identify as many particles on the tape as possible. Dust, ash, soot, pollen and other particles may be present.
9. Ask the students to draw conclusions about the particulate pollutants in the test areas. Are there differences in the particles from different areas
10. Have each student develop a chart or graph using the information gathered by the class and write a summary of what they found.
11. Discuss the results

CLASS DISCUSSION

- Where was the most particulate matter found? Which areas has the least? Why do you think that is? What are the sources?
- Do you think time of day affects levels of particulate matter?
- Where do you think the particulate matter is the most concerning, likely to affect the most people, plants or animals?
- Do you think that people have a right to know what the air pollution level is where they live?
- Who is responsible for reducing air pollution?
- How could levels of particulate matter be reduced in the worst areas?

OPTIONAL EXTENSION ACTIVITIES

Further tests
The students might want to conduct further tests, looking at other areas of the school or further afield, or whether time of day makes a difference.

Action plan
The students can use their results and conclusions to create an action plan for reducing particulate matter in the school or reducing student exposure. This might involve designing and mapping a landscape plan for the school, planting trees and plants in areas where the particulate matter is high.

You can find examples of useful plants here: museumoflondon.org.uk/application/files/4915/2604/2216/2018-05-11-phytosensor-final-web-ok-compressed_1.pdf

STUDENT DIRECTIONS

1. Using a ruler to measure, cut a strip of poster board or cardboard that is 2 inches wide and 10 inches long.
2. Cut 5 holes, each about an inch in diameter, in the strip. Use a ruler to find a round object of the right diameter or use a compass to draw the circles. (Note: a two pence coin is roughly an inch in diameter.)
3. Use a hole punch to put a small hole in one end of the strip. Tie a string through the hole. The string will be used to hang the strip at your selected site.
4. Put a long piece of clear tape across one side of the strip. Be sure to cover all 5 holes.
5. The sticky side of the tape will collect particulate matter from the air. Make sure you do not touch the sticky side of the tape over the holes.