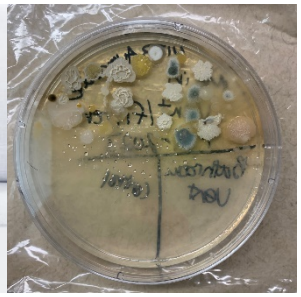
Indoor Environmental Quality



Name: What's in the Air We Breathe?
Grade: Elementary & Middle Schools, 3rd – 6th Grade
Topic: Bacteria, fungi, air pollution, indoor air quality
Time: Activity #1: 1 – 2 Hours; Activity #2: 3 – 5 Days

Introduction:

Have you ever wondered what is in the air we breathe? This Indoor Environmental Quality kit provides two hands-on and interactive activities that use air quality sensors and nutrient agars to make the invisible; visible. The activities and accompanying lesson plan is designed to give an introduction to indoor air quality, using air quality sensors, and interpreting the results.

Activity # 1: Indoor Air Quality Map
In this experiment, students will choose and map locations inside and outside of their school environment. Students will then collect a variety of air quality measurements at different times of the day. Students will then compare the collected data and observe differences in the measurements based on occupied and unoccupied spaces as well as the differences from measurements collected outdoors versus indoors.

Activity # 2: What's in the Air?
Microbes such as bacteria and mold exist all around us. While many microbes are harmless, and can even be helpful to people, some microbes can be unsafe. In this experiment, students will sample, grow, and observe microorganisms in the indoor environment.

Materials

Kit will include:

- One Bosean Air Quality Detector
- Four pre-poured nutrient agar plates
- Four 5”x5” plastic bags and one-gallon size bag
- Indoor Environmental Quality 101 Package
    - Introduction and Key Terms
    - Worksheets

Videos and additional Information can be found on the DFW Earth Day website

Additional Materials Needed:

- Black permanent marker
- Pens/colored pencils
- Clear adhesive tape
- Camera (optional)
- Diluted bleach solution

Activity #1 Indoor Air Quality Map

In this activity, students will collect air quality readings from outdoor and indoor areas and try to find sources of indoor air pollutants.

Materials:

- Air quality detector
- Introduction and key terms package
- Indoor Air Quality Map Worksheet
- Pencils/Clipboard

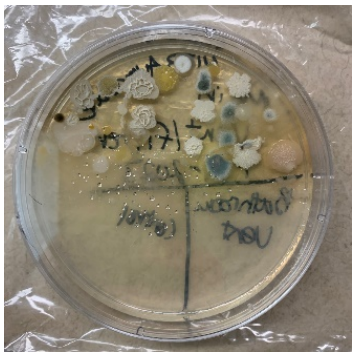
Procedure

1. Before beginning the activity:
    a. Review the introduction and key terms package
    b. Charge the air quality detector
    c. Power on the air quality detector and allow the device to preheat. Once it is preheated, you can change the temperature reading from °C to °F by pressing the “set” button, then “system set”, and “Temp unit”.
2. Decide which indoor locations to include in your air quality study. Suggested locations include those that typically have a large occupancy rate such as classrooms, gyms, and cafeterias. Divide the class into groups and direct them to draw a map of the study locations on the indoor air quality map worksheet in the grid portion of the worksheet. Label the study areas on the worksheet.
3. Before recording air quality readings, allow the air quality detector to “settle” for at least 2-5 minutes in each study location. To ensure accurate readings, hold the air quality detector away from your body and breathing zone.
4. First, collect air quality measurements from the “Outdoor Test # 1 Location” and record the time and measurements on the worksheet.
5. Next, collect air quality measurements from “Test # 1 Location” while the room is unoccupied and record the time and measurements on the worksheet. Repeat this step when the room is fully occupied for comparison purposes.
6. Next, collect air quality measurements from “Test # 2 Location” while the room is unoccupied and record the time and measurements on the worksheet. Repeat this step when the room is fully occupied for comparison purposes.
7. Finally, a second set of air quality measurements from the “Outdoor Test # 2 Location” for comparison purposes.
8. Review the collected air quality measurements and discuss your findings on page two of the worksheet.

Activity #2 Procedure (What's in the Air?)

In this experiment, students will sample, grow, and observe microorganisms collected from the indoor environment.

Materials:



- Four pre-poured nutrient agar plates
- Four 5"x5" plastic bags and a one-gallon size bag
- Indoor Environmental Quality 101 Package
- Microbial Life Observation Sheet
- Black permanent marker
- Pens/colored pencils
- Clear adhesive tape
- Camera (optional)
- Diluted bleach solution (for disposal)

Procedure

1. Divide the class into groups. Choose different locations around your environment mapped out in Activity #1 to place your agar plates. (Refer to the list of suggested sample areas below.)
2. Wash your hands thoroughly and put on gloves.
3. Using a sharpie, label the plates on the rim or on a small area on the bottom of the plate with the name of the selected area, and the date and the time of placement.
4. Place the agar plates in the 4 selected locations with the lid off for approximately 4 hours. Do not leave the lid off the agar plates for longer than 4 hours as this could cause the agar to dry and prevent the growth of microorganisms.
5. After 4 hours, replace the lid on the plates. Apply clear adhesive tape on the rim of the plates to secure the lid.
6. Place the agar plate into a 5"x5" plastic bag and seal it.
7. Leave plates away from direct sunlight and in a warm location where the temperature does not change much.
8. You can expect bacterial/fungal growth to be noticeable within 3 – 4 days. Inspect the plates every day, making notes about your observations using the attached Microbial Life Observation Sheet. Count the number of colonies of bacteria found in each plate and draw the different varieties that you have found. Optional: Take photos of the plates each day to observe how the microbial colonies multiply over time.

Suggested Test Locations

- One outside location for comparison to the indoor areas
- Areas with high occupancy (hallways, cafeterias, classrooms, gyms)
- Area under HVAC filters
- HVAC outlet vents
- Areas that were identified to have better or worse air quality based on the results of Activity #1

Dispose of Your Petri Dishes !

After one week of observation, it is time to dispose of the used agar petri dishes. Do NOT open the agar petri dish or plastic bag once it is sealed!

After 1 week of observations, place all the petri dishes into the gallon resealable bag. Add 1 cup diluted bleach to the bag and seal it.

2. Throw the entire sealed bag of petri dishes into the trash.

Conclusion/Key Takeaways:

Activity # 1

The air we breathe is an incredibly important factor impacting human health. The quality of the air we breathe is also impacted by a variety of factors and pollutants in our environment. Different areas of the environment that you interact with on a day-to-day basis will have vastly different air quality parameters that can be influenced by numerous factors. Indoor air quality can be influenced by how many people are in a space, how often that space is cleaned, the activity being done in that part of the building, the age of a building, and the quality/maintenance of the HVAC system being used. The quality of outdoor air quality can be influenced by industries and cars contributing to pollution in the area, vegetation in the area, and activities occurring in that outdoor space. Have you identified the factors that impact the air quality parameters in the spaces in which you took measurements?

Activity # 2

In addition to the invisible pollutants that were previously identified in the air we breathe, there are also microscopic mold and bacteria that exist in the air that is invisible to the human eye. Typically, there are more of these micro-organisms in outdoor air because these living things are a part of nature, and outdoor habitats (much like the petri dish that was used during the activity) have the right moisture and nutrient conditions to allow these organisms to flourish. Indoor air environments typically have some form of HVAC filtration that can filter out many of these microorganisms. These HVAC systems also circulate air to control humidity and temperature to create inhospitable for many molds and bacteria. Was this trend reflected in the different areas where petri dishes were placed? Do these trends relate to the results of the particulate matter trends from the previous activity?