Data Collection & Reflection Worksheet for Module 2 HOA B

Grouping: Pairs or small groups (3–4)
Time: 35–45 minutes (initial setup) + ~5–10 minutes every 2–3 days for monitoring
Materials: Refer to the **Instructions Worksheet** for a full list of materials and safety guidelines (e.g., buckets, bran, gloves, pH strips, etc.). Use this sheet to record data during the Bokashi fermentation process.

Background

In this activity, you will collect data on pH, odor, and leachate (liquid) production to track how microbes transform food scraps during Bokashi fermentation. **Bokashi** is an anaerobic fermentation method – it relies on microbes that thrive **without oxygen** to break down the sugars, starches, and proteins in food waste, producing organic acids and preserving the material. Unlike traditional composting, Bokashi fermentation happens in a sealed bucket. It yields two products: a fermented solids mixture (which can later be buried or composted to become soil amendment) and a nutrient-rich liquid often called "Bokashi tea" (the leachate).

As the fermentation progresses, you can measure several changes to understand what's happening:

- **pH:** The leachate (liquid that drains into the bottom bucket) should become more **acidic** over time (dropping toward roughly pH 4). Tracking the pH at different intervals shows how quickly and effectively the Bokashi microbes are creating acids. A steadily dropping pH indicates active fermentation.

- **Leachate Volume:** Measuring the amount of liquid produced (in milliliters) provides insight into the breakdown process. More leachate might mean the scraps contained a lot of moisture that is being released, or it could indicate the degree of decomposition. Tracking volume over time lets you see when the most breakdowns are happening.

- **Odor Observations:** The smell of the Bokashi bucket contents will change as fermentation progresses. It typically starts neutral or faintly sweet (thanks to the bran) and then becomes a strong, sour, pickled smell (often compared to vinegar or silage) as acids form. Recording how the odor changes provides qualitative evidence of microbial activity, helping to confirm that fermentation (not rotting) is occurring. The **leachate's odor** is also notable – it might smell acidic or yeasty.

- **Appearance Notes:** You might notice a white fuzzy mold or yeast layer on the top of the scraps – this is normal and often a **good** sign (commonly a type of yeast or harmless mold that works with Bokashi microbes). The food scraps will soften and take on a pickled appearance over time. You may also see condensation on the lid or sides of the bucket. Note any visible changes, such as color, mold growth, or texture, of the material.

By collecting both **quantitative data** (numbers like pH values and liquid volume) and **qualitative data** (descriptions of smell and appearance), you are building a complete picture of how microbes drive the fermentation process and **prevent putrefaction**. Essentially, you'll observe how we can **preserve and transform food waste into a resource** for soil health, rather than letting it rot and release greenhouse gases. This is a small-scale example of a circular system in action!

Bokashi Bucket Log

Fermentation Monitoring Log
Use the following table to record your observations at each check-in. Each time you open the Bokashi bucket to monitor, fill in a row. If you have pre-planned check days, you can label them (Day 7, Day 10, etc.) or just use actual dates.

Date	Leachate Volume (mL)	pH Reading	Smell Description	Visible Changes (condensation, white mold, liquid at bottom)	Notes (food types, chopped or whole)
Day 0 (Setup)	– (none yet)	– (n/a)	Neutral, bran-like (initial state)	Fresh scraps mixed with bran; no liquid present yet	(Example: Mixed cafeteria scraps – fruit peels, rice, bread; chopped into small pieces.)
Day 7					
Day 10					
Day 14					
Day 18					
Day 21 (Final)					

Guiding Questions: *(Discuss these as you monitor the fermentation and after you complete the experiment.)*

- **pH Trend:** How did the pH of the leachate change over the monitoring period? Did it drop quickly, gradually, or not much at all? What does the pH tell you about how active the fermentation was at different stages?
- **Odor Evolution:** How did the smell change from Day 0 to Day 21? Describe the odors (e.g., from a neutral or bran smell to a sour, fermented smell). At which point did the smell become the strongest or most noticeable?
- **Leachate Production:** How did the volume of leachate change over time? For example, was there a big jump in liquid after the first week, or did most of it come out later? What might the amount of liquid suggest about the decomposition process or the moisture content of the scraps?
- **Microbial Activity:** What microbial processes might explain the changes you observed (in pH, smell, and appearance)? Consider what the Bokashi microbes are doing: producing lactic acid and other compounds, out-competing rot-causing bacteria, and so on. How do those processes create the trends you saw in your data?
- **Microbes and Waste Reduction:** Based on this experiment, what does it suggest about the role of microbes in reducing or stabilizing food waste? (Think in terms of preventing foul odors, preserving nutrients, and reducing what would otherwise become harmful landfill emissions.)

After you have collected all your data and filled out the tables, use the questions below to reflect on the broader significance of what you observed.

Reflection and Analysis

Now take a step back and look at the bigger picture of this activity. Discuss the following with your group and record your thoughts:

- **Summarize your findings:** In a short paragraph, recap what you observed during the Bokashi fermentation. What were the key changes from start to finish (pH dropped, smells changed, leachate produced, appearance of scraps, etc.)? Were there any surprises or particularly interesting results?
- **What does this fermentation process reveal about microbial ecology and food system sustainability?** Consider how the microbes effectively preserved and transformed the waste. Why is that valuable for sustainability? (Hint: It shows how we can use biological processes to manage waste, keep nutrients cycling through the system, and avoid creating methane as in a landfill. It's an example of working *with* natural processes to solve a problem.)
- **If you were advising your school or community, what two recommendations would you make to reuse or reduce cafeteria food waste?** Think about how to apply what you learned: Would you set up a Bokashi system campus-wide? Should you start a composting program or a food donation initiative? Perhaps a combination of methods? List two concrete actions or programs and briefly explain why you chose them. Consider both technological solutions **and** behavior changes (for example, needing students to sort their waste, or an awareness campaign to reduce waste in the first place). How do these actions align with making our food system more circular and sustainable?

By reflecting on these questions, you'll connect the hands-on data to real-world implications. You have seen in miniature how a **circular waste-to-resource system** can work (turning food scraps into soil nutrients). This ties into global sustainability efforts – for instance, reducing food waste and returning nutrients to soil supports **UN Sustainable Development Goals** like **Responsible Consumption and Production (SDG 12)** and **Climate Action (SDG 13)**. In the next module, we'll take this a step further by using the fermented Bokashi material to enhance soil and see first-hand how it benefits plant growth (linking to **Module 3: Soil Health**).

Skills You'll Use:

- Following a **protocol** to set up and monitor an anaerobic fermentation system.
- Collecting and analyzing both numerical data (pH levels, volumes) and observational data (sensory changes like smell and sight).
- **Interpreting data** to infer biological processes (e.g., understanding how microbial fermentation progresses from the trends you see).
- Applying **systems thinking:** recognizing how this small-scale experiment is part of a larger **circular system** – connecting cafeteria behavior, waste management technology, and environmental impact.
- Drawing connections between hands-on activities and broader concepts in sustainability and science (from classroom lessons to global challenges).