Developing a Research Question for your Biodigester Research

Writing a Research Question

Research questions have the following format:

How does **A** affect the **B** of **C**?

A: independent variable (what you will change)

B: dependent variable (what you will measure)

C: The subject of your experiment (what you will be experimenting on)

Example of a Research Question

Suppose you are interested in what affects the quality of the water in an aquarium…

How does A affect the B of C?

A: independent variable (what you will change)

B: dependent variable (what you will measure)

C: The subject of your experiment (what you will be experimenting on)

Example of a Research Question

Suppose you are interested in what affects the quality of the water in an aquarium …

A: independent variable (what you will change)

What can we change about the quality of water?

4

Example of a Research Question

Suppose you are interested in what affects the quality of the water in an aquarium …

B: dependent variable (what you will measure)

What kinds of data can we observe and record about the fish tank?
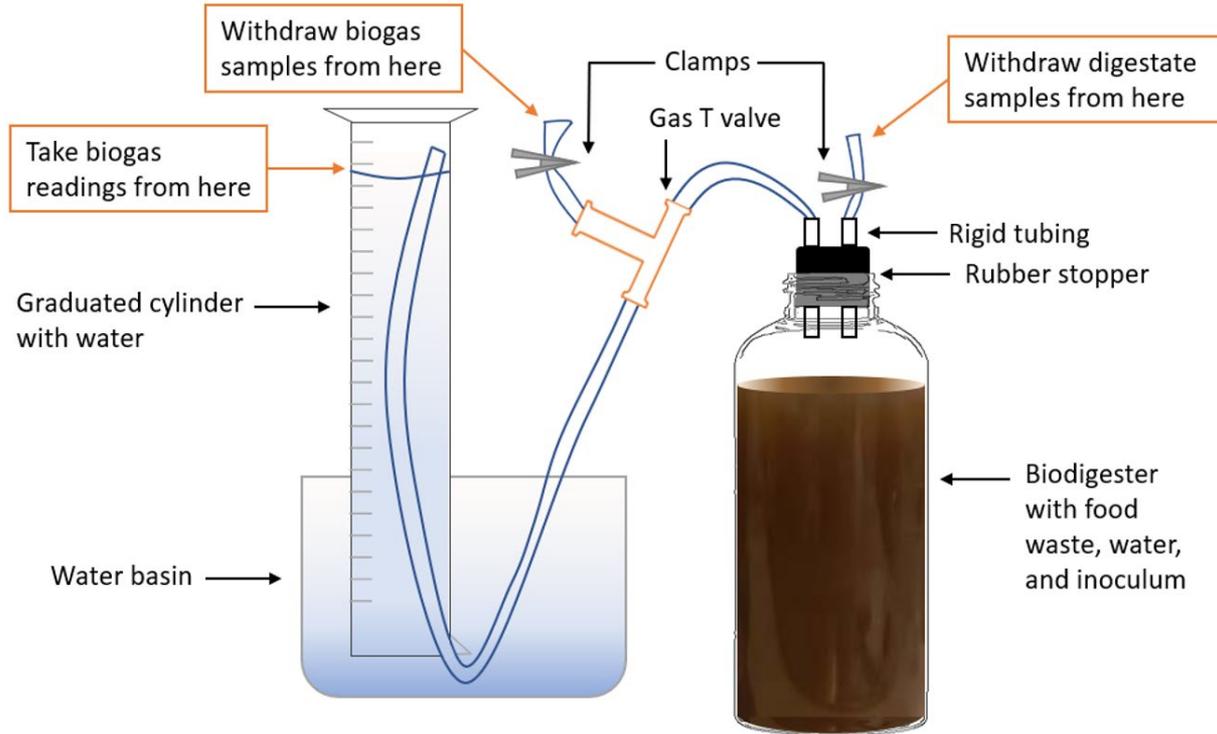
Example of a Research Question

Suppose you are interested in what affects the quality of the water in an aquarium …

C: The subject of your experiment

(what you will be experimenting on)

The subject of the experiment is the **water in the aquarium**, but we could also experiment on the **fish** or **plants** inside.

Remember the model biodigester?

Withdraw biogas samples from here

Clamps

Withdraw digestate samples from here

Take biogas readings from here

Gas T valve

Rigid tubing

Rubber stopper

Graduated cylinder with water

Biodigester with food waste, water, and inoculum

Water basin

What variables affect the biodigester?

Remember the elements of the model biodigester:

- A biodigester containing:
  - Feedstock (a mixture of organic waste)
  - Inoculum (microorganisms consuming the feedstock)
  - Water

- A gas collection system, where we measure:
  - How much biogas is produced
  - How much of the biogas is methane

Can you identify the independent and dependent variables listed above?

What variables affect the biodigester?

Remember the elements of the model biodigester:

- A biodigester containing:
  - Feedstock (a mixture of organic waste)
  - Inoculum (microorganisms consuming the feedstock)
  - Water

Independent variables

- A gas collection system, where we measure:
  - How much biogas is produced
  - How much of the biogas is methane

Dependent variables

Writing a Research Question

Using the biodigester:

How does **A** affect the **B** of **C**?

A: independent variable (what you will change)
B: dependent variable (what you will measure)
C: The subject of your experiment (what you will be experimenting on)

What independent variable can we change to affect the dependent variable in the biodigester?

Writing a Research Question

Possible independent variables:

- Temperature and changes in temperature over the day

- pH, or the level of acidity in the solution

- How much water is in the solution

- How much food and inoculum are in the solution

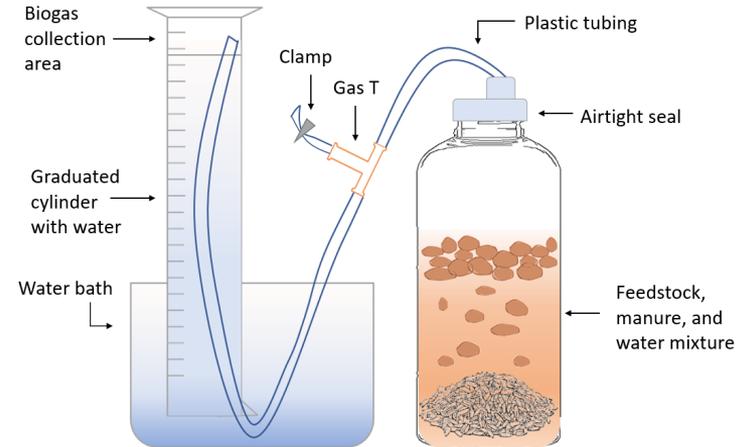- What kind of inoculum or manure is used
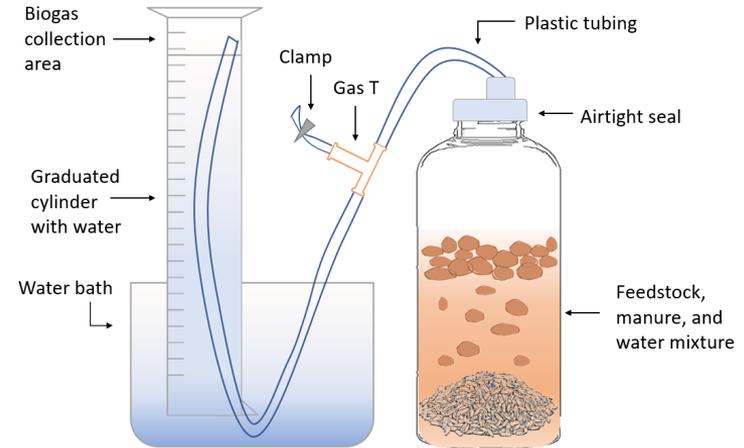
What others can you think of?

Writing a Research Question

Possible dependent variables:

- pH, or the level of acidity in the solution
- Biogas production
- Methane content of the biogas

What others can you think of?

Biogas collection area

Graduated cylinder with water

Water bath

Clamp

Gas T

Plastic tubing

Airtight seal

Feedstock, manure, and water mixture

Writing a Research Question

Write at least one research question about the biodigester using this format:

"How does _____ affect the _____ of the biodigester?"

Then answer these questions:
1. *How would you set up the experiment to answer your question?*
2. *What will remain constant? What will you change?*
3. *What measurements will you make?*