

4.2.3 Soil Buffers

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Problem

What is the relationship between soil texture and buffering capacity of soil?

Hypothesis

We hypothesized that the clay texture of soil will have a high buffering capacity.

Materials

PPE: Apron, Safety Glasses, Gloves

3 100 ml Beakers

2 250 ml Beakers

 One with the buffer solution

 One to be used for a rinse container

3- 30 ml cups

1 -Electronic balance

1-35g sample of clay, silt, sand

3 9 oz dixie cups

1 bottle of distilled water

1 bottle of sodium hydroxide

1 tape

1 permanent marker

1 LabQuest2

1 Dissolved Oxygen Probe

Procedures

+Procedures were developed based on the Project 4.2.3 of the AFNR Curriculum+ They were modified but not created by this group.

1. Obtain a 250 ml beaker with 100 ml of buffer solution.
2. Using tape and permanent marker label the 250 ml beaker buffer solution
3. Label the second 250 ml beaker rinse beaker
4. Set up the LabQuest2 for date collection
5. Attach the pH sensor to Channel 1
6. On the Meter screen, tap Mode. Change the data collection mode to Events with Entry
7. Enter the Entry Label as drops and leave Units field blank
8. Use a permanent marker pen and tape to label a 100 ml beaker acidic.
9. Place 30 ml of distilled water in the beaker
10. Poor in the 35g samples of clay, sand and silt into each 100 ml filled with 30 ml of distilled water
11. Rinse the pH sensor thoroughly with distilled water
12. Place the sensor into the buffer solution
13. Rinse the pH sensor thoroughly with distilled water
14. Place sensor into the combination of distilled water and soil texture: sand

15. Start the data collection. Monitor the pH readings displayed to the right of the graph.
When the readings are stable, tap keep
16. Using the numerical keyboard displayed on the screen, Enter 0 as the number of drops you have added. Select ok to store the first data set for this experiment
17. Rinse the pH sensor thoroughly with distilled water and place the sensor into the beaker of buffer solution then rinse with distilled water
18. Add 5 drops of NaOH(base). Stir the solution thoroughly with a stirring rod after adding the acid
19. Place the pH sensor in the solution
20. When the LabQuest2 readings are stable, tap Keep. Enter the total number of drops of NaOH added to the water in the beaker and select OK
21. Rinse the pH sensor thoroughly with distilled water and place the sensor into the beaker of buffer solution then rinse with distilled water again
22. Repeat Steps 18-21 adding 5 drops of NaOH each time until the amount added is a total of 30 drops
23. Stop data collection by tapping on the red square on the screen
24. Examine the data on the displayed graph.
25. Repeat steps 18-21
26. Record the data on the graph
27. Repeat steps 14-26 with the soil texture: silt
28. Repeat steps 14-26 with the final soil texture: clay
29. Record data onto graph and complete the total change in pH for each texture type

Data Collection

Soil Type	0 Drops	5 Drops	10 Drops	15 Drops	20 Drops	25 Drops	30 Drops
Sand	6.37	9.49	9.77	9.9	9.99	10.06	10.16
Silt	6.86	6.88	6.93	6.93	6.94	6.94	7.11
Clay	7.62	7.75	7.74	7.93	8.06	7.93	7.86

Total pH Change:

Sand= 3.79

Silt= .25

Clay= .44

Analysis of Results

The results we collected did not match our hypothesis. The highest buffering capacity was actually the Silt soil. Shortly behind was Clay and sand was as we expected.

Conclusions

Our predictions were not completely wrong. We predicted that Clay would have the highest buffering capacity it was not from the data we collected. This could have been caused by human error. We could have put too many drops in on one of the drop sections, not have rinsed the dissolved oxygen probe completely or not have stirred the mixture well enough. The questions are group has if we were to repeat this experiment with the exact same materials and procedures would we receive the same results? Would our hypothesis be correct? According to

the science and soil scientist we are correct. How much of an error did we have? Should we have calibrated before the experiment. Overall the experiment was very enlightening to what we were wanting to know which was what soil type had the highest buffering capacity.