**Effects of pH on Solubility**

You probably have heard that it is important to manage proper soil pH. Have you ever wondered why? Why do farmers worry if the soil is too acidic or basic? What is the right range of pH for healthy plant growth? In this experiment, you will test the solubility of iron (III) nitrate and make an inference as to why pH is a critical factor in plant growth.

**Learning objectives:**

* Observe and qualitatively characterize how pH affects solubility of iron (III) nitrate
* Reason about what might happen when the pH of soil or hydroponic solution is not in the right range

**Materials**

* 0.1 M Iron (III) Nitrate
* 0.5 M Hydrochloric Acid
* 0.5 M Ammonium Hydroxide
* 100 mL beaker
* pH probe
* Gloves S, M, L

**Safe Notes**

* Waste can go down the drain.
* The experiment should be performed in the fume hood.

**Procedure**

1. Add about 40 ml of the Iron (III) nitrate solution to a 100 mL beaker.
2. Using the pH probe, measure the pH of the solution and record it in the table below.
3. Add 0.5 M Ammonium Hydroxide to the ferric nitrate solution by the amount indicated in the left-most column of Table 1. With each addition, calculate the total ammonium hydroxide solution added and record it in the second column. Then, measure the pH, make observations of the reaction in the beaker, and record in the table.

Table 1

|  |  |  |  |
| --- | --- | --- | --- |
| Ammonium Hydroxide Solution Added | Total Volume of Ammonium Hydroxide Solution Added |  pH probe reading | Observations  |
| Initial (0 mL) | 0 | 1.58 | Yellow orange solution |
| 0.5 mL | 0.5 | 1.60 | Solution forms a “cloud” that disappears upon shaking |
| 0.5 mL | 1.0 | 1.65 | Solution is cloudy |
| 4 mL | 5.0 | 1.91 | Clumps form |
| 1 mL | 6.0 | 2.01 | More clumps form |

1. To the same beaker of solution used above, add 0.5 M Hydrochloric Acid in the amount indicated in the left-most column of Table 2. With each addition, calculate the total hydrochloric acid solution added and record it in the second column. Then, measure the pH, make observations of the beaker, and record in the table.

Table 2

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrochloric Acid Added  | Total Volume of Hydrochloric Acid Solution Added |  pH probe reading | Observations |
| Initial (0 mL) | 0 | 2.01 | Red orange solution with some clumps |
| 2 mL | 2 | 1.90 | Some clumps disappear |
| 2 mL | 4 | 1.71 | Red orange solution with some turbidity |
| 1 mL | 5 | 1.65 | Red orange solution with some turbidity |
| 1 mL | 6 | 1.61 | Clear red orange solution |
| 1 mL | 7 | 1.55 | Clear red orange solution |

Data Analysis and Discussion

1. Summarize the findings and explain the relationship between pH and solubility of iron (III) ion.
2. What might be the precipitation observed in Step 3? Why do you think so?
3. Based on this finding, explain why it is important to manage pH of soil or hydroponic solution. Think of what might happen to soil and hydroponic solution if its pH is high and how plants might be impacted.