

"Healthy Water, Healthy People" Experiment: Parameter - Hardness



Turbidity Sensor (PS-2122)



Overview:

The water hardness test is significant for residential consumers who find hard water interferes with household cleaning effectiveness. This test is also crucial to industrial processes seriously impacted by the effects of hard water on expensive equipment as well as their final product.

Equipment:

For each lab group:

- Turbidity Sensor: [PASPORT \(PS-2122\)](#)
- Computer Interface: [PASPORT Xplorer \(PS-2000\)](#) | [PASPORT Xplorer GLX \(PS-2102\)](#)
- Limestone, concrete or antacid tablets
- Four 2-liter plastic bottles
- Cardboard box
- Sand
- Coffee filters
- Bath water softener
- Cation-exchange resin
- Liquid Ivory hand soap



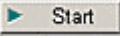
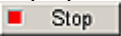
Software Setup:

1. Click on one of the links below to download a pre-configured DataStudio file for this Turbidity experiment, and then open the file.
File Format: [Windows \(.zip file\)](#) or [Macintosh \(.sit file\)](#)
2. When the file is opened, you should see a graph display and a table display of Turbidity vs. Solution #, as well as a digits displays of Turbidity.

3. Connect the Turbidity sensor to an Xplorer or Xplorer GLX.

Experimental Procedure:

Data Recording:

1. The day before the experiment, prepare hard water by adding limestone, concrete, or antacid tablets to tap water.
2. Place four funnels cut from plastic 2-liter bottles in a rack made from an upside down cardboard box with holes cut in the bottom.
3. Position four jars under the 2-liter bottle funnels.
4. Place a coffee filter in each funnel.
5. Fill one funnel one-third of the way with sand.
6. Fill the second funnel one-third of the way with a bath water softener containing sodium hexametaphosphate (e.g. Calgon).
7. Fill the third funnel one-third of the way with a cation-exchange resin.
8. Leave the last funnel empty, except for the filter, as a control.
9. Pour 5 ml of hard water through each funnel and collect it in the jars.
10. Take a sample of each water and fill a clean, empty cuvette.
11. Place the first cuvette into the Turbidity Sensor and close the lid.
12. If outdoors and not connected to a computer or laptop, press the () on the Xplorer or GLX to begin collecting data. Watch the digits display for the turbidity reading to stabilize, and note the result. Click the () on the Xplorer or GLX to end data collection.
13. If indoors and connected to a computer or laptop, click the Start button () in DataStudio. Watch the digits display for the turbidity reading to stabilize, and note the result. Click the Stop button () in DataStudio to end data collection.
14. Remove the cuvette from the Turbidity sensor.
15. Repeat steps 10-14 for each cuvette.
16. Add one drop of liquid Ivory hand soap (not liquid detergent) to each jar.
17. Stir each water sample gently, cleaning the stirring device between each sample.
18. Collect new samples and repeat steps 10-14 for each cuvette, and compare the cloudiness or turbidity. The more turbid the water, the more the soap is dispersed. Soap that is highly dispersed cleans better.