

Activities To Go

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Coagulation/Flocculation Experiment

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What are coagulation and flocculation? These are related processes that can occur naturally, and that are promoted in water and wastewater treatment to remove particles from the water. Coagulation is the initial gathering together of small particles. Flocculation is when the particles further gather together to form clumps that then settle out of the water.

Suspended particles in water cause the water to look dirty or cloudy. Clay is a good example. Clay particles are very small and do not have enough mass to settle very quickly. They also have a negative charge. Chemicals or polymers added to the water either wrap around the particles or are attracted by charge. Alum and lime are two common chemicals used. The resulting flocs settle to the bottom and form a sludge.

If too little chemical is used, some of the clay will remain suspended. If too much chemical is used, the charge can be reversed and the positive charges will cause the materials to remain suspended... and the water to remain cloudy. These chemicals can also be expensive or create a large volume of sludge. Therefore, drinking water treatment plants will conduct "jar tests" to determine the proper chemical dosage.

Materials:

- "Dirty water": 1-gal of tap water with 1/4 cup of dirt (organic, sand, and clay components) added. Shake well and allow to settle for 10 minutes prior to filling 8-oz. bottles.
- 8-oz. screw-cap water bottles (empty)
- alum or pickling lime
- measuring spoons

Procedure:

Students can work in pairs or individually. Fill each 8-oz water bottle to its shoulder with the "dirty water" after allowing it to settle. Assign each student or group an amount of alum or pickling lime to add. For example, 1/8 teaspoon (tsp), 1/4 tsp, 3/8 tsp, 1/2 tsp, 5/8 tsp, 3/4 tsp, 7/8 tsp, 1 tsp, 1 1/8 tsp, 1 1/4 tsp, etc. Screw on cap and shake vigorously for 7 seconds. THEN, swirl very gently for 1 minute. The shaking allows the chemical to contact all of the water rapidly, whereas the swirling allows the small clumps to begin to form. If swirled too rapidly, the clumps can break apart and won't settle as well. After swirling, place the bottle on the counter and allow to settle for 10 minutes.

Which dosage resulted in the clearest water? The required dosage changes with water quality, so water treatment plants perform this test periodically. When would the water likely be cloudier than usual? What causes this? (Hint: Sediment is the number one pollutant in North Carolina).

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