Module #10

Calculating Water Quality Index

Adapted and excerpted from Field Manual for Water Quality Monitoring: An Environmental Education Program for Schools by Mark M. Mitchell and William B. Stapp

Materials

small water sample bottle and cap (holding at least 100ml and rod sampler if needed
(constructed from a series of metal rods that can be extended and rubber tubing that holds a sample bottle)
gloves
300 ml beaker
oven or burner
tongs, pads or gloves
sensitive balance
pipette or graduated cylinder

Background Information

from http://www.h2ou.com/h2wtrqual.htm a subsite of hach.com

Total solids (sometimes called total residue) is related to turbidity, except that it includes not just suspended solids, but also dissolved solids such as the mineral ions calcium, phosphorus, iron, sulfur and bicarnonate. A certain level of these ions is essential for life. Cells also depend on the density of total solids to determine the amount of water that flows in and out of the cell.

However, too much dissolved solids in water can affect humans by inducing a laxative effect and giving the water a mineral taste. Increased total solids has a similar effect to turbidity in that water clarity is reduced, water temperature can rise, oxygen levels can fall as a result of less photosynthesis, and solids can bind to toixc compounds and heavy metals.

This water quality measure (also referred to as total residue) includes: 1) dissolved solids or that portion of the materials in water that pass through a filter and 2) suspended solids or that portion of the toal retained by a filter. Dissolved or inorganic materials include calcium, bicarbonate, nitrates, phosphates, iron, sulfur, and other ions found in a water body. A constant level of these materials is essential for the maintenance of aquatic life because the density of total solids determines flow of water in and out of organisms' cells.

A. TOTAL SOLIDS Sampling Procedure

It is important to obtain representative water samples either from the middle of the river or at least out from the shore as far as possible. Water samples should also be taken between the surface and river bottom if possible.

B. TOTAL SOLIDS Testing Procedure

1. Place a glass-stoppered bottle (that holds at least 100 ml) about halfway to the bottom of the river if sampling from shore without a sampling device. Remember those gloves! Open the bottle and fill; stopper the bottle and remove from the water. Remove any large floating particles or submerged masses from the sample.
2. In the laboratory, clean a 300 ml beaker (a 300 ml beaker provides greater surface area) and dry in a 103°C oven for one hour. The beaker may also be placed over a burner with low red heat.
3. Remove beaker from heat with tongs and allow it to cool, then weigh with a sensitive balance (to the nearest .0001 gram). Do not touch the beaker with bare hands because body moisture will be transferred to it, thereby changing the weight of the beaker. Use tongs, if available, or otherwise pads or gloves.
4. Transfer a 100 ml sample into the 300 ml beaker. If sample has been sitting, swirl the sample water before measuring by pipette or graduated cylinder.
5. Evaporate the sample, dry the beaker and resulting residue in a 103°C oven overnight. Allow the beaker to cool, then reweight it. It is important not to touch the beaker with your hands.
6. Subtract the weight of the beaker (before the sample) from the weight of the beaker and residue to obtain the increase in weight, or the weight of the residue (in grams). See formula on back.

The formula for determining total solids is:

$$\frac{\text{Increase in weight in gm}}{\text{Volume in milliliters (ml)}} \times \frac{1000\text{mg}}{1\text{ gram}} \times \frac{1000\text{ml}}{1\text{ liter}} = \text{mg/l}$$

Example: Weight of beaker and residue = 48.2982 grams
Weight of beaker 48.2540 grams
Weight of residue .0442 grams

$$\frac{.0442\text{ grams}}{100\text{ml}} \times \frac{1{,}000\text{mg}}{1\text{ gram}} \times \frac{1.000\text{ ml}}{1\text{ liter}} = 442\text{ mg/l}$$

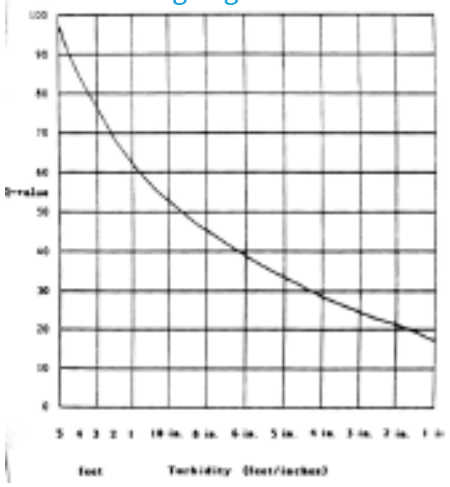
C. TURBIDITY Calculating the Results

To compute the Q-value for the turbidity, follow these steps:

1. Find the weighting curve chart (below);
2. Locate your test result on the bottom (horizontal or "x" axis) of the chart;
3. Interpolate the Q-value for your test result using the following steps;
4. From your test result value on the horizontal ("x") axis of the chart, draw a vertical line up until it intersects the weighting curve line;
5. From this point of intersection, draw a horizontal line to the left hand side (the vertical or "y" axis) of the chart;
6. Where this horizontal line intersects the vertical ("y") axis of the chart, read off the value. This is the Q-value for this test; it should be recorded in Column B on the WQI chart on the Calculating Water Quality Index (Module 10).

The Q-value for each test should then be multiplied by the weighting factor listed in the chart on the Water Quality Index page. Record the product of this calculation in Column D of the chart.

Total Solids Weighting Curve Chart



TS: mg/l Note: if TX>500.0, Q=2-/0