

## Chemical and Nutrient Analyses of Water Samples

### Introduction

The varying geological substrates and overlying soils that a river runs through can alter the chemical composition of the water found in that particular water body. The chemical parameters of water can be measured using different techniques. **Dissolved oxygen, pH, temperature and conductivity** are all measured using probes and meters. Parameters such as **alkalinity** and **hardness** on the other hand can be measured on site using test kits. Both alkalinity and hardness are measured using colorimetric tests. This means chemicals are added to the sample until a particular colour change occurs. The amount of the chemical needed to produce the colour change can then be used to determine the alkalinity and total hardness of the sample. **Nitrates** and **Phosphates** can be measured using either simple colorimetric tests or spectrophotometers.

### Objectives

- To determine the water chemical status of two river samples (River Kipp and River Cross)
- To establish the nutrient levels within the two river samples
- To examine and compare the chemical and nutrient composition of the river samples

### Method

#### 1. Using probes and meters

Use the probes provided to determine and record the pH, temperature, conductivity and dissolved oxygen (mg/L, % Saturation & Temperature °C) of each river sample.

#### 2. Conducting colorimetric tests

Using the instructions below carry out tests for alkalinity and hardness on the two water samples.

#### ***Alkalinity tests (High Range)***

- a. Fill the glass mixing bottle to the second line with the water sample to be tested
- b. Add one drop of Phenolphthalein Indicator Solution to the mixing bottle
- c. If the water remains colourless, the phenolphthalein alkalinity is zero. Proceed to Step E
- d. If the water turns pink, add Sulphuric Acid Standard Solution drop by drop to the mixing bottle. Count each drop added until the solution becomes colourless. The phenolphthalein alkalinity corresponds to the number of drops of Sulphuric Acid Standard Solution added to change the colour from pink to colourless
- e. Add the contents of one Bromcresol Green-Methyl Red powder pillow to the mixing bottle and swirl.
- f. Add more Sulphuric Acid Standard Solution to the mixing bottle drop by drop until the colour changes from blue-green to pink. Continue counting each drop added to the mixing bottle.

- g. The total alkalinity in grains per gallon  $\text{CaCO}_3$  is equal to the total number of drops of Sulphuric Acid Standard Solution added
- h. To express the results in mg/l, multiply the number of grains per gallon by 17.2

### ***Alkalinity tests (Low Range)***

- a. Fill the glass mixing bottle to the first line with the water sample to be tested
- b. Add one drop of Phenolphthalein Indicator Solution to the mixing bottle
- c. If the water remains colourless, the phenolphthalein alkalinity is zero. Proceed to Step E
- d. If the water turns pink, add Sulphuric Acid Standard Solution drop by drop to the mixing bottle. Count each drop added until the solution becomes colourless. The phenolphthalein alkalinity corresponds to the number of drops of Sulphuric Acid Standard Solution added to change the colour from pink to colourless divided by 2.5
- e. Add the contents of one Bromcresol Green-Methyl Red powder pillow to the mixing bottle and swirl.
- f. Add more Sulphuric Acid Standard Solution to the mixing bottle drop by drop until the colour changes from blue-green to pink. Continue counting each drop added to the mixing bottle.
- g. The total alkalinity in grains per gallon  $\text{CaCO}_3$  is equal to the total number of drops of Sulphuric Acid Standard Solution added
- h. To express the results in mg/l, multiply the number of grains per gallon by 17.2

**Remember !!** You only divide by 2.5 the number of Sulphuric Acid Standard Solution drops added between steps a-d . Always multiply by 17.1 to convert grains per gallon to mg/l.

### ***Hardness***

- a. Fill the glass mixing bottle to the second line with the water sample to be tested
- b. Add three drops of Buffer Solution (Hardness 1) to the mixing bottle and swirl
- c. Add one or two drops of ManVer Hardness Indicator Solution (Hardness 2) to the mixing bottle and swirl
- d. Add titrant reagent (Hardness 3) drop by drop to the mixing bottle until the colour changes from pink to blue
- e. If the water remains colourless, the phenolphthalein alkalinity is zero. Proceed to Step E
- f. The hardness in grains per gallon  $\text{CaCO}_3$  is equal to the total number of drops of Titrant Reagent added
- g. To express the results in mg/l, multiply the number of grains per gallon by 17.2

### ***3. Using spectrophotometer to determine phosphate and nitrate***

#### ***Phosphate analysis (LR)***

- 1. *Carefully* remove the foil from the screwed on DosiCap Zip.
- 2. Unscrew the DosiCap Zip.
- 3. Pipette 2.0 mL of your water sample into the tube.
- 4. Pipette into the cuvette: 0.2 mL Reagent B (LCK 349 B). Close Reagent B *immediately* after use.

5. Screw a *grey* DosiCap C (LCK 349 C) onto the cuvette.
6. Invert a few times. After *10 min* invert a few times more, thoroughly clean the outside of the cuvette and evaluate.
7. Record you results

### ***Nitrate Analysis***

1. Select test 355 from the stored programs available on the DR2000
2. Fill a sample tube with 10ml of your water sample
3. Add one NitraVer 5 Nitrate Reagent Powder Pillow and Stopper the tube
4. Press the 1 min timer – OK (a one minute reaction period will begin)
5. Shake the cell vigorously until the timer expires
6. Press the 5 min timer – OK (a five minute reaction period will begin). At this point an *AMBER* colour should appear if nitrate is present
7. Prepare a blank/control sample by filling a second sampling tube with 10ml of your water sample
8. Wipe the blank and insert into the cell holder with the fill line facing right
9. Press *zero* (0.0mg/l)
10. Within one minute after the 5min timer expires, wipe the prepared sample and insert into the cell holder with the fill line facing right
11. Press read
12. Record you results

### **Conclusion**

Record the results in your write up and on the board.

As a group, discuss the results recorded by the group and summaries these discussions in your own words.

***Remember !!*** It is important to take accurate notes here as you will need this information and interruptive skills to take part in the Discussion Forum and for your Catchment Write-up