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## MEASUREMENT OF WATER QUALITY PARAMETERS

### OBJECTIVES

1. Describe the parameters that characterize water quality
2. Measure the water quality parameters using analytical equipment
3. Compare the measured parameters against the established standards

### INTRODUCTION

The different sources of water are as follows:

- Groundwater
- Surface Water
- Oceans
- Reclaimed Wastewater

Drinking Water Standards have been established to ensure that the tap water is safe for consumption. The different categories of water quality are:

- ❖ Physical – appearance (color, taste, odor, temperature, turbidity)
- ❖ Chemical – (organic, inorganic compounds)
- ❖ Biological – (microorganisms)
- ❖ Radiological- presence of radioactive substances

Water quality parameters are further categorized into primary water quality parameters which safeguard the human health and secondary water quality parameters which are related to aesthetics.

Primary water quality parameters check for the following

- Organics: Pesticides, Solvents, Fuels
- Inorganics: Metals.
- Radionuclides: Beta particles, alpha particles, radon
- Microbes: viruses, bacteria, protozoa, helminthes

Secondary water quality parameters check for the following characteristics

- Taste
- Odor
- Clarity
- Color

In this lab, we will estimate the water quality parameters for three different water samples: (1) Tap water (2) Rowan Pond (3) Alcyon lake near Pitman, NJ (next to the Lipari landfill superfund site)

A brief description of the different water quality parameters that are estimated in the lab are as follows:

**Turbidity** - The tendency of water to scatter light at 90 degrees. Turbidity is a measure of water clarity. Caused by suspended solids (thus, turbidity is an indirect measure of suspended solids). Measured in NTUs, using a Turbidimeter. For most people, water with  $\leq 5$  NTUs looks clear. The American Water Works Association (AWWA) recommends that water to be disinfected should be  $\leq 0.1$  NTU.

**Color** - True color is caused by dissolved compounds in water. It can be natural or anthropogenic. Dissolved and suspended solids (together) cause apparent color. For example, brown colored water could be the result of dissolved byproducts of plant biodegradation (true color) or suspended clay particles (apparent color) or both (also apparent color). Color is measured in Platinum-Cobalt units (PCU). The AWWA recommends  $\leq 15$  Platinum Cobalt units. This is also the U.S. secondary drinking water regulation. Color can be measured using light with a wavelength of 455 nm.

**Pathogens** - Pathogens are disease-causing microorganisms.

**pH** – pH indicates the intensity of the acid or alkaline condition of a solution. It expresses the hydrogen ion concentration. pH is an important factor that impacts most water treatment processes such as disinfection, coagulation, water softening and corrosion control. pH has no units. The term may be represented by

$$\text{pH} = -\log[\text{H}^+ \text{ in moles/liter}]$$

**Alkalinity**- The alkalinity of water is a measure of its capacity to neutralize acids. Three major classes of materials cause the major portion of alkalinity in natural waters. These are as follows: (1) hydroxide (2) carbonates and (3) bicarbonates. Bicarbonates represent the major form of alkalinity.

**Hardness** - Hardness is caused by the presence of divalent cations. Such ions are capable of reacting with soap to form precipitates with certain anions present in the water to form scale. The main cations causing hardness are calcium, magnesium, ferrous iron and manganous ions. The unit is expressed as mg/L as  $\text{CaCO}_3$ .

Waters are normally classified in terms of the degree of hardness as follows:

mg/L as $\text{CaCO}_3$	Degree of Hardness
0-75	Soft
75-150	Moderately Hard
150-300	Hard
300 up	Very Hard

**Organic Compounds-** There are a number of methods for determination of organics such as the Total Organic Carbon Analyzer and the Chemical Oxygen Demand Test. Most organic compounds show absorbance at 254 nm.

**Conductivity-** This is a measure of the presence of ions (cations and anions) in solution. Conductivity is used to measure the concentration of dissolved solids which have been ionized in a polar solution such as water. The unit of measurement commonly used is one millionth of a **Siemen** per centimeter (micro-**Siemens** per centimeter or  $\mu\text{S}/\text{cm}$ ).

**Nitrate-** Nitrate is a primary drinking water standard. Its presence also causes the blue-baby syndrome in infants. Nitrate is also a nutrient for algae and can stimulate growth of algae. The drinking water standard is 10 mg/L as the maximum contaminant **level** (MCL) for **nitrate**-nitrogen and 1 mg/L for nitrite-nitrogen for regulated public **water** systems.

**Phosphate** - Phosphate is a major source of pollution in surface waters from human activities such as irrigation and agriculture. It is a nutrient for plants and algae and can cause eutrophication of lakes.

### **References:**

1. Davis, M. and Masten , S. J. (2004) Principles of Environmental Engineering and Science, McGraw Hill.
2. <http://www.epa.gov/safewater/mcl.html#mcls>

### SAMPLE DATA COLLECTION FORM

**Date Collected:**

**Team Members:**

**Time:**

**Temperature:**

**Weather Conditions:**

Parameter	Units	Equipment Used	Rowan Pond Water	Tap Water	Alcyon Lake
pH					
Dissolved Oxygen					
Alkalinity					
Hardness					
Conductivity					
Turbidity					
Color					
Organics					
Nitrate					
Phosphate					

## **DELIVERABLES (LAB REPORT)**

1. Title Page
2. Letter of Transmittal
3. Abstract
4. Introduction
5. Materials and Methods
  - Write paragraphs and explain what you did (DO NOT WRITE NUMBERED LISTS OR BULLET POINTS)
  - All instruments used in lab should be identified in the lab report
6. Results and Discussion
  - Compare the results with established standards
  - Tap water should be compared against USEPA drinking water standards<sup>1</sup>
  - Surface water should be compared against NJ Surface Water Quality Standards (SWQS)<sup>2</sup>.
  - Discuss whether your results are within the established standards and explain if they exceed.
7. Conclusions – Summarize your results
8. References – Use any standard referencing format and be consistent throughout the report.

1. <http://water.epa.gov/drink/contaminants/index.cfm>

2. [https://www.nj.gov/dep/rules/rules/njac7\\_9b.pdf](https://www.nj.gov/dep/rules/rules/njac7_9b.pdf)