Experiment 3
Determination of Turbidity of Water



Introduction:

Turbidity is the technical term referring to the cloudiness of a solution and it is a qualitative characteristic which is imparted by solid particles obstructing the transmittance of light through a water sample. Turbidity often indicates the presence of dispersed and suspended solids like clay, organic matter, silt, algae and other microorganisms. So in short turbidity is an expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through the sample.

Environmental significance:

When the turbid water in a small, transparent container such as drinking glass is held up to the light, an aesthetically displeasing opaqueness or milky coloration is apparent. The colloidal material which exerts turbidity provides adsorption sites for chemicals and for biological organism that may not be harmful. They may be harmful or cause undesirable tastes and odors. Disinfection of turbid water is difficult because of the adsorptive characteristics of some colloids and because the solids may partially shield organisms from disinfectant. In natural water bodies, turbidity may impart a brown or other color to water and may interfere with light penetration and photosynthetic reaction in streams and lakes. Turbidity increases the load on slow sand filters.

The filter may go out of operation, if excess turbidity exists. Knowledge of the turbidity variation in raw water supplies is useful to determine whether a supply requires special treatment by chemical coagulation and filtration before it may be used for a public water supply. Turbidity measurements are used to determine the effectiveness of treatment produced with different chemicals and the dosages needed. Turbidity measurements help to gauge the amount of chemicals needed from day-to-day operation of water treatment works. Measurement of turbidity in settled water prior to filtration is useful in controlling chemical dosages so as to prevent excessive loading of rapid sand filters. Turbidity measurements of the filtered water are needed to check on faulty filter operation. Turbidity measurements are useful to determine the optimum dosage of coagulants to treat domestic and industrial wastewaters. Turbidity determination is used to evaluate the performance of water treatment plants.

Turbidity in water may be caused by a wide variety of suspended matter suspended matter, such as clay, silt, finely divided organic and inorganic matter, soluble colored organic compounds, and other organisms. Under flood conditions, great amounts of topsoil are washed to receiving streams. As the rivers pass through urban areas, the domestic and industrial wastewaters may be added.

Guideline:

According to WHO standard 5 NTU (Nephelometric turbidity unit) is suggested as the turbidity limit for drinking water, while 1 NTU is recommended to achieve adequate disinfecting safety.
According to Bangladesh Environment Conservation Rules (2023), drinking Water standard for Turbidity is 5 NTU.

Principle:

Turbidity is based on the comparison of the intensity of light scattered by the sample under defined conditions with the intensity of the light scattered by a standard reference suspension under the same conditions. The turbidity of the sample is thus measured from the amount of light scattered by the sample taking a reference with standard turbidity suspension. The

higher the intensity of scattered light the higher is the turbidity. Formazin polymer is used as the primary standard reference suspension.

Because of the wide variety of materials that cause turbidity in natural waters, it has been necessary to use an arbitrary standard. The original standard chosen was; **1 mg SiO_2/L =1 unit of turbidity.** The silica used had to meet certain specifications as to particle size. The Jackson candle turbidimeter has been replaced by more reliable, sensitive, and easier to use instruments that depend upon the principle of nephelometry. As a standard reference material, Silica has been replaced by formazin polymer. The formazin suspensions were first calibrated against the Jackson candle turbidimeter. The standard nephelometry procedure is now reported in nephelometric turbidity units (NTU). Because the basic principles difference for Jackson candle turbidimeter method and nephelometric method, results got from the two methods can vary widely. In order to avoid any confusion this may cause, turbidity measurements by the standard nephelometry procedure are now reported in nephelometric turbidity units (NTU), and the other one is reported in Jackson candle turbidimeter units (JTU).

40 NTU are about equivalent to 40 JTU.

The applicable range of this method is 0-40 nephelometric turbidity units (NTU). Higher values may be obtained with dilution of the sample.

Sample handling and preservation:

Water samples should be collected in plastic cans or glass bottles. All bottles must be cleaned thoroughly and should be rinsed with turbidity free water. Volume collected should be sufficient to ensure a representative sample, allow for replicate analysis (if required), and minimize waste disposal. No chemical preservation is required. Keep the samples at 4°C. Do not allow samples to freeze. Analysis should begin as soon as possible after the collection. If storage is required, samples maintained at 4°C may be held for up to 48 hours.

Precautions:

The following precautions should be observed while performing the experiment:

- The presence of coloured solutes causes measured turbidity values to be low. Precipitation of dissolved constituents (for example, Fe) causes measured turbidity values to be high.
- Light absorbing materials such as activated carbon in significant concentrations can cause low readings.
- The presence of floating debris and coarse sediments which settle out rapidly will give low readings. Finely divided air bubbles can cause high readings.

Apparatus:

1. Turbidity Meter

Chemicals

1. Formazin Polymer standards

Procedure:

1. For testing the given water sample first the reagents are to be prepared. Then the turbidity meter is required to be calibrated.
2. To the sample cells, add sample water up to the horizontal mark, wipe gently with soft tissue and place it in the turbidity meter. Cover the sample cell with the light shield.
3. Check for the reading in the turbidity meter. Wait until you get a stable reading.

Assignment

1. Why turbidity is important in "filtration" and "disinfection" processes?

DATA SHEET

Experiment Name :
Experiment Date :

Student's Name :
Student's ID :
Year/ Semester :
Section :
Group :

Table

Sample No	Source of Sample	Temperature of Sample (°C)	Turbidity (NTU)

Signature of the course teacher and date