

Water Supply & Sanitary Engineering (DI05006021)

Unit 2: Quantity and Quality of Water

Lecture 6: Water Impurities and Collection of Samples

GTU Diploma Engineering

Agenda

- Pure, Potable, and Palatable Water
- Classification of Impurities
- Physical Impurities
- Chemical Impurities
- Biological Impurities
- Purpose of Water Sampling
- Procedures for Collection
- Preservation of Samples

Types of Water Terminology

- Pure Water: Consists ONLY of H₂O molecules (Distilled water). Not ideal for drinking.
- Potable Water: Safe to drink. Free from disease-causing bacteria and toxic chemicals.
- Palatable Water: Aesthetically pleasing. Good taste, odor-free, clear, and cool.

Classification of Impurities

- Water is a universal solvent. As it travels through the hydrological cycle, it picks up impurities.
- Impurities are broadly classified into:
 - 1. Physical Impurities
 - 2. Chemical Impurities
 - 3. Biological / Bacteriological Impurities

Physical Impurities

- Impurities that affect the appearance, taste, or odor of water.
- Suspended Solids: Clay, silt, sand, mud (causes turbidity).
- Dissolved Organics: Decaying leaves/algae (causes color and odor).
- Temperature: High temperatures reduce dissolved oxygen and promote bacterial growth.

Chemical Impurities

- Substances that dissolve in water altering its chemical properties.
- Inorganic Salts: Calcium and Magnesium (causes hardness), Chlorides, Sulfates.
- Toxic Metals: Lead, Arsenic, Fluoride, Mercury.
- Dissolved Gases: CO₂, H₂S (rotten egg smell), Methane.

Biological Impurities

- Pathogenic (disease-causing) micro-organisms.
- Bacteria: Salmonella (Typhoid), Vibrio cholerae (Cholera).
- Viruses: Hepatitis A, Polio.
- Protozoa: Giardia, Cryptosporidium.
- Non-pathogenic: Algae, fungi (cause odors but generally harmless).

Purpose of Water Sampling

- To determine the nature and extent of impurities present.
- To decide on the necessary sequence of water treatment units.
- To check the efficiency of the treatment plant operations.
- To ensure the final supplied water meets BIS / WHO standards.

Types of Samples

- Grab Sample: Collected at a specific spot at a specific time. Represents conditions only at that instant.
- Composite Sample: A mixture of multiple grab samples collected over a period (e.g., 24 hours). Represents average conditions.

Collection for Physical/Chemical Tests

- Use clean glass or plastic bottles (usually 2 to 3 liters).
- Rinse the bottle 2-3 times with the water being sampled before filling.
- Fill completely and tightly cap to prevent aeration (which alters dissolved gases).
- Label clearly with location, date, time, and sampler's name.

Collection for Bacteriological Tests

- Requires utmost care to avoid accidental contamination.
- Use STERILIZED glass bottles (typically 250 ml).
- Keep the bottle closed until the exact moment of sampling.
- Do not touch the inside of the cap or the neck of the bottle.
- If sampling from a tap, flame the tap mouth first.

Preservation and Transportation

- Samples undergo rapid chemical and biological changes once collected.
- Tests must be conducted as soon as possible.
- Store in an ice box at 4°C to slow down biological activity.
- Chemical preservatives (like acids) may be added for specific heavy metal tests.

Summary

- Water contains physical, chemical, and biological impurities.
- Biological impurities cause diseases; physical/chemical affect aesthetics and long-term health.
- Physical/Chemical samples require clean bottles and rinsing.
- Bacteriological samples require strictly sterilized bottles and aseptic techniques.