

VERVIEW OF STANDARD SETTING PROCESSES AND CHALLENGES IN REGULATING NEW AND EMERGING CONTAMINANTS IN INDIA



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Role of Quality in Analytical Techniques in Modern World

- **Analytical measurements affect almost all spheres of our activities**
- **Chemicals are part of our life, whether it is medicines, plastics, metals, pesticides or agrochemicals.**
- **Analytical chemists have a role to play in industry**
 - For assay of raw materials
 - For quality control
 - For quality assurance of finished products
 - For environmental management



UNIQUE NATURE OF WATER

- Water is an unique solvent in view of its
 - High boiling and freezing point
 - High heat capacity
 - High latent heat of fusion and vapourisation
 - Good solvent properties



Sources of water

- 95 percent of water is in the oceans
- Of the remaining about 75 percent in polar ice caps and glaciers
- Usable forms of water are
 - River runoff, surface water
 - Underground water



Distribution of water

- Water rich countries
 - Canada, Panama, Malaysia, Sweden, USSR, USA

Water poor countries

India, Pakistan

African countries



Ground water - characteristics

- Soil and rocks act like filters
- Organic matter is oxidised to carbon dioxide
- Hardness, TDS, carbon dioxide content are more
- Bacterial count is low
- Water is inherently safe



Contamination in ground water

- Contamination from surrounding area
- Dissolution of constituents of rock eg F, As, Fe, Mn
- Dissolution of organic pollutants, radioactive elements, detergents, pesticides
- Sewage contamination and increased bacterial load



Sources of chemical contamination

- Nitrates from agricultural fertilizers
- Pesticides and detergents
- Waste water discharge containing heavy metals
- Hydrocarbon and industrial chemicals from storage tanks
- Chemical spillage during transit



Natural defence mechanism

- Soils act as cation exchangers and replace Pb, Cd, Ni by Na, K, Ca and Mg
- Removal of organics by adsorption
- Biological processes like biodegradation
- These work only if contamination is low



Surface water pollution

- Discharge of untreated sewage and agricultural waters and effluents
- Disturbance of land surface through mining operations
- Dumping of toxic waste
- Oil spills from giant oil tankers



Water for industries

- For fertilizer (ammonia) based on gas, naphtha, coal
- Petrochemicals, cement (wet process)
- Chrome leather, viscose rayon
- Paper and pulp, industrial alcohol
- 80 % is used for cooling, 15% for process and 5% for steam generation



Industrial waste water

- Brewery, dairy and distillery – organic load
- Dyeing, leather tanning, textiles – colour, organic load, heavy metals
- Oil and petroleum – hydrocarbons
- **UNTREATED INDUSTRIAL EFFLUENTS CAN AFFECT WATER SOURCES**



Water for domestic use

- Water is needed for drinking, cooking, cleaning, gardening, recreational uses
- Bacteria and microbiological parameters are important
 - Turbidity has a major effect as it can cause increase in bacterial load
 - Waste effluents from sewage contribute to bacterial load
 - Monitoring is difficult



Water for domestic use

- Organic contaminants arise from
 - Commercial detergents of anionic nature
 - Fertilizers
 - Pesticides
 - Hydrocarbons
 - Industrial organic compounds
 - Chlorination by-products



Standards for water

- Standards for domestic water for drinking purposes are made by
 - WHO on an international level
 - BIS for India
 - IS-10500 is the standard for drinking water
 - Standards for packaged drinking water and packaged mineral water are different



Standards for water

- Different standards exist for
 - Water for ice manufacture
 - Water for food processing industries
 - Water for swimming pools
 - Water for thermal power stations for boilers
 - Effluent standards also exist
 - Specifications are different in each case



Need for standards

- To ensure the quality of a product for the intended application
- To enable a quality check and ensure customer satisfaction
- Standards vary depending on application
 - Hardness is important for boiler water
 - Microbiological parameters are important for food processing applications



Factors deciding standards

- Standards have to be set based on
 - Safety of the product especially if it is for human consumption directly or indirectly
 - Quality of the product and customer expectations
 - Cost and practicability
 - Availability of test methods, expertise etc



Specifications for metals

- Need and toxicity of metals are different for different metal ions in water
- Ca, Zn, Na, K, Fe are essential
- Pb, Cd, Hg, As etc are toxic
- Cu, Co, Fe, are needed at trace levels but are toxic at higher levels



Speciation of metals

Speciation of metals refers to their particular chemical form

Complexation may change toxicity eg mercury, arsenic etc

Oxidation states affect toxicity eg, As, Cr

Bioassimilation and bioavailability are also important in deciding toxicity



Analysis of metal ions

- Low levels need sensitive methods
- Interferences are possible from matrix materials
- Pre-concentration may lead to increased blank
- Validation of procedures and reference materials are always needed



Analysis of pesticides

- Levels are in ppb or sub ppm levels
- The variety of contaminants are more
- Separation may be incomplete
- Pre-concentration may introduce errors
- Sensitive and expensive methods are needed
- Biodegradation and hydrolysis may affect results



Fixing the limits

- It is based on animal studies
 - Values depend on weight, size, sex, age etc
 - Interspecies and intra-species variations occur
 - Correlation to man is indirect
 - Data is not available for all contaminants
 - There is a need for generation of good quality data of relevance to each country



Role of organisations

- Any standard affects different sectors differently eg manufacturers, consumers, governmental and non-governmental agencies
- Standard setting is a continuing process and has to change depending on newer scientific finding
- Cooperation of all sectors of society is essential for a safe and practical standard



Thank You
