

Chapter three

WATER QUALITY

3.1 Introduction:

Precipitation in the form of rain, hail, or sleet contains very few impurities. It may contain trace amounts of mineral matter, gases, and other substance as it forms and falls through the earth's atmosphere. The precipitation, however, has virtually no bacterial content.

Once precipitation reaches the earth's surface, many opportunities are presented for the introduction of mineral and organic substances, microorganisms, and other forms of pollution that tend to lower water quality to such a point that it constitutes a health hazard or impair the usefulness of the water. When water runs over or through the ground surface, it may pick up particles of soil. This is noticeable in the water as cloudiness or turbidity. [21]

There must be sum standardized values for TS, SS and DS of water, used by man for various purposes, which is called water quality requirements. Water quality contains not only the standard values for turbidity, but for other characteristics of water as well such as physical, chemical or biological characteristics.

3.2 Water quality requirement:

Water quality is affected by a wide range of natural and human influences. Their influence is greatest when water qualities are low and they must be imitated in order to make use of water as much as possible.

3.3 properties of drinking water:

Drinking water must have specified properties so that it does not affect the health of consumers.

There are several types of properties such as physical and chemical properties.

3.3.1 Physical properties of drinking water:

3.3.1.1 Temperature:

The ideal temperature of drinking water is from 9 to 12 C and it is not recommended to distribute drinking water having more than 15 C. [22]

3.3.1.2 Suspended solid material:

Amounts of suspended solids are available in water of nature, such as organic material (remain of plants or animals), biological material such as bacteria, and also industrial waste, sewage water and the growth of algal.

The world health organization advices that drinking water must have a maximum suspended solid material concentration of 30 gm/L.

3.3.1.3 Color:

Pure water is color less at 2m depth and becomes skyly blue at 3m depth. The standard value for the color of water is letter illustrated in the paragraph of standard units.

3.3.3.4 Taste and smell:

Water in nature has special taste and smell, natural factors such as the presence of dissolved oxygenetc.

Drinking water must have no taste no smell, and it can be measured in laboratory, it must not exceed 2 BAL (BAL is the measuring unit of taste and smell).

3.3.2 Chemical properties of drinking water:

3.3.2.1 PH index:

Water in nature usually has a PH higher than 8.5 and some times inside forests it becomes acidity and it's PH is equal to 6.

A standard value of PH for drinking water is illustrated in the paragraph of standard units.

3.3.2.2 Durete (Hardness):

Durete stem from the presence of mineral in water a specially calcium and magnesium.

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Durete is calculated by (TH) unit which refers to (titre hydrometrque) and the best amount of TH for drinking water is Between 12 to 13. [23]

3.3.2.3Un desired elements:

Some elements must not exist in drinking water only in small amounts, for several causes, such as organic or teqnical causes or some times because they are toxic. Their properties must not exceed standard values of the world health org. and is illustrated in the standard unit paragraph.

3.4 Standard units:

3.4.1 General:

Limitations are made for all of water characteristics in order to obtain water quality suitable for man use. These limitations are called standard units for water quality.

3.4.2 Standard Iraqi units:

The Iraqi standard units for water quality, in this project, are taken from Al-Karama water project as shown in **table (3-1)**.

Table (3-1) Iraqi standard units from Al-Karama project

Analysis	The standard maximum accepted
Turbidity N.T.U	5 N.T.U
Alkalinity as CaCo₃	170-200
T.Hardness as CaCo₃	500
Calcium as Ca	200
Chloride as Cl	200
Magnesium as Mg	150
PH	8.5
Color	10
Free chlorine	0.3-1.0
Sulfate as So₄	400
Total Dissolved Solid (T.D.S)	1000
Iron as Fe	0.3
Fluoride as F	1.0
Aluminum as Al	0.2

Nitrite as No₂	3.0
Nitrate as No₃	50

3.4.3 Standard international units:

International standard units for water quality are known in **table (3-2a-b)** for several countries.

Table (3-2a) international standard units

Element or material	WHO	Europe standard	Canada standard	USEPA	Russian standard
Color TCU	15	20	15	15	-
Solvent solid material	1000	-	500	500	-
Turbidity NTU	5	4	5	1-5	-
PH	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5
Dissolved oxygen	-	-	-	-	4
Hardness	500	-	-	-	-
Ammonia	-	-	-	-	2
Nitrate	-	50	-	-	10
Nitrite	-	0.1	-	-	1
Phosphor	-	5	-	-	-

Table (3-2a) continue

Element or material	WHO	Europe standard	Canada standard	USEPA	Russian standard
Biological Oxygen Demand BOD	-	-	-	-	2
Sodium Na	200	150-170	-	-	-
Chloride Cl	250	250	250	250	250
Sulfur compound SO₁	400	25	500	250	500
Sulfur SO₁	-	-	0.05	-	-
Fluoride F	1.5	1.5-(1.7) ⁵	1.5	2	1.5
Boron B	-	1	5	-	-
Cyanide CN	0.1	-	0.2	-	0.1
Aluminum Al	0.2	0.2	-	-	-
Arsenic AS	0.05	0.05	0.05	0.05	-
Barium Ba	-	0.1	1	1	-
Cadmium Cd	0.005	0.005	0.005	0.01	0.001
Chromium Cr	0.05	0.005	0.05	0.05	0.1 (0.5) ⁸
Cobalt Co	-	-	-	-	0.1
Copper Cu	1	1(0.1)	1	1	1
Ferric Fe	0.3	0.3	0.3	0.3	0.5

Manganese Mn	0.1	0.05	0.05	0.05	-
Mercury Hg	0.001	0.001	0.001	0.002	0.005
Lead Pb	0.05	0.05	0.05	0.05	0.3
Nickel Ni	-	0.05	-	-	-
Selenium Se	0.01	0.01	0.01	0.01	-
Zink Zn	5	0.1-3	5	5	1
Ammonium	-	0.5	-	-	2

Table (3-2b) international standard units

Organic pollutant	WHO	Europe standard	Canada standard	USEPA	Russian standard
Oil & Petroleum Products	-	0.01	-	-	0.3
Total Pesticides	-	0.5	0.1	-	-
Individual Pesticides		0.1	-	-	-
Aldrin & Dieldrin	0.03	-	0.7	-	-
DDT	1	-	30	-	-
Lindane	3	-	4	0.4	-
Methoxychlor	30	-	100	100	-
Benzene	10	-	-	5	-

Hexachlorobenzene	0.01	-	-	-	-
Pentachlorophenol	10		-	-	-
Phenols	-	0.5	2	-	1
Detergents	-	0.2	-	12(0.5)	0.5

WHO = World Health Organization

USEPA = United State Environment Protection Agency

NTU = Nephelometer Turbidity Unit

3.5 Standard units for TDS:

From tables (3-2a) and (3-2b) one can see that the limits of TDS for drinking water is 1000mg/l for ISU and WHO while it is 500mg/l for Canada standard and US EPA.