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# WATER QUALITY ASSESMENT FOR DRINKING AND IRRIGATION PURPOSE

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## ABSTRACT

**Water is an essential natural resource for sustaining life and environment. Rapid urbanization and industrialization has led to pollution of surface and ground water. The quality of water is of vital concern to mankind as it has a direct link with the human health. The recurring environmental issues regarding hazardous waste, global climate change , ground water contamination have become focus of environmental attention. In the management of water resources , quality of water is as important as its quantity. This paper deals with various parameters to assess water quality for drinking and irrigation purpose. The parameters used for assessing water for drinking purpose includes pH, electrical conductivity , TDS, calcium , magnesium, sodium, potassium, chloride, sulphate, fluoride, carbonate, and bicarbonate. The criteria for suitability of water for irrigation purpose are TDS, EC, sodium salts[sodium adsorption ratio] and bicarbonate concentration [residual sodium carbonate].**

**KEYWORDS:** Industrialization,Water Quality Parameters

Fresh water is the most precious material for survival on earth, not only for human life but also for flora and fauna. The ground water scenario in India, which receives a substantial amount of rainfall, is not very encouraging primarily due to imbalance between recharge and groundwater exploitation. Variation of groundwater quality in an area is a function of physical and chemical parameters that are greatly influenced by geological formations and anthropogenic activities. An attempt has been made in this paper to review standards of water quality of drinking and irrigation purpose.

### Groundwater Quality Analysis for Drinking Purpose

Standards for quality of drinking water have been set by different agencies like APHA[1], WHO [2,3], and Indian drinking water specification.[4] (Table 1)

### pH

pH is the measure of hydrogen ion concentration in the water. A pH range of 6.5-8.5 appears to provide protection for life of freshwater organisms

### Chlorides

Chlorides are the inorganic compounds resulting from combination of chlorine gas with metal. Public drinking water standards require chloride level not to exceed 250mg/L

### Fluoride

According to WHO and Indian drinking water specification the maximum limit of fluoride in drinking water is 1.5 mg/L. Fluoride concentration above permissible limits cause dental fluorosis and much higher concentration cause skeletal fluorosis.

### Arsenic

According to WHO and Indian drinking water specification the highest desirable limit of arsenic is 0.05 mg/L. Chronic exposure to arsenic contaminated drinking water includes dermal lesions, peripheral neuropathy. Major dermatological signs are melamosis, diffuse keratosis, and leucomelanosis (Saha et. al. 1999).

### Total Dissolved Solids (TDS)

TDS denotes various types of minerals present in the water in dissolved norms. Concentration of TDS is an important parameter in drinking water and other water quality standards. According to WHO and IS maximum permissible limit of TDS in drinking water is 1000 mg/L and 2000 mg/L respectively.

### Nitrate

The high nitrate concentration in drinking water is toxic and causes blue baby disease/methaemoglobianemia in children and gastric carcinomas. Permissible limit of nitrate is 50mg/L according to WHO.

### Quality of Groundwater for Irrigation

The suitability of groundwater for irrigation is determined on the basis of physical, chemical and bacteriological characteristics. The criteria for suitability of groundwater for irrigation are based on Total Dissolved Solids (TDS), Electrical Conductivity (EC), Sodium Salts and bicarbonate concentration [(Richards L.A., 1954) (Todd D., 1980) (Eatson E.M., 1950) (Davis S.N. and Dewiest R.J., 1966)(Singh A.K., 2002)].

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**Electrical Conductivity**

Electrical conductivity is a function of temperature, type and concentration of various ions. Classification of irrigation water based on electrical conductivity is presented in Table 2

**Sodium**

If the proportion of sodium is high in groundwater for irrigation purpose, it can destroy soil structure (Table 3). A simple method for evaluating the changes of high-sodium is the Sodium Adsorption Ratio (SAR)[6,7] and the sodium percentage ( soluble sodium percentage, SSP) is calculated as follows:

$$SAR = Na^{+} / \sqrt{\frac{Ca^{2+} + Mg^{2+}}{2}}$$

$$\text{and } Na\% = \frac{Na^{+} + K^{+}}{Ca^{2+} + Mg^{2+} + Na^{+} + K^{+}} * 100$$

**Residual Sodium Carbonate (RSC)**

Irrigation water with high RSC[8,9] is considered to be deleterious to the physical properties of the soil. More RSC may reduce permeability of soils and tendency of fixing the sodium in soils (Table 4). The residual sodium carbonate is calculated using the following equation:

$$RSC\ (meq/L) = (HCO_3^- + CO_3^-) - (Ca^{2+} + Mg^{2+})$$

## CONCLUSION

All the parameters of permissible limits of drinking water are not set by different agencies i.e. APHA, WHO, IS. The permissible limits which are set by different agencies are not uniform. The World Health Organization and Bureau of Indian Standards should fix the permissible limits of all the parameters which should be uniform as well. It will be useful for the public health officers, doctors and researchers and for the society as a whole.

**Table 1: Standards for Quality of Drinking Water**

| Parameters | USEPA | WHO | ISI Permissible (acceptable) |
|---|---|---|---|
| Ph | 6.5-8.5 | 6.5-8.5 | 6.5-8.5 |
| EC | - | 1400 | - |
| Total Hardness (mg/L) | - | 500 | 600 (200) |
| TDS (mg/L) | - | 1000 | 2000 |
| Calcium (mg/L) | - | 200 | 200 (75) |
| Magnesium (mg/L) | - | 50 | 100 (30) |
| Fluoride (mg/L) | 4 | 1.5 | 1.5(1.0) |
| Arsenic (mg/L) | 0.05 | - | 0.05 (0.01) |
| Lead (mg/L) | - | - | 0.01 |
| Mercury (mg/L) | 0.002 | - | 0.001 |
| Iron (mg/L) | - | - | 0.3 |
| Chloride (mg/L) | 250 | 250 | 1000(250) |
| Nitrate | - | 50 | 45 |
| Sulphate | - | 250 | 400 (200) |
| Sodium | - | 200 | - |
| Potassium | - | 12 | - |

**Table 2: Classification of irrigation water based on electrical condiuctivity**

| Type of Water | Classification | Electrical Condutivity (micromhos/cm) |
|---|---|---|
| Low saline | Excellent | 100-250 |
| Medium Saline | Good Permissible | 250-750 750-2000 |
| Highly Saline | Doubtful | 2000-3000 |
| Very Highly Saline | Unsuitable | Over 3000 |

**Table 3: Classification of water based on SAR**

| Type of water | Classification | SAR Value |
|---|---|---|
| Low Sodium Water | Excellent | Below 10 |
| Medium Sodium Water | Good | 10-18 |
| High Sodium Water | Doubtful | 18-26 |
| Very High Sodium Water | Unsuitable | Above 26 |

**Table 4: Classification of water based in RSC**

| Class | RSC |
|---|---|
| Excellent | Below 1.25 |
| Good | 1.25 – 2.50 |
| Unsuitable | Above 2.50 |

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