



Estimation of Tap Water Quality in Babylon Governorate /Iraq, (2017) in Accordance with CCME

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Abstract

This research included evaluation quality of water by utilizing Canadian Council of Ministers of the Environment Water Quality Index (CCME WQI) by analyzing many chemical and physical properties of tap water (inside houses) for five regions (AL Musayab, AL Kasim, AL kifil, AL Mahawil and Hilla Center) in Babylon Governorate, Iraq. The properties included (PH, temperature, Ec, Hardness, turbidity, T.D.S, Ca, So₄, Mg) through three months (January, February, and March) / 2017. The evaluated amounts of CCME WQI proved that the quality of water round five regions were good through study interval and calculated amounts of properties were in Iraqi standards of drinking water (No. 417,2001) except Ca and turbidity.

Keywords: CCME WQI Water Quality Index, Iraqi Standards (No. 417,2001), Physical and Chemical Properties.

1. Introduction

Evaluating water quality can be a difficult process that requires various requirements that can cause different pressures on water quality in general. To assess the quality of water for huge number of tests, each one contains concentrations of many factors is complex. Therefore, water quality indicators are methods that greatly reduce data volume and simplify the expression of water quality. The CCME WQI is a tool for simplifying the reporting of water quality data. The quality of water guide can be assessed on the sources of different bacteriological, chemical and physical characteristics. Many water quality indicators have been developed around the world that can simply decide the total water quality in a given area quickly and effectively. To indicate water quality, different water quality indicators are used to assess water quality, which aims to give one value to the water quality from the source of limiting a large amount of determinants to an easier appearance and to enable simple clarification of the checking statistics (Poonam T et al., 2015; Kumar et al., 2014).

2. Samples Gathering

Samples of water have been gathered from five regions in Hilla city included (Al- Kasim, Al-Kifil, Al-Musayab, Al-Mahawil and Hilla center). The samples were taken from tap inside houses and tested for physical and chemical properties in the laboratory. The Iraqi suggested objectives for drinking water requirements are listed in Table 1.

3. Calculation of Water quality index

(CCME WQI) was used in this study. This indication can be calculated as shown below (CCME, 2001).

$$F_1 = \left(\frac{\text{Number of Failed Variables}}{\text{Total Number of Variables}} \right) \times 100 \dots \dots \dots (1)$$

F₁ is named Scope which denotes the proportion of variables which do not convene their goals as a minimum once through the period under regard (“failed variables”), comparative to the total number of variables calculated.

$$F_2 = \left(\frac{\text{Number of Failed Tests}}{\text{Total Number of Tests}} \right) \times 100 \dots \dots \dots (2)$$

F₂ is named Frequency that denotes the proportion of weakened tests.

$$\text{Excursion} = \left(\frac{\text{Failed Test Value}}{\text{Objective}} \right) - 1 \dots \dots \dots (3)$$

When test rate is larger than the objective, Excursion is shown:

$$\text{Excursion} = \left(\frac{\text{Objective}}{\text{Failed Test Value}} \right) - 1 \dots \dots \dots (4)$$

$$\text{nse} = \left(\frac{\sum_{i=1}^n \text{Excursion}}{\text{Number of Tests}} \right) \dots \dots \dots (5)$$

F₃ is a function of nse. as sees:

$$F_3 = \left(\frac{\text{nse}}{(0.01+0.01 \text{ nse})} \right) \dots \dots \dots (6)$$

Lastly CCME WQI is verified as shown below:

$$\text{CCME WQI} = 100 - \left(\frac{\sqrt{F_1^2 + F_2^2 + F_3^2}}{1.732} \right) \dots \dots \dots (7)$$

Table 1: Iraqi Standards (Objectives) for Drinking Water, No. 417, 2001(second update)

parameter	unit	Iraqi standard
pH	-	6.5-8.5
Alkalinity	mg/L	125-200
Total Hardness as CaCO ₃	mg/L	500
Magnesium (Mg ²⁺)	mg/L	100
Calcium (Ca ²⁺)	mg/L	150
Sodium (Na ⁺)	mg/L	200
Chloride (Cl ⁻)	mg/L	350
Iron (Fe ²⁺)	mg/L	0.3
Sulphate SO ₄ ²⁻	mg/L	400
Turbidity	NTU	5
Conductivity	µs/cm	2000
TDS	mg/L	1000

Table 2: CCME WQI Classification (Haseen et al., 2005)

Rank	Value of WQI
Poor	0-44
Marginal	45-64
Fair	65-79
Good	80-94
Excellent	95-100

4. Results and Discussion

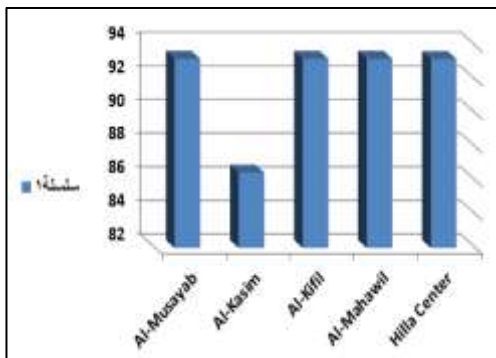


Figure1: Water Quality Index of Study Area

The evaluated amounts of CCME WQI were (93.24,86.47,93.24,93.24 and 93.23) of the study area (Al-Musayab, Al-Kasim, Al-Kifil, Al-Mahawil and Hilla Center), fig. : 1, which proved that the quality of water for the five regions was good.

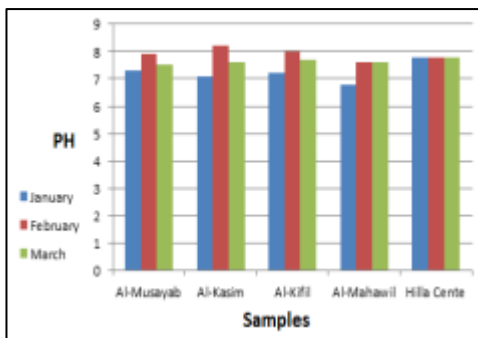


Figure2: the values of PH

Figure: 2 illustrated the values of PH for study area through three months (January, February, and March), the values of PH in the range (6.8-8.2) for all period and it's in the permissible limits (6.5-8.2) according to Iraqi standards.

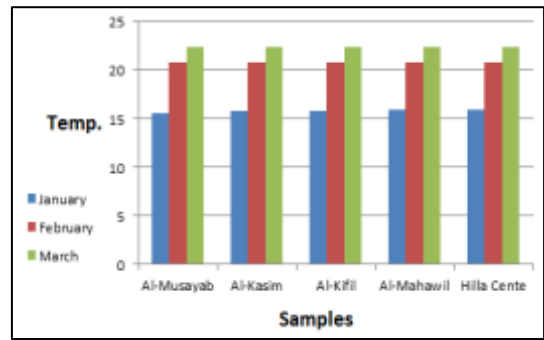


Figure3: the values of Temp.

The temperature was measured at the time of collection the water samples for five regions where temperature ranged (15.6-22.4) °C as shown in figure (3), the temperature was of the important measurements because it is the critical factor related to the growth of microorganisms.

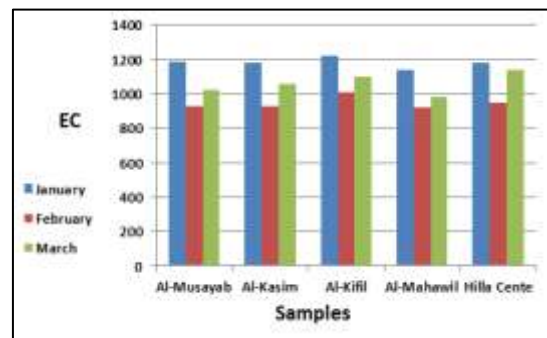


Figure 4: the values of EC

The electrical conductivity EC values ranged (920-1220), and it is in the permissible limits of Iraqi standards (2000) µs/cm as shown in figure (4).

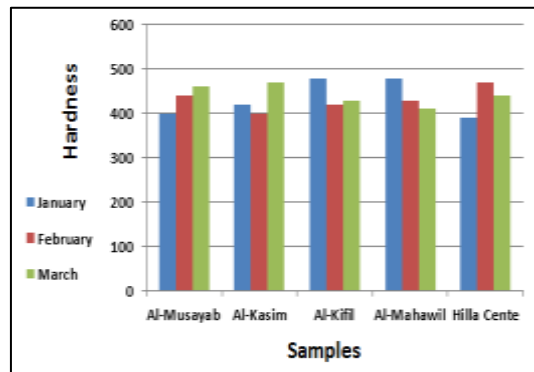


Figure5: the values of Hardness

Hardness is Ranging between (390-480) mg/l which is within the allowable limits to the Iraqi standard 500 mg/l as shown in figure (5).

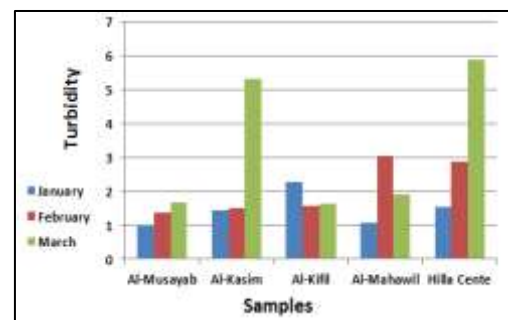


Figure6: the values of Turbidity

Turbidity is considered one of the important tests due to its direct effect on the quality of the water, the values ranged between (0.99-5.89) NTu and some values aren't meet the allowable limits for Iraqi standard (5) NTu as shown in figure (6).

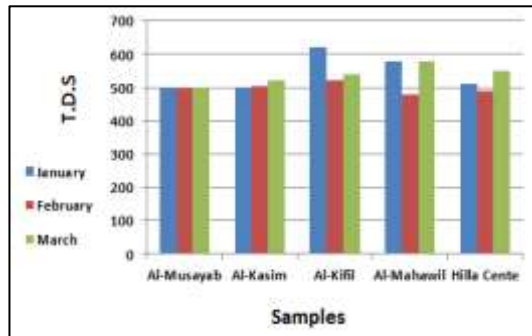


Figure7: the values of T.D.S.

Total dissolved solids (TDS) Ranged (478-620) mg/l and are within the Permissible limits of the Iraqi standard 1000 mg/l as shown in figure (7).

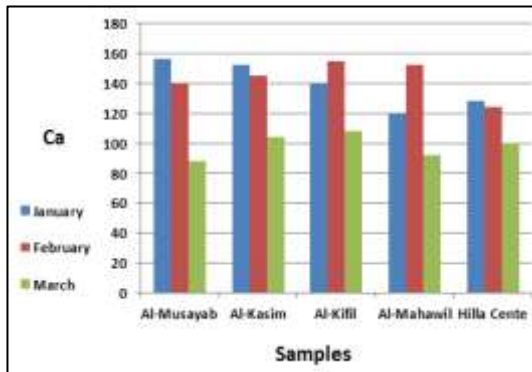


Figure8: the values of Ca.

The values of Ca. ranged (88.1-156.27) mg/l and do not meet all the permissible limits of Iraqi standards 150 mg/l, as shown in figure (8).

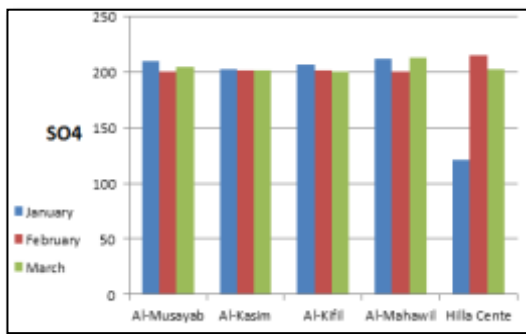


Figure9: the values of SO₄

The values of the sulphate So₄ at all areas were between (199.91-214.85) mg/l. In general, the concentrations of sulphate were within Iraqi standards (400) mg/l, as shown in figure (9).

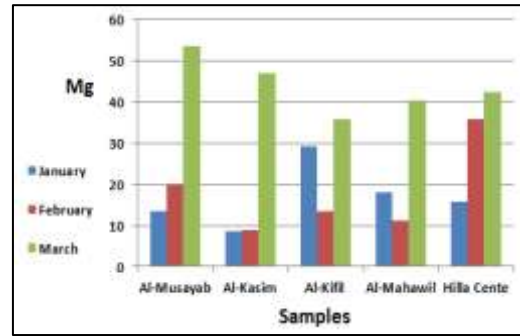


Figure10: the values of Mg

Magnesium Mg concentrations for all areas were ranging (8.69-53.76) mg/l. All values of magnesium concentrations were within Iraqi standards (100) mg/l, as shown in figure (10).

5. Conclusion

The calculations appeared that the water quality for investigation zone around five (Al-Musayab, Al-Kasim, Al-Kifil, Al-Mahawil and Hilla Center) regions were good in accordance with CCME WQI category through study time. The gauged values of water properties were in Iraqi standards.

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