IAU-ARAK

J. Iran. Chem. Res. 1 (2008) 141-144

Journal of the Iranian Chemical Research

www.iau-jicr.com

Chemical and physical analysis of some ground water sample in Al-Quti wells Hodiedah, Yemen

Atta Ibraheem Atta [a], Badr Ismael Abdul Razzak [*,b]

[a] *Department of Medical Laboratory, Faculty of Medicine Science, Hodeidah University, Yemen*
[b] *Department of Chemistry, Faculty of Education, Hodeidah University, Yemen*

Received 7 July 2008; received in revised form 16 December 2008; accepted 17 December 2008

Abstract

Study of the ground water quality in Hodeidah is an essential ingredient for a healthy population. In this research, study of drinking water samples for eight water sources wells in the Quti field has been achieved. The purpose was to a certain the quality of water from these sources, the physical properties such as pH, electrical conductivity (EC) and total dissolved solids (TDS), showed the variation of pH (7.24-7.80),TDS (744.0-1008.6) mg L^{-1}, within the permissible limits for World Health Organization (WHO). Except well(1) which had slight excess for TDS (100.8 mg L^{-1}). The measurements of total hardness (TH) , NO_3^-,SO_4^{2-}, PO_4^{3-}, Cl^- , Na^+, K^+, Ca^{2+} and Mg^{2+} has been measured. The levels of NO_3 were unacceptable by the value of (70-153) mg L^{-1}. And SO_4^{2-} by the range of (130-420) mg L^{-1}, recalls exceeding the allowable values given by WHO, while Cl^-, Na^+ , Ca^{2+} ,TH, total alkalinity and Mg^{2+} were the permissible limits for WHO and Yemen standard (YS). The analysis data of heavy elements concentration Cr, Fe, and Mn were far from the pollution and within the permissible limits.

Keywords: Ground water, Hodeidah, Yemen, Heavy elements, Chemical and physical analysis

1. Introduction

Water is important to the mechanics of the human body and the body cannot work without it. Water quality is essential for the well being of all people, the quality of water can be affected by different pollutants such as, chemical, biological and physical. contaminates such as bacteria, viruses, heavy metals, nitrate and salt have found their way into water supplies,the water pollution occurs when a body of water is adversely affected due to the addition of large amounts of materials to the water. The sources of water pollution are categorized as being a point source or non-source point of pollution, point sources occurs when the polluting substance is emitted directly into the waterway while, a non- point source occurs when there is runoff of pollutants into a water way [1].

In Yemen, ground water is considered as the first water source for irrigation and other uses.Tihama basin, Figure1, is located in the west of Yemen, along the red sea cost, the climate of the tihama plain can be described as being hot, windy and arid with humidity due to the influence of red sea. Mean annual rainfall in the tihama range (100 mm-600 mm), the air

[*] Corresponding author. Tel.: +96 7734039433; fax: +96 73250511.
E-mail address: badrasml@gmail.com (B.I. Abdul Razzak)

temperature is over 33 ^{o}C in the period from May to September (DHV Consulting Engineers1988). The source of drinking water in Hodeidah city is only ground water, and there are a few published studies on water quality [2]. The aim of this study was to investigate the quality of the ground water. Samples were collected from the Al-quti wells. Chemical and physical characteristics were determined analytically.

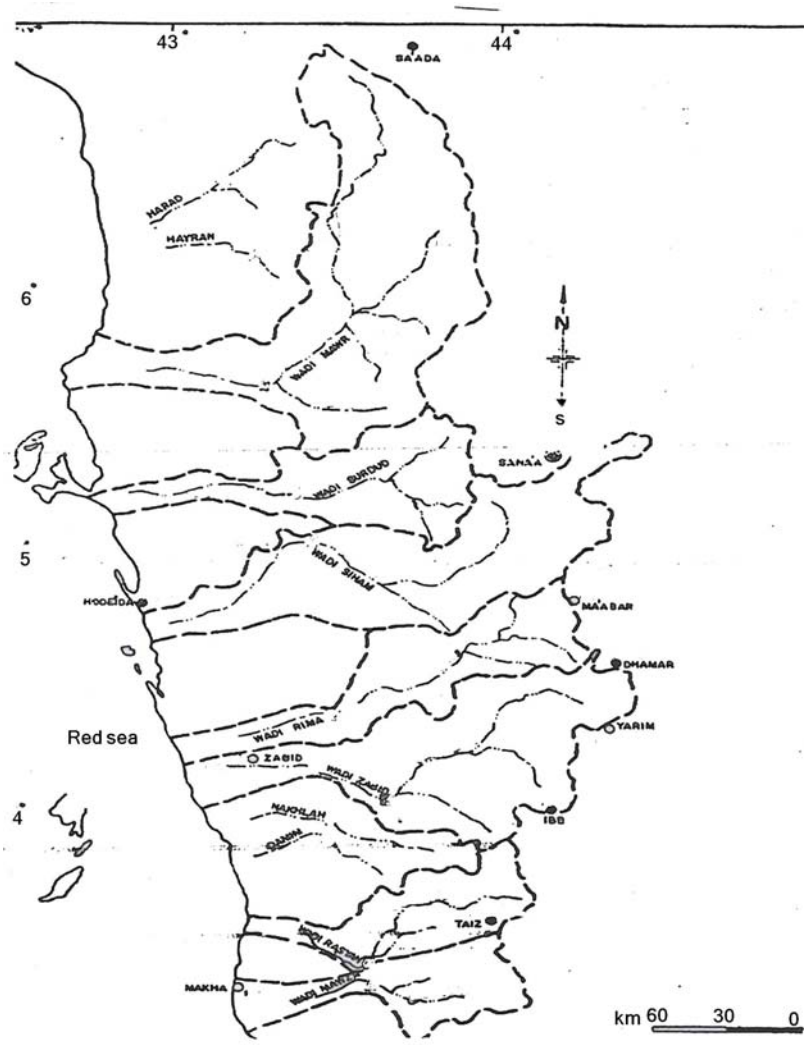

Fig. 1 Tihama basin of Hodeidah water supply

2. Experimental

The water samples were collected using 1 L polyethylene container after cleaning by acid (6 mol L^{-1} HNO_3), the pH (pH meter HANNA Model HI9025) and the conductivity (conductivity meter HACH Model 862) has been used for direct measurement during collecting the samples, all samples were collected in August 2007 and stored in cool environment (4 ^{o}C) to prevent the vaporization and biodegradation [3], the temperature of the water samples were determined at the same time of sampling. In this research we used spectrophotometer (HATH, Model DR2004) and the chemicals and reagents (metallochromic indicators) used were purchased from BDH, HACH and Merck (A.R., 99.9%) to determine the Cu, Fe, Cr, Mn, NO_3^-, SO_4^{2-} and PO_4^{3-}.

The ions Na^+ and K^+ determined by flame emission spectroscopy, while the remaining alkalinity and ions (Ca^{2+}, Mg^{2+} and Cl^-) were analyzed by titration method [4]. The precision of measurements was checked taking three replicates from the sample.

3. Results and discussion

The analysis results of ground water samples for eight water sources wells in Al-quti field are showed in Table 1, the values indicate that the physical measurements pH, EC, turbidity and TDS were the range (7.24-7.80), (1240-1681) μS cm^{-1}, (not detectable-3) and (744-1008.6) mg L^{-1}, respectively, within the permissible limits given by WHO and YS, except well (1) slightly excess for TDS (100.8 mg L^{-1}). The results values of chloride ion for eight ground water wells showed range (115-310) mg L^{-1}, within the permissible limits for WHO and YS, except well (1) the value was (310 mg L^{-1}), may be due to the increase in the depth of well, which gives the greater concentration of salts.

Table 1
The physical and chemical properties of ground water samples

Parameters	WHO	YS	wells							
			1	2	3	4	5	6	7	8
T (^oC)	--	--	38.8	38.0	36.2	36.7	36.7	37.6	36.8	36.7
E.C (μS cm^{-1})	--	450-2500	1681	1617	1572	1575	1530	1584	1240	1425
TDS (mg L^{-1})	1000	650-1500	1008.6	970	943	945	918	850.4	744	855
pH	6.5-8.5	6.5-9	7.66	7.24	7.35	7.35	7.80	7.55	7.55	7.66
Turbidity	٥	--	Nil	Nil	Nil	2	Nil	3	3	3
Cl^- (mg L^{-1})	250	200-600	310	225	200	205	205	255	115	145
TH (mg L^{-1}) as $CaCO_3$	500	100-500	465	480	377	430	375	395	300	320
Ca^{2+} (mg L^{-1})	200	75-200	96	94	78	90	78	82	52	54
Mg^{2+} (mg L^{-1})	--	--	55	60	44	50	44	46	41	45
T. Alkalinity (mg L^{-1})	200-250	--	125	145	170	195	170	200	190	250
NO_3^- (mg L^{-1})	50	10-50	63.0	70.0	70.3	76.0	84.0	90.0	89.0	152
SO_4^{2-} (mg L^{-1})	250	200-400	420	280	295	310	245	260	130	160
Na^+ (mg L^{-1})	200	Max400	220.0	160.0	175.8	177.0	162.0	180.0	90.0	115.0
K^+ (mg L^{-1})	--	8-12	3.08	3.30	3.25	3.25	3.57	3.40	2.20	2.30
PO_4^{3-} (mg L^{-1})	--	--	0.43	0.10	0.18	0.18	0.05	0.12	0.12	0.43

Water hardness is defined as the concentration of calcium and magnesium ions expressed in term of calcium carbonate [5], the values of TH were in the range of (300-480) mg L^{-1}, within the permissible limits for WHO and YS, the hardness scale is shown value more (180 mg L^{-1}), water is very hard [6] these mineral in water can cause some everyday problems, they react with soap and produce a deposit called "soap curd", the calcium and magnesium ions were found to be in the range of (52-96) mg L^{-1} and (41-60) mg L^{-1} respectively, these values were within optimum limit. Alkalinity is an important parameter because it measures the water's ability to resist acidification, the value for alkalinity ranged from 125 to 265 mg L^{-1}, all wells have values within the permissible limit.

The sodium and potassium ions are investigated in drinking water samples, the concentrations were in the range of (90-220) mg L^{-1}, (2.20-3.57) mg L^{-1} respectively these results were within the permissible limits by WHO and YS, the relatively high concentration of phosphate ion due to the effect of phosphate fertilizers at the cultivation regions.

The nitrate ion in the investigated samples were found to be in the range (63-152) mg L^{-1}, these results were higher than the permissible limit given by (WHO) and (YS), may be due to the presence of these wells in the cultivation zones, whereas the ammonium nitrate is used as chemical fertilizer. It is a dangerous indicator of pollution especially in children less than six months ages who drink water containing nitrate, symptoms include shortness of breath and blue-baby syndrome [7].

The concentrations of trace metals (Fe, Cu, Mn and Cr) ions in the drinking water samples are presented in Table 2. The results indicate, there is no pollution of heavy elements, the values fall within allowable according WOH.

Table 2
The analytical results of heavy metals in ground water samples

Parameters	**WHO**	**Y.S**	**wells**							
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Fe (mg L^{-1})	0.3	0.3-1	Nil	0.06	0.22	0.03	0.01	0.04	0.06	0.01
Cu (mg L^{-1})	1	0.5-1	0.03	0.07	0.04	0.07	0.04	0.03	0.09	0.06
Mn (mg L^{-1})	0.1	--	0.1	0.01	0.01	Nil	0.02	0.02	0.01	Nil
Cr (mg L^{-1})	0.05	--	Nil	Nil	0.01	Nil	Nil	0.01	0.01	Nil

4. Conclusions

(1) The analytical data of TDS, T.H, chloride ion and sodium ion concentration were in the permissible limit by WHO and Y.S. (2) The concentration of nitrate ion was very higher than WHO and Y.S guide lines. (3) The concentration of sulphate ion was higher thane the permissible limit given by (WHO), except well (7&8). (4) The results of heavy metal ions indicate being far from pollution

Acknowledgment

The authors would like to thank the water locality institution, Hodiedah branch for their assistance in the survey. We would like to express Mr.Y. Mtahher for helpful comments

References

[1] S.E. Manahan, Environmental Chemistry, Lewis publishers, Boca Raton: CRC Press, 2000.
[2] B.I. Abdul-Razzak, A.I. Atta, A. Khalil, J. Edu. College, 1 (2008) 23.
[3] Anonymous, Guidelines for Drinking Water Quality, World Health Organization (WHO), 1996.
[4] United Nations Environment Programme (UNEP): Analytical Method for Environmental Water Quality. Water Programme in collaboration with IAEA, 2004.
[5] M.L. Looper, D.N. Waldner, Water for Dairy Cattle, Cooperative Extension Service College of Agriculture and Home Economics, 2007.
[6] N. Turky, P. Mcginely, D. Hoverson, Shawano Lake Watershed Project, University of Wisconsin-Steven Point, 2006.
[7] J.R. Self, R.M. Waskom, Nitrates in Drinking Water**,** 2005.