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Water pollution management in wells of zawar village for investigation of effects of nitrogen fertilizers in nitrate entry into groundwater

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ABSTRACT

Application of N fertilizers in agricultural operations is one of the important sources of nitrate entry into groundwater. In Iran, especially in coastal areas with a high groundwater level, in agricultural areas, there is a risk of pollution of groundwater and surface water to nitrates. This research was conducted with the aim of determining the concentration of chemical parameters of drinking water wells in a Tonekabon village and comparing with acceptable standards. The present study was carried out on groundwater resources of Zawar village of Tonekabon city for six months and then data were analyzed to determine the concentration of chemical parameters and water resources type based on anions and cations in water. The results of this study during the investigation of different wells showed that the total number of samples tested from a drinking water well in Zawar, Tonekabon, the range of nitrate concentration from 8 to 33.7 mg / L, TDS from 233 to 435 mg in liters and the total hardness varied from 211 to 372 mg/L. According to the definition of pollution, the wells were classified in the permitted class in terms of nitrate. However, the approach of nitrate levels in some wells to 20 mg per liter (a sign of the impact of human activities) is also worthy of serious consideration. determining the quality of the area reduces the amount of nitrate in the groundwater and thus increases the quality of groundwater.

1. Introduction

For a long time, groundwater has been considered as one of the vital sources of water supply and meeting the needs of human societies. In fact, this water supply has led to the establishment of civilizations in the field of plains and lands away from freshwater rivers, and today it also plays an important role in the economic growth of various societies.

In recent years, with the increase in population in the country and the lack of attention to how scientific exploitation of groundwater, this vital source, like other resources, has undergone dramatic changes and the amount of groundwater extraction from aquifers has been increasing day by day. In Iran, with increasing population, the use of groundwater has become more prevalent, so that agricultural water supply, drinking water and water requirements are mostly met by the underground water resources.

Water is not found purely in nature, but it always contains amounts of solutes, suspended matter and soluble gases, so water resources in different regions have different characteristics.

One of the most important issues in hydrology is the quality of water. Because most of the hydrological activities are for supplying water for agricultural or drinking and industrial purposes, each of them qualitatively and qualitatively must have qualitative characteristics and certain criteria, and if such a water supply is not possible, these activities are ineffective. Today, water quality surveys have become widespread and include issues related to surface water and groundwater pollution.

The issue of pollution is not only in industrialized countries, but also in developing and developing countries. For example, in most cities of Iran where drinking water is supplied from underground resources, the problem of contamination of these resources with nitrates and other toxic elements that may be used by sewage wells or fertilizers and pesticides used in agriculture and associated with penetrating water into aquifers comes to notice. Therefore, in hydrologic studies along with a quantitative study of water content, its qualitative criteria are also examined.

The purpose of water quality control is to be aware of the status and the process of changing the physical, chemical and microbial properties of water resources at the site of use. Qualitative control processes confirm the possibility of continuing to supply water from a specified range or source. Therefore, conducting chemical tests and determining the main parameters for each source of drinking water, is one of the essential and essential activities of quality control in all water and wastewater companies. Be After analyzing, for each water supply source, a series of data and results are obtained that in most cases these data are abandoned raw and it is difficult to achieve a correct and comprehensive understanding of these data, but also requires time There is a lot. On the other hand, given the high cost of the laboratory in each water and wastewater company, the importance of qualitative analysis of the desirable use of these data is necessary, to examine the status of the source of water supply, as well as the status of resources at the village level, City, province and in each region. By doing statistical analysis of the results, comprehensive knowledge and knowledge can be obtained that this knowledge improves the productivity and aims of investment and innovation. It is also designed to control the pollution of groundwater. Chemical parameters of water samples are necessary. Studies in this area have long history due to the importance of the subject. The World Health Organization published the first guidelines for the quality of drinking water from 1984 to 1985. And in 1988, the revision of the guidelines began until 1988, when revisions were made (Nabihzadeh Nodehi and Faezi Razi 2007). In Iran, the standards for

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physical and chemical drinking water were first prepared in 1954 and after four times the revision of the one hundred and ninety-fifth session of the National Committee of the Standard was published as the official standard of Iran (Imandal et al. 1997). In this area, studies have also been conducted in different parts of the country. In Safari studies on mineral resources in the city of Mianeh, the main problem of water resources was the total hardness, TDS and bicarbonate ions, and other parameters were good to acceptable (Safari and Vaezei 2003). According to a study by (Kacaroglu and Gunay 1997), seasonal fluctuations in nitrate concentration (10-10 mg/lit) were observed in underground water samples, so that during the wet season, low concentrations and in the dry season, the concentration of the measured Made in this study, seasonal variations in nitrate concentration in wells were observed, these changes may be due to: 1. groundwater recharge 2. changes in the concentration of pollution sources 3. changes in meteorological conditions (fall, evaporation) 4- Underground water level fluctuations and agricultural activities. Farshad et al. (1998) reported that nitrate and nitrite ions were 51.96 and 16.16 mg/lit, respectively, in the study of nitrate and nitrite ions in the industrial units of Tehran region of Karaj. In a comprehensive study on nitrate in drinking water in Qazvin, from 2000 to 2001, about 31% of wells had nitrate levels above the limit (Farshad and Imandel 2002). In a study by Dindarloo et al. (2006) on drinking water quality in Bandar Abbas, it was found that fluoride ion was 2.47 mg/lit, while nitrite, chlorine, sulfate, sodium and TDS also exceeded Reported a standard limit and also placed drinking water in the area in a very difficult water type and reported that the city's underground water resources are among the sources of water cannot be used alone. In a study on the groundwater quality of Hamedan plain by Rahmani and Shokohi (2007), the results of this study showed that due to the low table recession, the quality changes of groundwater reservoir have not yet reached the acute state, but Majority in 18 stations is more polluted than other stations, and 43.3% of these stations have high concentration of nitrate and one third of stations with TDS above the standard level. Water quality studies in some of cities, including Tehran, Arak and Mashhad, have also shown that the concentration of nitrate in water of some of the wells is more than standard, so that these chains use the operating circuit for consumption drinking has been delegated to municipalities for agricultural use. Poor irrigation management and agronomic activities, along with undesirable hydrodynamic conditions, are among the most important factors in groundwater contamination. Latif et al. (2005) conducted a study to determine the pollution level of groundwater nitrate in Mashhad plain and to identify the causes and source of contamination. For this purpose, 40 wells in the drinking, agricultural and industrial parts of the plain for the period. They sampled 6 months from July to December and compared their chemical and microbial parameters to international standards. The results showed that the polluted areas of the population and the good quality of water in the agricultural and industrial sectors. Also, the high concentration of nitrate in parts of Mashhad was due to leakage of domestic sewage to groundwater. Ehteshami and Sharifi (2007) measured the nitrate pollution in the groundwater resources of the city of Ray, which consists of 40 to 50 percent of their drinking water, measured nitrate in the central and eastern parts of the city to 65 mg /lit. They showed that the sewage collection network could reduce the nitrate concentration to 30 mg/lit. Society studied.

2. Study method

The method of study in this research is field trial. Sampling is carried out to determine the concentration of chemical parameters of groundwater resources in the drinking water of the villages of Tonekabon city. The city of Tonekabon is located between the geographical coordinates of North 's 45º and Eastern 12º51. The height of this city is from the sea level of 20 meters and its area is 2140 square kilometers. For this purpose, a drinking water well ring was selected in the study area of Tonekabon. In the village of Zawar, it was sampled monthly for 6 months. Due to the location of the well in the vicinity of agricultural land, this area was selected for studying chemical parameters. Characteristics of well is shown in Table 1.

Table 1. Location and characteristics of well sampled.

Well	x	Y	depth (m)	Rate of well discharge (liters per second)
Zawar	36.74091	50.97175	72	15

3. Periodic analysis of drinking water quality

For periodic analysis of the quality of drinking water sources, with a view to ensuring quality during consumption, as well as a review of quality change over time, a plan has been developed so that with the available facilities and constraints, there is a high degree of certainty and a better estimate of the annual change in resources. Chemical analysis of resources in all seasons of a year requires the use of more force and budget and higher costs. Therefore, a plan has been developed that takes into account the existing conditions for the desired management objectives. In this project, a chemical analysis period for all water supplies will be carried out in the first six months of the year. Then seasonal control will be based on measuring one of the main criteria for examining TDS changes, electrical conductivity, and changes to it. Nitrite, nitrate and ammonium changes can also be considered. Bringing on-site analytical results for electrical conductivity and laboratory analysis results, in addition to making water resource quality changes possible, helps control the processes of both systems (sampling, measuring, and recording results). Investigating and investigating cases where there is a discrepancy is necessary by the laboratory's quality control officer.

3.1. Steps to implement the plan

The stages of implementation of the project are as follows:

1. An equal list of water supplies for periodic laboratory and seasonal measurements is provided.

2-The same standard instructions for sampling method and location are provided and taught.

3. Planned to sample these groundwater resources according to the standard instructions and all chemical water variables are measured.

4. For sources with no significant difference in data, the results of a complete analysis of qualitative variables in the laboratory are considered valid data.

5- It is planned to analyze and analyze the results of the control samples. From the analysis of periodic results and control with seasonal data, considering the validity of the data, reliable and valid results for each water source are determined.

3.2. Review the results of the analysis

The results of the analysis are recorded in mg/lit (electrical conductivity in micro siemens), along with the resource specifications of the city in Excel, and the items are selected based on their effects and their role in determining the water quality, including: turbidity, TDS, electrical conductivity, total hardness Total alkalinity, temporary hardness, permanent stiffness, calcium hardness and magnesium hardness, sulfate, chlorine, fluorine, nitrate, nitrite, phosphate, ammonia, bicarbonate, sodium, magnesium, calcium, iron, potassium and magnesium. American Public Health Association recommended limit for nitrate in drinking water in terms of nitrogen 10 mg/lit (in terms of nitrate 50 mg /lit) and permissible nitrite level of 1 mg/lit (in terms of nitrite 3 mg/lit) recommendation has given. Water sources are classified into three groups of nitrate concentration: highly contaminated (more than 50 mg/lit), contaminated (20-50 mg/lit) and slightly contaminated (less than 20 mg/lit).

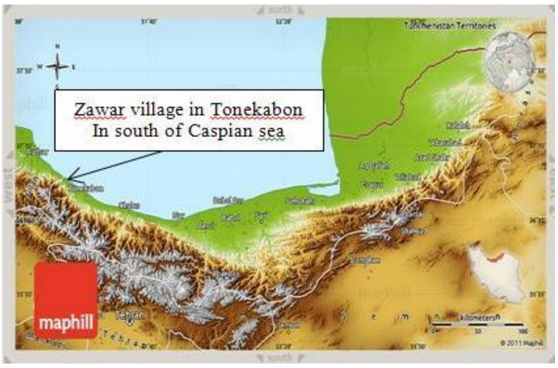

Fig. 1. Zawar village in Tonekabon, in south of Caspian Sea (http://www.maphill.com/iran/mazandaran/maps/physical-map/).

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Table 1. Results of experiments on chemical parameters of Zawar (March 2016).

Unit	Results (mg/lit)	Test method	Test title	Rows
NTU	2.55	Odometry	Opacity	1
S/Cmμ	568	Conductivity measurement	Electric conductivity (E.C)	2
mg/lit	276	Conductivity measurement	Dry residue (TDS)	3
Caco3	278	Titration	Total hardness	4
Caco3	214	Titration	Total alkalinity	5
Caco3	170	Titration	Temporary difficulty	6
Caco3	108	Titration	Permanent hardship	7
Caco3	182	Titration	Calcium hardness	8
Caco3	96	Titration	Magnesium hardness	9
F^-	0.1	Spectrophotometer	Fluorine	10
CL^-	6.1	Spectrophotometer	Chlorine	11
$SO^{2-}{}_4$	68	Spectrophotometer	Sulfate	12
$NO^-{}_3$	24	Spectrophotometer	Nitrate	13
$NO^-{}_2$	0.21	Spectrophotometer	Nitrite	14
PO_4^{3-}	0.15	Spectrophotometer	Phosphate	15
Ammonium ion	0.09	Spectrophotometer	Ammonia	16
I^-	1.24	Spectrophotometer	Iodor	17
$HCO^-{}_3$	260.97	Titration	Bicarbonate	18
$CO3^-2$	–	Titration	Carbonate	19
OH^-	–	Titration	Hydroxide	20

Table 2. Results of experiments on chemical parameters of Zawar (May 2016).

Unit	Results (mg/lit)	Test method	Test title	Rows
NTU	3.18	Odometry	Opacity	1
S/Cmμ	567	Conductivity measurement	Electric conductivity (E.C)	2
mg/lit	275	Conductivity measurement	Dry residue (TDS)	3
$CaCO_3$	274	Titration	Total hardness	4
$CaCO_3$	210	Titration	Total alkalinity	5
$CaCO_3$	172	Titration	Temporary difficulty	6
$CaCO_3$	102	Titration	Permanent hardship	7
$CaCO_3$	171	Titration	Calcium hardness	8
$CaCO_3$	103	Titration	Magnesium hardness	9
F^-	0.09	Spectrophotometer	Fluorine	10
CL^-	4.5	Spectrophotometer	Chlorine	11
$SO^{2-}{}_4$	65	Spectrophotometer	Sulfate	12
$NO^-{}_3$	20.4	Spectrophotometer	Nitrate	13
$NO^-{}_2$	0.213	Spectrophotometer	Nitrite	14
PO_4^{3-}	0.15	Spectrophotometer	Phosphate	15
Ammonium ion	0.06	Spectrophotometer	Ammonia	16
I^-	1.17	Spectrophotometer	Iodor	17
$HCO^-{}_3$	256.097	Titration	Bicarbonate	18
$CO3^-2$	–	Titration	Carbonate	19
OH^-	–	Titration	Hydroxide	20

4. Conclusions

The chemical parameters of rural water resources in Tonekabon are not problematic from a health point of view, but because of the lower quality of extracted water, some of the underground resources can be consumed if necessary, with other waters such as surface water to the extent that it provides the desired range of standards, mixing and then using.

Although the concentration of nitrite and nitrate in all cases is lower than the standard drinking water in Iran. But according to the definition of water pollution in terms of nitrate wells are located on the "infected" and "slightly contaminated" floors. In addition, the difference in concentration of nitrate in the wells of the area, as well as the approximation of some nitrogen nitrates to 20 mg/lit (which is a sign of the effect of human activities), is also important and deserves serious attention.

According to the above, it is suggested that studies be repeated over time to understand the impact of human activities on nitrate and nitrite contamination. Nitrogen nitrate concentration at different stages was not affected by the short time interval between stages. Our findings indicate that nitrate concentrations are higher in winter and spring compared to the rest of the seasons. The highest concentration of nitrate is usually in the late winter (March of 2015) and mid-spring (May 2015). It is observed that the amount of nitrate in March is the maximum that can be attributed to nitrate washing due to winter rainfall and the beginning of the growing season and fertilization Be Plant growth in April and May can result in the use of soil nitrate and reduced its leaching. Therefore, there is no possibility of nitrate leaching to zero, and under any circumstances some nitrogen is leached as nitrate from the soil, but it can be minimized by proper management. Of course, the beginning of the wintering season at the end of winter at this time caused the maximum concentration of nitrate, although by diluting the concentration of nitrate decreased, but did not return to the initial amount and increased by fertilization. This principle is not always the case, and other factors such as rainfall can change it. This research is an underlying study to investigate the distribution of chemical parameters such as nitrate and to identify the cause of contamination, its origin and further studies on the effects of different factors such as soil characteristics, geology, fertilization management, type and planting system, Irrigation water and fluctuations in groundwater aquifers are necessary in each region. Investigations showed that nitrate and nitrite concentration in one well in the village of Zawar is a sign that there is a risk of increasing nitrate concentration. However, it is recommended that water quality control of the city be carried out on a regular basis and the sanitary protection of wells should be fully observed and, if not possible, new sources should be replaced.

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