International Journal of Applied Research 2019; 5(7): 243-247

ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2019; 5(7): 243-247
www.allresearchjournal.com
Received: 24-05-2019
Accepted: 28-06-2019

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The investigation of NO_2 and NO_3 anion in underground and surface waters of Herat city

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Abstract
In Herat, Water as a main living substance is used for drinking, washing, agriculture and industrial purposes. Water can be infected by anything that dissolve in it, which directly threats human being's health. Nitrite (NO_2) and Nitrite (NO_3) are the most important polluter anions. Whish respectively with more concentrations from 50 mg/lit and 0.2mg/lit is poisoning to drink and at times deadly. Therefore, studying of water quality is too important. The goal of this research is the laboratorial analysis of waters quality especially the Herat city NO_3 and NO_2 parameters. The method of this research is analytic, descriptive and quantitative and from the segmental type which the samples of water from the three section or part of Herat city (Karbar, Ju-e-Naw and Ju-e-Enjeel) three samples were taken from each place. The results are explained in graphs and are compared with the international range. The results show that the density of NO_2 in all parts are fitted according to the international standards (WHO) except in Kartah area that will not occur any problem. Whereas, the density of NO_3 in (Ghaizan, Pol-e-Rangeena and Kartah) areas are higher than international standard (WHO) and using of water is worrying. For decreasing of this problem, it is necessary to avoid using of unqualified and useless fertilizer in the farms as possible as we can.

Keywords: Nitrate (NO_2), Nitrite (NO_3), Herat city, water quality, pollution

Introduction
Water is a critical ingredient. There are abundant surface and underground water in different parts of Herat city, and in these waters, there are ions of Nitrate and Nitrite in the form of solutions in these water, which in some areas these are higher and in some regions less. Unfortunately, so far no research has been done on the amount of Nitrate and Nitrite anions in the aforementioned areas. Although the research in this case is not easy, and, in view of the need for the Department's vision, I would like to investigate on Nitrate and Nitrite in three different locations in the city of Herat on the surface and underground waters (the Karbar, Ju-E- Now and Ju-E-Injel of Herat province) and will check amounts of ions of nitrate and nitrite in the water of above mentioned areas in laboratory conditions.
The study found that water located on the ground and underground has chemical compounds known as cuprous anions that are composed of different components and play an important role in human life. The objectives of this research are to evaluate the quality of water in Herat city by analyzing and comparing it with the International Standards of world health organization (WHO). Research has been done on controlling contamination of nitrate in groundwater of Shah Rood aquifer and concluded that the concentration of nitrate in urban and rural areas of Shah Roud has increased by more than 45 mg /Liter, the main cause of nitrate pollution in the Shah Rood aquifer is the domestic sewage sedimentations, which increases the concentration of nitrate than the WHO standards. (Jafari, *et al*., 2015).
The results we obtained by comparing the research conducted by Jafari in Shah Rood aquifer in the areas (Karta, Pol-e- Rangina, Gizan Surface waters, as well as in underground waters of Gizan) are relatively similar.

Nitrate and nitrite
Nitrate chemical formula is NO_3 is colorless, tasteless and odorless material. And also nitrite chemical formula is NO_2 is colorless, tasteless and odorless substance too. Except through analyzing in laboratories, it cannot be detected otherwise, and in the agricultural industry, Potash Nitrate and Sodium Nitrate are widely used,

they mostly are used as chemical fertilizers in the agricultural industry. Nitrate and nitrite are naturally found in drinking water and underground water (well water, springs, and kariez) and surface water in seas and streams. Other factors include increasing the amount of nitrates and nitrites in drinking water is excessive use of this substance in agriculture, industrial waste containing these ions, as well as fossil fuels. Which contaminates surface water and underground water widely (Adibfar, 2010).

Nitrate and nitrite bad effects on human health

The detrimental effects of Nitrite and Nitrite anions on the health of the human body are many, including the ability to oxidize iron into the human blood red cells circulating. Ultimately, the red cells of blood cannot carry the oxygen needed to the body tissues and completely damages the body tissues, this deficiency and lack of oxygen causes the death of different cellars. The American Society for Public Health recommends a limit of nitrate in drinking water in terms of 10mg / lit nitrogen, of course, this standard is for children, pregnant women and nursing mothers. But other people are advised not to use water that have high nitrate and nitrite levels and follow the above standard. Long-term use of water including nitrate and nitrite, has an adverse effect on human health and increases the incidence of cancer (Adibfar, 2010).

Methods for removing and reducing nitrate from drinking water

Varieties of methods for water purification and separation of nitrate and nitrite from water can be used. Such as use of distillation, reverse test, ions exchange and mixing methods. It should be noted that the boiling of water and the use of a purification filter for propylene and active carbon to remove nitrate and nitrite from water is not effective, it should be taken into account that boiling water, in addition which can't removing nitrate and nitrite ions from water, also increases the concentration of nitrate and nitrite in water (Shahbazi, 2002) [2].

Distillation

In this way as its name implies, it first boils water and then by collecting vapors, nitrate and nitrite which is in the water is removed. In this way, almost all nitrates and nitrites are removed from the water. It is inappropriate method due to the difficulty and need of hard working as well as difficulty of providing distillation conditions and unavailability. And also because the water obtained from this method is distilled water and which mineral is not in water so it is not useful for health (Shahbazi, 2002) [2].

Mixing method

In this way, by mixing the water containing high nitrate with water containing low percentage of nitrate, the amount of nitrate in water decreases. This water is great for the elderly because it reduces the amount of nitrate in water, but it is not suitable for children. Also, due to the fact that it is not possible to accurately measure the mixing of contaminated water with nitrate with healthy water and that the principles of safe water for mixing in different situations are not available, this method is not suitable and not use a lot (Shahbazi, 2002) [2].

Ionic exchange

In this method, cations and anions which exist in the water containing nitrate and nitrite is replaced with cations and anions of Resin polymer and purified water from nitrate and nitrite in the discharge water. The way of action of this method is that the cations and anions contained in water containing nitrate and nitrite are replaced by cations and anions in Resin polymer so nitrate as well as nitrite is removed from the water. This method which is very costly so it is not cost-effective for separating nitrate and nitrite from water (Shahbazi, 2002) [2].

Inverse osmosis

In this method water with nitrite passes with pressure throw filter, it causes removal of nitrite. To know better about this method study the home water filtering system and inverse osmosis method. It should be noted that charcoal and lightweight filters do not remove nitrate from water, and boiling water not only does not remove and reduce its concentration but also increases the concentration of nitrate in the water. It should be avoided to remove nitrate by this method (Shahbazi, 2002) [2].

Cycle of nitrogen

Nitrogen component forms 0.003% of the Earth's crust, and nitrogen gas forms for more than 78% of our breath air. Nitrogen is present in various forms in nature. The most important compounds used in its microscopic structure include the types of amino acids, Urea, ammonia, penta oxide nitrate (N_2O_5), and nitrogen tri -chloride (NCl_3), organic form of nitrogen forms from the decomposition of plants and animals. Nitrogen is an essential part of amino acids structure. This contributes to the formation of animal protein. As a result of proteins decomposition, organic nitrogen, produced ammonium ion, which is a biological processes named nitrification, it is a two stage process, first by nitrifying bacteria change to nitrite (NO_2) and then by nitrobacteria's oxidized to nitrate oxide (Panahi, 2003) [3].

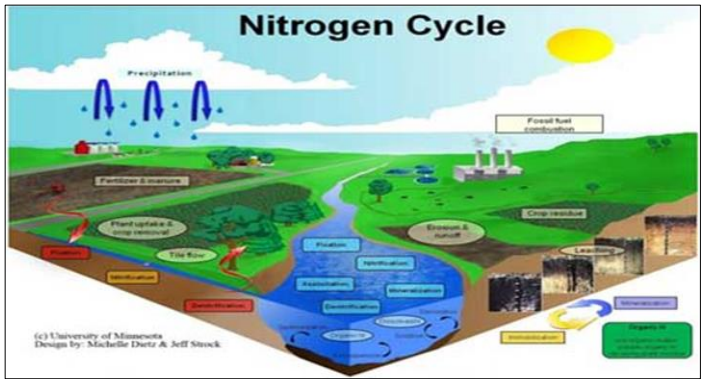


Fig 1: Nitrogen cycle

Threats to groundwater resources

Industrial and urban sewage leakage, domestic sewage, non-sanitary discharge of sewage on the surface of the earth, non-health use of animal fertilizers, use of nitrogen fertilizers in fields and agricultural gardens and storage sites of waste are the most important threats to underground water. Pollution of groundwater is caused by the use of point sources such as septic tanks or through non-point sources such as use of nitrogen fertilizer in agricultural lands. Due to the solubility of Nitrite and Nitrate, this compound easily passes through various layers of soil into underground water sources (Ghafoory, 1995) [9].

Identification of nitrite and nitrate ions

As Nitrite is a colorless, tasteless and odourless compound, therefore, it is not detectable in water without laboratory procedures. Testing of drinking water sources for Nitrite and Nitrate should be done at least once a year. Since it takes long time to infiltrate pollutants into underground water, it is necessary to treat source of drinking water every year to improve the quality of water resources. Water testing to determine the amount of nitrite is required by one of the environmental quality assurance centers, labs of health centers in a city or village, or private labs. The lab should be selected to have the appropriate coat to determine the amount of nitrate ion, including sterile bottles, sampling, information recording form, sampling instructions, and sample delivery boxes (Panahi, 2009) [11].

Standard quantity of nitrite and nitrate in drinking water

According to standard no. 1053 institute of standards of industrial research of Iran, the standard amount of Nitrite is 50mgr/lit and Nitrate is 0.2mgr/lit. It should be noted that due to the possibility of the presence of Nitrite and Nitrate ion in drinking water, the sum of the ratios of the measured values should be less or equal to the values of the standard. And also the WHO range has accepted this standard.

Nitrite

According to studies conducted by the organization, the maximum permissible is 50mgr / lit, and the national standard of Iran is the same in terms of nitrate content. The US Environmental Protection Agency has set the maximum nitrite limit 10mgr / lit in nitrogen, equivalent to 44.28mgr / lit in terms of nitrate (Zari, 2014) [17].

Research Methodology

The samples collected from Karbar, Joy Naw and Joy Enjil villages and in the laboratory, the parameters NO_3, NO_2 were measured scientifically and tested By a DR 6000 spectrophotometer the results were analyzed by different software, including SPSS ver. 20, ArcView GIS 9.3.

Finding and controversy

Field research tools were special bottle containing 0.001% Nitric Acid, Pepit, Gloves, Mask and laboratory research tools: Includes special enzymatic enzymes for angiotensin-ionizing reagents, baker, test, micropipette, centrifuge, heat source, gauze, sensitivity scale of 0.001 grams، (spectrophotometer). According to high harmful effect of anion nitrite and nitrate in surface and ground water the results of Karbar, Joy Naw and Joy Enjil compared with international standards. In this investigation the composition of anion of nitrite and nitrate with various values were performed after testing in the laboratory at 3mlit/ lit measured by the spectrophotometer. After calculation, we will find the amount of these anions is in one liter of water. (For example, calculation of amount of nitrite and nitrate were as follows).

Calculation of anion Nitrate (NO_2)

1000mlit 941.666mgr

3mlit x

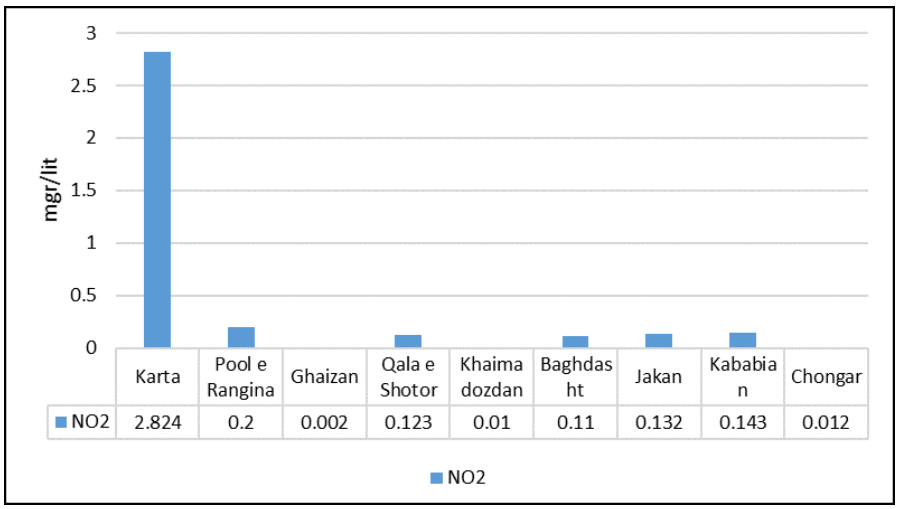
$$x = \frac{3mlit \times 941.666mgr}{1000mlit} = 2.824mgr/lit$$

Calculation of anion Nitrite (NO_3)

3mlit 0.219gr

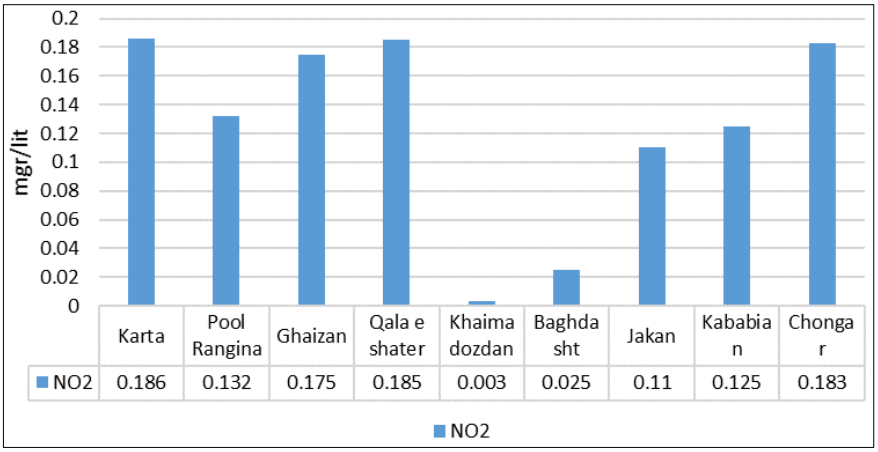
1000mlit x

$$x = \frac{1000mlit \times 0.219gr}{3mlit} = 73mgr/lit$$



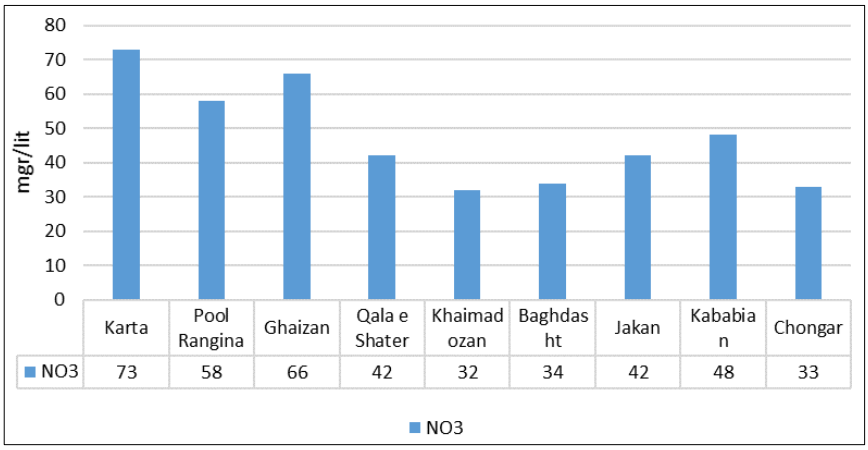
Graph 1: Nitrite content in surface water of Joy Naw, Karbar, Joy Enjil

Graph (1) showing the amount of Nitrite in surface water of Joy Naw, Karbar, Joy Enjil, in this figure the quantity of nitrite were normal and only in Karta place it was high than WHO standards, and it use is can make problem for drinking and agricultural uses.



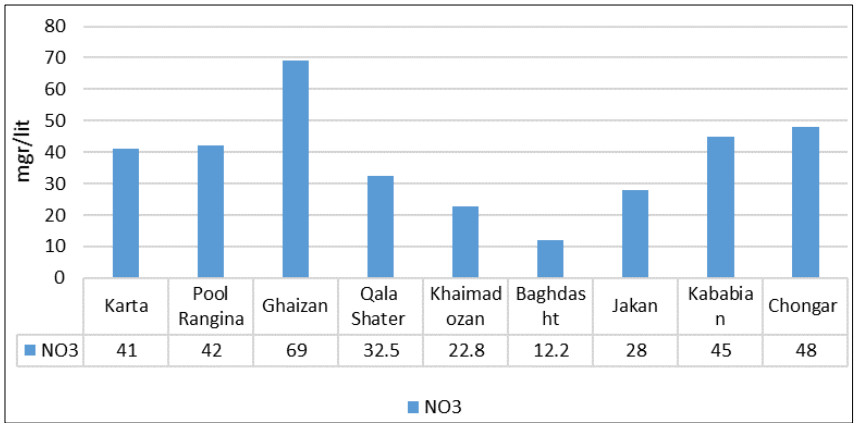
Graph 2: Quantity of Nitrate in ground water of Karbar, Enjil and Joy Naw

Graph (2) is showing the amount of nitrate in ground water of Karbar, Enjil and Joy Naw, in this figure the amount of NO_2 in all the villages are not more than WHO standards, therefore use of them has not any problem.



Graph 3: Quantity Nitrite in surface water of Karbar, Joy Naw and Joy

Graph (3) shows the amount of Nitrite in surface water of Karbar, Joy Naw and Joy Enjil. The amount of nitrite in Karta, Pool rangina and Ghaizan is higher than WHO standards therefore, it is not good for drinking and agriculture purposes.



Graph 4: Showing the amount of nitrite in surface water of Karbar, Joy Naw and Joy Enjil

Graph (4) showing the amount of nitrite in ground water of Karbar, Joy Naw and Joy Enjil. Samples from Ghaizan is higher than WHO standards, therefore is not good for drinking and agriculture purpose. The results compared with international standards. The results shows that amount of NO_2 in all the villages are equal to WHO standards except Karta village, therefore they are good for drinking and irrigation purpose. While the concentration of NO_3 in the surface water of (Ghaizan, Poole Rangina and Karta) and also in Ghaizan the underground water is high basin of the international standards (WHO) and its use is alarming. In order to reduce the extent of this problem, it is necessary to avoid the use of non-quality fertilizers and their unnecessary use in agricultural land as far as possible.

Conclusion

Nitrite and Nitrate are anions that always present in surface and underground water, if the amounts of these anions are higher than international standards can cause many problems in surface and underground water. These problems affect the animal and plants cells and cause a sudden mutation (mutation). the mutation cause due to increasing amount of nitrite and nitrate in water, the cells division process increasing and cause death or cancer. The international standards for nitrate is 0.2mgr/lit and for nitrite is 50mgr/lit. the results compared with international standards, they shows that amount of NO_2 in all the areas except Karta area are equal to international standards (WHO) therefore, they are harmless. While the amount of NO_3 in (Ghaizan, Pool rangina and Karta) in surface water and in Ghaizan in underground water compare to international standards (WHO) is high.

Suggestions

1. In order to stop the contamination of underground and surface water, the government has to control the import of low quality fertilizers.
2. Establishing of quality control labs to improve the quality of chemical fertilizers, and increase the precision of preventing the penetration of harmful ions, and on the other hand, to provide farmers high quality fertilizers.
3. To reduce the extent of this problem, it is necessary for the government to prevent the introduction of non-quality chemical fertilizers and its unusual use in agricultural lands as far as possible.

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