



Development Of A Chemistry Teacher Environmental Competence

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Abstract

The problem of a chemistry teacher ecological competence development is considered in the work. The importance of environment protection problem and the upbringing of student careful attitude towards nature is substantiated. All processes occurring in the environment must be studied not only from the point of view of chemistry, but also from physical, biological and anthropogenic aspects. Such training contributes to a deeper understanding of the processes occurring in the environment, their influence on a man's body. In this regard, within the framework of this study, they studied scientific literature, normative documents and practical experiments concerning the composition and the quality of spring water at Nizhny Kuzmes' village of the Kukmorsky district in the Republic of Tatarstan were performed to determine its suitability as a source of drinking water for population.

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Key words: environment, ecological problems, hydrochemistry, chemical composition of water.

Introduction

People have always polluted the environment, but at low levels of civilization development pollution was not such a serious problem. With the development of large industrial cities, with the increase of the number of cars, the problem of environmental pollution became an urgent one [1]. The most important role in environmental problem solution belongs to education. From the earliest age, every person living on the Earth must know the consequences of a carefree attitude towards the environment. It is necessary to have an idea about the diseases and genetic deviations caused by environmental pollution, about the death of animals and plants, the reduction of soil fertility, the depletion of drinking water supplies and other negative changes in the habitat. And not only know, but also feel personal responsibility for its condition. However, modern school graduates are poorly oriented in global problems, including environmental ones, the problems of human health and the biosphere preservation [2].

In order to understand the importance of the world protection a teacher should familiarize the children with environmental problems, to develop stable feelings of respect for nature. The enhancement of environmental security implies the responsibility and an active involvement of all people, regardless of their social or economic status. It is necessary to learn how to save any natural resources - no matter whether they are scarce or not. At the same time, it is necessary to calculate all possible results of any activity in advance, taking into account not only the obvious but also the most improbable consequences, and also to realize that any violations of the ecological balance lead to natural disasters and health impairment [3].

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In our country, the attention to the issues of environmental protection grows, and a number of regulatory and legal acts is developed in this regard. For example, the Federal Law No. 7-FL "On Environmental Protection" issued on 10.01.2002, Federal Law No. 96-FL "On the Protection of Atmospheric Air" issued on 04.05.1999, Federal Law No. 89-FL "On Production Wastes and Consumption" issued on 24.06.1998 [4].

At the chemical institute named after A.M. Butlerov K(P)FU the students of pedagogical profession (profile - bachelor of chemistry) study the discipline "Chemical processes in the environment" in order to form the ecological competence of future teachers. The feature of this course is its integrative nature. All processes occurring in the environment are studied taking into account chemical, physical, biological and anthropogenic factors that affect nature. Such integration develops a more qualitative competent superstructure, promotes an in-depth understanding of current environmental processes, including negative ones, and involves the development of practical skills to conduct the activities on the study of natural phenomena, as well as to prevent harmful effects of economic activity and improve the environment. One of the trends of such work is the analysis of scientific literature and practical experiments on the study of water quality [5]. In the process of this course study, students perform various experimental tasks in addition to theoretical work. In particular, in the section "Hydrochemistry", they study the ecological status of water bodies.

Water is the most important component of our planet and serves as a necessary condition for the existence of all living organisms on Earth. Since the most ancient times the whole life of a man is related to the use of water and aqueous solutions [6]. According to the scientific literature, it is very difficult to find water without harmful impurities, as it contains dissolved salts of metal, iodine and fluorine, etc.

It was proved that a man's body contains a significant amount of water: a body of a newly born child contains up to 75% of water, and a body of an old man contains more than 50% of water. If the water content in a body decreases by at least 2%, then there is an immediate need for it. If more than 12% of water is lost, a person can not recover without the help of doctors, and the loss of 20% of water leads to death. The percentage of water content in the main organs of a man: brain - 90%, blood - 85%, lungs - 83%, kidneys - 79%, heart - 73% and muscles - 79% [7].

Water is the source of life for a man. One person consumes up to 60 tons of water during his life only for drinking. Water performs a transport function in a body, delivering oxygen and nutrients to every cell of our body. Due to the presence and polyfunctionality of water, our body can regulate body temperature. It also promotes food processing into energy, helps cells to absorb nutrients. Besides, water removes slag and waste from our body.

Water participates in a variety of mechanisms and life cycles on earth. First of all, the water cycle in nature allows animals and plants to obtain much-needed moisture for their existence. Secondly, seas and oceans, rivers and lakes play a major role to create the climate of a given terrain, and the high heat capacity of water provides a comfortable temperature regime on our planet. Thirdly, water plays an important role in the process of photosynthesis. Due to water, plants can process carbon dioxide into oxygen.

Against many useful functions performed by water, its pollution is an extremely serious problem and should concern the humanity. Water pollution is a process of reservoir saturation with harmful substances, production waste and household waste. Thus, water loses most of its useful properties and becomes unsuitable for further consumption. The main sources of pollution are the wastes from oil refineries, heavy metals, radioactive elements, pesticides, urban sewage and livestock farm drains. In this case, even a small amount of harmful impurities can harm health.

According to the World Health Organization, there are no sources on our planet with pure natural water. And this threatens with the catastrophe of our civilization, since humanity will not survive without water.

People constantly use water in everyday life, so the quality of water is extremely important. Even a relatively small amount of harmful impurities can harm health. However, it is impossible to visually determine the purity of water - many of the harmful substances dissolved in it are completely invisible, and they can not be detected without special instruments.

Materials and methods

Within the framework of the training course "Chemical Processes in the Environment", during the study of water

research methods, we conducted the analysis of spring water at Nizhny Kuzmes' village in the Kukmorsky district of the Republic of Tatarstan in order to determine its suitability for drinking, in accordance with RF state standard "Drinking water. General requirements for the organization and the methods of quality control".

The object of the study is a sample of water extracted from the source.

The standard of comparison is distilled water.

Research equipment is a set of chemical glassware and chemical reagents from a set of analytical chemical laboratories.

Results and discussion

Experience № 1.

The study of water started with the study of organoleptic indicators: chromaticity, turbidity, the presence of odor, taste.

1. Chromaticity is a natural property of water, conditioned in nature by the presence of humid substances and complex iron compounds in its composition. It can depend on a reservoir location, its structure, and also on plants that grow around a reservoir, the animals living next to and many other factors [8].

A graduated cylinder with the capacity of 250 ml was filled with distilled water as a control sample, and the same amount of water was taken from the spring as another sample. The comparison of samples did not show the difference in color. Therefore, the water from this reservoir does not have a specific color.

2. Water turbidity is associated with the content of insoluble particles of different origin in it. If the water is turbid, precipitation can be detected during a chemical reaction. The sediment may be absent, weakly represented, be noticeable, large and very large [8]. A visual method was used in order to determine the turbidity of water. The purity of water taken for the studies was determined with a chemical beaker and a common newspaper. A small amount of water was poured into a beaker and a sheet of newspaper was attached to it. The letters written in a newspaper were clearly visible. This serves as a qualitative indicator of a sample transparency.

3. The smell of water is determined by the presence of volatile fragrances that enter the water in a natural way, or with sewage. Almost all organic substances (in particular liquid ones) have a smell and they transfer it to water [8]. The smell was determined at room temperature (20 °C) and at elevated (60 °C) water temperature. Under normal conditions, the smell was not felt, but a barely perceptible marsh odor appeared when heated in a water bath to 60 °C.

4. Taste of water. Water can be salty, bitter, sweet, sour depending on the chemical composition of substances, mineral salts, or the presence of organic compounds in it. The water taken for an experiment has a weakly perceived specific taste.

Experiment № 2. «Determination of water pH».

In order to determine the pH of water, a test tube with water and a universal indicator paper were used. Using a pipette, water was applied to the indicator and compared with the standard. The resulting pH = 6. Consequently, the medium is slightly acidic one.

Experiment No. 3. The study of water sample chemical composition. The study was carried out according to the methods of state standards determining the quality and composition of drinking water.

1. GOST 4245-72 Drinking water. The methods for chloride content determination; GOST 18190-72 Drinking water. The methods of residual active chlorine content determination [10].

When a solution of silver nitrate was added to a water sample, a white precipitate was developed, which means the presence of chloride ions in water [9].

2. GOST 4389-72 Drinking water. Methods for sulphate content determination [10].

The result of our studies showed the presence of sulfate ions in the sample.

3. GOST 4192-82 Drinking water. Determination methods of mineral nitrogen-containing substances [10].

Nessler reagent was used in order to determine the ammonium ions in water. "Trace" amounts of ammonium ions

were detected, which manifested itself as a barely noticeable yellow coloration [9].

4. GOST 4011-72 Drinking water. Methods of total iron mass concentration measuring [10].

A reaction was carried out with potassium hexacyanoferrate (II). A dark blue precipitate of Berlin azure fell out. This confirms the presence of iron (III) ions in water [9].

5. GOST 4974-72 Drinking water. The methods of manganese content determination [10].

The performed experiment demonstrated the precipitation of brown color, which indicates the presence of manganese ions [9].

At home water can be cleaned in the following ways:

1. Boiling. During water boiling, it is sterilized and cleared of pathogens. At that, the vessels where the boiling occurs, should not be closed, because the harmful volatile compounds contained in it will be removed with the vapors. But there are also disadvantages of such cleaning. First of all, the chlorine compounds remain in boiled water. Such compounds are dangerous to health, as they turn into a carcinogenic substance - chloroform, which causes cancer. Secondly, the water is obtained during boiling in which the level of salts, nitrates and heavy metals becomes higher than in conventional tap water. This can be judged by observing the walls of dishes, in which water is boiled. Salts settle on them. Thirdly, boiled water is called "dead water", the use of which does not benefit a person.

2. Settling. A vessel with water should be left for 8-9 hours. At that, water can be stirred to evaporate the chlorine compounds that are present in it. The salts of heavy metals won't be evaporated - at best, they will just settle on the bottom of a vessel. Therefore, when you use such water, it is necessary to leave a precipitate developed on the bottom of the cookware.

3. The purification of water using sodium chloride (common salt). 2-liter container should be filled with tap water and 1 tablespoon of salt should be dissolved in it. After 20 - 25 minutes you can drink water. Such water will be freed from harmful microorganisms and heavy metal salts, but it is not recommended to drink it every day.

4. Freezing is another effective method of water purification. It is necessary to fill a vessel with water, but not in full, as the water expands during freezing. Clean fresh water will freeze faster than water with salt impurities. Therefore, when the water is frozen in a vessel halfway, the unfrozen water must be poured away (all harmful impurities are contained in it), and the frozen water can be melt - you can drink it and use for cooking. Defrosted (thawed) water, drunk immediately after defrosting, is extremely useful, capable of speeding up many recovery processes in a body. It may increase efficiency, alleviating the condition during allergies, dermatitis, itching, bronchial asthma and stomatitis.

There are also popular methods of water purification.

1. Purification with a cluster of ashberries: if you lower it in water for 2-3 hours, you get a clean liquid.

2. The cleansing with willow bark, onion husks, juniper branches and bird cherry leaves are also effective and good to obtain clean water, but the cleaning process will take 12 hours.

Chemical methods of water purification:

1. Ozonation is the most effective one. Ozonation is the process in which water maintains the acid-base balance in the norm, without the content of salt increase. Ozone is an allotropic modification of oxygen. The speed of reaction is explained by it: during the ozonation, the rate at which an oxygen atom is released to other substances is very high. Ozone is considered as the most effective metal oxidizer among the reagents used in water treatment [11].

2. Neutralization with the use of alkalizing or acidifying substances. Typically, this method is used in the purification of industrial wastewater, the hydrogen index of which is disturbed. This method is successfully used to remove heavy metals from water. The neutralization method is the interaction of alkalis, acids, which stabilize the level of the hydrogen index (it should not exceed the coefficient of 8.5 and fall below 6.5 by standards).

Conclusions

Based on the conducted studies, it can be concluded that water from the natural source at the village of Nizhny Kuzmes' of the Kukmorsky district of the Republic of Tatarstan meets the basic requirements of state standards for

drinking water. This is evidenced by such signs as the absence of odor, mechanical and organic impurities, the neutrality of pH environment, as well as the content of the basic mineral substances that determine the taste characteristics of water.

Summary

The results of the analysis concerning the qualitative composition of water make it possible to recommend water from the natural source under study for drinking and cooking.

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