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NITRATE IN WATER AND METABOLISM EFFECTS

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ABSTRACT

Introduction
Nitrate from pollutants that threaten human health is not possible to see contamination because it does not affect the color, odor or taste of the water resources**.** Nitrate converts to nitrite, invite many diseases, especially cancer. The most important reason for the toxic acceptance of these substances is that they react with secondary minerals present in the human body to form nitrosamines which are carcinogenic. Studies conducted in recent years show that in most countries the nitrate concentration in drinking water sources exceeds the permissible limit value.

Aim of the study
In this review, the effects of nitrate on public health, toxicity, chemistry and nitrate removal processes have been investigated. Main purpose, reduce the excessive use of nitrogenous fertilizers in agricultural land, domestic and industrial wastewater treatment and prevent uncontrolled disposal or storage of animal wastes by raising public awareness.

Results. Nitrate and nitrite in the water are indicators of water quality. Since the pollution formation is a rather expensive and laborious process, it is necessary to control the sources causing nitrate pollution.

Conclusions
Nitrate pollution waters and risky areas should be determined, nitrate pollution prevention and remediation studies should be done in risky and polluted waters. Drinking water sources and their surroundings must be protected from nitrate pollution sources. People should be conscious of this issue as the most important factor to prevent danger before pollution occurs.

Keywords: Water, Nitrate, Nitrite, Toxicity, Cancer, Process.

INTRODUCTION

Nitrate pollution in surface and groundwater is caused by biodegradation of organic matter in the soil and use of fertilizer. If the nitrate formed in the soil is partially consumed by the plants, the remaining nitrate pollutes the ground waters and surface waters by passing the water through the ground with rain water. The use of too much fertilizer also leads to soil and aquatic nitrate transfer. In ideal conditions, 50-70% of the nitrogen taken to the soil is used by the plants; It is said that 2-20% is lost by evaporation, 15-25% is combined with organics in clay soil, and the remaining 2-10% is mixed with surface and underground waters. However, these values can change because there are many factors that affect the passage of nitrate into the water (1).

It is not possible to see contamination because the nitrate, which is very common and is a threat to human health, has no effect on the color, odor or taste of the water resources. With the determination of adverse health effects, the nitrate concentration permitted in drinking water is limited to 10 mg / L NO3- N. (WHO-1996). Studies conducted in recent years show that in most countries the nitrate concentration in drinking water sources exceeds the permissible limit value (2).

Nitrate contamination of water, nitrogen fertilizers on agricultural land too much use of animal, vegetable and animal wastes, resulting in decomposition of the protein oxidation of ammonia, the discharge of domestic and industrial wastewater without treatment, the uncontrolled disposal or storage of animal wastes (3).

The use of nitrate-containing waters above the limit values reduces nitrite in the gastrointestinal tract. This can lead to irreversible damage to human metabolism. In children, blood poisoning called blue disease results in death. Adults, on the other hand, consume a high proportion of nitrate-containing water, causing great harm to metabolism. There are studies showing that consumption of longer nitrate-containing waters results in cancer (4).

The most important reason for the toxic acceptance of these substances is that they react with secondary minerals present in the human body to form nitrosamines which are carcinogenic. Nitrate and nitrite in the water are indicators of water quality (5).

There are many processes used for nitrate removal. Most of these are physicochemical processes and their applicability is difficult and expensive. These processes are often confronted as advanced treatment methods. Autotrophic or heterotrophic bacterial denitrification is an alternative to physicochemical processes. With the biological denitrification process, nitrate can be easily removed with an efficiency of over 95% (6,7). Removal of nitrate by biological processes may be in the following species;

PROCESS	POLLUTION	% REMOVAL
Kemolitotrophic denitrification	Nitrate	% 92 (8)
Biologically active carbon (BAC)		% 99 (9)
Intermittent denitrification reactors		% 28.7 (10)
Biologically active carbon and Wheat straw		% 90 (11)
Biological denitrification with plastic filling material		% 99 (12)
Sulfur-limestone autotrophic denitrification		% 74 (13)
With H2, F0 and S0 Autotrophic denitrification		% 95 (14)
Upflow bioreactors with sand and plastic material		% 99 (15)

Effect Of Nitrate in Water

Nitrates are inorganic chemicals with high solubility in water. Most of the nitrogen-containing materials in the natural waters are converted to nitrate, while the main sources are fertilizers and sewage. Other sources of nitrates; Mineral deposits, soil, sea water, fresh water systems and the atmosphere, these resources can be found naturally in the environment (16).

In most countries, nitrate level is generally below 10 mg / L in drinking water obtained from superficial sources, whereas nitrate level in drinking water obtained from wells usually exceeds 50 mg / L. Nitrite levels are often seen at very low levels, such as several milligrams per liter.

Chemical contaminants in the water threaten public health. It is increasing the contact with industrial and agricultural wastes, nitrous amines and other carcinogenic compounds. The reason for the increase in nitrates and nitrites in food and drinks is due to the use of organic fertilizers in the soil, the use of nitrogenous fertilizers and pesticides, and chemical industry wastes.

Within the scope of the EU Integrated Environmental Adaptation Strategy 2007 - 2023 Water Framework Directive, objectives and targets are determined for all directives including irrigation systems and re-injection systems, Nitrate Directive, Directive on the Quality of Surface Waters for Drinking Water Quality and Urban Waste Water Treatment Directive Strategies to be followed in order to reach them have been identified. An integrated approach is followed, taking into account the interactions between these directives during their implementation (16).

Apart from nitrate intake from the outside, the body can also produce up to 62 mg of nitrate per day, and the amount of nitrate formed in the body in disease and infection cases is also increasing (17).

Nitrate Nitrite Conversion

The negative effects of nitrates on health are due to nitrite conversion. Nitrate taken from the mouth is saliva in all age groups, while in infants it is converted to nitrite in the gastrointestinal tract. Approximately 10% of the nitrate that is digested in infants is converted to nitrite, while in other age groups approximately 5% of the nitrate is converted to nitrite (17).
According to a report released by the US Environmental Protection Agency (EPA) in 2003, the limit value in water for nitrates is 10 mg / L (17).

WHO limit values have been established to prevent the risk of methemoglobinemia. The limit value for nitrate uptake is 50 mg / L for bottle-fed infants, the limit value for nitrite uptake is 3 mg / L for bottle-fed infants, and the limit value for nitrite uptake is 50 mg / L (18).

Nitrate Chemistry

Nitrate is one of the most frequent pollutants in surface and ground waters, as stated in a study on the amount of nitrate in drinking water. The most important sources are domestic and industrial wastewater discharged using agricultural fertilizers and without further purification. The limit values for nitrate and nitrite in drinking water according to TS 266 are 11.3 mg NO3 - N / L and 0.15 mg NO2 - N / L respectively. Thiobacillus denitrificans and Thiomicrospira denitrican are used in the sulfur-based autotrophic denitrification process and use sulfur donor electron donor, nitrate and nitrite as electron acceptor. At the end of the process sulfur sulfur is converted into nitrate gas. CO_2 is used as carbon source in the reaction (18).
Although the sulfur-based autotrophic denitrification system has many advantages, its main disadvantage is the production of sulphate and acidity. However, in the heterotrophic denitrification, 3.57 g $CaCO_3$ per gram NO_3 - N is produced when sulfate is not produced.
In heterotrophic processes, although there is no decrease in sulfate production and pH, the net adjustment of the electron source is the main disadvantage. The addition of high organic matter may cause residual organic matter to remain at the outlet, while the loading of low organic matter may cause nitrite in the outlet water. For this reason, the mixtrophic systems formed by the combination of heterotrophic and autotrophic processes can control the exit sulphate, organic residue risk and pH problem. In addition, nitrate can be reduced at higher levels than autotrophic processes (19).

Nitrate Toxicity And Public Health Impact

A study published in Asia showed that there was a positive correlation between the concentration of nitrate in drinking water (mean value 10.55 mg / L) and the incidence of esophageal cancer, and this correlation was also found to be statistically significant (20). In addition, there are studies that have a statistically significant relationship between the increased mortality of esophagus cancers when the nitrate concentration is 19.6 mg / L (21).
A study published in Denmark showed that a statistically significant increase in the incidence of gastric cancer was found in drinking water compared to a region with a high nitrate content (27.1 mg / L) (0.2 mg / L), but the same result was not valid for the incidence of esophageal cancer (22).
The study, published in Poland, resulted in a statistically significant increase in the incidence of gastric cancer in males living in areas with high nitrate content in drinking waters (23).
In Slovakia, the statistical relationship between gastric cancer development and nitrate content in drinking water in 60 villages was examined. In this study, there was no statistically significant relationship between the increase in nitrate levels in drinking water and the incidence of gastric cancer (24).

In another study, it was concluded that there was a negative correlation between the amount of nitrate taken in the diet and the risk of gastric cancer development, and this correlation was also statistically significant (25).
In a study published in 1994, it was concluded that there was a negative correlation between the amount of dietary nitrate and the risk of gastric cancer development, and this correlation was also statistically significant. However, in the same study, negative correlation was removed when correction was made according to vitamin C and alpha tocopherol (26).
In one study, the relationship between the amount of nitrate taken in the diet and the risk of developing glioma was investigated and it was concluded that there was a statistically significant positive correlation between the amount of nitrate taken in the diet and glioma development in males (27).
It has been concluded that there is a statistically significant positive correlation between the amount of nitrate taken during pregnancy through drinking water and the risk of developing brain tumors in children (only for astroglial tumors) (28).

DISCUSSION

Certain parts of nitrate found in soil and water are used by plants. The remaining part is mixed with underground and surface waters, threatening human, plant and animal health and aquatic systems. Nitrate accumulates in the tissues of plants and poses a risk to public health. In water ecosystems, the decrease in oxygen level due to the increase in the nutrient ratio may result in a post-eutrophication. People are exposed to nitrate, consumption of various foods, drinking water, vegetable and meat intake or inhalation. There are experimental studies showing the carcinogenic effects of N-nitroso compounds, a formation of nitrate.
Nitrates and nitrites are compounds that should not be present in foods due to their negative effects on human health. For this reason, legal regulations regarding the maximum levels of nitrate and nitrite in the world are being established. Nitrate and nitrite are found naturally in the water. Many pollutants in drinking water can be removed by physical and chemical methods. However, these methods are expensive or difficult to implement. For this reason, biological treatment is considered an appropriate alternative.
The nitrate present in the drinking water can be removed easily and cheaply from the water by the biological denitrification process. Current studies indicate that pollutants such as arsenic, pesticide, and perchlorate, which are frequently found in drinking waters along with nitrate removal, can be treated together with biologic denitrification process or additional adsorbents to be processed. Studies up to now show that biological treatment in drinking water contaminated with secondary pollutants is an effective and effective method (29).

CONCLUSIONS

There are many factors in the formation of cancer. Radiation is closely related to smoking, nutrition, exercise and other lifestyle habits. According to different sources, about 10% to 70% are related to nutrition. Generally this rate is accepted as 35%. In addition, about 70% of all cancers are associated with nutrition, exercise and other lifestyle habits.
Danger levels and cancer incidence rates for male and female individuals according to the results of the correlation analysis, there is a statistically significant relation between colon cancer, pancreatic cancer, bladder cancer and non-hodgkin lymphoma and nitrate hazard level, but it can be said that this relationship has a weak character. It has been determined that there is no significant relationship between gastric and renal cancers and nitrate concentration in drinking water (29).
It has been determined that there is a statistically significant but weak correlation between colon cancer, bladder cancer, pancreatic cancer and non-hodgkin lymphoma and nitrate hazard level according to the results of correlation analysis between cancer levels and cancer levels in female subjects.

When all these effects are taken into account, it is important to keep nitrate at the limit value in drinking water. The most effective method for the prevention of nitrate and nitrite pollution; The destruction of the source before it occurs, the control of the sources causing the nitrate pollution. Nitrate pollution waters and risky areas should be identified, nitrate pollution prevention and remediation studies should be carried out in risky and polluted waters. Care should be taken to protect drinking water resources and their environment from nitrate pollution sources, to take the necessary precautions, agricultural activities and settlements in these areas should be controlled. Especially in agricultural applications, fertilization activities should be done in a planned manner and regular registration should be ensured. Irrigation water and nitrogenous fertilizers

Be careful in use, avoid excessive fertilizer and water usage. People should be conscious of this issue as the most important factor to prevent danger before pollution occurs.

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