

# Prevention Techniques of Nitrate and Fluoride Pollution and Advances in Water Treatment

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**Abstract-** In recent decades, there has been a great concern for the environmental and health problems caused by pollutants, mainly hazardous pollutants like nitrate and fluoride. Nitrate contamination can pose methemoglobinemia and fluoride contamination can cause dental and skeletal fluorosis along with many other diseases. Advances in water treatment and pollution prevention explores the latest research in the field of water pollution. More specifically, the article analyzes the causes and effects of nitrates and fluoride contamination of water and defines preventive measures that can be taken to accommodate and to overcome this type of pollution worldwide.

**Keywords:** Nitrate, Fluoride, Nitrogen fertilization, Preventive techniques, Water treatment technologies

## 1. INTRODUCTION

During the last few decades there has been a major environmental and health concern for the problems resulting pollution, mainly hazardous pollutants like nitrate and fluoride. This concern was born in countries with greater economic development, forced to face problems of environmental pollution and resulting adverse effects on public health. Experience has shown that an infrastructure to facilitate taking the necessary actions to ensure proper management of hazardous waste is required [1,2]. It is understood that proper water treatment is one that considers the processes of generation, handling, storage, transport, and target new or final treatment, all without causing negative impacts on the environment or the living things, and if possible, at a reduced cost.

## 2. NITRATE POLLUTION

Nitrogen is one of the main pollutants of groundwater. It is known that plants make only 50% of nitrogen supplied to the subscriber, this means that excess nitrogen, usually washed from the soil by water that seeps into the ground, being dragged into aquifers, rivers and reservoirs, polluting, therefore water intended for human consumption. In fact, many researches have concluded that the primary responsibility for the pollution of groundwater by nitrates factor is agriculture [2,3].

This phenomenon has been studied worldwide in the UK estimated that, with the normally recommended fertilization rates in the country, lost 50-60 kg nitrogen per hectare per year occur and, in places, quite hit 100 kg. It is also noted that in the same area, the total inflows to the aquifer nitrate, 58% comes from agricultural activities [2,4]. In Castellon, in citrus groves, it can lose up to 250 kg. Excess nitrogen fertilization results in the accumulation

of nitrates in the soil with rainfall or irrigation excess nitrates are washed into aquifers. The result is pollution of aquifers and, with them, Wells [2, 4].

In general, most of the authors seem to agree that the excess nitrogen fertilization and misapplication, are the main contributors to nitrate pollution of groundwater. Various studies carried out in UK shows that the pollution of groundwater by nitrates affecting large areas. The most contaminated areas are, in many cases, those in which intensive agriculture is practiced, with high inputs of fertilizers and irrigation [5].

### 2.1 Effects of Nitrates on Health

Above all, the problem is that nitrate can be reduced to nitrite into the human body, especially in children under three months of age and in adults with certain problems.

Nitrites produce transforming hemoglobin to methemoglobin. Hemoglobin is responsible for transporting oxygen through the blood vessels and capillaries, but the methemoglobin is unable to recruit and functionally yielding oxygen. The normal amount of methemoglobin does not exceed 2%. Between 5 and 10% manifests as the first signs of cyanosis. Between 10 and 20% a lack of muscle oxygenation is seen and above 50% can be fatal [6,7]. Once formed nitrites can react with amines, substances widely present in our body, causing nitrosamines, a class of compounds for which there is no doubt carcinogenicity. In laboratory experiments it has been found that about 75% of them can cause liver cancer and, although less frequently, also of lung, stomach, kidney, esophagus and pancreas. It has also been ascertained that there is a direct correlation between the consumption of food or water with excess nitrates and gastric cancers and between work in factories and chemical fertilizers such as cancers [4,6].

It has been found that when pregnant women ingest high amounts of nitrates mortality rises during the first days of life of the child, mainly due to malformations affecting the central nervous system, muscle or bone. They have also been described deleterious effects on hormonal glands [9].

### 2.2 Avoid Excessive Risks

Overwatering favors the leaching or washing of soil salts and therefore nitrate pollution. An adjusted dose of irrigation, only saturate the soil layer explored by the roots, avoid these losses, always taking care not to reach salinization. To do this, with the traditional irrigation systems (irrigation blanket, furrow, etc.), we must adjust the slope to the length of the boards of irrigation and water

infiltration rate or go to drip irrigation systems (exudation , micro, drip) or sprinkler irrigation. Equally important it is to achieve a high uniformity of irrigation [9].

### 3. FLUORIDE POLLUTION

Water scarcity has led to the development of large underground works for the exploitation of aquifers. Fluoride contamination in water for human consumption is an imperative global issue. The maximum fluoride concentration limit laid down by WHO is 1 ppm, but that value depends on the characteristics of each place. In the case of UK, the upper limit of fluoride in water is 0.7 ppm; when concentrations exceed this value, the user should not consume iodized-fluoridated salt [5].

Fluoride ion is a high electronegativity, abundant in the earth's crust; it is commonly associated and form fluorides in rocks. The most common mineral in Earth's crust fluoride is fluorite containing fluorite or calcium fluoride, cryolite, and apatite; usually a calcium compound, fluoride, carbonates and sulfates. It has been reported that fluorine is a highly reactive in combination with ionic or covalent component elements; it occurs mainly in alkaline igneous rocks and soils. Fluorite is the compound most widely available, which is in granite, gneiss and pegmatite. The fluoride concentration in the water of an aquifer depends on several factors, among which fluorine concentration in the ore, decomposition, dissociation, dissolution, and residence time of the chemical reaction kinetics [5,9]. Some studies indicate that the solubility of the fluoride in the water differs depending on the type of rock.

Fluoride is found mainly in drinking water, salt and bottled beverages, which are the main sources for human consumption. Moreover, it can be found in lower concentrations in many foods and products used for oral hygiene. It is noteworthy that from the eighties, the toothpastes have high concentrations of fluoride for use in children. It has been reported that more than five million people in UK are chronically exposed to high concentrations of fluoride through the water for human use and consumption. Chronic exposure to higher concentrations of fluoride in water at 1 ppm causes various diseases in the body, such as dental and skeletal fluorosis, increased susceptibility to kidney disease and cancer, as well as involvement in brain development and the reduction of IQ of school children [7].

Chronic and boundless assimilation of fluoride can advance to astringent accident to the cartilage anatomy of the individual. Early affection cover desultory affliction and bound movement in joints, headache, abdomen affliction and beef weakness may be admonishing of the problem. Another term is probably osteosclerosis and back are damaged, and the system of joints, anatomy and extensive buoy. Skeletal fluorosis is abundant added austere aftermath fluorosis and may impact the fulfillment of burning fluoride level to baptize best 4-15 ppm in the Arctic Tanzania. Abstrakcja the highest accident irregularities appear fluorotic cartilage previous capacity usually captivated by baptizing to the highest levels of fluoride. Radiological tests showed that the basic are very

dense or sclerotic and that abnormal calcification is common in the intervertebral ligaments, where tendons attach muscles to bones, and in interosseous areas, such as in the forearm. Skeletal fluorosis can cause back pain and stiffness and neurological deformities. The dental and skeletal fluorosis is irreversible and no current treatment. The only remedy is to prevent and avoid excessive intake of fluoride [4].

The latest information shows that fluorosis is endemic in at least 25 countries around the globe. The total number of people affected is not known, but a conservative estimate is several tens of millions. Some governments are not yet fully aware of the fluoride problem or convinced of its adverse impact on their populations. More efforts to support further research in this field and promote prudent government policies regarding contaminant fluoride as needed.

### 4. PREVENTION TECHNIQUES

#### 4.1.1 Non-agricultural

Based on six factors affecting the leaching of fluoride and nitrates in the backyard, seven practices can be adopted by opinion yard pass to predict the leaching of nitrogen and fluorine. According to Bashir et al. (2013), [8] one of the many important assets of a greater absolute nitrogen; "Using nitrogen sources apathy toward acquittal or active bass bite nitrogen is often added when possible." (p. 29) In addition, the administrator must be a real abacus accommodation nitrogen alert periods in which the clay is not frozen, but the grass does not grow. The administrator must maintain excessive irrigation, increasing the adequacy of fluoride and nitrate leaching and cause the extinction of plants. One have to make the total available to reduce much of the active nitrogen in many ancient and aggregates the resulting baptism rather than accept that septic tanks into the river or stream. Finally, housing administrator zeolite modified [9]. Zeolite is a "high mineral cation exchange capacity that can go to things such as potassium, calcium, phosphorus, magnesium or ammonium." Many of these measures are still very important antitoxin in the areas of albino mud. After the administrator courtyard reduce nitrate leaching and groundwater fluoride suspended. If applicable, golf courses and sports fields have not any effect on nitrogen fertilizers and abuse of groundwater fluoride [9].

#### 4.1.2 Manure Storage Sites

Another method of preventive support agriculture manure lagoon. It is easy to break, because the problem is not the solutions that are greater for farmers aswell a new doping appeal sprawdzonej. Akumulatory seat is greater than the mentioned aloft is to abundance admixture in accurate manhole. Another accessible band-aid is to install a accumulator ability termed a Slurrystore. These accessories are accurate to abundance aperture admixture and are in fact added acceptable for the farmer, back they are installed.

#### 4.1.3 Flood Plain Management

One adjustment to anticipate nitrate and fluoride contagion of groundwater in a way accompanying to agronomics is in fact a adjustment of new technology, but not a acknowledgment to the old ideas. "Plains

Traditionally in the UK were not assiduously farmed, but now the arising allows these areas to be bashed or administer added assiduously with the grass." They point out that this activity leads to accelerated advice attenuated groundwater with nitrates and fluoride floodplain all this time to boring cesspool baptize boring through the floodplain. After working in the upper reaches of the Thames, England, Haycock and Burt they discovered a flooding river of grass just could significantly reduce the concentration of nitrates in groundwater in the winter [8]. Use an example to prove this point is that as a aftereffect of a austere blow in 1990 flow, nitrate and fluoride concentrations in groundwater has added by about 400%, admitting the nitrate flood apparent grass awning keeps the buffering accommodation abutting to its boilerplate level. Hua, Yeng and Deng (2012) concluded that "floodplain should be stored in (or return to) his condition has drained these areas have the potential to reduce nitrate concentrations in ground water throughout the year."(p. 1625) [8].

#### 5. ADVANCES IN WATER TREATMENT

The importance of water for humans is known to all, their uses are of all kinds: domestic, agricultural, industrial, entertainment, among others. Industry in particular requires for most of their high amounts of water processes with the aggravating circumstance that after being used in such processes have many, without making any decontamination treatment, creating a serious environmental problem that leads to the onset of disease, odor production, unwillingness of highly toxic and carcinogenic chemical contaminants such as aromatic compounds, heavy metals, dyes, heavy compounds of the petrochemical industry, etc. [10].

Conventional technologies for decontamination of most used industrial water include chemical, physical and biological treatments. Many of these treatments are effective depending on the type of contaminant to be treated. However, some disadvantages become apparent when it comes to implementing these treatments, some of them are very expensive, and others require high response times for optimum pollutant reduction, some like the case of the adsorbents retain contaminants but then they should be carried as landfill sites and all they do is transfer the pollution from one phase to another [12]. Because of these disadvantages of conventional technologies they have intensified research in the development of new technologies for treating industrial wastewater that are simple, economical and completely degrade the contaminant molecules.

These technologies include advanced oxidation processes (AOP's - for its acronym in English), which are characterized by profound changes in the chemical structure of pollutants, generating products with a polluting effect much smaller, means for generating transient species which have highly effective to oxidize organic matter. These transients, such as the hydroxyl radical HO, species are generated not by photochemical or photochemical means. The AOP's present very attractive advantages, such as complete mineralization of the contaminant to be treated (conversion of the contaminant in

CO<sub>2</sub> and H<sub>2</sub>O), oxidation of contaminants at very low concentrations, generating more friendly products with the environment, improved remarkable in the organoleptic properties of treated water and low power consumption compared to other methods [13].

In particular, some recent researchers have concentrated on the development of catalysts and photo-catalyst capable of degrading in an efficient manner, different pollutants found in industrial wastewater. Focusing on the use of wild-type catalysts as natural minerals or the use of waste materials of different industries such as coal, cement, power generation industries, among others. Giving solution to problems such as lower production costs of catalysts, re-use waste that can pollute and use these for the treatment of wastewater [10].

#### 6. CONCLUSION

In conclusion, nitrate and fluorides have great threat for human health and the environment, as well. Numerous types of technologies has taken a significant turn to treat water and waste water which has been achieved for treating water that previously could not, as the wastewater from the pharmaceutical industry that has known contaminants recalcitrant (difficult to degrade) and is known to have harmful effects on human health.

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