POLLUTED WATER IMPACT ON ENVIRONMENT AND HEALTHCARE IN ROMANIA

A. E. GHIMAN[1], Laura ȘMULEAC[2], Alina LAȚO
[1] Banat University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" from Timișoara
Corresponding author: laurasmuleac@usab-tm.ro

Abstract. *Reduced water quantity, represents a danger for existence of live cells, organisms and flora and fauna in general. Water has an essential importance, representing the structural and functional base for the living beings. In addition, water, is also an essential constituent of living matter, having a special role in vital processes development. Given the fact that 2/3 of global surface is covered with water, it is estimated that the planet Earth has 1,4 km3 of water. As a result of water use by consumers, it changes its composition, suffering natural quality changes, so it cannot be used for the same purposes as previous to the pollution. Substances and agents that cause the change of the initial composition of the natural waters are called pollutants. Considering U.N.O. definition of water pollution means a direct or indirect modification of water normal composition, in a measure that hardens upon all uses to which it may serve in its natural state. Pollution may be the consequence of some natural phenomena, but most frequently is strongly related to human activities. This article presents a synthesis of some analyzed water parameters in total of 1,683,561 determined in 2019 (this number is composed of analyzes performed in the way of audit monitoring as well as control monitoring for the quality parameters of potable water included in Annex no. 1 of Law nr. 458/2002 regarding water quality for human consumption, republish with subsequent amendments and completions) and also how polluted water influences the environment and human health.*

.

Keywords*: water, pollution, pollutant, purification, causes of pollution*

INTRODUCTION

Nowadays, we, as human kinds, are experiencing vast challenges: from economic crisis, health crisis, all the way to water and food crisis. We are struggling in our goal of maintaining a healthy and beautiful planet, but in the middle of all this fuss, we all have the same desire to live a peaceful, healthy and beautiful life. It is our God given right to desire so. In the last decade, many researches show the acute need of efficient natural resources gestion as well as methods and treatments for already polluted areas (soil, crops, ecosystem) including clean water crisis.

The purpose of this article is not meant to be unmerciful with those who are mistaking and failing to protect the environment but it does have the purpose to awaken our sleeping conscience and unite us for a noble cause.

Today, one of the biggest problems worldwide is water (clean water). Although two thirds of the planet is covered with water (70%), only 0.007% of planet's water is available to fuel and feed the entire human kind. (Freshwater Crisis, National Geographic Article, 26.01.2010). Now, before entering in this topic I just want to add one more important idea related to this matter: specific education for environment protection. There can be implemented various programs and workshops with the same central goal of environment protection, as well as wise consumption of worldwide resources, minimizing waste and increasing circular economy. Those kind of programs should be a great opportunity to build a strong bond between responsible actions of humans and the surrounding nature. (BACALU-RUS et all. 2021, PAȘCALĂU et all., 2021, ȘMULEAC et all. 2017, 2020, LAȚO et all., 2020).

In the following, the focus will be on water and its influence over healthcare as well as environment.

MATERIAL AND METHODS

Assessing the degree of water pollution, is made through some bacteriological, biological, chemical and physical indicators, none of which can characterize pollution itself, at most one aspect of pollution.

Physical indicators are considered:

The content of solid and undissolved substances, named MTS (total matters in suspension) including organic matters or minerals of the following dimensions:

- o >0,1 mm (course)
- o 0,1 mm – 0,1um (fine)
- o < 0,1 um (colloidal)
- Temperature (influencing physical, chemical and biological processes that takes place in water);
- Taste and smell (importance for potable water supply);
- Electric conductivity (indicator for dissolved substances in water);
- Radioactivity (considering the nature of corpuscular radiations such as alpha, beta, gamma);

Chemical indicators

This category is represented by:

- o Dissolved oxygen (O2);
- o Oxygen deficiency (O2);
- o Biochemical demand of oxygen (CBO5);
- o Chemical oxygen consumption (CCO);
- o Various forms of nitrogen (organic N, total N, ammoniac, nitrates and nitrites;
- o Phosphate;
- o And sulphurate hydrogen (H2S);

Total numbers of analyzes for monitored parameters in 2019 were 1.683.561 (this number is composed of analyzes performed in the way of audit monitoring as well as control monitoring for the quality parameters of potable water included in Annex no. 1 of Law nr. 458/2002 regarding water quality for human consumption, republish with subsequent amendments and completions).

RESULTS AND DISCUSSIONS

1. Water in nature and its importance

To define what water means, it requires the knowledge of its complexity in its forming elements which lead to what we call natural water, having the chemical formula H2O. In its natural background, water is never entirely pure because there is always a certain amount of dissolved substances. Water natural composition, considering the content and diversity of those substances, highlights the presence of the following component element groups:

- dissolved gases (O2, CO2, H2S);
- dissolved both organics and mineral substances;
- saprophytic flora;

Furthermore, water has an essential importance, representing the structural and functional base for the living beings. In addition, water, is also an essential constituent of living matter, having a special role in vital processes development. Given the fact that 2/3 of global surface is covered with water, it is estimated that the planet Earth has 1,4 km3 of water. More precisely, water reserve of this planet, under its all forms, gathers a total of 1,38 billions km3 (97,2% sea water and 2,15% ice).

Thus, however, the water from rivers, lakes, seas and oceans evaporates, passing into the atmosphere in the form of vapors, forming the atmospheric water. This kind of water, however, is carried out by air currents to colder areas, where it condenses and falls on the ground forming the meteoric water. Annually, 430.000 km3 of water evaporates, out of which 40.000 km3 falls back onto continents in the form of precipitations. Once arrived on the ground, water may face a permeable layer, which passes through, forming groundwater. Groundwaters totals 8.200.000 km3. Considering the other case, where the water remains on the surface of the ground, due to a waterproof layer, this kind of water along with groundwaters (underground waters) that reached again the surface and the meteoric waters already fallen, forms surface water. Al those four forms of water may be used by humans to satisfy their needs. (RADULESCU, 2018)

2. Demands and water consumptions

Because of its properties, water represents the ideal environment for developing various physiological processes. This affirmation is sustained by the fact that human body has 60% of its total mass, water. The younger the body, the higher quantity of water contained in the body. Water repartition in human body is very different, internal organs and tissues contain variable quantities of water (20 – 90%). In live cells activity, responsible for existence and functionality of the organs, water participates in three forms:

- intracellular water (50%);
- interstitial water (15%);
- circulant water (5%);

Reduced water quantity, represents a danger for existence of live cells, organisms and flora and fauna in general. (ROBESCU, 1988)

Every day water need of a human is on average 2,5 L, out of which 1,5 L is represented by the water form drinks, the rest of it is covered by the water contained in the solid food, being variable depending on the food and also the water that comes as a result of metabolic processes in the body. Water is used by human body not only for pure physiological needs, but also in multiple purposes and it is in a stable balance, losses and intakes being equivalent. Water loss of 0,5 – 1% out of human body total mass, leads to sensation of thirst. (MANESCU et. al. 1996).

3. Water pollution

As a result of water use by consumers, it changes its composition, suffering natural quality changes, so it cannot be used for the same purposes as previous to the pollution. Substances and agents that cause the change of the initial composition of the natural waters are called pollutants. Considering U.N.O. definition of water pollution means a direct or indirect modification of water normal composition, in a measure that hardens upon all uses to which it may serve in its natural state. Pollution may be the consequence of some natural phenomena, but most frequently is strongly related to human activities. Although pollution takes place as a result of anthropic activities, it is not to forget the auto pollution phenomena. (MANESCU et. al. 1978). Auto pollution is a natural phenomena and it is represented by massive destruction of flora and fauna, more likely after intense multiplying periods, known as water blooming.

Lately, another critical aspect is related to the presence and persistence of heavy metals in some waters close to urban development and mostly in the (heavily) industrialized areas. Here we can refere to Pb, Cd, or Zn, heavy metals that are frequently detected in wastewaters, as well as sewage contamination. This study was conducted by Nechita Adrian OROS, Lucian R. FÂRCAL, Anca CHEREJI in the article Pollution of soil and water with lead, zinc and cadmium in Copsa Mică area.

3.1. Pollutant factors

Leading factors for water pollution (various and many) may be as follows:

- demographic factors, depending on the number of people in a certain area, pollution being proportional with population density;
- urbanistic factors, appropriate for development of human settlements, which use high quantity of water removed from the local hydrological circuit or returned to nature in the form of waste water intensely impurified;
- industrial or economic factors, represented by the level of economic development and mostly industrial development of a certain area, with the reason of increasing pollution along with industrial development;

3.2. Pollution sources

Depending on the origin respectively pollution source, waste waters/used waters may be grouped as follows:

- domestic wastewaters: pollutants being represented by food scraps, manure, soap, detergents, microorganisms, eggs and parasites originate in general from the population, from the household activity.
- Livestock wastewaters in which pollutants are represented by remnants of feed, bedding, manure, substances used in washing and disinfection, micro-organisms, parasite eggs, antibiotics, biostimulators and results from the intensive, industrial growth activity of animals.
- Industrial wastewaters having a major pollutant effect and are represented by:
  - o Cooling waters, pollutant being represented by heat (caloric energy);
  - o Wastewaters from washing and transport, resulting from conditioning of raw materials;
  - o Water from production sites, used directly in the manufacturing process as environment for dissolving or reaction, pollutants being substances from raw materials;

3.3 Types of pollution

Pollutants from waters may be found as dissolved substances, in a colloidal dispersion state or various suspensions. Depending on the nature of existing pollutants agents in wastewaters, pollution as a general phenomena may be differentiated on three main pollution types:

- Physical pollution;
- Chemical pollution;
- Biological pollution;

Physical pollution (with radioactive substances, thermal pollution or determined by floating or sedimentable insoluble elements) is the most recent type of pollution related to advanced areas or intensely developed.

Bacteriological pollution (biological) , strongly related to viruses and parasites, it is directly dependent on human presence. It may result from human agglomerations, zootechnical (slaughterhouse) and is characterized by the presence of pathogen microorganisms that find favorable conditions for developing in standing warm and dirty waters. It is the most ancient type of water pollution, known as being characteristic to underdeveloped or developing areas.

Disease carried out through water may be represented by bacterial diseases (typhoid fever, cholera), parasitological diseases (ambiase, giardiasis, trichomoniasis) or other kinds of infectious diseases.

Chemical pollution is represented by the penetration into the water of some chemical substances of an organic and/or inorganic nature (of a kind easily degradable organics to toxic ones with long persistence and remanence)

Chemical organic pollution is generated by the presence of organic substances, carbohydrates protein or lipid type in waters. It is specific to wastewater resulted from paper and cellulose factories, slaughterhouses, petrochemical industry and organic synthesis. As decomposition products of organic substance it results phenols, amines, urea, ammonia, sulphurate hydrogen (H2S), nitrates and nitrites.

Chemical inorganic pollution is generated by inorganic salt components. It is characterised by oil extraction industry, petrochemical industry and inorganic chemical industry (chlorosodium industry).

In percentage mode, water sources are distributed as follows (figure 1):

- Profundity: 36.55%
- Surface: 61%
- Filtered water through bench: 2.43%
- Other sources: 0.01%.

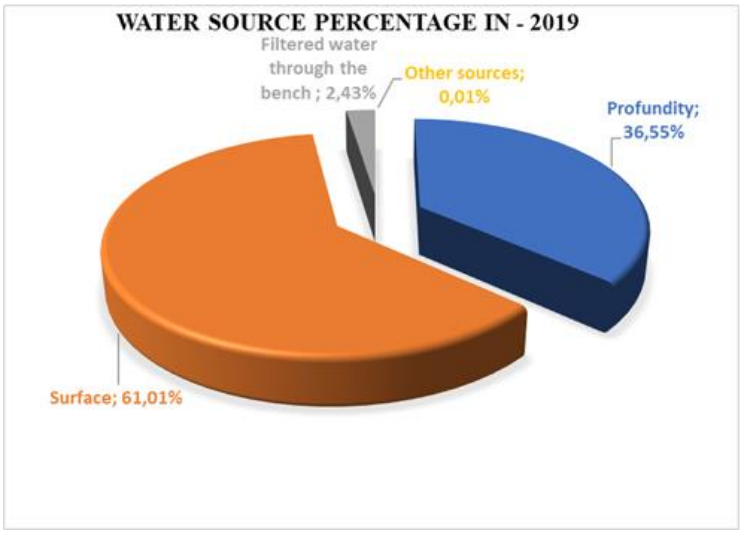

Fig. 1. Water source percentage regarding water supplied areas in Romania, 2019

Compliance degree of quality parameters regarding potable water at the values established in Law no. 458/2002 regarding quality of potable water republished, with changes and subsequent additions for 2019 (figure 2,3).

Counties that are not mentioned in the Figures 4-9, did not registered any nonconformites for displayed parameters.

Fig. 2. Representative chart regarding the pollutant substances allowance

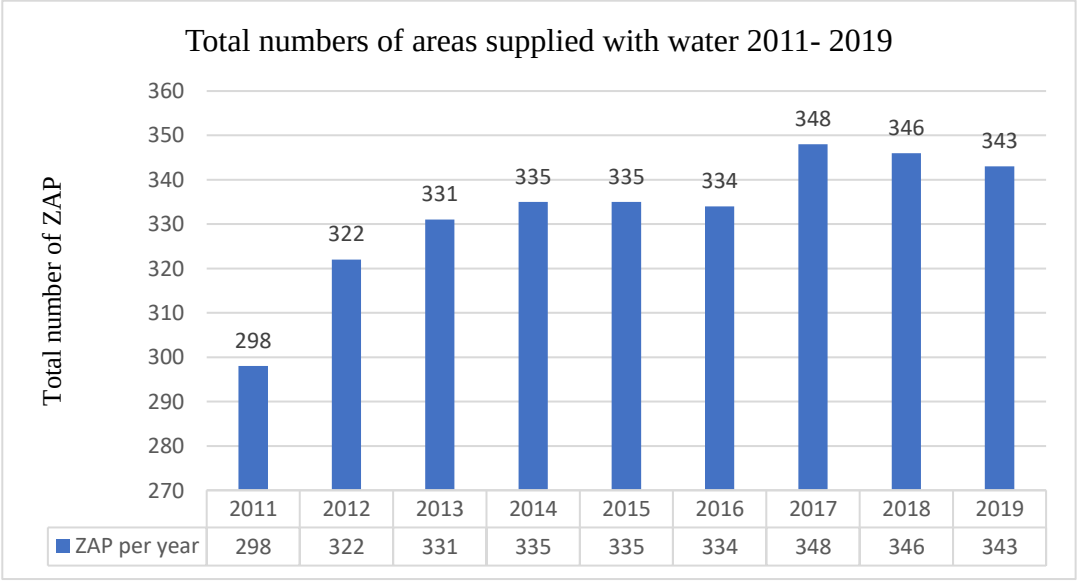

Fig. 3. Total numbers of areas supplied with water 2011- 2019

Total number of monitored parameters per county in 2019 were as follows in table 1.

Table 1

Monitored parameters in all counties of Romania

County	Monitored parameters	County	Monitored parameters
Alba	37	Harghita	26
Arad	50	Hunedoara	50
Arges	45	Ialomita	53
Bacau	34	Iasi	57
Bihor	38	Ilfov	27
Bistrita-Nasaud	48	Maramures	43
Botosani	37	Mehedinti	54
Braila	39	Mures	29
Brasov	35	Neamt	30
Bucuresti	57	Olt	27
Buzau	31	Prahova	46
Calarasi	44	Salaj	40
Caras-severin	30	Satu mare	30
Cluj	51	Sibiu	52
Constanta	30	Suceava	33
Covasna	26	Teleorman	20
Dambovita	42	Timis	26
Dolj	28	Tulcea	39
Galati	41	Valcea	30
Giurgiu	17	Vaslui	37
Gorj	21	Vrancea	39

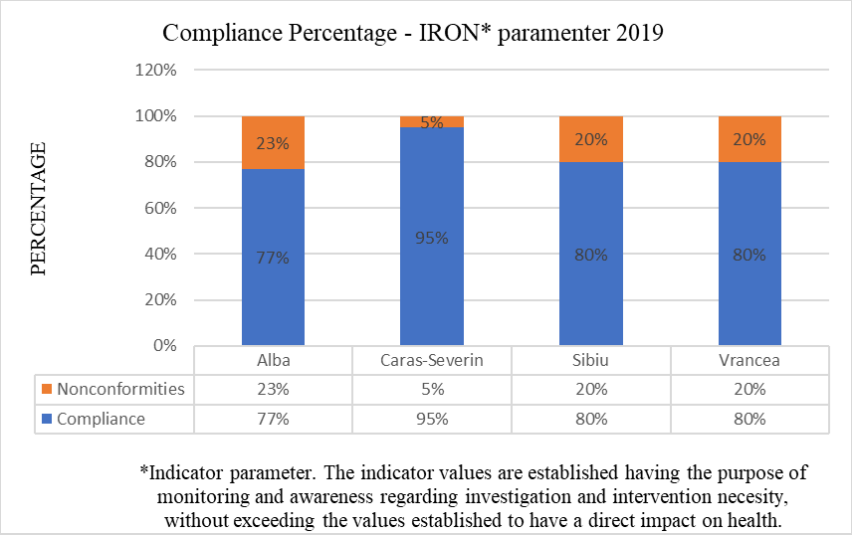

Fig. 4. Representative chart for compliance percentage for iron in 2019

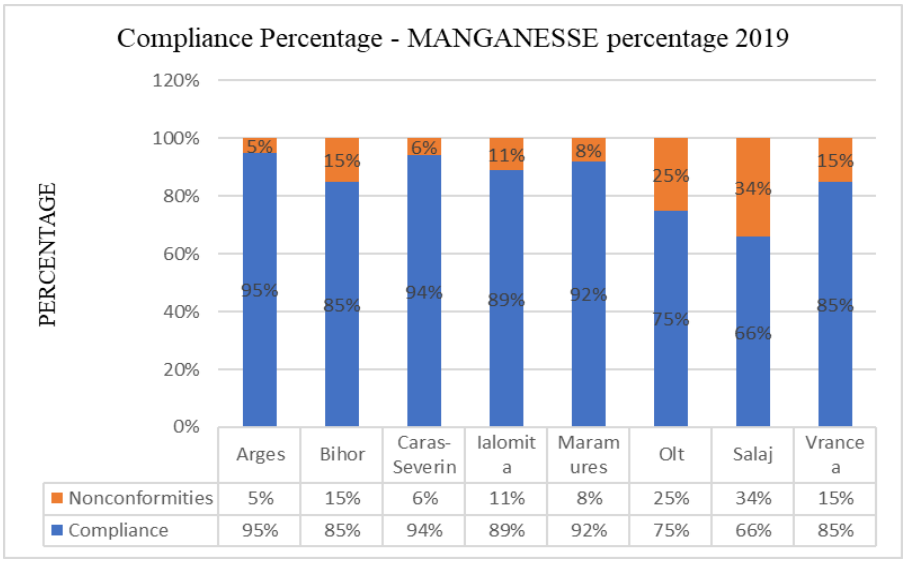

Fig. 5. Representative chart regarding compliance percentage for manganesse in 2019

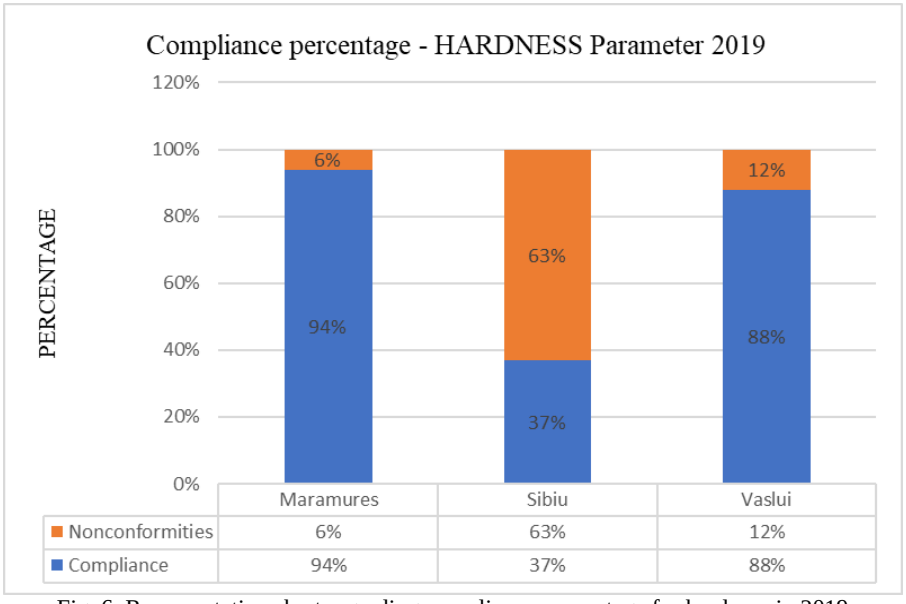

Fig. 6. Representative chart regarding compliance percentage for hardness in 2019

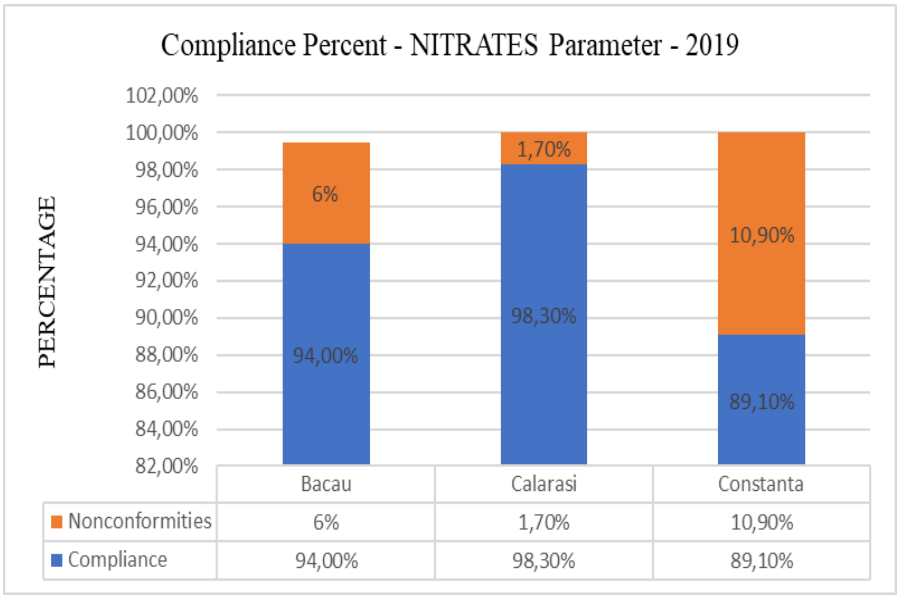

Fig. 7. Representative chart regarding compliance percentage for nitrates in 2019

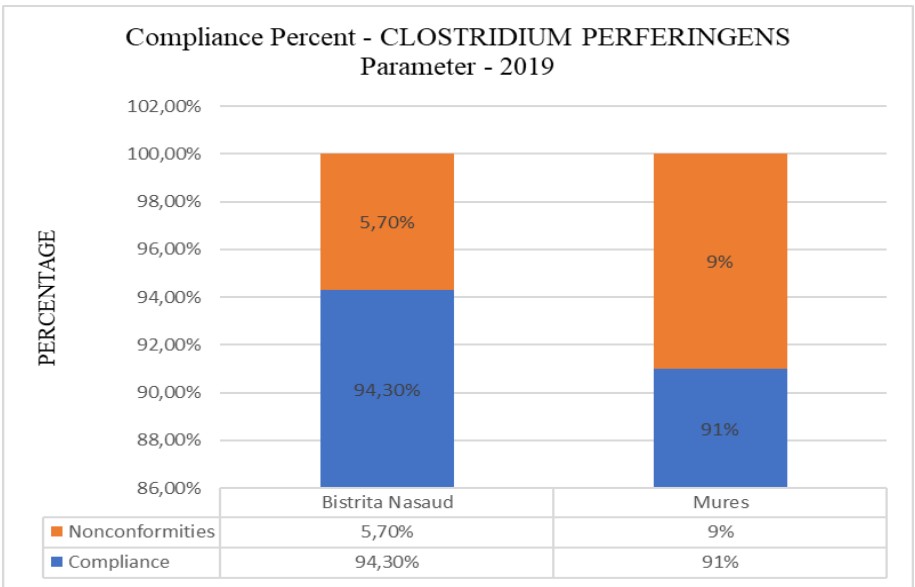

Fig. 8. Representative chart regarding compliance percentage for *clostridium perferingens* in 2019

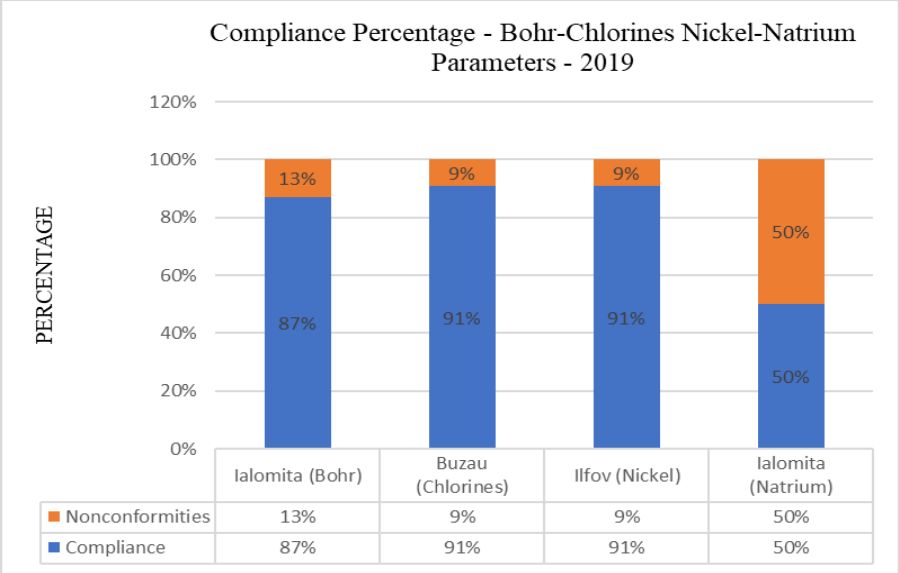

Fig. 9. Representative chart regarding compliance percentage for Bohr-Chlorines-Nickel-Natrium in 2019

5. The impact of polluted waters over environment and healthcare

It is a strong bond between pollution and healthcare and this raises a big problem around the globe. Various diseases are caused by microorganisms, identified as pathogens (microorganisms that can cause harmful effects) that can spread a certain disease according to the type of the microorganism and its origins directly to humans. Many of those diseases can be spread through water from man to man. In developed and developing countries, heavy rainfall, as well as flood, lead to creation of new disease due to extreme weather conditions.

Health risk associated with polluted water includes negative effects regarding human healthcare. These negative consequences may be expressed by cardiovascular disfunction, neurological disorders, various types of cancer and also respiratory diseases. respiratory diseases. A particular responsible chemical for cancer as well as blue baby syndrome are nitrogenous chemicals. First in row to be contaminated with those types of diseases are poor people (and/or people from underdeveloped countries) due to the lack of sanitation, clean water supply and, never the last, hygiene. Water being contaminated, represents a danger mostly for women exposed to such chemicals during their pregnancy. This may lead to low weight of new born babies as a result of their health issues. (The Effect of Polluted Water on Human Health (efficacyconstruction.com).

CONCLUSIONS

Water pollution is considered a worldwide issue, and along with it, human kind is facing negative effects of polluted water. Water pollution may have various sources, such as wastes from agriculture inefficient gestion of domestic wastes, demographic impact, pesticides and fertilizations and, above all, the effect of urbanization.

This is a warning for the actual governments to pay a great attention on public health, as well as environment protection. This can only be achieved by implementing treatments for wastewaters before entering into rivers. In this direction, there can be organized educational and awareness programs, in order to control the pollution.

One main explenation for all this actual clean water crisis, is the lack of efficient measures that can reduce the negative impact on water, measures that should be applied in all industrial areas as a mandatory procedure.

5.1. Effects of polluted waters over environment

Plants and animals cannot live without water. Therefore it is time to open our eyes and start gestion the waste we produce and conserve and protect our fresh water sources. If we do continue to contaminate the only fresh water sources we have, which is about less than 3% of global water, we risk to cause irreversible damages to both the ecosystem and ourselves as well.

5.1.1. Causes of pollution

Accumulation of wastes coming from household areas may cause a serios water pollution. As a negative example, we can consider the plastic objects (such as cans, plastic bottles, etc.) floating on the surface of water, and furthermore leading to the formation of "rubbish islands". Another dangerous area is represented by sewage leaks. Those are very dangerous due to the toxic elements and microorganisms (such as viruses or bacteria). Apart of the fact that this type of pollution makes contaminated water totally undrinkable, it also has a negative effect on soils and crops. And, in addition to this matter, regarding the heavy metals, there is an interesting phenomenon taking place in the superficial layers of soil (5-15 cm) characterized by a strong bond between the organic matter in the soil and the heavy metal, meanwhile in the lower layers of the soil the concentration decreases. (MĂNESCU S., et al., 1982).

Regarding this area, we can consider the sewage plants, having their main purpose to prevent water pollution as well as to recycle it.

Industrial tipping represents another major problem leading to water pollution, having truly devastating consequences. Even though this action carries heavy penalties with it, the truth regarding this matter is that it has been a problem since the Industrial Revolution and unfortunately, it still continues today.

Oil industry has a very negative effect over waters especially when it comes to transporting the oil resources via ocean because of oil leak or worse, accidents that releases big quantity of oil into the ocean. (How Does Water Pollution Affect The Environment (onehowto.com))

5.1.2. Consequences

The first consequence of water pollution of rivers, lake and sea side is the introduction of toxic elements into the food chain. We, as human beings, ingest a large quantity of fish and other food resources from seas and oceans. Therefore, we are exposed to the risk of ingesting heavy metals and other harmful elements in our body, due to contaminated fish.

6. Concrete actions to stop water pollution

Wastewaters generated by various branches of economy, are evacuated in the sewerage network or in natural receptors. Generally, small flows are evacuated in the city sewerage network, while in the case of big flows of wastewaters, generated by the industrial branch, the frequent solution is the evacuation of those flows in the closest receptors. This solution will be applied only when wastewaters does not degrade the quality of natural receptors.

The water purification process assembles two groups of successive operations, retention and neutralization of harmful substances followed by processing of substances resulting from the first operation, called sludge. As products of purification process, results purified water and sludge (mud). Purified water is released into emissaries (rivers) or it can be used in agriculture, through fertigation.

6.1. Mechanical purification

It is based on physical processes of suspension matters separation. Construction and installations used for mechanical purification allow the retention of course (gross) matter, floating through grates and sieves, decantation of suspensions by gravitational sedimentation processes with aid of decanters and desanders, separation of fats and oils as well as uniformity of the flows and of the quality of the subjected water treatment.

6.2. Chemical purification

It requires the use of chemical and physico-chemical processes to retain and neutralize the pollutants. This kind of purification can be applied in fine and colloidal matter separation through by prior coagulation with the help of chemical reagents, as well as the elimination of some dissolved pollutants.

6.3. Advanced purification

It is usually used in continuation of the first two stages of purification and it has a standard of water treatment (purification). Related to this treatment are the following processes: absorption, neutralization, flotation, extraction, distillation, freezing, foaming, ionic exchange, chemical oxidation, disinfection.

BIBLIOGRAPHY

BERBECEA ADINA, RADULOV ISIDORA, NIȚA L, VOGYVOLGYI C, LAȚO ALINA, ŐKROS A, CRISTA F, LAȚO KI, 2014, The Quality Of Maros River Water In Romania Hungary Cross Border Area. Research Journal of Agricultural Science . 2014, Vol. 46 Issue 2, p3-13. 11p.

BACALU-RUS SNEJANA, LAURA ȘMULEAC, A GHIMAN, CRISTINA TULBURE, 2021, Modern strategies for teaching environmental protection in High Schools, Research Journal of Agricultural Science, Vol 53 (2) Timișoara

LATO A, I RADULOV, A BERBECEA, A NEACSU, I LATO, F CRISTA, L SMULEAC, M CORCHES, 2020, Green Vegetables As Potential Source Of Nitrates And Nitrites For The Human Organisms, Journal Of Environmental Protection And Ecology, Vol. 21 (5)

MĂLĂESCU NICOLETA, ȘMULEAC LAURA, LAȚO ALINA, PAȘCALĂU RAUL, ȚIMBOTA OVIDIU, 2019, Study On The Groundwater Quality In Maru Commune, Caraş Severin County, Research Journal of Agricultural Science, Volumul 51, Numărul 2

MĂNESCU S., H. DUMITRESCU, Z. BĂRDUŃĂ, M.L. DIACONESCU (1982), Chimia sanitară a mediului; Editura medicală – Bucureşti

OROS NECHITA ADRIAN, LUCIAN R. FÂRCAL, ANCA CHEREJI, 2009, Pollution of soil and water with lead, zinc and cadmium in Copsa Mică Area, Bulletin UASVM Cluj Napoca, Cluj Napoca

PAȘCALĂU R, S STANCIU, LAURA ȘMULEAC, A ȘMULEAC, C SĂLĂȘAN, ALINA-ANDREEA URLICĂ, M BAKLI, 2021, Teaching Climate Change In Class, A Must And A Challenge, Research Journal of Agricultural Science, Vol 53 (2) Timișoara

RADULESCU H. 2018, Prevenirea și controlul integrat al poluării, Timișoara;

RADULOV ISIDORA, LATO ALINA, BERBECEA ADINA, LATO IAROSLAV, CRISTA FLORIN, 2016, Nitrate Pollution Of Water In Romania Serbia Cross – Border Area As A Consequece Of Agricultural Practices, International Multidisciplinary Scientific GeoConference : SGEM; Sofia, Vol. 3, (2016).

RANCU ANDREEA, LAURA ȘMULEAC, R PAȘCALĂU, 2020, Antropic impact on water quality in the lower Mures Basin, Research Journal of Agricultural Science, Vol 52 (3) Timisoara

ROBESCU D., STAMATOIU D., 1988, Bătălia pentru apa vie, Editura Ceres, București

ȘMULEAC LAURA, FLORIN IMBREA, IOANA CORODAN, ANIȘOARA IENCIU, ADRIAN ȘMULEAC, DAN MANEA, 2017, The influence of anthropic activity on Somes River water quality, AgroLife Scientific Journal, Vol 6, No 2

ŞMULEAC LAURA, SILVICA ONCIA, ANIŞOARA IENCIU, R BERTICI, A ŞMULEAC, V MIHĂIESC, 2014, Influence of anthropic activities on ground water in Boldur, Timis County, Romania, Research Journal of Agricultural Science Vol 46(2), Timisoara

***WWW.ONEHOWTO.COM HOW DOES WATER POLLUTION AFFECT THE ENVIRONMENT;

***WWW.EFFICACYCONSTRUCTION.COM THE EFFECT OF POLLUTED WATER ON HUMAN HEALTH;

***WWW.NATIONALGEOGRAPHIC.COM FRESH WATER CRISIS, 2010;

***RAPORT SĂNĂTATE ȘI MEDIU, CNMRC, 2019;.