

## Open Schools Journal for Open Science

Vol 3, No 3 (2020)



### Water Purity

*C. Bousiou, S. Mitropoulos, C. Moschovitis, P. Argyri*

doi: [10.12681/osj.23364](https://doi.org/10.12681/osj.23364)

Copyright © 2020, C. Bousiou, S. Mitropoulos, C. Moschobitis, P. Argyri



This work is licensed under a [Creative Commons Attribution-NonCommercial-ShareAlike 4.0](https://creativecommons.org/licenses/by-nc-sa/4.0/).

### To cite this article:

Bousiou, C., Mitropoulos, S., Moschovitis, C., & Argyri, P. (2020). Water Purity. *Open Schools Journal for Open Science*, 3(3). <https://doi.org/10.12681/osj.23364>

# Water Purity

C. Bousiou<sup>1</sup>, S. Mitropoulos<sup>1</sup>, C. Moschovitis<sup>1</sup>, P. Argyri<sup>2</sup>

<sup>1</sup> 11<sup>th</sup> grade, Evangeliki Model High School of Smyrna, Athens, Greece

<sup>2</sup> Mathematician, Evangeliki Model High School of Smyrna, Athens, Greece

## Abstract

The subject of this paper is the purity of water, the problems facing the whole planet in terms of it, solutions for them, as well as a little research conducted by us on our peers. Based on the theoretical framework of the work, we wanted to prove to the readers: a) The problem of water pollution has now taken on enormous proportions, and is no longer just a threat to countries far from Greece, b) there are ways to ensure drinking water for ourselves and for entire communities. Regarding the exploratory part of our work, the study involved 20 junior high school and high school students, who answered a questionnaire that examined issues such as the domestic use of water for each, their behavior towards water, etc. Then, the results were recorded and presented by means of in graphs.

## Key-words

Water purity, drinking water, seawater, health, biological treatment, pollution



## Part A

Drinking water is one of the most important goods for humankind. It is not only a necessary element of survival, but also a factor that has a significant impact on health. In many developing countries, poor water quality is the cause of epidemics and deaths. In 2010, the UN General Assembly explicitly recognized the human right to water and sanitation. According to this right, everyone is entitled to adequate, continuous, safe, acceptable, natural and accessible water for personal and home use [1]. In developed countries, where these problems have disappeared due to industries and agricultural pollution, they reduce the quality of natural water. This results in consumer health problems. These problems are the subject of intense research. The result of this effort is to produce standards that, when applied, ensure water quality. The problem of degraded water quality is a concern in many areas of the country. Recently, chemical cocktails have been detected in the groundwater of the Artaki-Psachon plain, while the problem with hexavalent chromium in Boeotia or heavy metals in Arcadia is known. Water is not always clean. In our glasses, substances that determine its hardness, show pollution, cause irritation, deterioration or damage to the body, and some of them prove to be carcinogenic. In fact, most are always present in natural waters and their risk is determined by high concentrations. As thousands of Greeks today live in fear, the "water dictionary" from the National School of Public Health can be an ideal first-hand guide to water quality and the dangers we face [2].

At the same time, an even bigger problem is marine pollution. Sea pollution is a global problem that is affected by local and chronic actions. From the very beginning of its existence, mankind has used the marine systems to maintain and develop its societies. Commercial and tourist routes were opened, peoples and cultures came into contact and trading, food and raw materials were extracted from these vast systems, maritime warfare was and will continue to be, dumping of all kinds of waste, facilities and resorts but. The uses of the systems in most cases were unreasonable and based on the assumption that such immense systems could not be easily affected while even in such a case the restoration would be quick and easy and above all by nature. Although this could make sense for substances that enter the marine environment and can be readily degraded without affecting organisms, the rapid development of technology and the use and synthesis of more and more substances have provided the seas with huge quantities of non- or difficult-to-degrade chemicals that are transported through the food chain from organism to organism and from generation to generation. The sea is an important source of protein for both its organisms and those living in the terrestrial environment.

So, its pollution affects all the organisms and ecosystems on earth and as such has a global dimension. But unlike the pollution of the land that could potentially be taken by the governments of the states facing the problem, the situation at sea is much more difficult or not at all because of its vast extent but also because it does not belong to most of it. It is in no state. Thus, while activities from all continents burden the marine environment, no state is formally responsible for remedying the problems. Actions are mainly taken in coastal areas, where the largest fishing activity is found. It is estimated that 90% of world fish production takes place in coastal areas with the remaining 10% coming from the oceans, which are also described as biological desert. More specifically, according to UNICEF (3):

In 2017, 5.3 billion people safely used potable water management services - that is, they used improved on-site water sources, available when needed and without contamination. The remaining 2.2 billion people without secure service management in 2017 included:



- 1.4 billion people with basic services, meaning an improved source of water on a 30-minute round trip
- 206 million people with limited services or an improved water source requiring more than 30 minutes to collect water
- 435 million people get water from unprotected wells and springs
- 144 million people collect raw surface water from lakes, lakes, rivers and streams
- In 2017, 71% of the world's population (5.3 billion people) used a safe drinking water management service - that is, one located on site, available when needed and free from contamination
- 90% of the world's population (6.8 billion people) used at least one basic service. A basic service is an improved source of drinking water on a 30-minute round trip to collect water
- 785 million people do not yet have a basic drinking water service, including 144 million people dependent on surface water
- Worldwide, at least 2 billion people use a source of fecally contaminated drinking water
- Contaminated water can transmit diseases, such as diarrhea, cholera, dysentery, typhoid and polio. Contaminated drinking water is estimated to cause 485,000 diarrhea deaths each year
- By 2025, half of the world's population will live in areas of high pressure
- In the least developed countries, 22% of healthcare facilities do not have a water service, 21% do not have sanitation and 22% do not have waste management services. Geographical, socio-cultural and economic disparities persist not only between rural and urban areas, but also in cities where people living in low-income, informal or illegal settlements usually have less access to improved sources of drinking water than other residents.

## Water and health

Contaminated water and poor sanitation are associated with the transmission of diseases such as cholera, diarrhea, dysentery, hepatitis A, typhoid and polio. Absence, inadequacy or inadequate management of water and sanitation services exposes people to risks that can be prevented. This is especially true in health care facilities where both patients and staff are at increased risk of infection and illness when health, hygiene and hygiene services are lacking. Globally, 15% of patients develop infection while in hospital, with the proportion being much higher in low-income countries. Inadequate management of municipal, industrial and agricultural waste means that the drinking water of hundreds of millions of people is dangerously contaminated or chemically contaminated.



About 829,000 people are estimated to die of diarrhea each year as a result of unsafe drinking water, sanitation and hand hygiene. However, diarrhea can be largely avoided and the deaths of 297,000 children under the age of 5 could be avoided each year if these risk factors are addressed. Where water is not readily available, people may decide that hand washing is not a priority, thereby increasing the chance of diarrhea and other diseases.

Diarrhea is the most well-known disease associated with contaminated food and water, but there are other risks. In 2017, over 220 million people needed preventive treatment for schistosomiasis - an acute and chronic illness caused by parasitic worms that have shrunk due to exposure to contaminated water.

In many parts of the world, living or reared insects carry and transmit diseases such as dengue fever. Some of these insects, known as carriers, are bred in clean, non-dirty waters, and domestic drinking water containers can serve as breeding grounds. The simple operation of covering water storage tanks can reduce the reproduction of the carriers and can also reduce the contamination of water feces at the household level.

## Economic and social impact

When water comes from improved and more accessible sources, people spend less time and effort on their natural collection, which means they can be productive in other ways. This can also lead to greater personal safety by reducing the need for long or dangerous routes to collect water. Better water sources also entail lower health costs, as people are less likely to get sick and suffer medical costs and are better

off staying productive. With children particularly at risk from water-related illnesses, access to improved water sources can lead to better health and therefore better school attendance, with positive long-term consequences for their lives.

## Challenges

Climate change, rising water scarcity, population growth, demographic change and urbanization are already challenging for water systems. By 2025, half of the world's population will live in areas of high pressure. Wastewater reuse, water, nutrient or energy recovery becomes an important strategy. More and more countries are using sewage for irrigation - in developing countries this represents 7% of irrigated land. Although this practice, if inappropriate, poses health risks, safe wastewater management can bring multiple benefits, including increased food production.

Options for water sources used for drinking water and irrigation will continue to evolve, with increasing dependence on groundwater and alternative sources, including sewage. Climate change will lead to greater fluctuations in rainwater harvesting. The management of all water resources should be improved to ensure supply and quality.



## WHO's response (World Health Organization)

As an international authority on public health and water quality, the World Health Organization (WHO) [4] promotes global efforts to prevent the spread of waterborne illness, advising governments on the development of targets and regulations. based on health.

WHO works closely with UNICEF in a number of areas related to water and health, including water, sanitation and hygiene in health care facilities? In 2015 the two organizations jointly developed the WASH FIT [5] (Hygiene Facility Improvement Tool), an adaptation of the water safety plan approach. WASH FIT aims to guide small, primary healthcare facilities in low- and middle-income environments through a continuous cycle of improvement through assessments, risk hierarchy, and specific and targeted actions. A 2019 report outlines the practical steps countries can take to improve water, sanitation and hygiene in healthcare facilities.

## Disease and death

- It is estimated that 801,000 children under the age of 5 are lost to diarrhea each year, mainly in developing countries. This accounts for 11% of the 7.6 million deaths of children under the age of five, meaning around 2,200 children die daily as a result of diarrheal diseases
- Unsafe drinking water, inadequate water availability for hygiene, and lack of access to sanitation contribute together to approximately 88% of diarrheal deaths.
- Worldwide, millions of people are infected with neglected tropical diseases (NTDs), many of which are related to water and / or hygiene, such as Guinea Worm disease, Buruli Ulcer, Trachoma and schistosomiasis. These diseases are most often found in places with unsafe drinking water, poor hygiene and inadequate hygiene practices
- Guinea worm disease (GWD) is an extremely painful parasitic infection spread through contaminated drinking water. GWD is characterized by spaghetti-type worms up to 1 meter long, which slowly emerge from the human body through cells in the skin anywhere in the body, but usually on the lower legs or lower arms. Infection affects poorer communities in remote parts of Africa that do not have safe drinking water. In 2015, 22 cases of Guinea worm disease were reported. Most of them were from Chad (41%)
- Trachoma is the leading cause of blindness worldwide and is the result of poor sanitation and sanitation. About 41 million people suffer from active Trachoma and nearly 10 million people have vision problems or are irreparably blind as a result of Trachoma. Trachoma infection can be prevented through increased facial cleansing with soap and clean water and improved hygiene.

## Part B

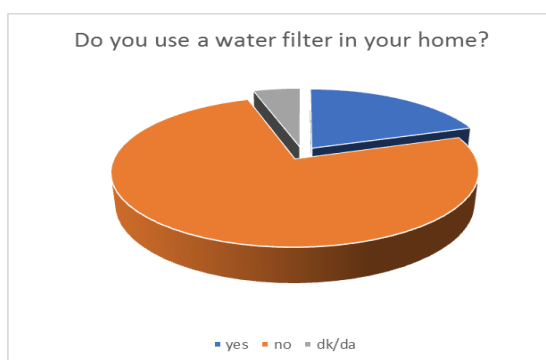
### Cleanliness of Water and Youth



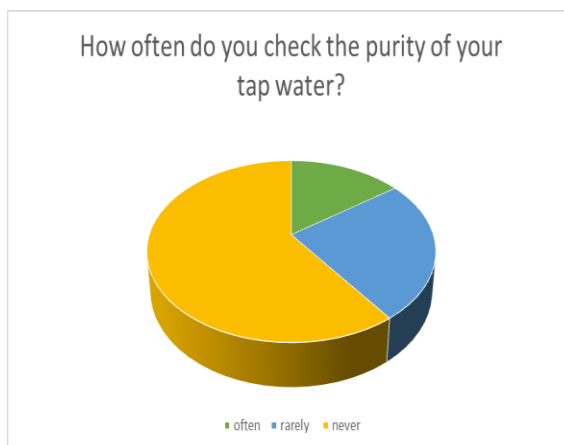
We decided to do a poll through a questionnaire we made. We asked 20 of our peers to answer some water-related questions to help us with our work. Here are the questions with the answers as well as some diagrams.

#### Regarding drinking water:

- Do you use a water filter in your home?
- We asked our friends who answered YES, the reason they use the filter and some of the answers were:
  - We use the filter to retain harmful substances as tap water is full of them
  - We use a water filter because we saw it in an advertisement on TV

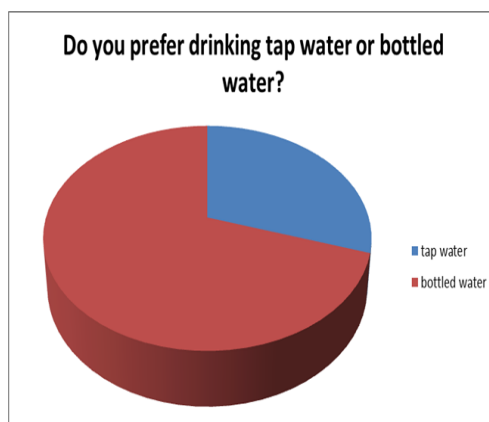


- How often do you check the purity of your tap water?



Interestingly, our friends who answered often used a water filter in their home!

- Do you prefer to drink tap water or bottled water?

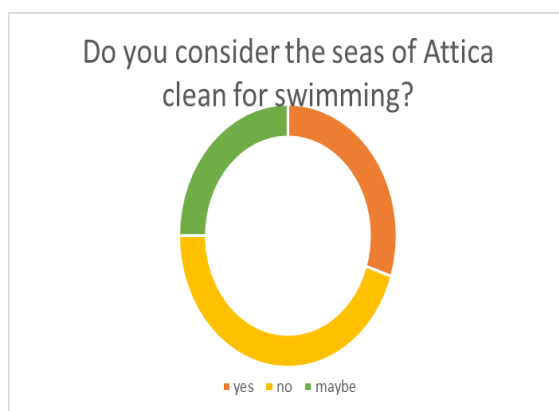




### Regarding seawater:

Do you consider the seas of Attica clean for swimming?

Although only 6 of them consider the seas of Attica clean, at least 14 of them have gone for a swim in Attica this summer!

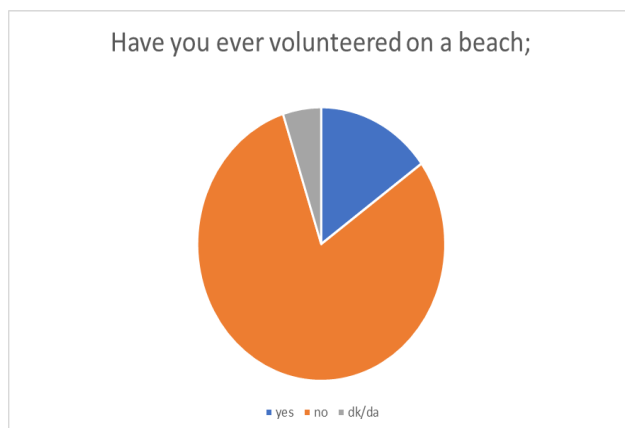


- Have you ever volunteered on a beach?

YES 3

NO 16

I DON'T KNOW / I DON'T ANSWER 1



### Discussion:

From the above poll, we came to the following conclusion. Unfortunately, our peers do not show much interest in the purity of the water as it has not bothered them immediately. This can be changed through education to raise awareness among the younger generation and to take further steps to address this very important issue.

Should children and teens get the right information regarding environmental issues in general, we believe that a better tomorrow will come for our country and for the whole planet!

### Part C

#### A. Removal of suspended (organic and inorganic) material

At this stage, materials, such as soil, sand, etc. are first removed by mechanical methods. Then large objects, such as wood, irons, etc. are removed to avoid damage to facilities and mechanical equipment during subsequent treatment. This is done with grills, and solid materials are retained. Then the sedimentation takes place through which heavy sewage (feces, mud) rises to the surface, which are removed.

#### B. Removal of organic matter through oxygenation (biological treatment)

At this stage, biological waste, such as human waste, detergents, etc., is removed. This is usually done through aerobic deconstruction. The effectiveness of the method depends on the deconstructions - that is, organisms, such as bacteria and protozoa that perform the deconstruction - which need oxygen and a substrate to live. The method can be performed in different ways. In all cases, degraders consume materials, such as sugar.

#### C. Removal of pathogens by chemical treatment, as proposed by the Department of Chemistry of the University of Crete. (7).

At this stage, pathogenic substances are removed from the water, usually ammonia (nitrogen) which is toxic to fish and salts (phosphorus compounds) that cause eutrophication in lakes or seas. Due to the high cost, this process is applied to sewage with an increased presence of industrial waste, in order to reuse these wastewater (e.g. in industry, for irrigation or recreation areas). But in addition to biological cleansing, which is a more effective solution, everyone's personal attitude towards water is also important. We all need to take care of their cleanliness, by all means, from the slightest action, such as volunteering on the shores or limiting activities that cause infection!

At a more individual level, it is quite easy to clean a small amount of water for personal use:

##### 1. The Sun.

Sunlight is a great way to get clean water without a lot of sediment and only depends on the planet's largest source of energy: the sun. Clean or filtered water should be placed in a glass container and stay in the sun for at least six hours and sunlight and heat will destroy pathogens that can cause water-borne diseases. PET vials are supposed to be a viable option for a container, but PVC should be avoided altogether.



## 2. Boiling

This is one of the best solutions, because water is immediately available to those who have a pot and a cooking oven. To ensure that all bacteria are killed, the water should be kept in a boiling pan for at least five minutes, adding another minute for every 1000 feet above sea level. Some chemicals will be removed as vapors, but to get rid of solids, minerals and minerals, boiled water must be allowed to settle. Clean water can then be removed from the top. Water distillation could lead to another notch in this process.

## 3. Gravity

Gravity filters are another viable option. Although some are skeptical of the end results, many will be happy to drink this water over tap water. The design requires a container that allows water to drain from the bottom and spill on top. Layers of activated carbon, sand and small gravel filters (moving from bottom to top) gradually remove smaller particles. If the water is cloudy, or the user is unreliable, this method can certainly be used to clean it before using one of the other methods to seal the agreement on pathogens.

### Instruction for drinking water

The Directive on drinking water (Council Directive 98/83 / EC of 3 November 1998 on the quality of water for human consumption) [7] concerns the quality of water intended for human consumption. Its goal is to protect human health from the adverse effects of any water pollution intended for human consumption, ensuring that it is healthy and clean. The consolidated text of the Directive with its latest amendments, including Commission Directive 2015/1787 of 6 October 2015 [7], is included in the European Union's list of consolidated legislation.

#### The drinking water directive applies to:

- A) all distribution systems that serve more than 50 people or supply more than 10 cubic meters per day, but also distribution systems that serve less than 50 people / supply less than 10 cubic meters per day if the water is delivered in the context of economic activity.
- B) drinking water from tankers.
- C) drinking water in bottles or containers
- D) the water used in the food industry, unless the competent national authorities find that the quality of the water cannot affect the hygiene of the food in its final form.

### Actions in our local community

1. Closing for use discrimination in school fountains.
2. Approach the mayor's files and fill in information leaflets with the water time.
3. Organize informative seminars from specific to schools and efforts.
4. Counseling News and videos on the Internet.



5. Participate in environmental researches every year
6. Users are also the individual help maintain water purity in the area

## Conclusions

After our research for the creation of this article, as well as the research on our peers, our team came to some very important conclusions. The problem of water purity is more than serious. In addition, young people are not sufficiently informed. That's why most teenagers are not particularly concerned. However, if young people get informed enough, they are willing to participate in volunteer activities. Thirdly, more people than anyone could imagine are struggling every day to provide clean water for themselves and their families. Finally, it is easy for each of us, starting with small actions in our local community, to help solve a part of the problem.



## Reference list

[1] Martin (2018). *Water and Sanitation - United Nations Sustainable Development*. [online] United Nations Sustainable Development. Available at:

<https://www.un.org/sustainabledevelopment/water-and-sanitation/>

[2] Eisenberg, J., Bartram, J. and Hunter, P. (n.d.). *A public health perspective for establishing water-related guidelines and standards*. [online] Available at:

[https://www.who.int/water\\_sanitation\\_health/dwg/iwachap11.pdf](https://www.who.int/water_sanitation_health/dwg/iwachap11.pdf) [Accessed 20 May 2020].

[3] UNICEF. (n.d.). *UNICEF - Water, Sanitation and Hygiene - Water quality: Safe water – save lives*. [online] Available at: [https://www.unicef.org/wash/index\\_water\\_quality.html](https://www.unicef.org/wash/index_water_quality.html) [Accessed 20 May 2020].

[4] W.H.O. (World Health Organization). *Assessing Access to Water & Sanitation. Global Water, Sanitation and Hygiene*. Healthy Water | CDC Website title: Cdc.gov

URL: <https://www.cdc.gov/healthywater/global/assessing.html> (Access 13 January 2020)

[5] Adams, J., Simms, J., Chartier, Y. and Bartram, J. (2009). *Water sanitation and hygiene standards for schools in low-cost settings*. Geneva, Switzerland: Unicef, Who.

[6] Publications Office of the European Union (Council Directive 98/83 / EC of 3 November 1998 and 2015/1787 of the Commission of 6 October 2015 on the quality of water for human consumption)

[7] University of Crete. Faculty of Health Sciences. Medical Department. Laboratory Medicine Department. Laboratory of Clinical Microbiology and Microbial Pathogenesis. Food, Water and Environment Microbiology Unit

