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Considerations regarding the consumption of drinking water to the detriment of the bottled one in large urban and rural areas

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Abstract: Water is a public good, not a commodity. The fundamental resource for our existence, water, covers an important surface of the globe. The date about water may create the impression that water is a resource we can abound. But, we must not forget that about 97.5% of the water on the entire planet is saltwater from the sea and ocean water. Turning it into water for consumption is difficult and costly, but we do find it in the Arab countries where about 40% of drinking water comes from this process. Water, a major element in the mineral and biological world, is very important for life and human activity. Currently, global water use, with its various domestic, industrial and agricultural uses added up, accounts for an impressive figure of 700 m^3 per person per year on average, bearing in mind that. And the disparities are still enormous, ranging from less than 100 m^3 for developing countries to over 2,000 m^3 for the United States. Consequently, it can be taken as read that mankind's water needs will continue to grow depending on the part of the world. Water consumption has increased significantly during recent decades, with domestic use accounting for approximately 10% of this consumption.

In this paper, a comparison is made between bottled water, which involves very high transport costs and tap water (municipal water).

Keywords: municipal water, drinking water, safe water, resources, conservation

1. INTRODUCTION

Drinking water is a fundamental right of every citizen. On 28 July 2010, through Resolution 64/292, the United Nations General Assembly explicitly recognized the human right to water and sanitation and acknowledged that clean drinking water and sanitation are essential to the realisation of all human rights. The Resolution calls upon States and international organisations to provide financial resources help capacity-building and technology transfer to help countries, in particular developing countries, to provide safe, clean, accessible and affordable drinking water and sanitation for all.

We also use it for many other purposes, such as washing, cleaning, hygiene or watering our plants. the European Union must implement the human right to water insofar as water and sanitation services are subject to European law (as a service of general interest). The European Union must promote national implementation of this human right by setting binding targets for all Member States to achieve universal coverage. Sufficient, safe, accessible, acceptable, physically accessible and affordable are essential for our daily life, for drinking and food preparation.

If we talk about "sufficient water," we talk about the water supply for each person must be sufficient and continuous for personal and domestic uses. These uses ordinarily include drinking, personal sanitation, washing of clothes, food preparation, personal and household hygiene. According to the World Health Organization (WHO), between 50 and 100 litres of water per person per day are needed to ensure that most basic needs are met and few health concerns arise.

"The safe water" means that water required for each personal and household use must be safe from micro-organisms, chemicals that constitute a threat to a person's health. Measures of drinking-water safety are usually defined by national and/or local standards for drinking-water quality.

"Acceptable water" is defined by an acceptable colour, odour and taste for each personal or domestic use. Everyone has the right to a water and sanitation service that is physically accessible within, or in the immediate vicinity of the household, educational institution, workplace or health institution. According to WHO, the water source has to be within 1,000 metres of the home.

Everyone must have safe and easy access to adequate facilities and services in order that clean drinking-water is secured and useable. For many people in the world today, the goal of providing access to water at home will not be realized in the short- or even medium-term.

Increasing access to drinking-water provides water for drinking, food preparation and hygiene. It potentially encourages hand-washing, general physical cleanliness and laundry, and improved living conditions. When water has to be collected at distant sources, there are risks – both direct and indirect– to health. It is usually women who collect water, and they may be physically attacked while performing

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this task. Carrying heavy loads may also cause spinal injuries.

Water should also be "affordable for everyone. It is a sad irony that it is often the poor who receive the lowest levels and least reliability of service and water of inferior quality, who pay most per litre for their water– for example, from water vendors in the street. According to one recent estimate, the poor pay on average 12 times more per litre of water than their counterparts with a municipal supply [4]. It is necessary to offer a range of levels of service and technologies, with the potential for progressive upgrading. In according to the United Nations Development Program (UNDP) water for consumption must not exceed 3% of a household's income. This right does not imply that people benefit free or unlimited quantities of water, but be used in a sustainable manner, to which everyone contributes as much as possible. However, some 884 million people do not have access to water and about 2.6 billion people do not have access to basic sanitation.

2. WATER – THE FINIT RESOURCE?

The water is actually more like solar power, or wind power, than coal or oil. Water is an infinitely renewable resource. In a natural cycle, rainwater falls from the clouds, returns to the salty sea through freshwater rivers and evaporates back to the clouds. Regardless of how the water gets used during that cycle, it always ends up back in the sea at some point only to begin a new cycle back into the clouds. he earth is also known as the "Blue Planet" due to the waters covering about 70% of its surface. This surface is, however, extremely thin compared to the volume of our planet. It may create the impression that water is a resource we have abundantly. However, about 96.5% of the water across the planet is salt water. Of the remaining 3.5%, over two thirds are solid, in the form of glaciers, which means we do not have direct access to these resources. Moreover, almost a third of the rest of the freshwater is underground or is found in the form of soil moisture or marsh.

This means that less than 1% of the total freshwater resources for humans and ecosystems are available, i.e. about 0.01% of the total water on Earth. An opportunity to get more water for the population is the process of turning saltwater into fresh water, a process called desalination. This method is already used, especially in Arab countries, where about 40% of drinking water comes from this process. This is due to the fact that freshwater sources in the region are very few compared to water requirements.

The cost of desalination is very high, the amount of energy used is also high, and the environmental impact on water and biodiversity in the oceans is an unfavourable one.

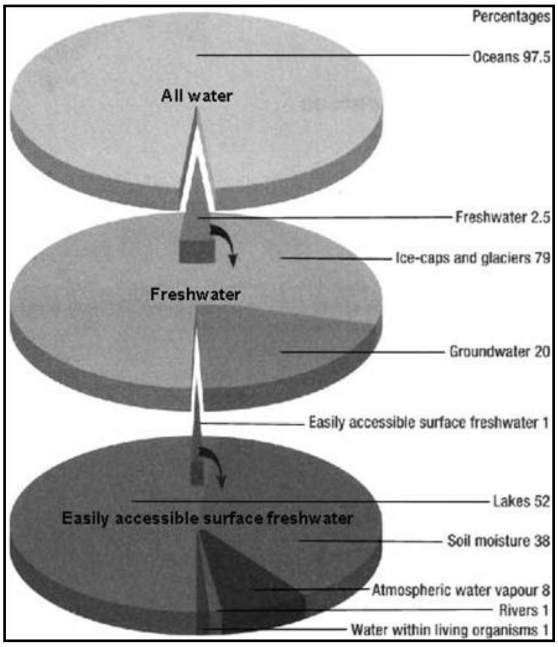

Figure1. Global water distribution

This results in an unsustainable process. This process should be used only as the last possible method, and if the technological development of this process takes into account the natural environment, regardless of the associated financial costs then it can be used. Water conservation processes are preferable, as they present much less risks and lower costs, but less profitable for companies. An estimate of global water distribution can be found in Table 1.

Table 1. An estimate of global water distribution

Water source	Water volumekm^3	Percentage of total fresh water	Percentage of total water
Oceans, seas and bays	1338000000	-	96.5
Glaciers, glaciers and permanent snow	24064000	68.7	1.74
Underground water	23400000	-	1.7
Freshwater	10530000	30.1	0.76
Salt water	12870000	-	0.94
Permanent and non-permanent ice in the soil	300000	0.86	0.022
lakes	176400	-	0.013
Freshwater lakes	91000	0.26	0.007
Saltwater Lakes	85400	-	0.006
Atmosphere	12900	0.04	0.001
Water from the marshes	11470	0.03	0.0008
Rivers	2120	0.006	0.0002
Biological water	1120	0.003	0.0001
Total	1386000000		100

3. WATER CIRCUIT IN NATURE

The hydrologic cycle representing the different paths through which water circulates and is transformed in the natural environment (Fig. 1). Being a cycle, it has no specific beginning or ending. Rather, liquid water from the Earth's surface, particularly the oceans, is evaporated into a gaseous form and enters the atmosphere as water vapour (clouds). The atmospheric moisture is returned to the Earth's surface in the form of rain or snow. It is estimated that approximately 100, 000 cubic kilometres (about 20% of the total global annual precipitation) falls onto the land surface of the continents.

The liquid fresh water moves over the land surface on its journey back to the ocean. During its overland journey, it creates rivers, lakes, wetlands and/or groundwater aquifers. Further, a portion (so-called endorheic water-bodies) has no direct access to the oceans. It is estimated that approximately 42,000 cubic kilometres of precipitation flows back to the oceans through the world's rivers each year. Some of the precipitation will step down into the Earth's surface and become groundwater. Some of it will be taken up by plants and subsequently released in gaseous form back into the atmosphere via a process called transpiration.

A substantial quantity of water is returned to the atmosphere in this manner, thereby short-circuiting the full hydrologic cycle. It is the fact that more water evaporates from the oceans than is directly precipitated back, thus creating the driving force for the hydrologic cycle.

A substantial input of heat energy is required to melt ice into liquid water, and to boil it into water vapour. A substantial uptake of heat energy also is required to freeze it. These properties give water a considerable capacity to resist freezing or boiling in response to temperature changes. Another factor is that humans can control the movement of water, including such measures as pumping it upstream against the force of gravity, pooling or storing it in different locations, and even moving it over long distances [2].

The ocean plays a key role in this vital cycle of water. The ocean holds 97% of the total water on the planet; 78% of global precipitation occurs over the ocean, and it is the source of 86% of global evaporation. Besides affecting the amount of atmospheric water vapour and hence rainfall, evaporation from the sea surface is important in the movement of heat in the climate system [3]. Water evaporates from the surface of the ocean, mostly in warm, cloud-free subtropical seas. This cools the surface of the ocean, and the large amount of heat absorbed the ocean partially buffers the greenhouse effect from increasing carbon dioxide and other gases. Condensing water vapour releases latent heat and this drives much of the atmospheric circulation in the tropics. This latent heat release is an important part of the Earth's heat balance, and it couples the planet's energy and water cycles (Fig. 2).

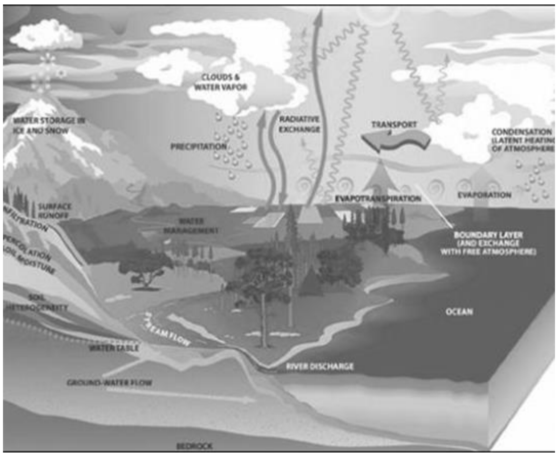

Figure 2. The water circuit in nature [2]

4. MUNICIPAL WATER

Many people live in municipalities (cities, towns, and villages with services such as water treatment, police, and fire departments). One benefit of living in a municipality is that potable water (water safe to drink) is usually available at any time by turning on the tap. Part of the responsibility of citizens and municipal officials however, is to manage and protect the local water supply. If municipal water becomes contaminated, the result can be far-reaching and rapid. Bacteria and viruses in water can spread throughout the underground reservoir of water (the aquifer) or throughout the miles of pipelines that carries water to houses in towns and cities. As well, non-living pollutants such as oil, gasoline and sediment can spread contaminate water.

People who live in a municipality usually have to pay money to the local government for their water. Municipal drinking water may come from wells, which pump water that is located underneath the ground (groundwater) into an underground reservoir. Groundwater is often free of contaminating chemicals and microorganisms because the contaminants are filtered out of the water as it moves downward into the ground, yet the water still must be tested to ensure the absence of contaminants. Once tested, the water is pumped through pipes that run underneath the streets of the municipality. The pipes lead to houses, fire stations, other offices, swimming pools, and the many other places where water is used [3].

Some municipal drinking water is obtained from streams, rivers, and lakes. This water is called surface water. Surface water must be treated before it can be used for drinking, because there is a greater chance that harmful chemicals or microorganisms could have washed into surface water. Municipalities that rely on surface water will pump the water from the river or lake to a water treatment plant. The water will be cleaned in a series of steps and tested to ensure that it is safe to drink. The treated water can then be pumped to storage tanks until it is used [4].

In many municipalities, one of the treatment steps is the addition of chemical called chlorine. This chemical kills bacteria such as E-coli, and so is an effective and inexpensive way to keep the water free from bacteria. The amount of chlorine that is added to water needs to be monitored, since too much chlorine can create taste and odour problems. Furthermore, excess chlorine can combine with organic material in the water (like rotting leaves) to form a compound called trihalomethane that has been linked to the development of cancer in humans. Some municipalities have installed other means of killing or removing microorganisms. These include the use of ultraviolet (UV) light, which kills microorganisms by breaking apart their genetic material. Another technique is to pass the water through a series of filters (a material that has very tiny holes in it). While the water molecules can pass through these holes, the holes are too small to allow most microorganisms to pass through.

After water is used, the chemicals, sewage, and other contaminants must be removed before the water can be reused or returned to a reservoir. In order to accomplish this, wastewater leaves buildings through sewage pipes that lead to the treatment facility, and the treatment cycle begins again [1].

5. BOTTLED WATER INDUSTRY

In the communities where there it is no access to clean water or where access to drinking water is limited, it is necessary to use bottled water. This is another alternative in times when municipal water poses risks to human health as a result of chemical or microbiological contamination. Regardless of the reasons for these occasions, it is important to have the opportunity to get clean water. In areas where municipal water is sufficient and safe, good in terms of quality and affordability, bottled water is not an alternative. This is due to the fact that in the process of production and distribution of bottled water resources are consumed and waste is produced that is not biodegradable

- Packaging of bottles bottle

General characteristics

- packaging of bottles of water is bottled in PET packaging;

- for the manufacture of one kilogram. of PET material uses about 2 l of petroleum and significant amounts of energy;

- Plastic production consumes around 8% of world oil production;

- the process by which petroleum is transformed into PETs is illustrated in Fig. 3

• The energy required to produce bottled water

According to a study in the United States, the use of bottled water is less energy efficient than the use of the reservoir network, storage tanks and pipelines supplying tap water. The vast majority of the energy required in the bottling water process takes place during the production of plastic water bottles and their transport (Figure 4.).

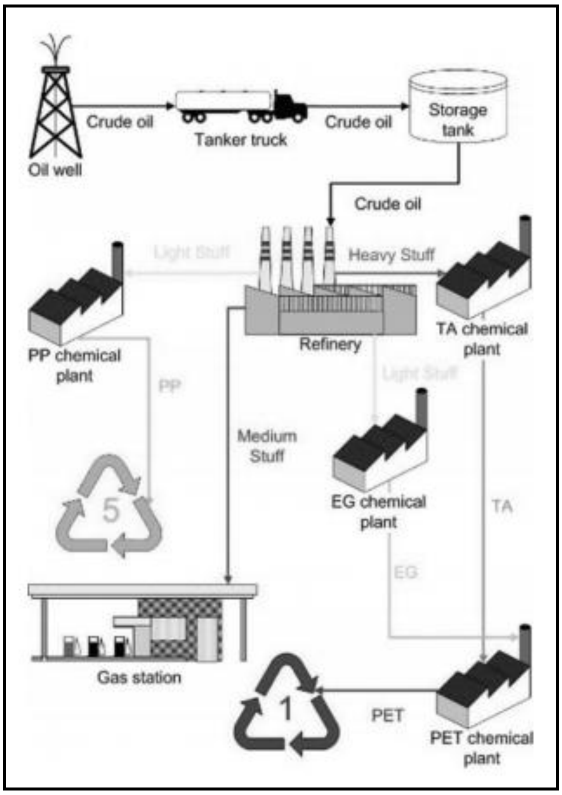

Figure 3. Production of petroleum compounds [3]

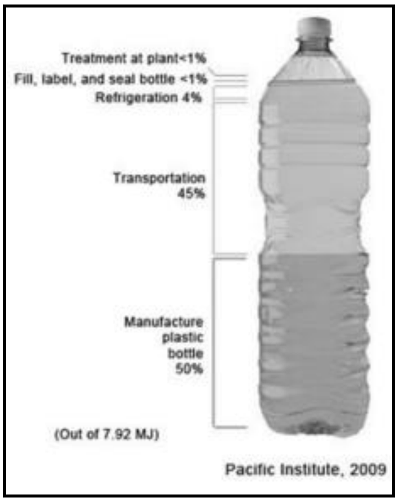

Figure 4. Energy required making bottled water

- Impact on the environment and animals

Bottled water involves waste of water. For each litter of bottled water we consume, we need about 25 litters of water to produce and transport it. Only in the United States, about 17 million barrels of oil are used to produce plastic bottles in one year, which means about 24 billion bottles consumed. Of these, about 1/6 are recycled, the rest being discarded.

A single PET bottle disintegrates between 500 and 1,000 years and much of it comes directly into nature. About 90% of the ocean surface was plastic (not just PETs). All of these have a direct impact on the ecosystems and, implicitly, the animals. It is estimated that about 1 million birds and marine mammals die because of the interference or ingestion of plastic [4, 5].

• Impairment of the right to water

Bottling factories can adversely affect local water supply. Due to the pumping of large quantities of water, underground aquifers can be exhausted. These aquifers feed water with local communities and wild aquatic habitats. A drought that affected the state of California in 2015 forced the authorities to impose restrictions on water consumption by local communities for the first time in their state history. But water companies have not stopped bottled water production, they have still extracted water from the regions most affected by drought.

- Bottled water quality

Bottled water is subject to controls by authorized institutions to verify that bottled water is subject to water quality standards. Unlike municipal water that is tested by state institutions as well as bottled water service providers, bottlers of water bottlers are not required to provide the results of analyzes to the general public in most areas of the world. This happens even if some bottled water companies use the same water sources as municipal water in their bottling process of known brands, which they sell at an exponentially higher price than the price a consumer would pay if would consume the same water from the tap.

There are various studies that found irregularities in some samples of bottled water, such as the presence of traces of E. coli or arsenic. These studies have not been able to demonstrate that bottled water is qualitatively inferior to municipal water, but has drawn attention to the bottling water regulation framework, which it has labelled as inadequate to provide consumers with purity or water safety.

Other studies draw attention to the possibility of transferring the chemicals contained in the plastic bottles into the water contained therein. Polyethylene terephthalate, the plastic used to pack most of the bottled bottles of disposable water, is not intended to be reused, but consumers often refill and reuse these bottles. PETs are considered more stable and less prone to such transfers than other forms of plastic, but some studies suggest that, with the repeated use of PET bottles, di (2-ethylhexyl) phthalate (DEHP) a compound and probably human carcinogen that affects the endocrine system.

6. COMPARATIVE ANALYSIS OF DRINKING WATER QUALITY WITH BOTTLED WATER

For the case study, several water quality parameters (hardness, oxidisability, nitrates, nitrites, pH) were used.

For the total hardness obtained in the analyzed samples, they meet the norms provided by the law, both for tap water and for bottled water. Variation of total hardness values for water samples analyzed in the case study is represented in fig. 5 [3].

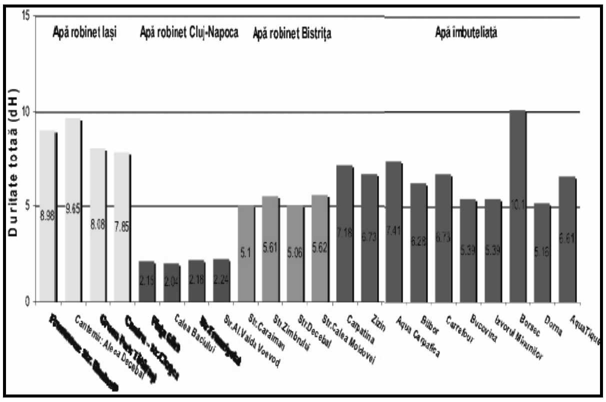

Figure 5 Variation of total hardness values for water samples

For oxidisability, the comparative analysis of the test results indicates that this parameter is within the legal limits for all the samples taken into account for the case study for both tap water and bottled water. Variation of oxidation values for the water samples analyzed in the case study are represented in fig. 6[3].

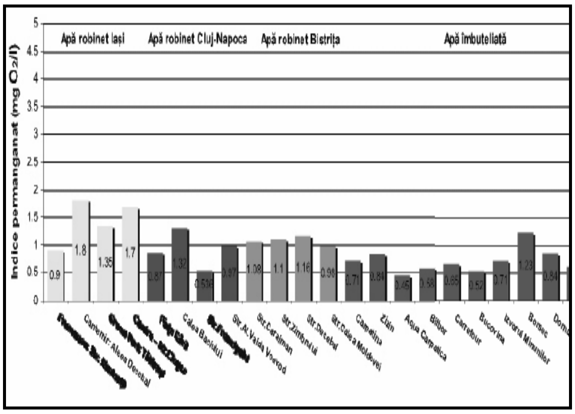

Figure 6. Variation of oxidation values for the water samples

The comparative analysis of the nitrate test results indicates that this parameter is within the legal limits for all the samples taken into account for the case study for both tap water and bottled water [5].

Once ingested, the nitrates are converted to nitrites (NO_2) - substances that are more toxic than nitrates by contact with the bacterial microflora of the stomach. The analysis of nitrite test results shows that this parameter is below the detection limit for all samples taken into account for the case study.

The pH of water is very important, whether it is tap water or fountain, and only a pH of between 6.5 and 9 is tolerated by the human body, although there are different needs internally and externally [4].

Based on the comparative analysis of the pH test results, this parameter is within the legal limits for all the samples taken into account for the case study for both tap water and bottled water.

7. CONCLUSIONS

Water is necessary to survive and we must take over and distribute the water for our existence. This must, however, be done in a fair and sustainable way, in order to maintain that equilibrium that is so necessary with nature, both now and in the future

There are some studies that draw attention to the possibility that bottled water may contain in some quantities some substances with more or less harmful potential for human health. They cannot be categorized as inappropriate for consumption. Drinking water analysis should be done with increased transparency. This could provide greater assurance of bottled water quality

Consumption of energy, oil, water from the production process and the transport of bottled water, as well as the huge quantities of waste entering or landfill in which the ecosystems are directly and indirectly affected, are a reality on which we need to be aware of and which we must take into account when we have the choice between different sources of water safe for our health. In conclusion, the more responsible the consumption of water means we will have a cleaner and richer environment. This is where we can coexist for a longer period of time in better environmental conditions.

Respecting safety means refraining from and preventing any actions that would lower the quality of drinking water to unsafe levels. Protecting safety means ensuring that water sources that are currently safe do not become unsafe as a result of pollution.

Fulfilling safety means improving water sources and the treatment of drinking-water; thus reducing or preventing pollution. Actions to fulfil may include support for treatment of water in households if this is the only reliable way of getting safe water to people.

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