



## Studying the challenges in the field of accessing to safe water in urban environments



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### Abstract

Safe and potable water is water needed for conducting the activities of man. Potable water is the most important renewable sources and this resource plays important role for survival of most living organisms as well as man based on supplying the water requirements and irrigation water. The trend for increased population and extended sources as well as needing for supplying the man's food, increased mortality, droughts, loss of water table, penetration of saline waters to potable water sources, change in the quality of water sources, endangering the public health, food safety threat, malnutrition and starvation, local, regional and international conflicts, evacuation of rural regions due to loss of water (as a main living infrastructure), destruction of biodiversity in the ecosystems and wild life,... are considered as potential threats exposed the water sources particularly potable water sources in the cities and countries levels during future years.

By development of urbanization, today, the subject of sources management in the civil areas has been remarkably considered. Progress in the urban living made irretrievable damages to the nature and threatened many natural sources. One of the most important of these factors includes water pollution and its sources. Water safety, and preventing its pollution and its lost is one of the most important issues in our era. Water contamination is considered as a great environmental complication encountered with due to day-to-day progress of industries and technology.

This paper aims to investigate the existing concepts, factors making the contaminations, alternatives such as managerial methods, existing challenges, and recommendations in the field of preventing and reducing the contamination of water sources and using safe water.

**Keywords:** Safe water, waters contamination, challenges and alternatives, potable water, urban environment

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## **1. Introduction**

Water cycle makes a vital equilibrium between ecological systems of earth. In any stage of water cycle, industrial pollution, developed agriculture and increased population may influence on the quality and accessing to water.

According to declaration of UN, water may be considered as a natural source determining the range of sustainable development. Balance between demand and supply is one of the increasing requests of authorities for water supply. The limited sources of potable water may threat the health of men, society's economy and environment globally. Global water crisis has gone beyond the borders and accelerated in its route and influenced on the culture of communities and pressurized on all living organisms.

In last century, increased population growth and development of global economy increased the needs to potable water. Any year 80 million people are added to the world's population. On 2000, 508 million people were living in 31 countries with water shortage. Until 2025, 3 billion people will live in such countries. Today, 20% of global populations suffer from accessing to safe water, while 50% are living in low water conditions. The poorest people through the world, particularly women may be influenced more than others and hurt.

Tragic increase in population in most developing countries has made severe droughty conditions. Therefore, most industrial countries that have no increased population problem may less encounter with such issues. The water usage and pollution is continuing and endangers the return of water to the natural sources and its quality as well. The household usage of water in USA is extremely high comparing with other population through the world. The average consumption rate in Northern America is more than 170 gallons per person per day, i.e. close to 100 times of usage in European countries and 7 times of average usage in other countries through the world.

## **2. Materials and methods**

### **a- Concepts**

#### ***2.1. Global Situation of Water***

The water content of earth is almost invariable. This water is used for drinking, agriculture and industrial purposes,... and improves the man's living. If one can see the earth from the space, it is seen in blue, i.e. a sphere covered with waters more of its surface. It means the main part of earth covered by oceans and seas. Based on its volume and size, about 97.2% of waters comprise the atmosphere and water in the soils and ground water.

#### ***2.2. Natural Water Cycle***

Waters in the earth are always transforming. These waters are in the liquid, solid and gas state; and natural states of water is much extended. Some of it penetrates to the ground and comprise ground water. Some others reserved by branches, leaves, trunk and roots of trees.

Water in the atmosphere displaces between earth and atmosphere by its natural cycle every 9 days. In any year, this action repeats several times. The size of water provided by water circulation in the nature is about 40000 km<sup>3</sup>. By today's technology, man may exploit about 25000km<sup>3</sup> of water. Precipitation is not the same through the earth and in some places; precipitation is more than other places (Safavi (1998), Samadya. (2008))

### **2.3. Water Management Globally**

By new challenges due to melting the natural glaciers and reduction in the snow of earth's poles as well as increased level of seas globally, global warming, subject of crisis for water supply and drought in different points through the world, caused to provide the major water management globally as a comprehensive potable water management in access through the world, a work that is conducting during thousands of years in this corner of the world. Now, more than 3/2 of people are living in Asia and about 40% of such people are living in the common and integrated basins (Samadya. (2008))

### **2.4. Potable Water**

For its activities, man needs potable water. Potable water includes water with very low mineral content. The ocean and sea water is brine so using those needs purification and this also requires establishing the water treatment house with advanced mechanisms. High cost of this process forced man to be contended with potable waters in the lands and atmosphere. The size of potable water is very low globally and comprises about 2.8% of total water contents. For using the low size of potable water in the world, there are also some limitations, because some potable waters in the world are in the ice form in the pole and mountain glaciers and may not be exploited. But man is accessing to the potable waters in the rivers, lakes and ground waters. But for accessing to ground water it is needed to excavation, digging the wells, canaling and using water pumping devices as well as making some facilities and piping (Engineering Group (2010)).

### **2.5. Water Quality**

Water, one of the most abundant compounds, may not be found in pure state, because it has very high solubility that solves most elements in its route, on one side and man also pollute it directly or indirectly, on the other side; meanwhile, climate conditions also considerably influence on water quality, for example:

The water used for preparing the gaseous soft drinks may lack ferrous and manganese, otherwise it may have a bad taste; and water turbidity must be less than 1 and it must be odorless, colorless and without any organics and its hardness must be less than 200mg/ lit of calcium carbonate (Water sources management Co. (2003)).

The turbidity, hardness, color, ferrous and manganese content of water used in weaving industry for producing first class fabrics must be almost zero; otherwise, it may make stains on the products. Water used in tannery must lack ferrous with low content of ferrous minerals for preventing the production of colors and insoluble materials with tannin. (Engineering Group (2010)).

| <b>Property</b> | <b>Suitable value</b> | <b>Permissible value</b> |
|-----------------|-----------------------|--------------------------|
| Color           | 5 units               | 15 units                 |
| Odor            | 2 units               | 3 units                  |
| Turbidity       | 5 units               | 25 units                 |

**Table 1-** Physical properties of potable water (standards of potable water, Institute of Standard and Industrial Research of Iran)

In the paper industry, for preparing the fine paper, the water must lack color, ferrous, manganese and oily products. The concentration of soluble salts may extremely influence on the quality of agricultural waters, because tolerance of plants to the value and type of water soluble minerals is different.

If the sodium content of water is more than permissible value, it may corrupt the ground and reduces the water permeability to the ground, while calcium minerals may improve the soil.

Presence of boron in the arable waters is important and its increased content may be poisonous for plants and its shortage also may prevent plant growth, high chlorine content in the water may stop the plant growth. (M, Larijani (2009))

| <b>hardness</b> | <b>Classification (mgr/lit CaCO<sub>3</sub>)</b> |
|-----------------|--|
| Light           | 0-50   |
| Semi- light     | 50- 100  |
| Slightly hard   | 100- 150   |
| Semi- hard      | 150- 200   |
| Hard            | More than 200                                    |
| Very hard       | More than 300                                    |

**Table 2-** Classification of water hardness

#### **b.results**

### **3. Water Pollution**

Water, its refinement, and preventing its pollution and waste are very important issues of our time. Water pollution is a very big environmental issue that we encounter with due to the progress in industries and technology.

On November, 1986, due to precipitation of materials including Hg and types of poisonous organic materials like pesticides in Rhine River, all aquatics, from Ball city, Switzerland to the coast of Holland, were killed. In recent years, by wrecking the great oil tankers or their landing, they caused many damages to the sea life.

On 1983, due to 11000 polluting events, about 120 million liters of pollutants discharged in the USA waters.

On 1969, there was provided a definition for water pollution: “Water pollution includes increased content of any agent, whether, chemical, physical or biological, resulting in changes in its properties and fundamental role in its specific usages.

### **4. Water polluting Agents in the Environments**

Water is the most important and fundamental factor for living organisms, for this reason, it is very important preventing their pollution. The water polluting agents are very different and they can both pollute the ground waters and surface waters.

#### **4.1. Ground Water Polluting Agents**

Minerals in the surface mines may be a polluting agent due to changes incurred. For example, surface water (water from raining,...) when passing through the coal mines, may dissolve ferrous di sulfide II (Pyrite), together with coal and then by reacting with air, it may be turned to sulfuric acid. This acid when passing through different layers of ground water reservoirs may pollute them.

Collection of urban sewages, particularly if they enter to limy and or sandy basins, and they will be exposed to bacteria and analyzed, so they can directly penetrate to the ground water and pollute them.

Radioactive wastes are other main polluting agents of ground water sources today provided a big problem for authorities of nuclear technology, because they buried underground and they may pollute the ground water (Safavi. (1998)).

#### ***4.2. Surface Water Polluting Agents***

##### **Industrial Pollutions**

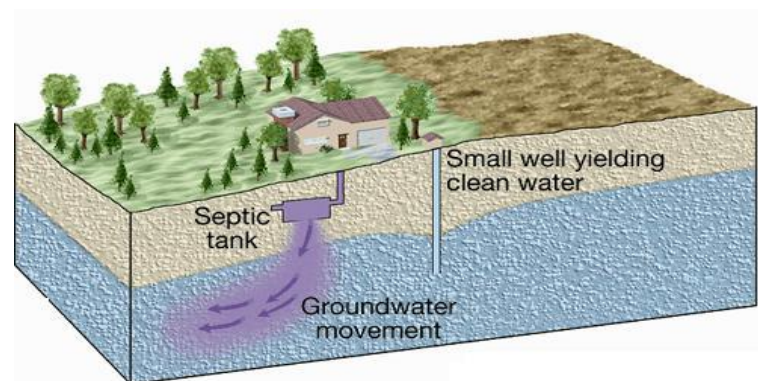
Most industrial wastes may seriously endanger the aquatics. For being neutralized, these wastes may consume high content of oxygen and reduce the oxygen required for aquatics and threat them to death. On the other hand, most of these wastes are toxic and may be poisonous for aquatics including heavy metals, Hg, Pb, Cu...

Entering the phosphorous and nitrogenous compounds to water may develop the algae that while producing abnormal odors and tastes in water, may consume water oxygen and damage to the aquatics. (Water sources management Co. (2003))

##### **Household Sewage**

All cleaners and detergents entering to surface water include compounds that if couldn't be neutralized and or analyzed by microorganisms may damage to aquatics due to making fetal poisons.

Insecticides, pesticides and fertilizers that include the necessities for agricultural development may pollute the surface waters; some of them include DDT (M, Larijani (2009)).



**Figure 1- Water pollutants**

#### ***4.3. Alternatives for Reducing the Pollutions***

For a time, people consume very low energy during their daily life, and most of their household devices comprised from degradable materials. These materials include woods that when discarded, they begin to be degraded.

Anyway, in the industrial world, there is used many energy for producing most devices needed by man and these materials mostly may not be degradable. Machines particularly are one of such problems. Machines may make pollutions both when being produced and when are used.

Our life style makes much pollution. All of us can reduce pollutions by using recycled materials. This important may be possible by recycling the materials and household devices as well as using public transportation routes. We may insulate our houses in the best form and turn off our heating system when they are not needed.

On industrial view, one can take action for reducing the rate of usage of raw materials. Recycling the cans and bottles are also saving the energy, by which less rubbish may enter to the environment and less pollution resulted from energy consumption may be made. The industrial pollution may be also reduced by reducing the packages and recycling some chemicals during production stages.

Most farmers use many chemical fertilizers and also use pesticides that are washing to rivers. Today, it has been determined that they can reduce their usage without damaging to the products itself.

In the future devices like cars and computers may be designed such that can be recyclable. Their components may be made such that their raw materials could be recycled and reused.

In recent years, engineers are seeking for cleaner energy sources; therefore they began some studies in this case. These energies include wind, sea wave power for producing the energy. In 21th century, electricity may supply the driving force for cars and vehicles. This energy might be supplied from a reserving and chargeable energy source like wind and sunlight. In this case, pollution from vehicles may be severely reduced (Engineering Group (2010)).

## **5. Probable Water Challenges**

- Effect of global climate changes and more influence on reduced precipitation and surface current during ten years of drought;
- Increased population rate during ten recent years than developing countries and more people's needs to potable water, hygiene, services, agriculture and industries;
- Development of welfare and health and increased consumption per capita;
- Changes in land usage and its effect on increased evaporation, perspiration and temperature;
- Not attending to the quality of water sources according to the limited access to these sources in the country in order for preventing the entrance of household sewages and industrial backwaters to the surface or ground waters as well as using the toxins and chemical fertilizers in the agricultural sector;
- Overproduction of wastes in the country resulted from increased population, relative welfare, lack of optimally consumption culture and extravagance in this field;
- Overexploitation of ground waters ignoring the limitation of such sources;
- Lack of implementing the irrigation and drainage networks based on modern irrigation methods;

- Not attending to the environmental needs and ecosystem protection by considering the importance of water cycle;
- Not using the agricultural, industrial and household sewages and backwaters by treatment in order for reuse;
- Not attending to the watershed plans, artificial feeding plans, to protect the quality and quantity of water sources in basins;
- Not attending to the adaptation with climate, applying the draught management and flood management in order for optimally using the water sources.

## **6. Alternatives and Recommendations**

By observing following items, one can improve the crisis and some existing problems:

- Establishing the proper institutional system for development and management of water sources;
- Preparing the national and executive policies of water sources in the country;
- Preparing the regulations and standards in the field of water;
- Modifying the planning system;
- Promoting the management of allocating the water sources;
- Stressing on the necessity of planning and management in emergencies;
- Making a proper supervision and evaluation system;
- Optimally protecting the water sources and environment;( Sharzehei, (2008))

## **7. Conclusion**

As stated above, the great and fast changes in the water part, on one side and increased population and demands and global pressures on the other side results in considering the coalition management besides traditional managements and optimal operations as well as performing the global managements and indeed making different types of structures.

But the challenges such as:

- Making the food security;
- Removing the poverty and social justice;
- Accessing to safe water for all people;
- Preventing the pollution of water sources;

Are also considered and not only they couldn't be reduced, but is increasing, for this reason, applying the integrated management of water sources and management of basins is necessary. There have been launched different management models like water management in the Tennessee, Colorado, and Mississippi basins, Moray basin in Australia, Rhine in Europe and common experience of India and Pakistan for concluding the exploitation treaty from Send valley on 1959 that are considered as good models of water experts that can be used for applying the individual tastes and testing others' experiences.

On the other hand, for adaptation with water shortage and sustainable water supply, it must be only taken action for sustainable operation instead of sustainable development, protection from water sources and making targeted formations; for this reason, it is recommended that managements must be based on importance of exploitation and protection from sources with reducing the pressures on such sources.

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