Scientific Bulletin of Politehnica University of Timişoara

Transactions on HYDROTECHNICS

Volume 61(75), Issue 1, 2016

Various technologies for water treatment

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Abstract: Modern technologies, natural disasters, crisis situations quickly destroy the ability of water to maintain life. The water sources are increasingly contaminated as a result of population growth and uncontrolled disposal of industrial waste water or chemical pollutants from agriculture. In contemporary agriculture are used a large amounts of herbicides, pesticides, nitrogen fertilizers which reached in lakes, rivers or underground sources. The literature mentions that worldwide have already discovered thousands chemical compounds in drinking water and more similar substances get into it. Drinking water is obtained by various purification techniques adopted depending on the number of consumers, initial quality water source type (deep or surface), the distribution of water to consumers etc. Traditional technology for obtaining drinking water involves successive stages of settling, chemical treatment, and filtration, with very high consuming materials, energy and production, matters giving rise to increasingly replacing it with more modern techniques, performing as membrane processes.
Keywords: water treatment, industrial waste water, drinking water.

1. INTRODUCTION

Although our planet is covered with more than 71% of water, only a fraction thereof may be used as drinking water. Only 1% of all fresh water can be used as drinking water. This is equivalent to 0.0026% of the total volume of water [3].

Table 1. Water sources contaminants

Raw water contamination	Phreatic water	Surface water	The most common sources
Microorganisms	+	++	Used water, agriculture
Nitrates	++	-	Used water, agriculture
Calcium/magnesium	++	-	Naturally
Sulphates	+	-	Naturally
Iron/manganase	++	-	Naturally
Fluoride	+	-	Naturally
Sodium / potassium (salts)	++	-	Naturally, inadequate irrigation
Particles (sand)	-	++	Erosion, rain
Contamination during distribution			
Microorganisms	++	++	Leaks in pipes and connectors
Metals: lead, cooper	+	+	Pipeline corrosion
Clorinated compounds / halogens	+	+	Clorinate
Phosphates	+	+	Phosphate treatment

\- low vulnerability
\+ medium vulnerability
++ high vulnerability

Drinking water is used in human nutrition. It must satisfy a number of physico-chemical and organoleptic conditions, that allow their consumption without compromising health. Daily consumption of drinking water, reported in the number of inhabitants is growing because it is not used only for drinking, but also in household activities, utilities and food industries. However, from the total consumption of water, drinking water has the smallest percentage, but primary importance. Deliveries and consumption of drinking water increased with the development of urbanization and increasing the industrialization degree of the economy.

The researchers determined that the operation of chlorination is used most commonly to correct microbiological indicators because it believes provide clean water, pure and without pathogens [5]. Rarely has a city where water is not disinfected or sterilized by the addition of chlorine compounds or by irradiation with silver quartz lamps. If this treated water is drunk consistently, many of the processes that should take place to achieve even water sterilization occur within the human body. Constant consumption of such water can result in dramatic consequences, consisting of the most serious diseases such as cancer.

When chlorine from water is in contact with

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organic matter, reaching in human body, it formed various halogenated compounds. According to some researchers, chlorine is the biggest and toughest "killer" of modern times, is an insidious poison that starts without symptoms, masking the true gravity. Many medical studies and research considered him harmless, but now findings are totally different, leading to the conclusion that, by using chlorine to treat drinking water is prevented explosion of disease, but other diseases occur. Moreover, some researchers dare to assert that by chlorination practically "kill is water" and thus obliged bodies a drink [4]. By consuming chlorinated water is done practically a blood sterilization so we preparing ourselves fertile ground for various disease. A powerful alarm is pulled also by researchers in the case of fluoride present in water that has consequences as disastrous as the chlorine.

2.RESULTS AND DISCUSSIONS

The problem of water is severely affected by two factors: - the absence or insufficiency of the works that make possible the use in social and economic aim of the entire stock of water from rivers, lakes and groundwater, allowing bringing water in places needed, in quantity and the time necessary; - Increasing water pollution, both the indoor water and the water from seas and oceans.

The amount of water for one person per day varies by living environment, standard of living, level of civilization. A mature person consumes water, daily for drinking, about 35 g / kg body weight.

Drinking water is obtained by various purification techniques, adopted depending on the number of consumers, initial quality of water, the type source (deep or surface), the distribution of water to consumers etc. Traditional technology for obtaining drinking water involves successive stages of settling, chemical treatment and filtration, with very high consuming materials, energy and production, matters giving rise to increasingly replacing it with more modern techniques, performing as membrane processes.

In Romania the river water quality requirements for drinking water are set by HG no.100 / 2002 (NTPA 013) Class A2, and the water, in order to be "drinking water" shall be establish by the Law of drinking water quality no. 458/2002as amended by Law no.311 / 2004.

In principle, required treatment processes in several steps to ensure that drinking water obtained from surface sources is suitable for domestic consumption at any time and does not has problems for storage and distribution network [7].

Using only the unity of ultrafiltration, without prior chemical processes treatment, is when the source of water for drinking is a surface source and after determination of chemical parameters relevant to the quality of water has been found that the water does not have a high degree of chemical or bacteriological load [8].

If the source of water for drinking is a source of groundwater and is potentially polluted with domestic sewage or manure, it is best that the ultrafiltration unit to be used after a preliminary physical, chemical and biological treatment, because water quality and groundwater sources is subject to increasingly more noxious influence of anthropogenic substances, agricultural pollution and a more pronounced presence of chlorinated hydrocarbons [1].

In Romania, natural water sources are relatively poor and unequally distributed in time and space. They consist of surface water (internal rivers, natural or artificial lakes and the Danube) and the groundwater. Although the Black Sea is a very important water resource, yet it cannot be considered, due to technical difficulties and economical seawater desalination.

Statistics show that 80-85% of the urban population and 10-15% of the rural population is connected to centralized water supply systems and installations for the capture, transport, pumping, treatment, storage and distribution over the whole country ensure flow of water of about 115-120 m^3/s. This flow has proved insufficient and therefore was called for the necessity of new techniques and technologies for the treatment and increases the capacity of water distribution installations.

At the same time, it has solved another problem of the population from certain areas of our country: the impossibility of applying classical technologies of drinking water or use these technologies in non-economic conditions. The actual installations used for water treatment are either disabled or uneconomic, so for solving the problems of drinking water it needed new, modern, clean and efficient installations, based on new processes, as the membrane.

To cope with the ever increasing drinking water demand, it has emerged as the optimal solution using the surface water (especially water river) as sources of drinking water because water from groundwater proved insufficient to meet requirements. Surface water cannot be consumed as such, but are processed in order to correct physicochemical and biological properties to fit the requirements of drinking water quality.

A classical technology for obtaining drinking water presents a number of disadvantages, among which the most significant are:

- plants require large areas of land;
- drinking water is obtained as variable over time due to the modifications of primary source after rainfall, silting of sand filters and progressive development of microorganisms on the surface and in their mass;
- chemical reagents used for coagulation phase, resulting in adverse change in the ion content;
- consume large amounts of disinfectant (chlorine or ozone);
- sometimes lead to excessive contamination with disinfectant (chlorine), with negative effects on consumers.

Because forms are Cl 2 and HOCl active bactericidal, it appears that at pH values greater than

7.6, less than 50% of total chlorine is in an active form [2].

$$Cl_2 + H_2O \rightleftharpoons H^+ + Cl^- + HOCl \quad (1)$$

$$HOCl \rightleftharpoons H^+ + OCl^- \quad (2)$$

For these reasons, they have sought alternatives to the conventional method to eliminate these shortcomings and, in particular, to ensure high quality drinking water.

Researches conducted in recent years have shown that physical separation processes using membranes can effectively solve the problem of potable water. Interest in membrane techniques is due to present multiple possibilities for use in various fields, as unconventional green technologies. The simplicity of these processes (physical separation without the use of chemical additives, the various compounds based on differences between their dimensions) determine their choice over other more sophisticated and expensive processes [6].

Development of membrane processes for water treatment represents a major step in the evolution of technologies for purification of this vital liquid. Membrane processes is option for solving many problems of drinking water, they intervening where traditional technologies not ensure proper quality indices in accordance with international standards. The membranes features (sub-micron pore size, porosity, chemical inertness, strength etc.) allow him to retain both colloidal suspensions, and dissolved substances. Separation is achieved due to capacity membranes favour the transport of a specific component in the mixture.

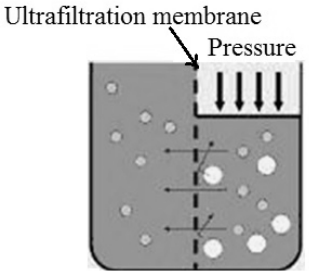

Figure 1. Ultrafiltration principle

Performances by using the techniques of membrane treating of contaminated water sources have demonstrated their viability due to advantages compared to the classic procedure: compaction of the plant, quickly putting into operation, constant quality of water, removing chemical reagents used in clotting, reducing the quantities of reagents used to disinfection.

The research results in recent years in obtaining and applying membrane processes demonstrates that the most appropriate correction physico-chemical and bacteriological indicators of water microfiltration and ultrafiltration are.

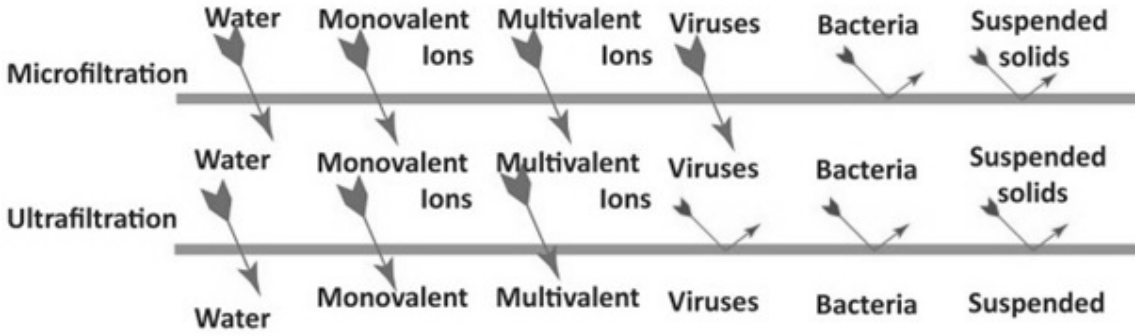

Figure 2. Membrane process capabilities

Like any other filtration technology, ultrafiltration is effective in certain operating conditions, filtration, water quality that need to be filtered. The major disadvantage of membrane processes is represented by limiting the flow of treated water by filtering membrane surface. For this reason, membrane techniques are recommended to ensure drinking water for small collectivises (maximum population: 15 000).

The laboratory of Water Treatment from Hydrotechnics Department of the Faculty of Civil Engineering, Politechnica University of Timişoara has an installation for water treatment, based on the latest technology, namely by the process of ultrafiltration membrane, which is one of the most selective regarding the separation (figure 3).

Figure 3. Ultrafiltration Unit

3.CONCLUSIONS

Unconventional water treatment technologies for drinking purposes, based on membrane processes, have a considerable social and economic impact and a positive impact on the environment.

The wide-spread introduction of installations for obtaining drinking water by unconventional membrane technologies will contribute to food safety and health of the population, especially in the isolated areas, and the general population in crisis. Drinking water facilities through membrane filtration allow for better monitoring, more complete and easier to water sources.

Ultrafiltration is a membrane filtration process permeable finesse between 0.1 and 0.01 micrometres, but does not require additional external pressure. Equipment use available system pressure should be approximately 2.5 bar.

The most important benefit of ultrafiltration is that it not pollute the environment because it does not give any chemical ago ultrafiltration.

Ultrafiltration is used both in industry (dairy and cheese), food (proteins), metallurgy (oil/separate emulsions), the textile industry and in the residential area. There housewife in the small ultrafiltration filters for a single consumption point (a sink) and whole house filters.

Ultrafiltration may be used as a prefilter for the nanofiltration and reverse osmosis. Prefiltration and water pre-treatment is very important when using nanofiltration and reverse osmosis filtering as well as the purification process can be destroyed. Prefiltration and pre-treatment is not only important for nanofiltration and reverse osmosis processes but also microfiltration and ultrafiltration of. Depending on the composition of the water will determine when new pre-treatment process is required.

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