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Application of membrane processes in drinking water treatment–state of art

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ABSTRACT

Membrane technology is widely accepted as a means of producing various qualities of water from surface water, well water, brackish water and seawater. In the treatment of water for drinking purposes first of all pressure-driven membrane techniques are used. The choice of the suitable membrane process depends on the size of the removed contaminants and admixtures from the water. Desalination of seawater and brackish groundwater is often the way to obtaining drinking water. Significant improvements in technology and design of reverse osmosis, the availability of alternative energy sources, the possibility of pretreatment and applied materials have caused the process to become environmentally-friendly source of fresh water in many regions of the world, particularly in those where their sources are limited. Nanofiltration and to some extent the reverse osmosis are the methods of water softening, as well as to remove disinfection by-products precursors and micropollutants. To remove inorganic micro-pollutants (nitrate, fluoride ions, boron, arsenic as well as chromium and heavy metals), nanofiltration, reverse osmosis, electrodialysis and Donnan dialysis, and ultrafiltration enhanced with polymers and surfactants as well as membrane bioreactors, have been successfully applied. Use microfiltration and ultrafiltration in the water purification processes, meet essentially the latest regulations, that dictate the need to more effectively remove turbidity and colloids (e.g., Fe and Mn) and micro-organisms in the treatment process based on conventional filtration. High pressure membrane processes (RO and NF) are an effective method for removal of soluble organic compounds (DOC) in the treatment of natural waters. Natural organic matter (NOM), anthropogenic organic pollutants and disinfection by-products, covering part of the NOM, and other micropollutants are typical examples of such compounds. To anthropogenic micropollutants found in waters count polycyclic aromatic hydrocarbons (PAHs) and surface-active substances as well as disinfection by-products and chemical oxidation used in the treatment of drinking water. In the processes volatile trihalomethanes (THM), and non-volatile compounds, mainly halogenacetic acids (HAA), are formed. In recent years special attention in natural waters is paid onto Pharmaceutical Active Compounds (PhACs) and Endocrine Disrupting Compounds (EDCs) which have biological activity. ECDs include a wide range of micropollutants, namely xenoestrogens, among which are the chlorinated pesticides, phthalates, alkylphenols, polychlorinated biphenyls, and the female sex hormone, synthetic pharmaceuticals (e.g., contraceptive components) and other chemicals and substances produced by man and put into the environment. Scarcity of water, environmental requirements and the simple logic of reusing water instead of discharging it are conditions, which call for increased use of membrane technology in a multitude of applications.

Keywords: Microorganisms removal; Removal of inorganic compounds; Water desalination and softening; Membrane processes; Removal of organic micropollutants; Natural waters

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