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ROZPRAWA DOKTORSKA

WYKORZYSTANIE OZONU W DEZYNFEKCJI I PODNOSZENIU BEZPIECZEŃSTWA EKSPLOATACJI SIECI WODOCIĄGOWEJ

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10. STRESZCZENIE W JĘZYKU ANGIELSKIM

Maintaining biologically and chemically stable water at the outlet of the water treatment plant before being pumped into the extensive water supply network ensures proper selection and operation of technological processes of water purification, appropriately selected to the quality of the water taken from the environment. The applied technologies guarantee that the parameters of the water supplying the distribution system meet the requirements of the applicable regulations, which is one of the basic factors ensuring the safety and continuity of water supply to the consumer. However, due to the fact that water supply systems are technical systems operating in a dynamically changing environment, high-quality water pumped into the water supply network changes its composition before it flows out of the consumer's tap. The common phenomenon of secondary water pollution in the water supply network is mostly visible in large water supply networks. Oversized diameters of pipelines, old networks susceptible to corrosion, made of steel or cast iron and random failures often cause water quality parameters to be exceeded, both bacteriologically and physiochemically. Moreover, the biofilm remaining inside the pipes is also one of the factors deteriorating the quality of drinking water. Situations of secondary water pollution in the distribution system cause interruptions in its supply to the customer which will result in a need to take corrective actions. The above-mentioned situations also contribute to the deterioration of the image of companies responsible for water supplies. In these circumstances, water supply companies take measures to optimize the water supply process on a system scale interpreted as water and water supply management, as well as on the scale of water facilities and devices in order to minimize the risk of poor-quality water supplied to the consumer. Taking into account all rational and economically justified preventive measures, it is impossible to fully secure the operation of a water supply system that gives full protection against the potential possibility of changing the composition of the water supplied to consumers.

Therefore, counteracting situations that generate secondary water pollution has become of utmost importance for the water supply companies nowadays as well as implementing emergency procedures that will reduce the time of the water supply interruptions to an absolute minimum in order to increase the security of water supply for people. The assumption of the research carried out as a part of this PhD thesis was to demonstrate the possibility of using a mobile SPID device producing degassed high-ozonized water injected into the pipeline in case of microbial secondary contamination of water in order to restore water supply to the consumer in the shortest amount of time.

The tests were carried out in 3 stages including laboratory tests, fractional-technical tests and real network tests:

- The aim of the research was to determine the time of ozone decomposition in distilled water which was a reference point for the interpretation of the results obtained throughout the entire research cycle. The time of ozone decomposition was also studied in real tap water and also in water inoculated with selected bacterial cultures. These studies show whether water pH and its salinity influences the effectiveness of water disinfection with ozone.
- In the second stage of research on a fractional-technical scale, the research was carried out on two model systems. The first system was an old, corroded cast iron pipe, obtained from the water supply network during the renovation works, covered with both mineral and organic deposits. The second test system was a new pipe system made of PE. The aim of the research was to determine the effectiveness of the removal of selected pathogens depending on the pH and chloride concentration under conditions reflecting the functioning of the new and existing water supply network.
- In the third stage of the research carried out on the actual water supply network, in the first part, the effectiveness of removing microbiological contamination in the newly commissioned water supply network was determined. In the second part, the effectiveness of ozone as a disinfectant was tested in recorded, actual situations of microbial contamination of water during its transport to the consumer. The tests were carried out on pipes made of various materials, i.e. cast iron, PE. The purpose of these studies was to determine the effectiveness of removing microbial contamination from water and to determine the optimal length of time needed to restore water supply to the consumer after an incident of microbial contamination.

On the basis of the three-stage research the high efficiency of degassed highly ozonized water produced in the mobile SPID device was proven to deactivate bacteria present in tap water. The short time of removing contaminants, e.g. coliform bacteria from the level of 200.5 NPL/100 ml to 0 NPL/100 ml in a few minutes shortens the time of interruptions in the supply of water to the consumer compared to the use of e.g. sodium hypochlorite. These studies confirmed that shortening the time of interruption in water supply increases the security of water supply.

An integral element of the research work was the development of a water network ozonation procedure with the use of a mobile SPID device. The conducted research shows that the use of the SPID device for the production of highly ozone water allows to increase the security of water supply through short interruptions in water supply. As far as exceeding water parameters are concerned,

compared to the use of sodium hypochlorite, the SPID device maintains the biological and chemical stability of water and also guarantees safety of the employees.