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Biological Stability of Water after the Biofiltration Process

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ABSTRACT
One of the most frequently implemented processes in the water treatment technology is filtration through a biosorption bed. The techniques based on biochemical processes involving bacteria result in obtaining high quality of water. There are a number of different materials used as the filler material for biological filters. Carbon deposits are the most popular, due to their high effectiveness. The problem with the use of this process is the leaching of microorganisms from the biofilm and the biological stability of water thus obtained. There is a need to develop quick methods to assess the microbiological quality of this water. Modern techniques for determining the amount of microorganisms, such as flow cytometry and luminometry may be the right tools. The water collected for testing came from the Water Treatment Station located in the Podkarpackie voivodeship. The microbiological tests carried out in the analyzed water samples collected after the filtration process on granular activated carbon. Both traditional culture method and modern techniques used to determine the number of microorganisms (flow cytometry, luminometric ATP assay) demonstrated an increase in the number of microorganisms in the examined waters (in the water after the filtration process and in the water introduced into the water supply network) after the incubation process for 3 and 7 days at 15 and 22°C.

Keywords: biofiltration, microbiology of water, biological stability of water, flow cytometry

INTRODUCTION

The mechanism of water purification using a biosorption bed is a complicated process. It consists of a series of changes on a physical, chemical and biological basis. In addition, the water treatment technology based on this type of deposit involves the physicochemical (adsorption, flocculation) and biochemical (nitrification, denitrification, biodegradation) processes. They occur with the involvement of the enzymes transferred with the help of a biological membrane. The groups of organisms present in the deposit are responsible for all of the processes. They are characterized by an extraordinary sensitivity to thermal fluctuations and physicochemical parameters of water. All of the changes occur directly in their cells as well as in the pores and channels of the filling material. Their number depends on the season and time of operation of the bioreactor [Papciak, 2011].

The implementation of the biotechnological purification mechanism offers many other benefits. It allows, among other things, elimination of micropollutants of organic and inorganic origin from water. This results in the removal of the causes responsible for the variability of water's biological stability. In addition, it reduces the risk related to the multiplication of colonies of individual microorganisms in the devices used for water treatment and distribution. Introduction and application of biotechnological methods offers the opportunity to reduce the demand of the treated water for disinfectants, e.g. chlorine. This also enables to reduce the possibility of side products resulting from the disinfection process [Tchórzewska-Cieślak, 2017].

Directly during the filtration process, a large number of microorganisms is introduced into the filter surfaces, along with the treated water. Most of them remain on the surface of the material that fills the filter, and when the facilities are cleaned, they are removed outside. The remaining microorganisms infiltrate into the filter, contributing to the formation of a coating that increases