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FACTORS AFFECTING WATER QUALITY IN A WATER SUPPLY NETWORK

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ABSTRACT
An effect of factors determining water quality in the water supply network in Kraków is assessed. The data collected over a four-year research period included quality parameters of water taken from the water distribution system in the period between 1 January 2011 and 31 December 2014. In the analysis the supply zones of four municipal water treatment plants in Krakow were considered. The selection of 29 water sampling points within the supply area allowed comparing water quality with respect to operational and technological aspects. Factor analysis enabled 4 components explaining correlations between tap water quality variables to be distinguished. It follows from the research performed that the obtained factors applied to 77% of overall water variability. The highest share was assigned to factor 1 that explained 32% of the chemical composition of water under consideration and was correlated with calcium, conductance, nitrates (V), magnesium and to a moderate extent with ∑ THM (with negative sign).

Keywords: factor analysis, secondary contamination of water, water supply network, water quality

INTRODUCTION

In water distribution systems both physicochemical and microbiological indices can change. There are a lot of factors that have an effect on secondary contamination of water that can be supplied to consumers. The type and intensity of processes occurring within water supply systems decide on the form of contamination (suspended, colloidal or dissolved). However, the type of concentration of contaminants penetrating into water depend on the amount and chemical composition of deposits in a water supply system, the number and kind of microorganisms living in biofilms, microbial metabolic pathways, biochemical processes and stability of flowing water [Kowal and Świderska-Bróż 2009, Pierścieniak 2009].

Chemical and microbiological stability of water in distribution systems is affected by the raw water quality [Jachimowski 2016] and reliability of treatment processes. Therefore, the main problem of all water supply systems is the loss of water stability during the transmission from water treatment plant to customer [Łomotowski 2007, Kowal and Świderska-Bróż 2009].

Water is considered as chemically stable when it does not cause the precipitation of deposits, mainly calcium carbonate ($CaCO_3$) [Świderska-Bróż and Wolska 2006, Biłozor et al. 2010]. The main indicators of contamination for chemically unstable water in the water distribution system are total iron and related turbidity, colour and the use of free chlorine [Świderska-Bróż i Wolska 2005]. However, biologically stable water does not support microbial growth. This is connected with the lack of organic and inorganic nutrients enabling microbial growth [Świderska-Bróż 2003, Świderska-Bróż and Wolska 2006, Kowal and Świderska-Bróż 2009, Biłozor et al. 2010].

Secondary bacterial growth in the water supply system imposes high doses of disinfection agents to be used to inhibit microbial growth. This is why the kind and concentration of disinfectant used depend on the number of microorganisms