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THE VARIATION OF THMs CONCENTRATION DEPENDING ON THE SURFACE WATER QUALITY PARAMETERS

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Introduction

Monitoring the content of trihalomethanes in a water treatment plant is a very important stage. The concentrations vary depending on several chemical parameters of the surface water used for treatment, but also on certain chemical parameters related to the technological process. The THMs are formed in the most important stage in the process that ensures the quality of drinking water from a microbiological point of view (the disinfection stage).

In this study, it is desired to demonstrate the variation of THMs concentration depending on the surface water quality parameters like pH, organic matter, total organic carbon (TOC) and some other chemical parameters that are related to the technological process like chlorine dose that is used in the disinfection stage and the correlation using an empirical equation between the predicted values of THMs and the one determined by gas chromatographic technique.

Materials and methods

The determination of THMs in drinking water using gas chromatographic technique [1] was performed using the gas chromatograph HP 7890 with MS5975C Agilent, and the system was verified with RESTECK individual standards for THMs.

Results and conclusions

The reaction sequence of THMs formation suggests that the pH would have a strong effect on THMs formation. This effect has been illustrated in the present study where it is observed that THMs concentrations increase with increasing pH as shown in Figure 1.

The study showed that there is a nearly linear relationship between chlorine dose and the concentration of THMs produced. When enough chlorine was consumed satisfying both the immediate and short-term organic chlorine demands, a long-term chlorine residual is obtained, and any further increase in THMs formation with chlorine dosage is small. The formation of THMs is strongly dependent on the amount of naturally present humic substances (Humic and Fulvic acid, TOC). The study showed that the concentration increases with increasing TOC in presence of free chlorine residuals. In this study, in order to describe the mechanisms of THMs formation, an empirical equation model [2] was used to predict the concentration of THMs as function of the various parameters under consideration.

As conclusion, the empirical equation showed a big correlation between the predicted values of THMs and the one determined according to [2] and can be used to determine the concentration of THMs in a much shorter time than a normal chromatography analysis using only the quality parameters of the safe water and the chlorine dose established in the disinfection stage.

$$THMs = 105{,}4958t^{0{,}22705}(6{,}721 - 1{,}733pH + 0{,}135pH^2)T^{0{,}00665T}0{,}59^{Cl_2}Cl_2^{1{,}3588}TOC^{\frac{0{,}99}{TOC}}Br^{1{,}69}$$

The fit of the data predicted by this correlation to experimental data is demonstrated in Figure 2, with correlation coefficient of 0.9726.

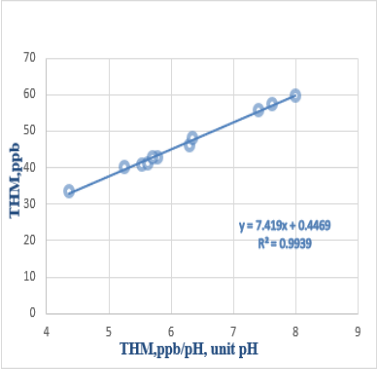

Fig. 1. Effect of pH on TTMs formation

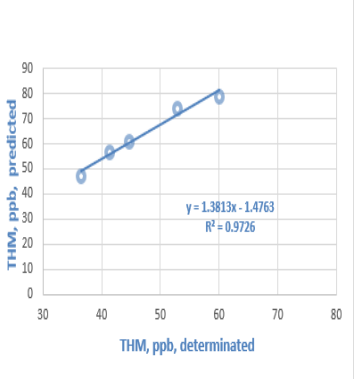

Fig. 2. Comparison between determined THMs concentration and predicted data

All the results showed that an increase in the value of any of these parameters has positive effects on the formation of THMs.

References

[1] STAS 12997-91: Determination of trihalomethanes content [in Romanian].
[2] Motasem Saidan, Khaled Rawajfeh, Manar Fayyad, American Journal of Environmental Engineering, 2013; 3(5): 207-212, 10.5923/j.ajee.20130305.02.