THE RESEARCH OF THE PHYSICO-CHEMICAL PARAMETERS OF WATER TREATED WITH SONIC TECHNOLOGY

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Abstract: *The sonic technology consists in using a installation with an ultrasound generator that induces simultaneously in water during operation an air-jet and ultrasound that influence the physical and chemical characteristics of the water. In order to asses the water quality status, were determined by the basic physico-chemical indicators of treated water, namely the dissolved oxygen, the turbidity, the pH, the content of nitrates, nitrites and ammonia. The paper presents the installation design for sonic treatment of water, the ultrasound generator, the working methodology and the effects of the sonic technology on the water characteristics.*

Keywords: *sonic technology, turbidity, dissolved oxygen, nitrate*

1. INTRODUCTION

The sonic water treatment implies the use of the ultrasound generator at certain working parameters: pressure with corresponding frequency and intensity, and treatment duration. During the sonic treatment, the ultrasound generator induces into the water mass the aeration, produced by the pulsating working air jet, and degassing, produced by ultrasound cavitation.

The cavitation process appears at propagation of ultrasound in liquid and it is produced by the high intensity acoustical waves [1].

2. THE INSTALLATION FOR WATER SONIC TREATMENT AND THE APPLIE D METHODOLOGY

The experimental installation (Fig.1) use as working agent for generating the ultrasound compressed air from a compressor with supply pressure $6 \div 8$ bar [2]. The pressure is reduced by passing through a pneumatic gear at the value of $1 \div 4$ bar needed for the generator's operation. A manometer controls the air consumption and the generator operation pressure and a valve adjust the inlet air pressure.

Fig. 1. The installation for water sonic treatment

The ultrasound generator is located inside a working tank with the water sample and it produces bubbling and ultrasound waves in the water mass.

Fig. 2. The ultrasound generator inside the water sample tank

The methodology of work consisted in using a raw water sample of one liter, a treating time in the range 5÷40 seconds and a working generator's pressure of 0,4 MPa with the corresponding frequency of 27,2 kHz and acoustic intensity level of 131 dB [3]. It was studied the influence of the duration sonic treatment on the water indicators at two different temperature namely 16^0C and 21^0C. The water parameters were determined according to the current Romanian Standards.

3. THE INFLUENCE OF THE SONIC TREATMENT DURATION ON THE WATER CHARACTERISTICS

The study compared the water indicators of the raw water and the ones of the water treated with the ultrasound generator in the above mentioned conditions. The water turbidity (Fig.3) shows an important decrease after 5 second of sonic treatment for both water temperatures, after which increasing treatment time the turbidity is almost constant.
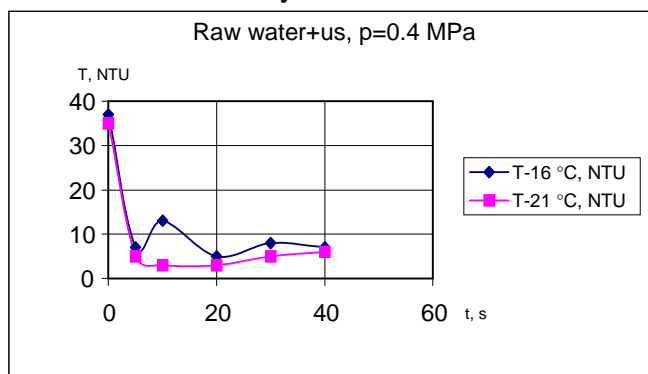
The water pH (Fig.4) is constant at the higher and different temperature with about one unit at 10 seconds, respectively 40 seconds of treatment at the lower water temperature.
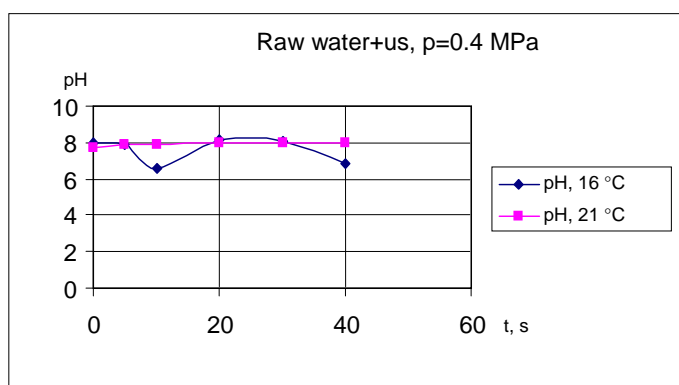

Fig. 3. The turbidity variation depending on water treatment duration

Fig. 4. The pH variation depending on water treatment duration

The dissolved oxygen (DO) content is with 4 mg O_2/l higher at 16^0C temperature than the one from the other water temperature considered (Fig. 5). But in both cases the dissolved oxygen content grows at 5 seconds and slightly decreases at 10 seconds of treatment.
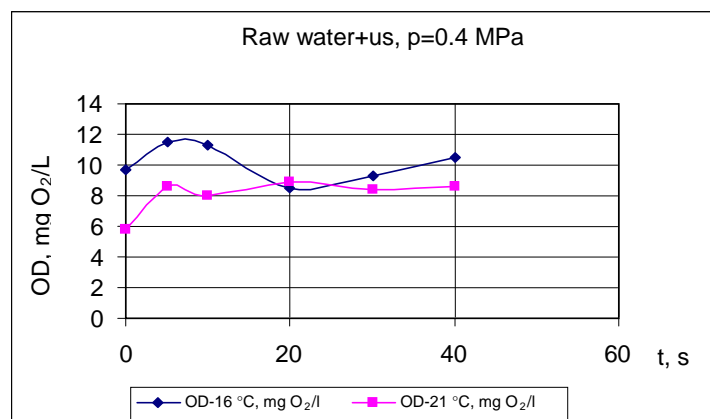
Fig. 5. The dissolved oxygen variation depending on water treatment duration

After that, the DO variation in time at the higher water temperature is almost constant, while at the lower temperature, DO decreases till 20 seconds and then grows back with about 2 mg O_2/L.

Although it has a low content, the nitrates (Fig. 6) show an upward trend at the lower water temperature and a minimum value at 20 seconds and 40 seconds of treatment at 21°C.
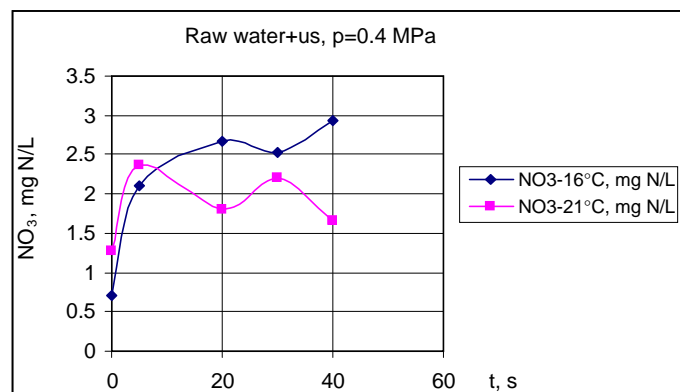

Fig. 6. The nitrate content variation depending on water treatment duration

The nitrite content (Fig. 7) is also very low, but one can notice a minimum value at 5 seconds of treatment followed by a ascending tendency at the lower water temperature and a descending trend till 20 seconds of treatment followed by a slight increase.
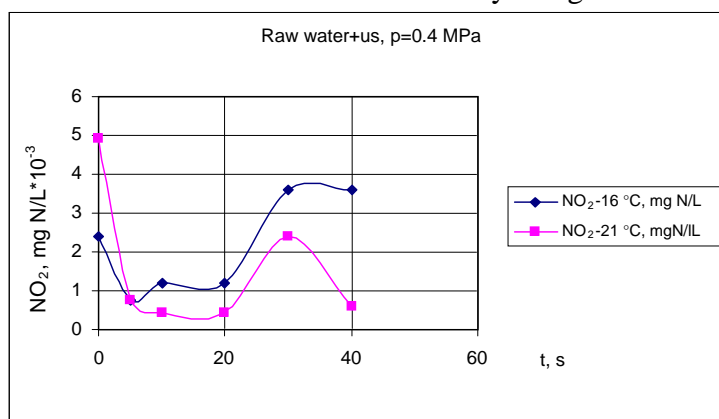

Fig.7. The nitrite content variation depending on water treatment duration

The ammonia content (Fig. 8) has also a low value and it decreases after the first 5 seconds of treatment at both water temperatures. After that, the variation is almost constant at

the lower temperature, while in case of higher temperature the ammonia slightly decreases at 10 seconds and than grows back with increasing treatment time.

The aim is to obtain lower values in the water for the three forms of nitrogen: nitrate, nitrite and ammonia, because they represent a danger for the human health and also are toxic for the aquatic environment.
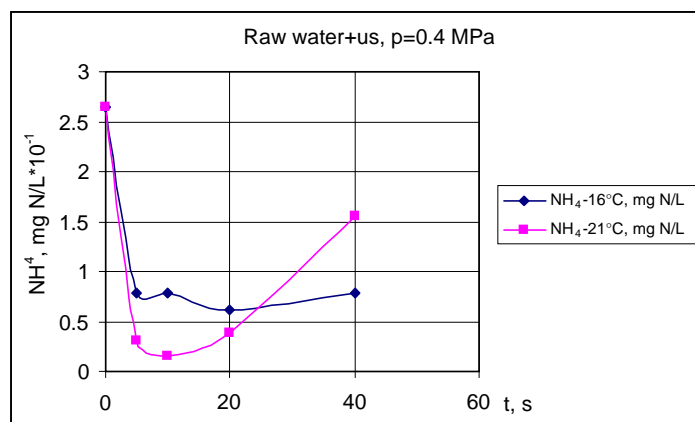

Fig. 8. The ammonia content variation depending on water treatment duration

4. CONCLUSIONS

The main conclusions that follow the results from the above graphics are:
- the best value for water turbidity is obtain at 5 seconds of sonic treatment regardless the temperature;
- the pH of the water might be influenced by the treatment time with about a pH unit in terms of reduction its value;
- the highest value for the water dissolved oxygen content is obtain at 5 seconds of sonic treatment regardless the temperature;
- the nitrate content is lower at higher temperature and under the influence of treating time has the smallest value at 40 seconds of sonic treatment;
- the nitrite content is also lower at higher temperature and it is influenced by the treating time by obtaining low values at 5, 10, 20 and 40 seconds of sonic treatment;
- the ammonia content is influenced by the treating time regardless the temperature and were obtained the lower values at 5, 10 and 20 seconds of sonic treatment.
The results show that the water characteristics are influenced by the treatment time and temperature of the water, and the study might indicate the duration treatment required to enhance or decrease the values of the physicochemical water indicators.

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