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Improvement of water preparation technology for the production of alcoholic beverages of stable quality

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Introduction. Prepared water makes it possible to increase the stability of alcoholic beverages during storage [1-3], increase the sensory properties of alcoholic beverages, and reduce their cost price [1]. Water prepared for the production of alcoholic beverages must be prepared in accordance with technical conditions [2]. Most often, three types of prepared water are used for the production of alcoholic beverages: drinking water; water is softened due to *Na*-cationization; water is demineralized by reverse osmosis [3]. For the production of alcoholic beverages, electrochemical activation is used as an alternative method of water preparation [2]. Electrochemical activation ensures: destruction of microorganisms and complete disinfection of water; effective removal of toxic elements and compounds; removal of excess concentrations of salts; water mineralization level management; directed change of redox potential and increase of biological value of water [2].

Materials and methods. Based on the results of experimental and mathematical-statistical studies, internal dependencies between the parameters of the prepared water were established using Pearson's correlation coefficients, which measures the strength of the linear relationship between variables. The correlation coefficient can take a range of values from +1 to -1. Positive correlation coefficient means that if one variable gets bigger, the other variable also gets bigger, so they tend to move in the same direction. Negative correlation coefficient means that the variables tend to move in the opposite directions: If one variable increases, the other variable decreases, and vice-versa. When correlation coefficient is close to zero two variables have no linear relationship.

Results. In order to improve the technology of prepared water, a study of the physical and chemical indicators of drinking water was conducted; water softened by *Na*-cationization; water demineralized by reverse osmosis; electrochemically activated water and their mixtures.

The strongest correlations for pairwise correlation coefficients are in the range |0.60-1.00|. The mass concentration of sodium (*Na*) in water has relationships with total alkalinity (*TA*), mass concentration of silicon (*Si*)/silicic acid (H_2SiO_3), total solids (*TS*), with the corresponding pairwise correlation coefficients r – 0.82; 0.70; 0.70; 0.87 (Figure 1).

This is explained by the interaction of silicon and salts of silicic acid (silicates) in water, which are in dissolved and colloidal states, and sodium in water. During the storage of vodka, water washes sodium from the glass, which forms hydroxides, as a result of which the alkalinity of the solution increases and silicates are leached from the inner surface of the glass with the formation of insoluble sediments (sodium and calcium hydrosilicates).

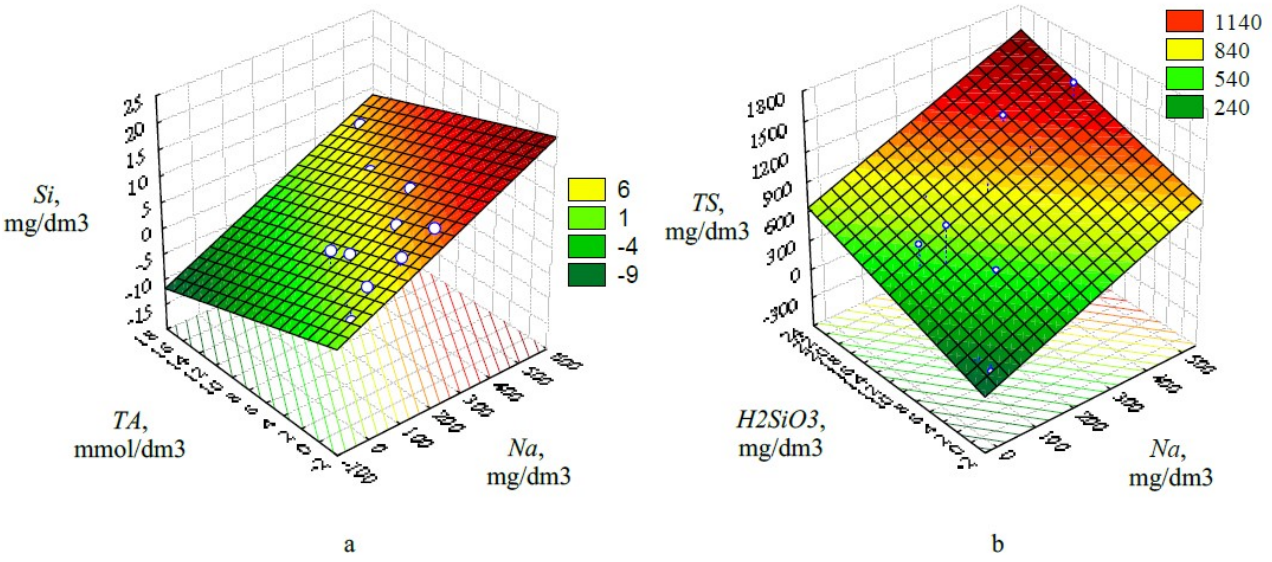

Fig. 1. Dependence of quality indicators of prepared water: a – mass concentration of sodium (Na) on total alkalinity (TA) and mass concentration of silicon (Si); b – mass concentration of sodium (Na) from the mass concentration of silicic acid (H_2SiO_3) and total solids (TS)

The effectiveness of electrochemical activation of prepared water, adapted to the technology of alcoholic beverages of stable quality, which involves the preparation of drinking water due to electrochemical activation, followed by *Na*-cationization, demineralization by reverse osmosis, was proven.

Conclusions. It was found that the sodium mass concentration of the prepared water affects the stability of alcoholic beverages during storage. To increase the stability of vodka according to the presented water technology, the following reduction occurs: the mass concentration of sodium (*Na*) by 23 times – from 266.1 to 11.6 mg/dm^3; total alkalinity (*TA*) by 21 times – from 4.1 to 0.2 mmol/dm^3; mass concentration of silicon (*Si*) by 13 times – from 6.5 to 0.5 mg/dm^3; mass concentration of silicic acid (H_2SiO_3) by 13 times – from 13.9 to 1.1 mg/dm^3.

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