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PRODUCTION OF ANTISEPTIC BORIC ACID

Abstract. To obtain antiseptic substances, boric acid must be synthesized from sodium tetraborate. The prepared 3% alcohol solution of boric acid can be used as an antiseptic solution to destroy bacteria and viruses, maintaining the health and cleanliness of people.

Keywords: boric acid, antiseptic solution, sodium tetraborate, bacteria, viruses.

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Introduction. In medicine, boric acid is used to prepare an antiseptic solution. Boric acid is obtained from sodium tetraborate. In addition, boric acid and borax are used to impregnate wooden structures to protect them from rotting and ensure fire resistance. Due to their antiseptic properties, boric acid and borax are used in medicine. They are also used as a preservative in the food industry.

Materials and methods. The following materials and methods were used in the study:

– Isolation of boric acid by the reaction of sodium tetraborate with sulfuric acid;

– Analysis of the resulting boric acid by chemical methods and IR spectroscopy;

– Preparation of an antiseptic solution by dissolving boric acid in a 3% alcohol solution;

– Determination of the refractive index of the prepared antiseptic solution by the refractometric method.

Research results and discussion. In the modern method of obtaining boric acid, borate flour is decomposed with sulfuric acid, as a result of which boron and magnesium enter the solution in the form of boric acid and magnesium sulfate. The solution is separated from the suspension by filtration. When the solution precipitates, boric acid crystallizes. Boric acid crystals are separated from the mother liquor by centrifugation. In this case, up to 20% of boric acid and magnesium sulfate remains in the mother liquor, the production of which is associated with additional costs.

Boric acid, used for medical purposes, is obtained from the natural mineral sodium tetraborate by reaction with solutions of sulfuric acids:

$$Na_2B_4O_7 + H_2SO_4 + 5H_2O = Na_2SO_4 + 4H_3BO_3 \quad (1)$$

Description of boric acid. Oily to the touch, colorless, transparent fine-grained white crystalline powder without odor. It dissolves well in cold and hot water. Soluble in alcohol (1:25), poorly soluble in glycerin (1:7). When heated for a long time to a temperature of 100℃, boric acid loses some water and turns into metaboric acid: $H_3BO_3 \longrightarrow HBO_2$ When heated to a temperature above 100°C, boric anhydride is formed in the form of a glassy mass.

$$H_3BO_3 \longrightarrow HBO_2 \longrightarrow B_2O_3 \quad (2)$$

The reaction of the formation of boron ethyl ether. The reaction with ethanol occurs in the presence of concentrated sulfuric acid. The mixture ignites and ignites with a flame with a green border [1,2].

$$HO - B - OH + 3C_2H_5OH \overset{H_2SO_4}{\longrightarrow} C_2H_5O - B - OC_2H_5 + 3H_2O \quad (3)$$

Prepare a 20% solution of sulfuric acid, add 5-6 g of sodium tetraborate salt to it, heat on an electric stove at a temperature of 30-40℃. Then cool the solution and filter through filter paper with a white ribbon. Pour the filtered solution into a glass and determine its concentration by refractometric method.

Preparation of a boric acid solution and its solubility are determined by refractometric method (Table 1). Concentration in a 100 m^3 measuring flask – 0.5; 1.0; 1.5; 2.0; 2.5; 3.0; 3.5; 4.0; 4.5; A 5.0% solution of boric acid was prepared. The refractive index of the prepared solutions was measured on a refractometer [3].

Table 1

Results of measurements on a refractometer

Concentration of boric acid C, %	Refractive index, n
0.5	1.3326
1.0	1.3328
1.5	1.3332
2.0	1.3336
2.5	1.3338
3.0	1.3342
3.5	1.3346
4	1.3350
4.5	1.3350
5.0	1.3350

The table shows that depending on the solubility of boric acid, boric acid does not dissolve completely in 4.5-5.0% percent samples, when the refractive index reaches – 1.3350, it shows a concentration of 4.0% solution. This is the limit of solubility of boric acid in the solution, after which a precipitate forms in the solution and the solubility begins to decrease. At the same time, boric acid hydrates begin to form.

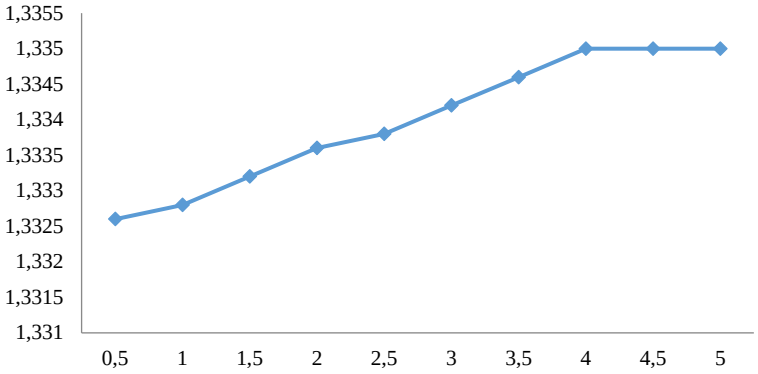

Fig. 1. Boric acid concentration versus refractive index

The X-axis shows the concentration of solutions, and the Y-axis shows the refractive index values of solutions.

As can be seen in Figure 1, when the refractive index value of solutions along the Y-axis is – 1.3350, the concentration of the total solution is 4.0%, and then it is clear that the solubility of the solution decreases. gradually.

Study of boric acid solution in an infrared Fourier spectrophotometer.

The FSM 1201 IR Fourier spectrometer is a laboratory spectrometer used to determine the middle and near IR range. The FSM 1201 IR Fourier spectrometer is used to analyze samples in various aggregate states (solid phase, liquid, gas); it is designed to determine the qualitative and quantitative composition of the substances being studied.

The figure below shows the IR spectral lines of boric acid formed as a result of the experiment.

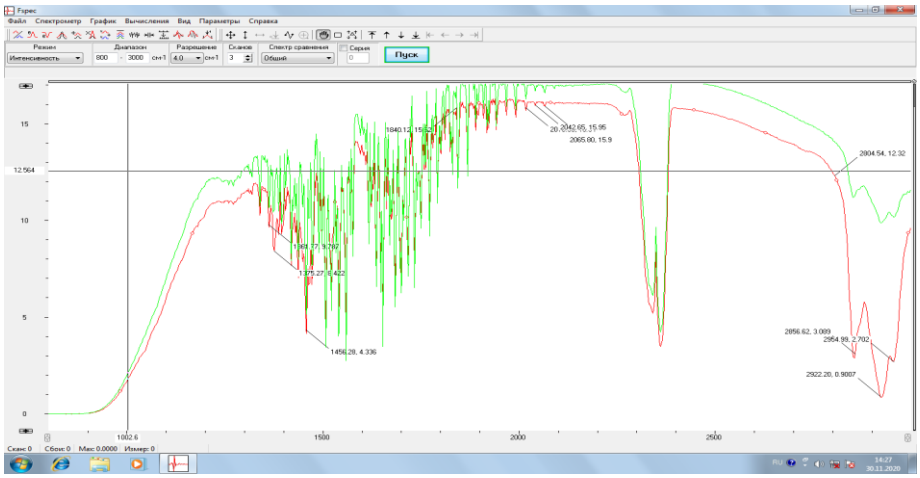

Figure 2. IR spectral lines of boric acid

Weak visible lines are formed at 1361 cm^{-1}, 1375 cm^{-1}, an intense line at 1456 cm^{-1}, weak lines at 1840 cm^{-1}, 2042 cm^{-1}, 2065 cm^{-1}, 2804 cm^{-1}, a line of medium intensity at Boric acid corresponds to the intensity line 2856 cm^{-1}, 2954 cm^{-1}, 2922 cm^{-1}. As a result of the experiment, adding sodium tetraborate to a solution of sulfuric acid and analyzing the synthesized product by chemical,

physicochemical methods, it was found that boric acid is formed in it. The chemical study was supplemented by the results of determining the resulting solution on an FSM 1201 IR Fourier spectrometer. Therefore, if you mix the resulting boric acid with 3% alcohol, you can get an antiseptic solution for viruses, bacteria and harmful insects. Boric acid can be used in medicine as an antiseptic and in the form of an ointment.

Conclusion. Due to their antiseptic properties, boric acid and borax are used in medicine. They are also used as a preservative in the food industry. The prepared 3% alcohol solution of boric acid can be used as an antiseptic solution to destroy bacteria and viruses, maintaining the health and cleanliness of people.

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АНТИСЕПТИЯЛЫҚ БОР ҚЫШҚЫЛЫН АЛУ

Аңдатпа. Антисептикалық заттарды алу үшін натрий тетраборатынан бор қышқылын синтездеу керек. Дайын болған бор қышқылына алдын ала дайындалған 3% спирттік ерітіндісін араластырып ерітінді дайындауға болады. Бұл ерітіндіні бактериялар мен вирустарды жою үшін антисептикалық ерітінді ретінде адамдардың денсаулығы мен тазалығын сақтауға себебін тигізеді.

Тірек сөздер: бор қышқылы, антисептикалық ерітінді, натрий тетраборатты, бактериялар, вирустар.

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ПОЛУЧЕНИЕ АНТИСЕПТИЧЕСКОЙ БОРНОЙ КИСЛОТЫ

Аннотация. Для получения антисептического вещества – борной кислоты – необходимо синтезировать из тетрабората натрия. Приготовленный 3%-ный спиртовой раствор борной кислоты можно использовать в качестве антисептического раствора для уничтожения бактерий и вирусов, поддержания здоровья и гигиены людей.

Ключевые слова: борная кислота, антисептический раствор, тетраборат натрия, бактерии, вирусы.