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Development and Validation of New Methods for Concentration of Vegetables and Fruit Juice

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ABSTRACT: Evaporation, when the juice is heated in vacuum in the appropriate trays, but this heat does not reach the boiling point, since during the boiling process all the useful substances will be destroyed. Currently, juice concentrates are produced by separating the water from the fresh juice. One of the following methods is used for the production of juice concentrates: evaporation of the freezing water or of the diaphragm method. The article represents the use of a new method developed for the production of juice concentrate, in which the water does not move away, but the water itself provides the production of the freezing process, repeating the evaporation completely, except of the temperature parameters. The water moves away under the action of cold. The diaphragm method, when the juices pass through the membrane with the smallest membrane holes. The mixture, obtained after evaporation, is similar to the most viscous jam, honey or thick syrup. Water infiltrations and large molecules of other juice substances remain. All these methods are connected to high expenses.

Keywords: Phased systems; aqueous solutions; separation; Hydrogen electrolysis gas bubbles and Juice concentrates.

INTRODUCTION: Evaporation, when the juice is heated in a vacuum in the appropriate trays, but this heat does not reach the boiling point, because during boiling all the useful substances will be destroyed.[1] Currently, concentrated juice is produced by separating water from fresh juice. For the production of concentrated juice, one of the following methods is used: the evaporation of the water or diaphragm freezing method. The freezing process repeats evaporation completely, with the exception of temperature parameters. The water moves away under the action of the cold.[2]

The diaphragm method, when the juices pass through the membrane with the smallest membrane holes. Water infiltrates and remains large molecules of other substances of juice.[1] The mixture, obtained after evaporation, is similar to the most viscous jam, honey or thick syrup. All these methods are connected to high expenses.

The developed method allowed to produce the concentration of the smaller particles in such a way that the water did not move away, but the water itself provides the collection (concentration) of these particles. According to Shoikhedbrod, 2017[3] a new method was shown to separate the smaller solid particles from the aqueous solutions and collect these particles as a high concentrate in the special receiver. Furthermore, the use of the developed method has demonstrated the high efficiency of waste water purification of juice production technologies. The document demonstrates the use of the developed method for a fast and economic juice concentration.

MATERIAL AND METHOD: The different juice productions of this plant were used: orange, apple and mango. The method was tested at the Ganir plant.

Method and developed devices: Therefore, the main task of concentrating the juice is reduced to the separation of these fresh juice microscope components and collecting their high concentration on the special receiver. Under the action of the electric field on fresh juice, negatively charged hydrogen bubbles form on the cathode[4]. The size of negatively charged hydrogen bubbles can be controlled and can be so small, as this requires the technological process of juice concentration. Fruit juice with all the main components inside the water presents precious microscopic particles composed of sucrose, sugar and acid. A completely new technological process of juice concentration has been developed, which uses the action of direct cur-

rent (direct current) on fresh juice.[3] The use of negative charges with calculated dispersible hydrogen bubbles can solve the main task of the technological process of concentration of juices, connected to the separation of microscopic particles of fresh juice, creating a strong hydrogen complex bubbles + precious microscopic particles of the solid component of the fresh juice in the process of floating elementary act.

After the formation and detachment of the cathode surface, the negative bubbles loaded with hydrogen increase in the juice; they are in the process of microscopic particles of precious solid component juice from considerably larger than a bubble and the bubbles induce positive charge in the area of the microscopic particle of solid material[5]. For the implementation of the developed juice concentration method, electroflotador special laboratory, whose common way is illustrated in Figure 1. As a result the attraction of opposite charges developed bubbles adhere to the microscopic particle, forming a strong contact, and the volume of the complex microscopic + hydrogen bubbles formed is increased strongly, and bubbles under the action of force considerably increased complexes Archimedes particles microscopic particles + hydrogen with greater speed to float above.

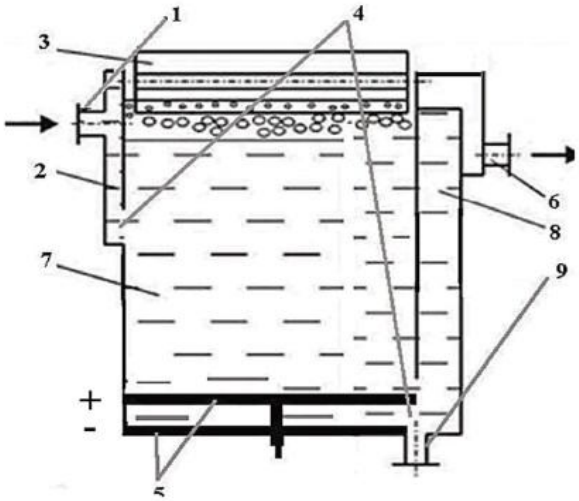


Figure 1: The common form of laboratory electroflotador.

The special laboratory electroflotador presents the cylindrical container from the special electroflotador laboratory has Plexiglas cylindrical container with an inner diameter of 2,0 cm, a height of 11 cm, the bottom (with a square S = 3,8 cm 2) It is made of stainless steel and serves as a cathode. The anode made of stainless steel in the shape of a ring, fixed at a distance of 5 mm from the cathode. The electroflotador was provided by manual separator on top of electroflotador of concentrated juice collection, obtained during the concentration of fresh juice in the receiving manifold. The volume, which fills the electroflotador with fresh juice, was about 40 cm^3. Therefore, the construction of the electroflotador of this form is an electroflotador of discrete action[6]. The tests were performed in the discrete and discontinuous regime. Fresh juice in the juice concentration process was filled by the top of the electroflotador. During the test, concentrated juice, using a manual separator, collected in the receiver manifold, and the remaining juice water was obtained through the valve electroflotador pin, located at the bottom of the electroflotador[7]. To carry out the concentration of the continuous action juice, the following electroflotador (Figure 2) was constructed.

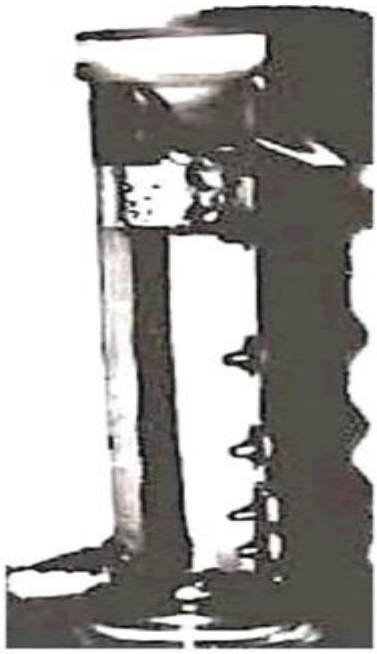


Figure 2: Electroflotador of continuous action for the juice concentration.

The electroflotador developed structurally for the continuous concentration juice you find thrust chamber - 7, whose angles are provided by the special inserts, following which, the inner part of the chamber takes the form of the cylinder and the upper wall. The back is supplied by the reflector. Encountered rectangular capacity, in the process of concentration of juice, fresh juice is inserted the pan - 7 through the tube crane 1, 2 and the pocket space 4, to carry out the separation of precious microscopic particles of fresh juice. The basic element of electrolyte electroflotador refers - 5, made as a plug and a special mechanism to simply adjust the size of the distance between the electrodes[8]. The anode was produced from corrosion-resistant metal lattice using the special construction,

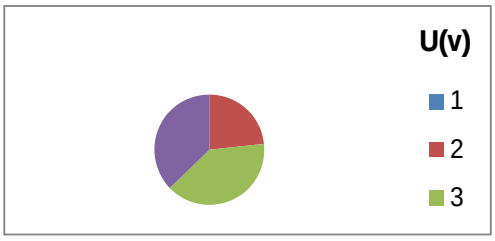
which is at the cathode that simply adjusts the size of the separation between anode and cathode. After completion of the cleaning of the electrofilter and the removal of all the remaining water, the branch pipe is supplied with the crane -9. The remaining water juice, after passing through the extra -8 cleaning chamber, away from the electroflotador pocket through the bypass line and the exhaust crane-6. The precious microscopic floating particles of juice are collected in the foam layer in the upper part of the chamber and removed from the pallet-3 device to the special receiving capsule. The cathode was produced from stainless steel and is mounted at the bottom of the chamber. The crane, during the electroflotador working process, is closed.

RESULTS AND DISCUSSION: During the electroflotador electrode tests, the DC voltage was supplied. The operating range of the composite DC voltage 60-90v. Test results are shown in Table 1 (I.R.D Laboratories). The tests were carried out at the Ganir plant (Israel). The tests were performed in the special discrete action laboratory electroflotador (Figure 1).

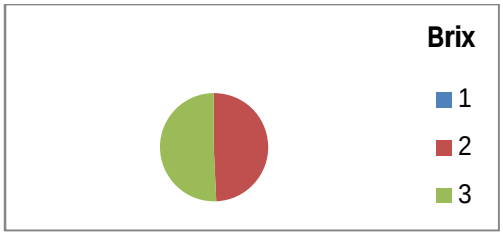
Table 1: The results of the juice processing method tests are concentrated in the electroflotador.

U(v)	Brix	Ascorbic acid, Mg/L	Pulp, %
50	66.0	13	8
85	68	13.7	11
80	64,8	17.7	13

Process time -18 seconds, Brix measurement for the mass ratio of sucrose dissolved in water at the ratio liquid, Ratio-sugar and acid in the concentrate.



(a)



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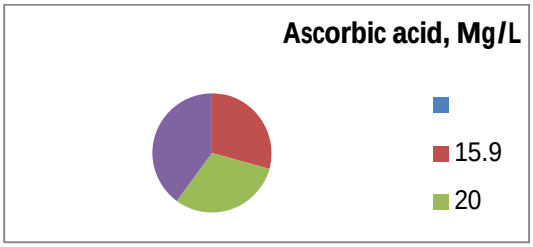

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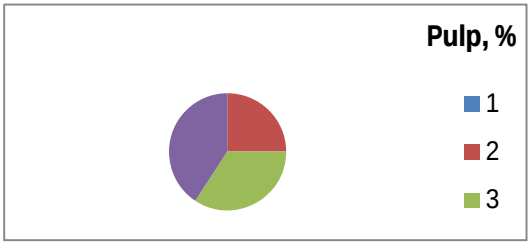

(d)

Figure 3: Above pie structures (a) to (d) showing results of electroflotador on different concentration.

It should be noted that the concentrate obtained is the concentrated juice foam which can be used to produce the hydrogen cocktail with various additives for fruit juices. It can be seen in Table 1 that the best results in obtaining high quality juice concentrates are achieved by the DC voltage at the 90v electrodes for determining the changes in the concentration parameters, which are shown in Table 1, It was decided to use the method developed for the purification of waste water, obtained after the general technological process in the plant[9]. It can be seen in Table 2 that Brix is decreased from 0.4 to 0.1 and the pulp from 2.5% to 0. It should focus on the COD parameter, which is the basic index of water contamination from organic matter. As can be seen from Table 2, after cleaning, the COD decreased from 7100 mg / l to 80 mg / l, which indicates the high efficiency of the application of the method developed for the purification of wastewater from this plant. The decrease in these parameters is explained by an increase in their content in the juice concentrate after cleaning. Table 2 presents the results of the waste water purification, obtained after completion of the general technological process at the Ganir plant (I.R. laboratories). COD (Chemical oxygen demand)-determines a quantity of organic pollutants in the water.

Table 2: Results of the purification of waste water of the plant Ganir.

	Brix	Pulp, %	COD, мг/л
Before cleaning	0.6	3.5	7300
After cleaning	0.3	0	82

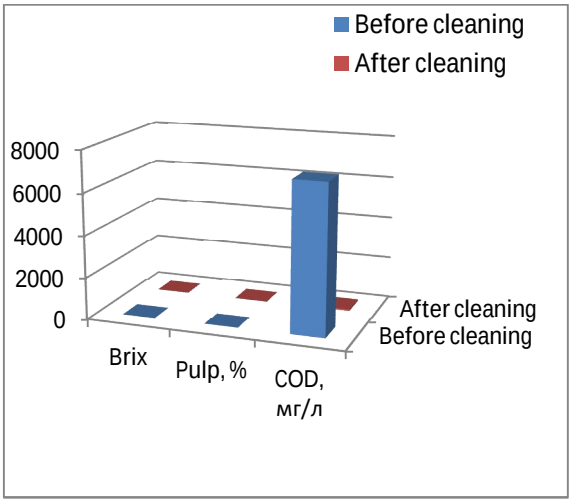

Figure 4: Graphical representation of results of Plant Ganir

CONCLUSION: The developed method showed the high efficiency of waste water purification of juice production technologies. The developed electrofilters make it possible to produce high quality juice concentrates and to clean wastewater with high efficiency in industrial practice. Therefore, tests of the developed juice concentrate processing method showed its high efficiency for the production of high quality concentrates. The method is simple, fast and economically advantageous (it does not require the application of evaporation, freezing and membranes).

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