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Experimental Study of Kiwi Juice under Sonication and Carbonation

N. Dizadji, P. Entezar,A. Afsari

Abstract**—**This paper focuses on the experimental impacts of ultrasonic, carbonate and a combination of them on the quality of fresh kiwi juice. Today, non-thermal methods like ultrasonic, which have imperceptible effects on some properties of the juice such as taste, flavor and color, are commonly used for killing microorganisms.In this paper, some properties of kiwi fruit juice under ultrasonic, carbonate and a combination of them has been researched. Those properties include pH, acidity, transparency and Brix. Its impact on microorganisms has been studied as well.The results show that using a combination of carbonate and sonicate make the cavitation more severe without a perceptible effect on non-activation of microorganisms.

Keywords**—**carbonate, juice, inactivation, ultrasonic

I. Introduction

NOWADAYS by necessity of energy consumption reduction, quality and health of food is an important issue in food industry. Usage of thermal treatment in food industry may result in reduction of nutritious since it spoils enzymes, proteins, and useful microorganisms. This method changes the taste and color and makes it undesirable [1].

Other methods which use in food industry are: membranous filtration [2], hydration[3], osmotic [4], electrolyze [5], [3].

One of the non-thermal treatments is ultrasonic cavitation which is well known as a method thatdoes not activate microorganisms [6]. This method is applicable for kind of foods like fruit juice [7].

In current paper we research the effects of ultrasonic on kiwi juice of Hayward variety in Iran.

II. Theory

Kiwi fruit is appropriate for juice purposes because 83% of it is water. Other continent of this fruit is glucose(2-6%), fructose (1.5-8%) and sucrose(0.2%) also it has pectin(0.17-0.18%), tannin(0.05-0.95%) and galacturonic acid (0.95%).

Kiwi is full of vitamin C and also it has vitamin A, B1, B2, B3 and contain high amount of potassium. Actinidin (0.2%) is one of important enzymes in this fruit this is kind of parser enzyme. This fruit has many varieties[8] but Hayward is must available in Iran.

N. D. Department of Mechanical Engineering, Science and Research Branch Islamic Azad University, Tehran, Iran (phone: +982144869724; fax: +982144869734; e-mail: ndizadji@srbiau.ac.ir).

P. E. Department of Chemical Engineering, Science and Research Branch Islamic Azad University, Tehran, Iran (e-mail: pegahent@yahoo.com).

A. A. Department of Chemical Engineering, Science and Research Branch Islamic Azad University, Tehran, Iran (e-mail: afsoon572000@yahoo.com).

To conduct the experiment ultrasonic device has been used. ultrasonic waves are sonic kind waves which cause high local temperature increase up to 5000 ˚K and also high local pressure from $10^2$to 10^4 Kpa in that region [9].

III. Material and method

A. Preparation of kiwi juice

In this study kiwi juice of Hayward variety has been used. This juice was extracted by using a home juicer and it has been refined with a strainer to remove pulps.

B. Experimental design

The experiment has been conducted on kiwi juice by using carbonation, sonication and combination of them. A comparison has been conducted between the results obtained from each method and primary conditions. This primary condition is called Control.

Kiwi juice has been divided into four separate units and they were kept in sterilized bottles under the temperature of 4 degree of centigrade. Each one of these units has been used as a sample in control, carbonation, sonication and combination of carbonation and sonication state.

C. Carbonate

Carbonation was performed by using Dry ice. In this method dry ice has been solved in kiwi juice with 1:1 ratio and in laboratory temperature. The dry ice which used in this experiment was supplied by Tehran's Alvand Gas factory.

D. Sonicate

Sonication operation has been performed by using a probe with frequency of 35 KHz; in Tehran's oil industry research center. Kiwi juice has been treated with sonication for 30 minutes.

Within the experiment, the temperature of the containers and also the juice has been controlled.

The sonicator device has been shown in Fig. 1.

E. Combination of sonicate and carbonate

Kiwi juice witch carbonated with sonicator device has been exposure to sonication.

Fig. 1 Sonicator device

IV. Evaluation Methods

To research the effects of carbonation, sonication, combination of both of them and its comparison with the control condition, different criterions including pH measurement, acidity indication, transparency and Brix and microorganisms analyses were employed.

A. pH

The pH meter, has been used to measure pH of 3 samples with 0.1 accuracy. PH meter is calibrated by using pH=4 and pH=7 buffers.

B. Acidity indication

One gram of kiwi juice with normal (NaoH) 0.1 sodium hydroxide and PH=8.2(±0.1) phenolphthalein is used as an indicator for the endpoint determination. Total acidity is calculated by using Malic acid formula, as a reference (1).

$$TA = \frac{V \times (0.1N \quad NaoH\ ) \times 0.067 \times 100}{m} \qquad (1)$$

Where TA is Total acidity, V is volume on the basis of ml and m is kiwi juice's gram.

C. Transparency

For measuring transparency, 40 ml of supplied samples of kiwi juice was centrifuged for 10 minutes and with temperature of 20 ˚C and angular velocity of 2500 rpm. Performing this operation provided us with a sample taken from lighter phase of liquid. The percentage of light passing 400 Nanometer to 1000 Nanometer wave length has been studied by using spectrophotometer (UV mini 1240 model). Distilled water has been used as machine calibration reference.

D. Brix

Kiwi juice's Brix is measured with a refractometer for each sample. The device has been cleaned with distilled water after each experiment.

E. Microorganism analysis

One ml of each samples have been enumerated by the pouring plate Technique under the microbial hood for measuring the bacteria with cultivation environment. The plates are kept in a 37 degree incubator for 48 hours.

Cultivation has been performed 3 repetitions in order to ensure the accuracy of results. Samples has been counted with a colony counter (Qallenkamr model) based on CFU.

V. Results

TABLE I
CALCULATION OF THE RESULTS FOR KIWI JUICE

Different conditions	Brix	Total acidity	pH
Control	15.3±0.1*	1.5±0.02*	3.47±0.05*
Carbonated	15.6±0.1*	1.6±0.04*	3.45±0.03*
Sonicated	15.2±0.1*	1.5±0.02*	3.47±0.04*
Combination of carbonated and sonicated	15.4±0.1*	1.7±0.05*	3.43±0.01*

* It could be mentioned that each stage was repeated for three times and the average of each column is not significantly different from each other.

Results of carbonate, sonicate and combination of this two method in comparison with control has been shown in Table I.Also the transparency scale is measured with spectrophotometer and it is shown in Fig. 2.

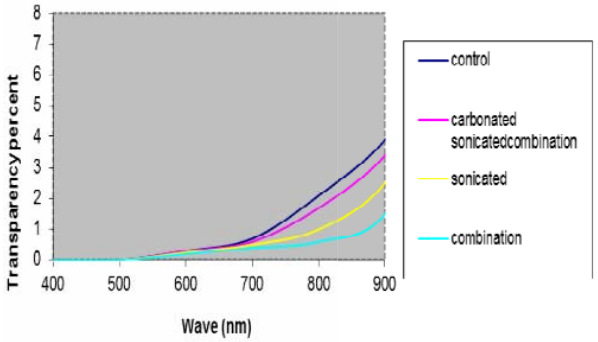

Fig. 2 comparison of transparency graph for different states

VI. Result and Discussion

Results of carbonate, sonicate and combination of this two method in comparison with control has been shown in Table I. As it clear from Table I, in all three states there is no significant difference in pH, total acidity and Brix of all samples.Lake of changes is due to buffer affect in the fruit juice because the samples are fresh and microbial fermentation

does not occur yet [10].You can see from the results that total acidity in every three state is approximately constant. It is justifiable why Brix does not change because sugar is the most important substance which has been solved in juice. In all states the amount of Brix does not have significant difference. Also changes occur in combination state is due to intensification effect of cavitation in sonicate as a result of creation of more kernel to cavitation resulted from carbonate. Reason of transparency reduction is due to suspension of Colloidal pectin particle in juice [10]. The effect of carbonate and sonicate combination except in deactivation of microorganisms is more than every other individual method, this method does not affect useful microorganisms.

VII. Conclusion

This paper provide effect of carbonate, sonicate and combination of these two on kiwi fruit juice.

As it has been indicated in the text, carbonate in combine with sonicate could be an appropriate method and this is in good agreement with other researches [10].

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