Journal of Food Science and Technology (Iran)

Homepage:www.fsct.modares.ir

Scientific Research

[DOR: 20.1001.1.20088787.1402.20.136.3.1]

[DOI: 10.22034/FSCT.20.136.26]

Effect of ultrasonic pretreatments and process condition on mass transfer rate during osmotic dehydration of orange slices

Eftekhari, A. [1], Salehi, F. [2*], Gohari Ardabili, A. [3], Aghajani, N. [4]

1. MSc Student, Department of Food Science and Technology, Bu-Ali Sina University, Hamedan, Iran.
2. Associate Professor, Department of Food Science and Technology, Bu-Ali Sina University, Hamedan, Iran.
3. Assistant Professor, Department of Food Science and Technology, Bu-Ali Sina University, Hamedan, Iran.
4. Assistant Professor, Department of Food Science and Technology, Bu-Ali Sina University, Hamedan, Iran.

ABSTRACT

The intensity and application time of ultrasound treatment before the osmotic dehydration process and the use of osmotic solutions of different concentrations can result in different dehydration intensities and sucrose gain in the orange slices and also can influence important qualitative parameters. In this research, the effect of ultrasound pretreatments (three levels of ultrasound intensity and at three different times) and the sucrose solution concentration (20, 30, and 40%) on the weight loss percentage, the solid gain percentage, the amount of removed moisture and the rehydration percentage of orange slices during osmotic dehydration process was investigated. By increasing the concentration of sucrose solution from 20 to 40%, the solid gain percentage of dehydrated orange slices increased from 7.94% to 16.29% ($P<0.05$); But with increase in the sonication power from zero to 150 W, the value of this parameter decreased. By increasing the sucrose solution concentration from 20 to 40%, due to the increase in the osmotic pressure of the solution, the amount of weight reduction and the moisture loss percentage of orange slices increased from 5.17% to 10.58% and from 13.11% to 27.14%, respectively. With increasing the ultrasound treatment time, the amount of removed moisture from the samples increased ($P<0.05$). With increasing ultrasound power, the rehydration of dried samples increased from 169.9% to 186.2%, but the ultrasound time had the opposite influence, and with increasing the ultrasound treatment time, the rehydration amount of samples decreased from 181.5% to 168.9%. In general, applying 5 min of ultrasound with a power of 150 W, due to the reduction of solid gain and increase in rehydration percentage, is recommended before the osmotic dehydration process of orange slices with a solution containing 40% sucrose.

ARTICLE INFO

Article History:

Received 2022/ 12/ 17
Accepted 2023/ 04/ 15

Keywords:

Orange slice,
Rehydration,
Solid gain,
Sucrose,
Weight reduction.

DOI: **10.22034/FSCT.19.135.21**
DOR: **20.1001.1.20088787.1402.20.135.3.9**

*Corresponding Author E-Mail:
F.Salehi@Basu.ac.ir

[DOR: 20.1001.1.20088787.1402.20.136.3.1]

[DOI: 10.22034/FSCT.20.136.26]

1. Introduction

In food storage, drying or dehydrating processes reduce the moisture required for the growth and abundance of microorganisms that cause food spoilage [1]. One of the most effective and appropriate methods to increase the shelf life of fruits and vegetables is osmotic dehydration.[1] Is. This process accelerates the movement of water molecules from the food to the osmotic solution and causes the transfer of a small amount of sugar or salt in the osmotic solution to the food, which results in an organoleptic product with suitable functional characteristics [2]. The process of osmotic water extraction has attracted the interest of researchers in recent years due to maintaining stability, creating high quality, improving application characteristics and reducing energy consumption. Osmotic dehydration is used to produce products with intermediate moisture, or this process can be used as a pre-process for subsequent processes such as drying or freezing [3, 4].

The application of osmotic dehydration as a pretreatment in the drying process, besides its positive effects on the process and also the quality characteristics of the produced product, is limited due to the slow speed of mass exchange and its time-consuming [5]. One of the factors that can help reduce this limitation is the use of additional methods such as ultrasound[2] Is. The ultrasound device works by creating intense pressure waves in a liquid environment. Pressure waves cause flow in the liquid and under the right conditions, it causes the rapid formation of microbubbles, which grow and unite these bubbles until they reach the maximum size and finally burst, which causes surface changes in the objects that are exposed to it. This phenomenon is called cavitation. The bursting of the bubbles produces a shock wave with enough energy to break the covalent bonds. Ultrasonic energy also increases the ambient temperature [4, 6-8]. Amjadi et al. (2018) investigated the effect of cavitation caused by ultrasound waves on the microbial load and physicochemical characteristics of orange juice processed with ultrasound waves. The results of this research indicated that ultrasound processing has no significant effect on acidity, pH and dissolved solids of orange juice samples; But processing with ultrasonic waves significantly reduces the microbial contamination of orange juice [9].

The combined use of osmotic dehydration processes and ultrasonic waves as a pretreatment before the drying process increases the quality of the final dried product and also increases the speed of the drying process. Ultrasonic waves increase the number of holes on the surface of the product, which increases the rate of water exit from the product [10]. Salehi et al. (2022) investigated the effect of ultrasound power and time on the efficiency of the osmotic dehydration process of banana slices. These researchers reported that by increasing the power of the ultrasonic device, increasing the time of applying the treatments and also increasing the concentration of the osmotic solution, the percentage of weight loss and as a result the amount of moisture removed from the banana slices increases. Also, by increasing the time of applying osmotic treatments, more moisture is removed from banana slices, and as a result, the percentage of moisture reduction for these samples has increased [11]. Qavami-Julandan et al. (2019) reported that the osmosis-ultrasound pre-process increases the water loss and decreases the weight of strawberries. Also, drying with osmotic-ultrasound pretreatment is more economical in terms of time [12]. Azobel et al. (2015) used osmotic-ultrasonic pretreatment to improve water removal and carotenoid retention during papaya drying. The results of this research showed that the drying rate of osmosis fruits is the lowest due to the presence of sucrose, while ultrasonic pretreatment increased the drying rate. Also, ultrasonic treatments before drying with hot air preserved most of the carotenoids in dried papaya. The

[1] .Osmotic drying

[2]. Ultrasound

[DOR: 20.1001.1.20088787.1402.20.136.3.1]

[DOI: 10.22034/FSCT.20.136.26]

amount of carotenoid in untreated samples, treated with ultrasound in distilled water, and treated with osmosis-ultrasound was 24%, 30.4-39.8%, and 64.9%, respectively [13].

Orange is one of the most important types of citrus fruit, which is used as fresh fruit, juice, concentrate or dried thin slices [14]. The aim of this study is the effect of ultrasound power, ultrasound application time and concentration of osmotic solution containing sucrose on the percentage of weight loss, the percentage of solids absorption, the amount of moisture removed and the percentage of rehydration of orange slices treated by the osmosis-ultrasound dehydration process.

2- Materials and methods

2-1- Preparation of orange slices

To conduct this research, first, orange slices with a thickness of 5 mm were cut by an industrial slicer (Jeremi, Italy[3]) were cut. The average weight of the prepared orange slices was 21.5 grams, which had an average initial moisture content of 84.91% on a wet basis. The moisture content of the samples was measured according to the method of AOAC (2010) by placing the samples in an oven at a temperature of 105 degrees Celsius until reaching a constant weight. Weighing the samples using a digital scale (Lutron[4], Taiwan) was done with an accuracy of one hundredth of a gram.

2-2- Ultrasound treatment process

After the initial weighing, the orange slices inside the ultrasonic bath machine (Baker[5] (Iran) model vCLEAN1-L6) containing distilled water at a temperature of 50 degrees Celsius. Using this device, ultrasound was applied to orange slices at different intensities (at three power levels of 0, 75 and 150 watts) and at three times of 5, 10 and 15 minutes. After the ultrasonic treatment, the samples were removed from the device and their surface moisture was removed with a cotton cloth.

2-3- Osmotic water extraction process

Orange slices treated by ultrasound were first weighed by a digital scale and then placed in containers containing osmotic solution prepared from sucrose with concentrations of 20, 30 and 40 degrees Brix at a temperature of 50 degrees Celsius. The temperature of the osmotic solutions was kept constant by Ben Marie (model R.J42, Pars Azma Company, Iran). During the osmotic dehydration process, every 10 minutes the slices were taken out of the osmotic solution and after removing the surface moisture, they were weighed and returned to the container containing the osmotic solution.

4-2- Drying by oven

To determine the amount of moisture reduction and absorption of solids, after 60 minutes of dewatering by osmosis, the removed samples were placed in a fan oven (Shimaz, Iran) at a temperature of 70 degrees Celsius until constant weight was reached. Weight loss percentage (WR)[6], the percentage of absorption of solids (SG)[7] and percentage of water reduction (WL)[8] Orange slices were calculated based on their weight in different stages through the following equations [15].

$$WR = \frac{A_0 - A_t}{A_0} \times 100 \quad (1)$$

$$SG = \frac{S_t - S_0}{A_0} \times 100 \quad (2)$$

$$WL = \frac{W_0 - W_t}{A_0} \times 100 = \frac{W_0 - (A_t - S_t)}{A_0} \quad (3)$$

In these equations: WR: weight loss percentage of orange slices in the osmosis stage, SG: solid absorption percentage, WL: water reduction percentage in the osmosis stage, A_0: Initial mass of orange slices sample (g), A_t: Mass of orange slices after osmosis (g), S_t: The amount of solid matter of the sample after osmosis (g), S_0: The amount of solid matter of the original sample

3. Girmi, Italy.

4. Digital balance, LutronGM-300p (Taiwan)

5. Laboratory, Ultrasonic, vCLEAN1-L6, Backer, Iran.

6. Weight reduction

7. Solid gain (SG)

8. Water loss (WL)

[DOR: 20.1001.1.20088787.1402.20.136.3.1]

[DOI: 10.22034/FSCT.20.136.26]

(g), W_0: initial moisture of the sample (g) and W_t: The moisture content of the sample after osmosis is (g).

5-2- re-watering of dried slices

To calculate the rehydration parameter, dry orange slices were weighed and immersed in distilled water with a temperature of 50 degrees Celsius.They got mad. Then, after 20 minutes, they were taken out of the water and weighed. The water absorption open ratio was calculated and reported by equation 4 [15].

$$RR = \frac{M}{M_0} \times 100 \quad (4)$$

In this equation, M is the weight of the sample after reabsorption of water and M_0 The weight of the sample is dry.

6-2- Statistical analysis

In this research, the effect of ultrasound power at three levels of 0, 75 and 150 watts, the effect of ultrasound application time at three levels of 5, 10 and 15 minutes and the effect of the concentration of osmotic solution containing sucrose at three levels of 20, 30 and 40 degrees Brix on kinetics Mass transfer was investigated during the osmotic dehydration process of orange slices. This research was analyzed in a factorial format based on a completely random design and using SPSS version 21 software. All the tests were performed in three repetitions and Duncan's multi-range test was used at the 95% probability level to compare the average of the observed responses. Excel (2007) program was also used to draw graphs.

3. Results and Discussion

3-1- The effect of ultrasound intensity

Figure 1-A shows the effect of ultrasound treatment intensity on the rate of weight loss of orange slices during the osmotic dehydration process. Also, in Figure 1, the effect of ultrasound intensity on the average percentage of weight loss (1-B), the percentage of absorption of solids (1-C), the percentage of water reduction (1-D) and the percentage of rehydration (1-E) of dehydrated orange slices. It is reported by osmosis method (after 60 minutes of osmosis). In all treatments, during osmotic dehydration, the weight of the samples decreased. By increasing the power of ultrasound treatment, the intensity and amount of weight loss decreased. Of course, in the 10-minute treatment of ultrasound and osmosis with a concentration of 30%, no significant difference was observed between different powers ($P<0.05$).

An important limitation of the osmotic dehydration process is the penetration of a large amount of osmotic soluble substance into the food, which causes the resistance of the food to remove water in the subsequent drying processes and change the sensory and nutritional characteristics of the product [16]. With the increase of ultrasonic power, the absorption percentage of solids of the samples decreased, which indicates the reduction of sucrose absorption by the dehydrated samples. The average absorption percentage of orange slices decreased from 14.5% to 11.6% by increasing the ultrasonic power of the device from zero to 150 watts (10 minutes of ultrasonication and osmosis with 30% concentration).

As can be seen in Figure 1-D, with the increase of ultrasonic power, the percentage of moisture reduction of the samples decreased, which was due to less moisture leaving the samples. Of course, in the 10-minute treatment of ultrasound and osmosis with a concentration of 30%, no significant difference was observed between different powers ($P<0.05$).

With the increase of ultrasonic power, the rehydration percentage of the samples increased and a significant difference was observed between the samples treated with 150 watts of ultrasonic power and the untreated sample ($P<0.05$). The rehydration percentage of orange slices for ultrasonic power equal to zero, 75 W and 150 W was 163.4%, 174.9% and 183.4%, respectively.

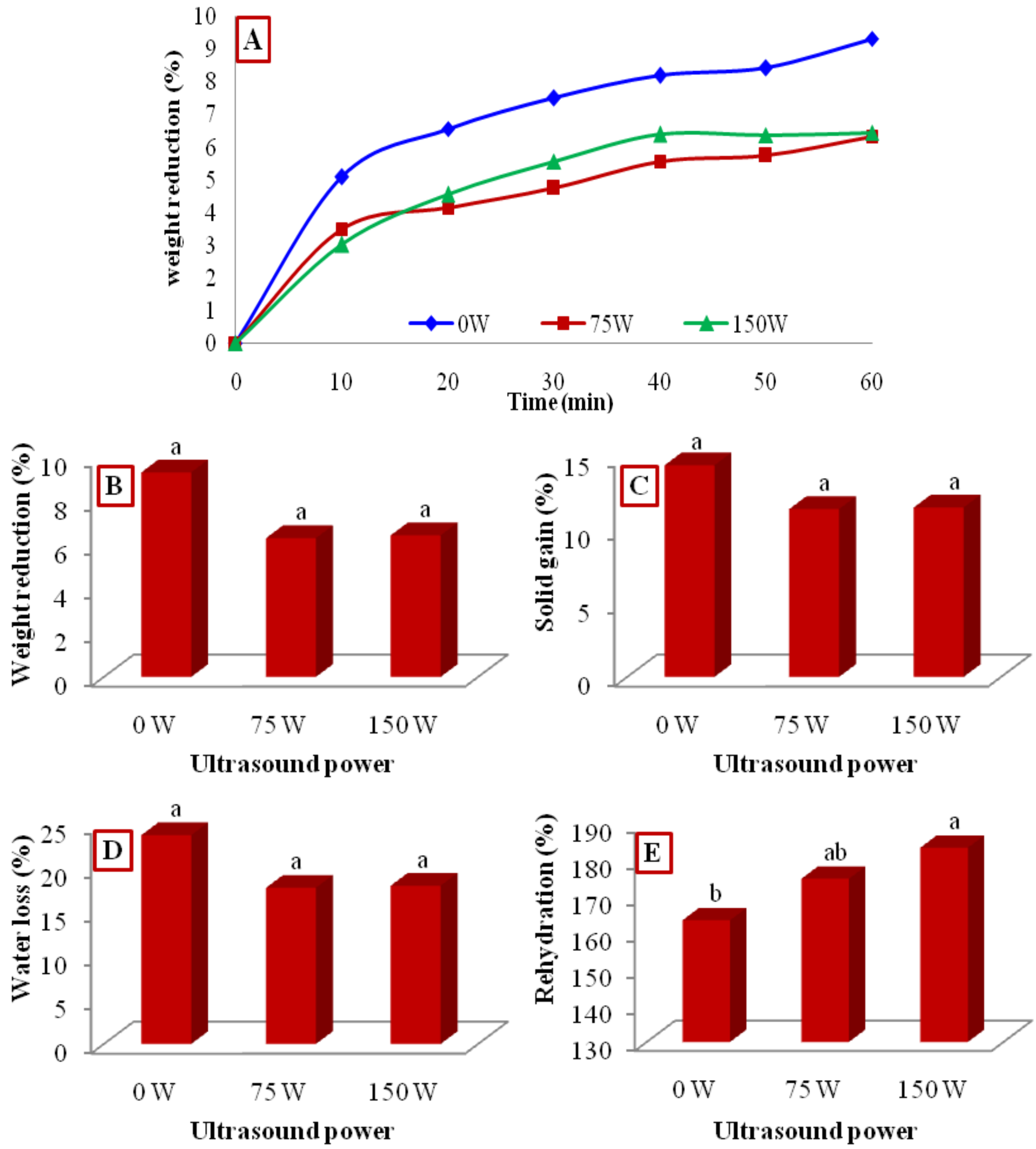

Fig 1 Effect of ultrasound power on the weight reduction (A), average weight reduction (B), average solid gain (C), average water loss (D), and average rehydration (E) of dehydrated orange slices (10 min and 30%). Means with different superscripts differ significantly (P<0.05).

2-3- Effect of treatment time

Figure 2-A shows the effect of ultrasound treatment time on the rate of weight loss of orange slices during the osmotic dehydration process. As it can be seen in this figure, with the increase in the time of applying ultrasound, more moisture is removed from the orange slices during the osmosis process, and as a result, the weight changes for these samples have increased. Also, in Figure 2, the effect of ultrasound application time on the average percentage of weight loss, percentage of solids absorption, percentage of water reduction, and percentage of rehydration of orange slices dehydrated by osmotic method (after 60 minutes of osmosis) is reported. In total, the weight loss percentage increased from 7.9% to 15.0% by increasing the time of osmotic dehydration process from 5 minutes to 15 minutes (P<0.05). No significant difference was observed between 5 and 10 minutes and also between 10 and 15 minutes in terms of weight loss percentage parameter (P<0.05).

Figure 3-C shows the effect of ultrasound application time on the amount of solid matter absorbed by orange slices during osmotic dehydration. As can be seen in these three graphs, the time of ultrasound treatment did not have a significant effect on the absorption of solids by orange slices (P<0.05). Of course, the average data of the absorption percentage of solids for all experiments showed that with the increase in the time of ultrasound treatment, the

[DOR: 20.1001.1.20088787.1402.20.136.3.1]

[DOI: 10.22034/FSCT.20.136.26]

percentage of solids absorbed by orange slices increased from 11.72% to 12.81%.

By increasing the time of applying ultrasound, more moisture was removed from the orange slices, and as a result, the percentage of moisture reduction for these samples treated for 15 minutes increased significantly (P<0.05). The water removal percentage increased from 25.7% to 32.7% by increasing the time of ultrasound application from 5 minutes to 15 minutes (P<0.05).

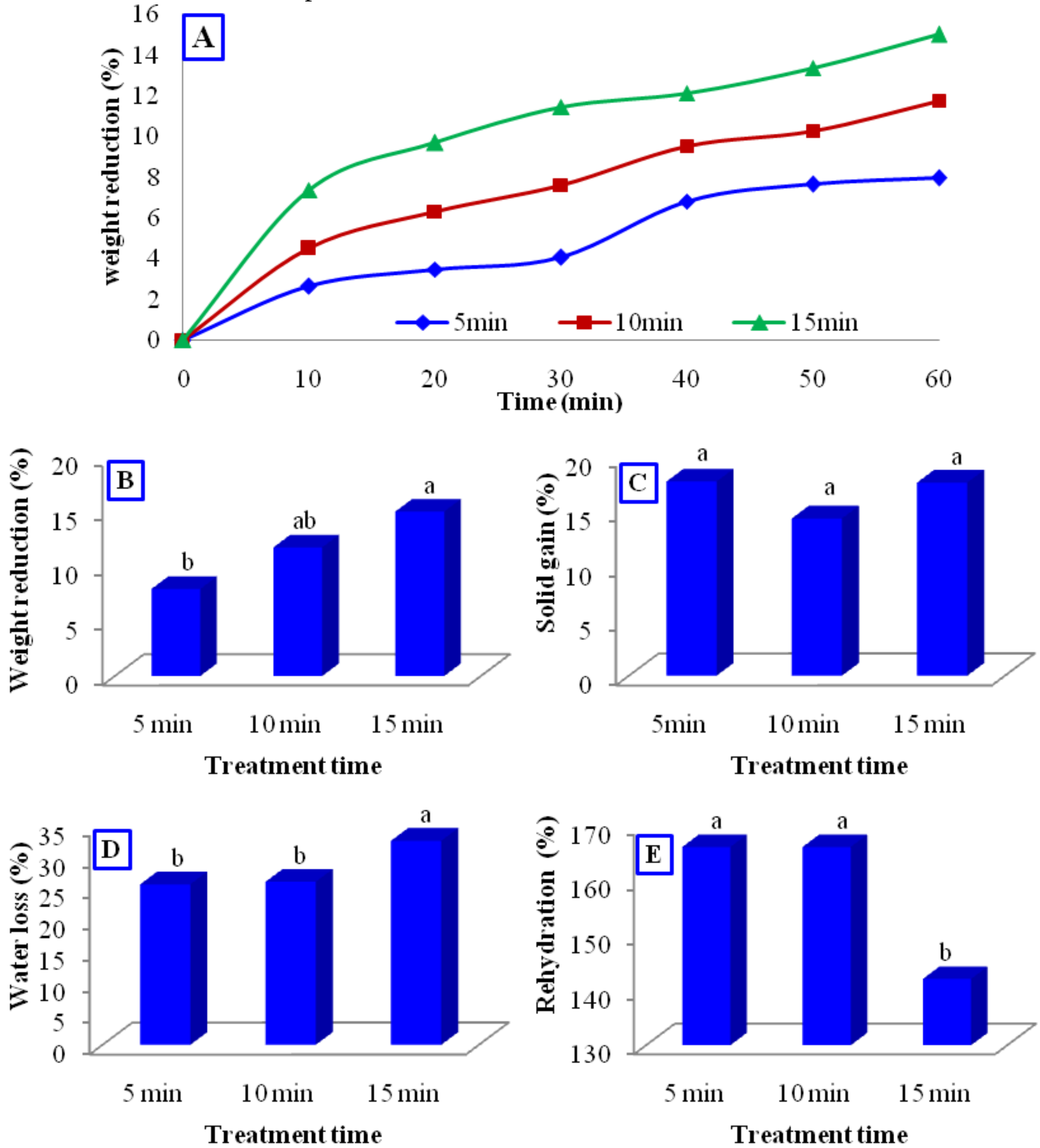

Fig 2 Effect of sonication time on the weight reduction (A), average weight reduction (B), average solid gain (C), average water loss (D), and average rehydration (E) of dehydrated orange slices (75 W and 40%). Means with different superscripts differ significantly (P<0.05).

As seen in Figure 2-E, by increasing the time of ultrasound treatment to 15 minutes, the percentage of rehydration of the samples decreased significantly (P<0.05) due to the change in the shape of the fruit tissue. The total average (all concentrations and powers) for the percentage of rehydration of orange slices treated by ultrasound at 5, 10 and 15 minutes was 181.5%, 178.8% and 168.9%, respectively.

3-3- Effect of osmotic solution concentration

Figure 3-A shows the effect of the concentration of osmotic solution containing sucrose on the speed of weight changes of orange slices treated by ultrasound during the

dehydration process. This figure shows that the amount of weight loss of orange slices placed in osmotic solution containing 40% sucrose was higher than other samples. Similar behavior was observed for other treatments. As expected, with increasing concentration of osmotic solution, more moisture was removed from orange slices due to increased osmotic pressure, and as a result, weight changes were greater for samples exposed to more concentrated osmotic solutions. The average percentage of weight loss (average of different powers and times) of orange slices placed in osmotic solutions with concentrations of 20, 30 and 40 degrees Brix was equal to 5.17%, 7.71% and 10.85%, respectively.

In Figure 3, the effect of osmotic solution concentration on average percentage of weight loss, percentage of absorption of solids, percentage of water reduction and percentage of rehydration of dehydrated orange slices (after 60 minutes of osmosis) is also reported. In all treatments, during osmotic dehydration, the weight of the samples decreased. With the increase in the concentration of the osmotic solution, due to the increase in the concentration of the medium, the orange slices absorbed more sucrose, and as a result, the percentage of absorption of solids calculated for these samples increased. The average absorption percentage of solids of orange slices (treated by ultrasound with intensity of 75 watts for 15 minutes) placed in osmotic solutions with concentrations of 20, 30 and 40 degrees Brix, equal to 10.2%, 13.9% and 7% respectively. It was 17.0% and the samples placed in a more concentrated solution

(40%) in terms of the amount of absorbed solid matter, there was a significant difference with the sample dehydrated by 20% solution ($P<0.05$).

In the osmotic dehydration method, the more moisture is removed from the product, the higher the efficiency of the process. As the concentration of the osmotic solution increased, more moisture was removed from the orange slices due to the increase in osmotic pressure, and as a result, the percentage of water reduction was higher for the samples that were exposed to more concentrated osmotic solutions (40%). The percentage of water reduction (average of different powers and times) of orange slices placed in osmotic solutions with concentrations of 20, 30 and 40% was 13.11%, 20.48% and 27.14%, respectively. In line with the results of this research, Abbasi Sidabad et al. (2011) while investigating the process of extracting juice from "beh" fruit in osmotic solutions containing salt, sucrose and glucose reported that in their research, sugar absorption, water excretion and moisture content were significantly increased with increasing The concentration of the osmotic solution has increased [17].

As the concentration of the osmotic solution increased, the rehydration percentage of the samples decreased. However, as seen in Figure 3-E for the samples treated by ultrasound with an intensity of 75 watts for 15 minutes, there is no significant difference between the rehydration percentage of the samples ($P<0.05$). In this research, the percentage of rehydration (average power and different times) of orange slices placed in osmotic solutions with concentrations of 20, 30 and 40 degrees Brix was 197.7%, 172.8% and 158.7%, respectively.

[DOR: 20.1001.1.20088787.1402.20.136.3.1]

[DOI: 10.22034/FSCT.20.136.26]

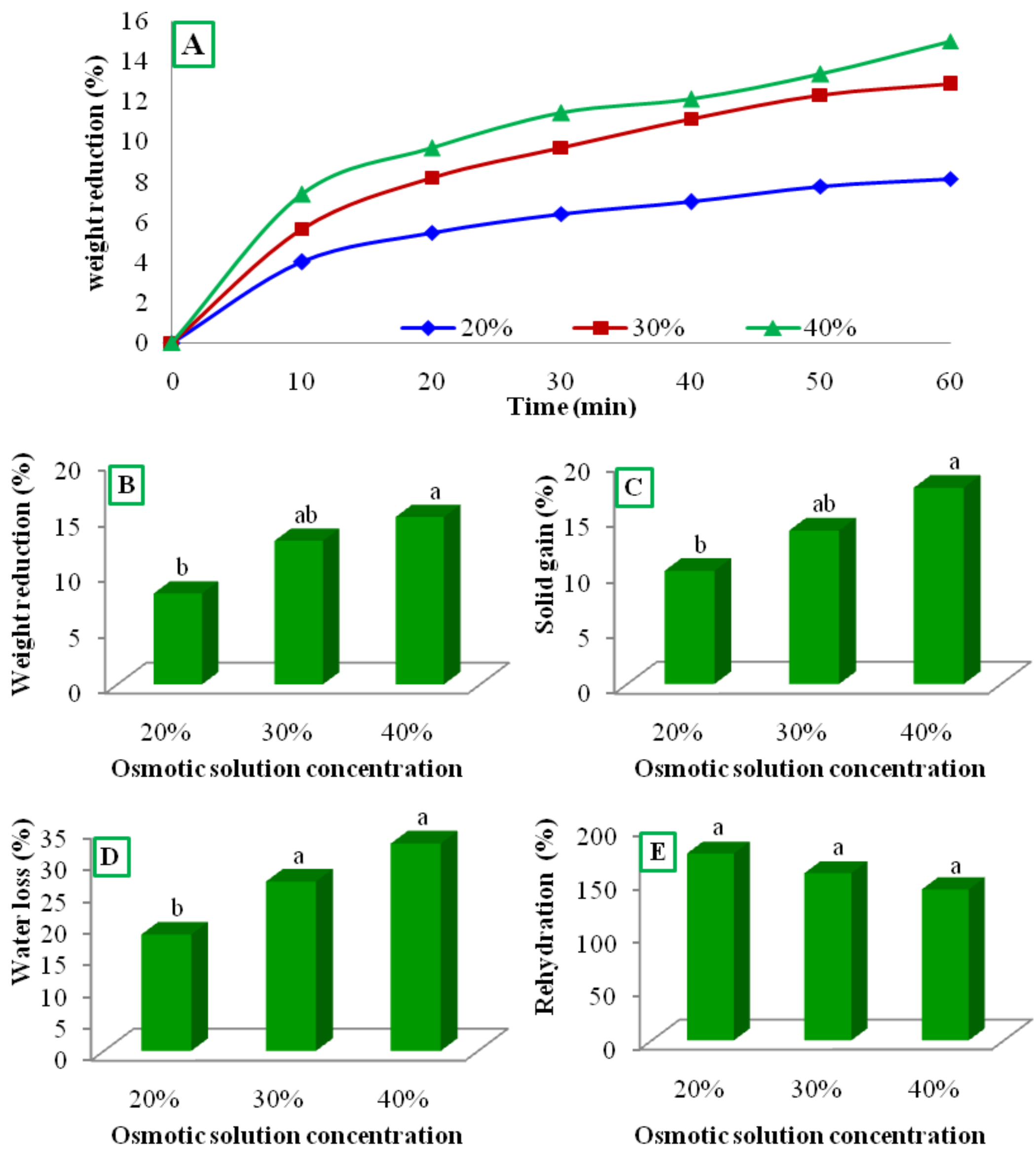

Fig 3 Effect of sucrose solution concentration on the weight reduction (A), average weight reduction (B), average solid gain (C), average water loss (D), and average rehydration (E) of dehydrated orange slices (75 W and 15 min).

Means with different superscripts differ significantly (P<0.05).

4 - Conclusion

The conditions of the osmotic process of orange slices and the pretreatments investigated in this research included the ultrasonic power in the range of 0 to 150 watts, the time of applying ultrasound in the range of 5 to 15 minutes, and the concentration of the osmotic solution containing sucrose in the range of 20 to 40% (w/w). The results of this research showed that with the increase in the concentration of the osmotic solution, the percentage of water withdrawal and as a result the percentage of weight loss of orange slices increases significantly (P<0.05). The weight loss percentage of orange slices increased from 7.9% to 15.0% by increasing the time of the osmotic dehydration process from 5 minutes to 15 minutes (P<0.05); Of course, no significant difference was observed between 5 and 10 minutes and also between 10 and 15 minutes in terms of weight loss percentage parameter (P<0.05). With the increase in the concentration of the osmotic solution, the numerical value of the percentage of solids absorption parameter increased significantly (increased sucrose absorption) (P<0.05), but with the increase in ultrasound intensity, the value of this parameter decreased (P<0.05), which shows Less absorption of sucrose by orange slices. With the increase of ultrasonic power, the rehydration percentage of the samples increased and a

[DOR: 20.1001.1.20088787.1402.20.136.3.1]

[DOI: 10.22034/FSCT.20.136.26]

significant difference was observed between the samples treated with 150 watts of ultrasonic power and the untreated sample (P<0.05); However, with the increase in the ultrasound application time and the concentration of the osmotic solution, the rehydration percentage of the samples decreased.

5- Resources

[1] Salehi, F. 2021. Recent applications of heat pump dryer for drying of fruit crops: A review, *International Journal of Fruit Science*. 21, 546-555.

[2] Kaur, D., Singh, M., Zalpouri, R., Singh, I. Osmotic dehydration of fruits using unconventional natural sweeteners and non-thermal-assisted technologies: A review, *Journal of Food Processing and Preservation*. e16890.

[3] Deepika, S., Sutar, P. P. 2017. Osmotic dehydration of lemon (*Citrus limon* L.) slices: Modeling mass transfer kinetics correlated with dry matter holding capacity and juice sac losses, *Drying Technology*. 35, 877-892.

[4] Salehi, F. 2023. Recent advances in the ultrasound-assisted osmotic dehydration of agricultural products: A review, *Food Bioscience*. 51, 102307.

[5] Azizi Khesal, M., Bassiri, A., Maghsoudlu, Y. 2013. Optimization of combined pulsed vacuum osmotic dehydration – hot air drying of orange slices by response surface methodology, *Food Technology & Nutrition*. 10, 63-72.

[6] Salehi, F. 2020. Physico-chemical properties of fruit and vegetable juices as affected by ultrasound: A review, *International Journal of Food Properties*. 23, 1748-1765.

[7] Azarpazhooh, E., Sharayeei, P., Gheybi, F. 2019. Evaluation of the effects of osmosis pretreatment assisted by ultrasound on the impregnation of phenolic compounds into aloe vera gel and dry product quality, *Food Engineering Research*. 18, 143-154.

[8] Awad, T. S., Moharram, H. A., Shaltout, O. E., Asker, D., Youssef, M. M. 2012. Applications of ultrasound in analysis, processing and quality control of food: A review, *Food Research International*. 48, 410-427.

[9] Amjadi, S., Alizadeh, A., Roufegarinejad, L. 2018. Cavitation effects of sonication on microbial load and physicochemical properties of orange juice, *Journal of Food Science and Technology (Iran)*. 15, 217-226.

[10] Fernandes, F. A., Gallão, M. I., Rodrigues, S. 2008. Effect of osmotic dehydration and ultrasound pre-treatment on cell structure: Melon dehydration, *LWT-Food Science and Technology*. 41, 604-610.

[11] Salehi, F., Cheraghi, R., Rasouli, M. 2022. Influence of sonication power and time on the osmotic dehydration process efficiency of banana slices, *Journal of Food Science and Technology (Iran)*. 19, 197-206.

[12] Samie, A., Ghavami Jolandan, S., Zaki Dizaji, H., Hojjati, M. 2019. The effect of osmotic and ultrasonic pre-treatments on the quality of strawberry drying process in hot air drying method, *Iranian Journal of Biosystems Engineering*. 50, 705-715.

[13] Azoubel, P. M., da Rocha Amorim, M., Oliveira, S. S. B., Maciel, M. I. S., Rodrigues, J. D. 2015. Improvement of Water Transport and Carotenoid Retention During Drying of Papaya by Applying Ultrasonic Osmotic Pretreatment, *Food Engineering Reviews*. 7, 185-192.

[14] Sharifi, M., Rafiei, S., Keyhani, A., Omid, M. 2010. Drying of orange and selection of a suitable thin layer drying model, 41, 61-67.

[15] Salehi, F., Cheraghi, R., Rasouli, M. 2022. Mass transfer kinetics (soluble solids gain and water loss) of ultrasound-assisted osmotic dehydration of apple slices, *Scientific Reports*. 12, 15392.

[16] Kheyabani, S., Ghanbarzadeh, B., Hoseini, M. 2021. Effect of antioxidant active coatings on osmotic dehydration efficiency and quality parameters of Shahroodi dried grape, *Journal of Food Research*. 31, 51-63.

[17] Abbasi Seydabad, V., Shaffafi Zonozian, M., Irani, M. 2011. Osmotic dehydration monitoring of quince through salt, sucrose and glucose osmotic solutions, *Journal of Innovation in Food Science and Technology*. 3, 39-49.

مجله علوم و صنایع غذایی ایران

سایت مجله: www.fsct.modares.ac.ir

مقاله علمی_پژوهشی

تأثیر پیش‌تیمارهای فراصوت و شرایط فرآیند بر سرعت انتقال جرم طی آبگیری اسمزی برش‌های پرتقال

احمدرضا افتخاری[۱]، فخرالدین صالحی[۲*]، اشرف گوهری‌اردبیلی[۳]، نرجس آقاجانی[٤]

۱- دانشجوی کارشناسی ارشد، گروه علوم و صنایع غذایی، دانشگاه بوعلی سینا، همدان، ایران.

۲- دانشیار، گروه علوم و صنایع غذایی، دانشگاه بوعلی سینا، همدان، ایران.

۳- استادیار، گروه علوم و صنایع غذایی، دانشگاه بوعلی سینا، همدان، ایران.

٤- استادیار، گروه علوم و صنایع غذایی، دانشگاه بوعلی سینا، همدان، ایران.

اطلاعات مقاله

تاریخ های مقاله :

تاریخ دریافت: ۱۴۰۱ /۰۹/۲۶

تاریخ پذیرش: ۱۴۰۲/۰۱/۲۶

کلمات کلیدی:

آبگیری مجدد،

برش پرتقال،

جذب مواد جامد،

ساکارز،

کاهش وزن.

DOI: 10.22034/FSCT.19.135.21

DOR: 20.1001.1.20088787.1402.20.135.3.9

* مسئول مکاتبات:

F.Salehi@Basu.ac.ir

چکیده

شدت و زمان استفاده از تیمار فراصوت قبل از فرآیند آبگیری اسمزی و استفاده از محلول‌های اسمزی با غلظت‌های مختلف می‌تواند منجر به شدت آبگیری متفاوت و جذب ساکارز در برش‌های پرتقال شود و همچنین می‌تواند پارامترهای کیفی مهمی را تحت تأثیر قرار دهد. در این پژوهش، اثر پیش‌تیمارهای فراصوت (سه سطح شدت فراصوت و در سه زمان مختلف) و غلظت محلول ساکارز (۲۰، ۳۰ و ٤۰ درصد) بر درصد کاهش وزن، درصد جذب مواد جامد، مقدار رطوبت خارج شده و درصد آبگیری مجدد برش‌های پرتقال طی فرآیند آبگیری اسمزی مورد بررسی قرار گرفت. با افزایش غلظت محلول ساکارز از ۲۰ به ٤۰ درصد، درصد جذب مواد جامد برش‌های پرتقال آبگیری شده از ۷/۹٤ درصد به ۱٦/۲۹ درصد افزایش یافت ($P<0/05$)؛ اما با افزایش توان فراصوت از صفر به ۱۵۰ وات مقدار این پارامتر کاهش یافت. با افزایش غلظت محلول ساکارز از ۲۰ به ٤۰ درصد، به دلیل افزایش فشار اسمزی محلول، مقدار کاهش وزن و درصد کاهش رطوبت برش‌های پرتقال به ترتیب از ۵/۱۷ درصد به ۱۰/۵۸ درصد و از ۱۳/۱۱ درصد به ۲۷/۱٤ درصد افزایش یافت. با افزایش زمان تیماردهی با فراصوت نیز مقدار رطوبت خارج شده از نمونه‌ها افزایش یافت ($P<0/05$). با افزایش توان فراصوت، مقدار آبگیری مجدد نمونه‌های خشک‌شده از ۱٦۹/۹ درصد به ۱۸٦/۲ درصد افزایش یافت اما زمان فراصوت تأثیر معکوس داشت و با افزایش زمان تیماردهی با فراصوت، آبگیری مجدد نمونه‌ها از ۱۸۱/۵ درصد به ۱٦۸/۹ درصد کاهش یافت. در مجموع، اعمال ۵ دقیقه‌فراصوت با توان ۱۵۰ وات، به دلیل کاهش جذب مواد جامد و افزایش درصد آبگیری مجدد، قبل از فرآیند آبگیری اسمزی از برش‌های پرتقال توسط محلول حاوی ٤۰ درصد ساکارز، توصیه می‌شود.