Studies on the Preparation of Preserved Melon (Honeydew) Fruit

Khin Yadanar Win[*], San San Htwe[**], Yi Yi Myint[***]

Abstract

Myanmar, one of the developing countries, produces a wide range of fruits, vegetables, cereals, etc, which is favorable for the development of food processings. Fruits and vegetables after harvest are highly perishable and there is a loss in storage, transportation and processing. Among the food processings, preservation of melon (honeydew) was conducted in this research to retain the aroma, color, taste as the fresh form and the prolonged shelf-life. The objective of this research was to prepare the value-added preserved food from tropical fruits. Preparation of preserved melon (honeydew) was carried out by osmotic dehydration in lime water, citric acid and sugar syrup mixture solution combined with hot-air drying. The method and parameters of processing such as concentration of each food additive solution, soaking time in osmotic dehydration, drying time and drying temperature were optimized. The physico-chemical characteristics of preserved melon (honeydew) such as pH, acidity, moisture content, organoleptic properties and shelf-life were determined. Their nutritional composition such as protein, carbohydrate, fat, calcium, magnesium, sodium, potassium, phosphorous, vitamin A, vitamin C and ash were investigated to compare with that of fresh honeydew melon fruit. The outcome of this research would be implemented someway for the development of rural communities and for producing value-added products.

Keywords: osmotic dehydration, hot air drying, physico-chemical characteristics.

Introduction

Fruit processing is necessary where it ensures fair returns to the growers to improve their economic condition. It also helps to mitigate the problem of under employment during off-seasons in the agricultural sectors. Varieties of fruit processing are jam, jellies, juice, fruit bar, fruit candied, fruit leather etc. In addition to consumption of the fresh fruit, melons are sometimes dried and stored as melon candied and leather. Other varieties are cooked as vegetables or grown for their seeds, which are processed to produce melon oil (Candied fruit, www.wikipedia, the free encyclopedia By Elizabeth LaBau, About.com Guide).

Melons are non-toxic, non-fat and low in calories, but due to their very high water content, they have modest nutritional value. Honeydew is a cultivar group of muskmelon. Honeydew is a smooth-skinned variety with pale green flesh which is not strongly scented. Composition of fruit and vegetables not only vary for a given kind in according to botanical variety, cultivation practices, and weather but change with the degree of maturity prior to harvest and the condition of ripeness, which is progressive after harvest and is further influenced by storage conditions.

Honeydew was distributed throughout the world as trade and also in middle Myanmar. Honeydew is the ideal food for people having trouble with body weight, because it is mostly water with some fibres and few calories. Honeydew has a significant high nutritional value, resulting in a number of healthy benefits to its consumers. Honeydew is the best choice for preserved melon. Fruit is preserved by being soaked in sugar syrup and dried (Rodrigues and Fernandes, 2006).

The osmotic dehydration can be used as a pretreatment before air drying to reduce the initial water content of the fruit, reducing total processing and air drying time. Osmotic dehydration is a useful technique that involves the immersion of the fruit in a hypertonic aqueous solution leading to the loss of water through the cell wall membranes of the fruits

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and subsequent flow along the intercellular space before diffusing into the solution. The osmotic process has received considerable attention as a pretreatment since it reduces energy consumption, improves food quality, inhibits microorganism's growth, retains the fruit natural color and also helps to retain volatile materials during the subsequent air drying (Rodrigues and Fernandes, 2006).

The main objective of fruit and vegetable processing is to supply wholesome, safe, nutritious and acceptable food to consumers throughout the year (Dauthy, 1995). Preserved honeydew melon can be used for dipping in chocolate or incorporated in other recipes. Osmotic dehydration has become a novel approach in production of healthy and tasty minimally processed foods. (Rodrigues and Fernandes, 2006).

Materials and Methods

Materials

Fresh and ripe melon (honeydew) fruits, cultivated in Myit Nge Township, Mandalay Region were used for dehydration. Sugar, citric acid and lime water were purchased from local markets and Able chemical store, Mandalay.

Methods of Preparation

Fresh and ripe melon (honeydew) fruits were selected for processing. The whole fruit was washed thoroughly with water to remove adhering dirt and air dried for a few minutes. The whole fruit was weighed, peeled and sliced into the halves. Then the seeds and undesirable portions were removed, followed by cutting the halves of melon (honeydew) into the strips (about 1 cm thickness) and the strips were reweighed.

After pretreatment, the strips were soaked in 10% lime water at room temperature (27-30^{o}C) for 30 minutes and straining the melon strips. Then, the treated honeydew melon strips were soaked in the mixture of sugar syrup (60^{o}Brix) containing citric acid (1% by weight) using the melon and sugar syrup mixture ratio of 1:2.5 at room temperature (27-30^{o}C) for 1 hour. After soaking, the strips were strained and dried at 70^{o}C for 10 hours. These preserved fruits (candied form) were cooled down to room temperature and then they were packed in air-tight clean dry plastic bags and stored at cool dry place (Figure 1)

Optimization of Parameters in Preparation on the Characteristics of Preserved Melon (Honeydew)

The effect of citric acid content in sugar syrup mixture on the characteristics of preserved melon (honeydew) was determined by varying the citric acid content in the range of 1–5% (by weight) while the other variables were fixed using the same procedure mentioned above.

To determine the effect of the total concentration of sugar and citric acid (fixed amount) mixture solution, the total concentration of mixture was varied from 45 to 65°Brix while the other variables were fixed using the same method of preparation.

Alternatively, soaking time in sugar and citric acid mixture solution was varied from 15 to 75 minutes while the other fixed variables were used in the same procedure for the investigation on the effect of soaking time.

In order to obtain the information on the effect of drying time and drying temperature, drying time in the range of 8-12 hours and the drying temperature in the range of 60 - 80ºC were varied alternately while the other variables were fixed using the same method of preparation.

Methods of Analysis

The essential parameters showing the quality of preserved melon (honeydew) fruit such as moisture content, pH value, acidity, shelf – life, color, flavor, texture and nutritional values such as protein, carbohydrate, fat, calcium, magnesium, sodium, potassium, phosphorous, vitamin A, vitamin C, ash content of the products were determined. The basic parameters such as yield percent of the products and shelf-life of products were also examined.

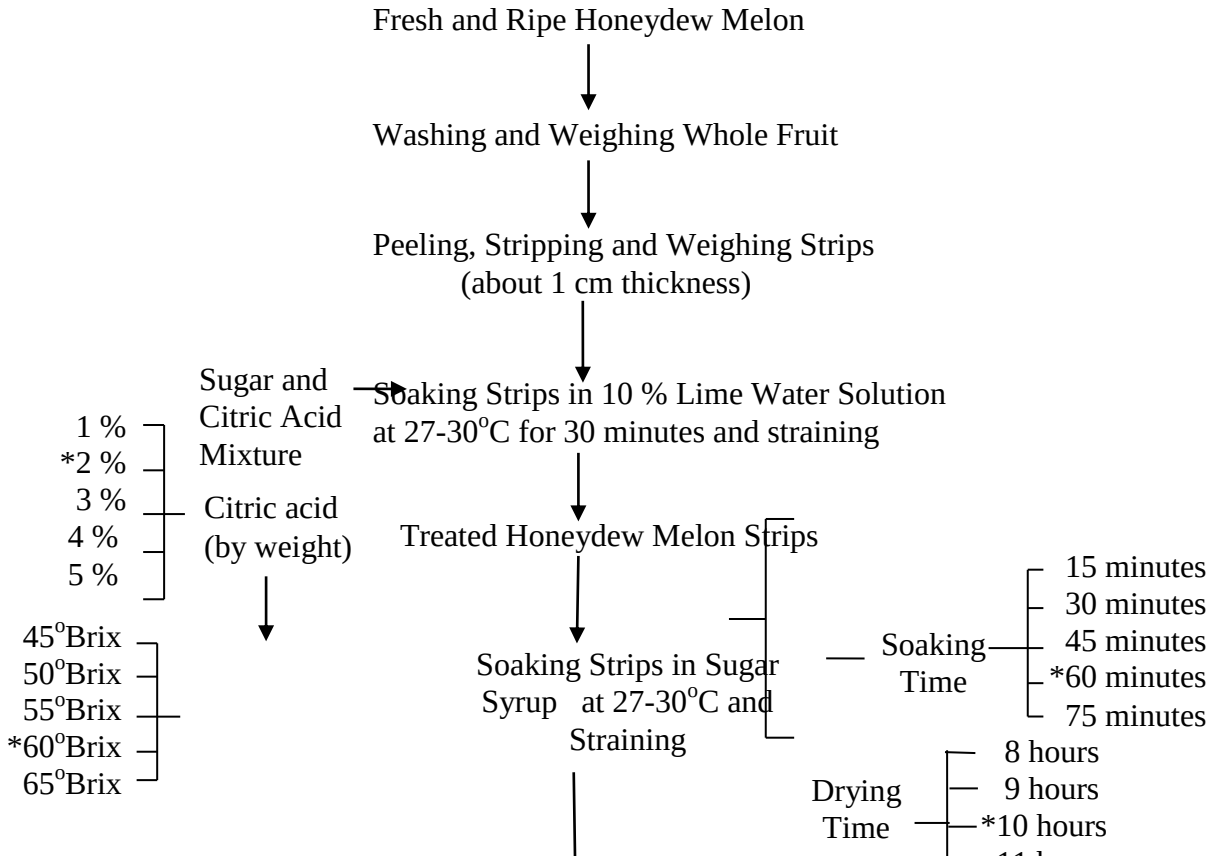
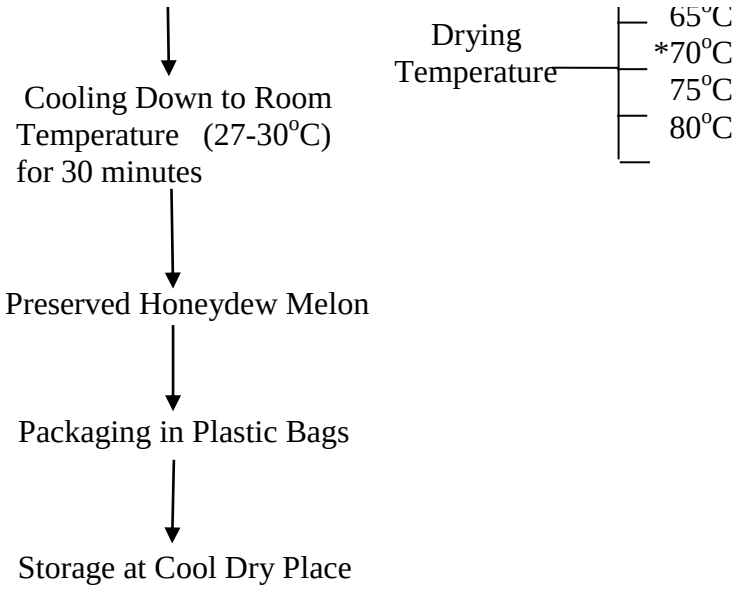


Figure (1) Flow Diagram for Processing of Preparation of Preserved Melon (Honeydew) Fruit



Results and Discussion

In the research of processing and processing conditions including liming, soaking time, concentration of sugar syrup, total concentration of sugar syrup with citric acid, drying time and drying temperature affect the characteristics of preserved melon (honeydew) samples.

In the osmotic dehydration, the syrup or solution has a protective effect of colour, flavour and texture. The protective effect remains throughout the drying process and makes it possible to produce dried products of high quality. Thus liming as a pretreatment is desirable because it aids in preserving texture and suppressing the browning action in preserved fruit. Also osmotic dehydration in sugar syrup or mixture solution, it improve the color and odor of the preserved food, supply in more rapid reconstitution of the dried product and increased the drying rate.

Melon and sugar syrup [1:2.5(w/v)] ratio was constant because this ratio was sufficient to immerse the melon in sugar syrup mixture. So, sugar syrup was penetrated the inner layer of melon fruit. The combination of osmotic dehydration and addition of weak acid is a mild process that results in a final product with organoleptic properties very similar to fresh and "ready to eat" fruit, appropriate for immediate consumption. The purpose of this work was to evaluate the influence of citric acid on the production of osmotically dehydrated preserved melon and on its final quality. Combination of sucrose and glucose led to better flavor and appearance (Rodrigues and Fernandes, 2006).

Effect of the variation of citric acid content in sugar syrup mixture in the preparation are shown in Table (1). From the results, yield percent and pH values decreased with increasing citric acid content and more sour taste occurred. According to the highest yield percent, medium pH values (less acidic) of preserved melon, 2% (by weight) of citric acid content was designated as optimum condition.

The effects of the total concentration of sugar and citric acid (fixed amount) mixture solution on the characteristics of preserved melon (honeydew) are recorded in Table (2). From these results, it is obvious that yield percent and pH values of preserved melon increased slightly with increasing concentration of sugar and citric acid mixture solution. The optimum condition of sugar and citric acid mixture was 60^{o}Brix resulting the better organoleptic properties. The organoleptic properties of sample using other sugar and citric acid mixture (^{o}Brix) were brownish white color.

As the effects of soaking time in sugar and citric acid mixture solution, yield percent and pH values decreased slightly with increasing soaking time. Shelf – life of all samples remained constant, 60 minutes of soaking time in sugar and citric acid mixture solution was selected as optimum condition due to the better organoleptic properties (hard, brightly white color, slightly sour taste and pleasant smell) of the preserved melons prepared under this condition Table (3).

The results of the effect of drying time shown in Table (4) point out that yield percent and moisture content decreased slightly with increasing drying time. Shelf-life were varied throughout the variation of drying time. Thus 10 hours of drying time was selected as optimum condition based on the better organoleptic properties (hard, brightly white color, slightly sour taste and pleasant smell) of preserved melon.

The variation of drying temperature shown in Table (5) had the similar effect as the drying time on the characteristics of preserved melon. Thus 70^{o}C of drying temperature was designated as optimum condition.

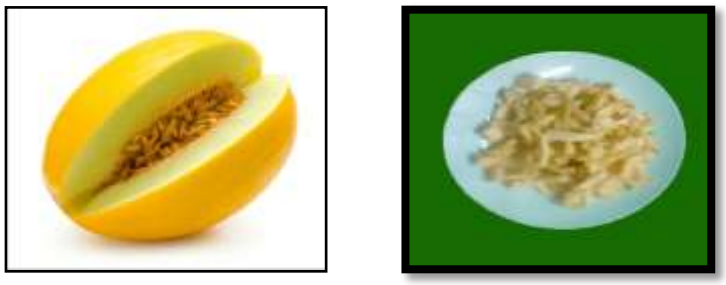
Finally, The optimum conditions selected for the preparation of preserved melon (honeydew) fruit were done by using citric acid in sugar syrup mixture 2% (by weight), total concentration of sugar and citric acid mixture – 60^{o}Brix, soaking time in sugar and citric acid mixture – 60 minutes, drying time – 10 hours and drying temperature – 70^{o}C. In drying, fruit

losses its moisture content, which results in increasing the concentration of nutrients in the remaining mass.

Vitamin C content of the preserved melon was lower than that of fresh fruit because vitamin C is easily destroyed by oxidation and at high temperature and can be easily lost during processing, storage and drying. Moisture content was reduced during the drying process. Content of the calcium, magnesium, sodium, potassium, phosphorous and vitamin A of the preserved melon fruit were lower than that of fresh fruit because of the loss of soluble mineral salts. Ash of the preserved melon was higher than that of fresh melon but moisture content of the preserved melon significantly lower than that of fresh fruit due to the higher content of carbohydrate in preserved melon (honeydew) fruit.

Results in Table (6), including the values of pH, acidity and organoleptic properties were acceptable values of health and safety for consumer. The osmotic dehydration as a pretreatment is mainly to improve the nutritional, organoleptic and functional properties of the product. As this process is effective at the ambient temperature, the damage due to heat on the quality of fruits and vegetables is minimized, and the high concentration of sugar surrounding the fruit prevents discoloration. Figure (2) shows the appearance of fresh melon (honeydew) fruit and preserved melon (honeydew) fruit.

From the results in Table (7), it points out that the protein and fat content of the preserved melon (honeydew) fruit were lower than that of fresh melon but carbohydrate content of the preserved melon was significantly higher than that of fresh melon (honeydew) fruit due to the moisture content of the preserved melon (honeydew) fruit was significantly lower than that of fresh melon and sugar are added as preservative. Finally, packaging and storage affect nutrients. It is points out that the soil and climate conditions have a bearing upon the quality of the finished product.



(a) (b)

Figure (2) (a) Fresh melon (Honeydew) Fruit, (b) Preserved Melon (Honeydew) Fruit

Table (1) Effect of the Citric Acid Content in Sugar and Citric Acid Mixture on the Characteristics of Preserved Melon (Honeydew) Fruit

Fresh Melon Strips = 100 g
Ratio of Melon and Sugar and Citric Acid Mixture = 1:2.5 (w/v)
Total Concentration of Sugar and Citric Acid Mixture = 60^{o}Brix
Soaking Time in 10% Lime Water Solution at 27-30^{o}C = 30 minutes
Soaking Time in Sugar and Citric Acid Mixture at 27-30^{o}C = 60 minutes
Drying Temperature and Drying Time =70^{o}C and 10 hours

Sample No	Citric Acid % (by weight)	Yield (%)	Moisture Content (%)	pH Value	Acidity % (w/v)	Shelf-life (month)	Organoleptic Properties
1	1	40	30	5.0	0.00804	6	Hard, brightly white colour, slightly sour taste and pleasant smell
*2	*2	39	30	4.6	0.01072	6	Hard, white colour, sour taste and pleasant smell
3	3	38	30	4.3	0.01474	6	Hard, white colour, sour taste and pleasant smell
4	4	37	25	4.0	0.02001	6	Hard, white colour, more sour taste and pleasant smell
5	5	35	20	3.3	0.04082	6	Hard, white colour, more sour taste and pleasant smell

*Optimum Citric Acid Content = 2 % (by weight)

Table (2) Effect of the Total Concentration of Sugar and Citric Acid Mixture on the Characteristics of Preserved Melon (Honeydew) Fruit

Fresh Melon Strips = 100 g
Ratio of Melon and Sugar and Citric Acid Mixture = 1:2.5 (w/v)
Soaking Time in 10% Lime Water Solution at 27-30^{o}C = 30 minutes
Citric Acid Content in Sugar Syrup Mixture = 2% (by weight)
Soaking Time in Sugar and Citric Acid Mixture at 27-30^{o}C = 60 minutes
Drying Temperature and Drying Time = 70^{o}C and 10 hours

Sample No	Sugar and Citric Acid Mixture(^{o}Brix)	Yield (%)	Moisture Content (%)	pH Value	Acidity % (w/v)	Shelf-life (month)	Organoleptic Properties
1	45	28	20	4.8	0.00938	6	Hard, brownish white color, slightly sour taste and pleasant smell
2	50	31	20	4.9	0.00831	6	Hard, brownish white color, slightly sour taste and pleasant smell
3	55	34	20	4.9	0.00831	6	Hard, brownish white color, slightly sour taste and pleasant smell
*4	*60	40	30	5.0	0.00804	6	Hard, brightly white color, slightly sour taste and pleasant smell
5	65	41	30	4.9	0.00831	6	Hard, brownish white color, slightly sour taste and pleasant smell

*Optimum Total Concentration of Sugar and Citric Acid Mixture = 60^{o}Brix

Table (3) Effect of the Soaking Time in Sugar and Citric Acid Mixture on the Characteristics of Preserved Melon (Honeydew) Fruit

Fresh Melon Strips = 100 g
Ratio of Melon and Sugar and Citric Acid Mixture = 1:2.5 (w/v)
Soaking Time in 10% Lime Water Solution at 27-30^{o}C = 30 minutes
Citric Acid Content in Sugar Syrup Mixture = 2% (by weight)
Total Concentration of Sugar and Citric Acid Mixture = 60^{o}Brix
Drying Temperature and Drying Time = 70^{o}C and 10 hours

Sample No	Soaking Time in Sugar and Citric Acid Mixture(minutes)	Yield (%)	Moisture Content (%)	pH Value	Acidity % (w/v)	Shelf-life (month)	Organoleptic Properties
1	15	34	30	4.9	0.00831	6	Hard, brownish white colour, slightly sour taste and pleasant smell
2	30	36	30	4.9	0.00831	6	Hard, brownish white colour, slightly sour taste and pleasant smell
3	45	38	30	4.9	0.00831	6	Hard, brownish white colour, slightly sour taste and pleasant smell
*4	*60	40	30	5.0	0.00804	6	Hard, brightly white colour, slightly sour taste and pleasant smell, good mouth feel
5	75	40	30	4.9	0.00831	6	Hard, brownish white colour, slightly sour taste and pleasant smell

* Optimum Soaking Time in Sugar and Citric Acid Mixture = 60 minutes

Table (4) Effect of the Drying Time on the Characteristics of Preserved Melon (Honeydew) Fruit

Fresh Melon Strips = 100 g
Ratio of Melon and Sugar and Citric Acid Mixture = 1:2.5 (w/v)
Soaking Time in 10% Lime Water Solution at 27-30^{o}C = 30 minutes
Citric Acid Content in Sugar Syrup Mixture = 2% (by weight)
Total Concentration of Sugar and Citric Acid Mixture = 60^{o}Brix
Soaking Time in Sugar and Citric Acid Mixture = 60 minutes
Drying Temperature = 70^{o}C

Sample No	Drying Time (hours)	Yield (%)	Moisture Content(%)	pH Value	Acidity % (w/v)	Shelf-life (month)	Organoleptic Properties
1	8	50	40	4.9	0.00831	3	Soft, brownish white colour, slightly sour taste and fermented odour
2	9	45	30	4.9	0.00831	3	Soft, brownish white colour, slightly sour taste and fermented odour
*3	*10	40	20	5.0	0.00804	6	Hard, brightly white colour, slightly sour taste and pleasant smell, good month feel
4	11	38	15	5.0	000804	6	Hard and shrink, white colour, slightly sour taste and pleasant smell
5	12	35	10	4.9	0.00831	6	Hard and shrink, white colour, slightly sour taste and pleasant smell

* Optimum Drying Time = 10 hours

Table (5) Effect of the Drying Temperature on the Characteristics of Preserved Melon (Honeydew) Fruit

Fresh Melon Strips = 100 g
Ratio of Melon and Sugar and Citric Acid Mixture = 1:2.5 (w/v)
Soaking Time in 10% Lime Water Solution at 27-30^{o}C = 30 minutes
Citric Acid Content in Sugar Syrup Mixture = 2% (by weight)
Total Concentration of Sugar and Citric Acid Mixture = 60^{o}Brix
Soaking Time in Sugar and Citric Acid Mixture at 27-30^{o}C = 60 minutes
Drying Time = 10 hours

Sample No	Drying Temperature (^{o}C)	Yield (%)	Moisture Content (%)	pH Value	Acidity % (w/v)	Shelf-life (month)	Organoleptic Properties
1	60	47	40	5.4	0.00536	2	Soft, brownish white colour, slightly sour taste and fermented odour
2	65	43	30	5.4	0.00536	2	Soft, brownish white colour, slightly sour taste and fermented odour
*3	*70	40	20	5.0	0.00804	5	Hard, brightly white colour, slightly sour taste and pleasant smell, good mouth feel
4	75	37	15	4.9	0.00831	5	Hard and shrink, white colour, slightly sour taste and pleasant smell
5	80	34	10	4.9	0.00831	5	Hard and shrink, white colour, slightly sour taste and pleasant smell

*Optimum Drying Temperature = 70^{o}C

Table (6) Physico-Chemical Properties of Preserved Melon (Honeydew) Fruit

Properties	**Experimental Values***
pH	5.0
Acidity %(w/v)	0.0084
Moisture Content %	20
Organoleptic Properties	Hard, brightly white colour, slightly sour taste and pleasant smell, better mouth feel.

* These values were determined from the preserved melon (honeydew) fruit sample prepared under optimum condition.

Note: pH, acidity, moisture content and organoleptic properties were determined at Industrial Chemistry Department, Yadanabon University.

Table (7) Comparison on Nutritional Composition of Fresh and Preserved Melon (Honeydew) Fruit

No.	Nutritional Composition	Literature values of Fresh Melon (Honeydew)**	Experimental values of Preserved Melon (Honeydew)*
1	Protein (%)	0.50	0.299
2	Carbohydrate (%)	9.20	71.57
3	Fat (%)	0.10	0.086
4	Calcium (mg)	6.00	1.844
5	Magnesium (mg)	1.09	0.585
6	Sodium (mg)	10.00	0.497
7	Potassium (mg)	271.00	3.827
8	Phosphorous (mg)	10.00	0.21375
9	Vitamin A (IU)	3224	1626.40
10	Vitamin C (%)	2.48	0.45
11	Ash (%)	0.64	1.28
12	Water / Moisture (%)	90.00	20

***** These values were determined from the preserved melon sample prepared under optimum condition.

** These literature values were obtained from the USDA, Nutritional Nutrient Database for Standard Reference, Release 22, 2009 and http://en.www.Gale Encyclopedia of Food and Culture.com.

Note: Nutritional compositions of preserved melon (honeydew) fruit were determined at Myanmar Pharmaceutical Factory (Sagaing), Ministry of Industry.

Conclusion

This research points out that the effect of the total concentration of sugar and citric acid mixture solution and osmotic dehydration were mainly related to the improvement of some organoleptic properties. Fruit processing have many benefits and economic potential such as reduced volume and weight, reduced packaging, easier handling and transportation, and much longer shelf life.

The nutritional composition of preserved melon (honeydew) fruit depends upon the pretreatment of melon and process conditions of preserve melon fruit. Operating parameters affect the quality of final product. So, the variation of factor affecting the product properties should be required to obtain optimum conditions of the final product.

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