STUDY ON DRYING AND QUALITY CHARACTERISTICS OF TRAY AND MICROWAVE DRIED GUAVA SLICES

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ABSTRACT

Uniform sizes of guava (Psidiumguajava L.) in India is considered to be most popular fruit and it is given the name of apple or tropical parts. This is the fourth fruit after mango, banana, and citrus which is most important in area and production. Now guava is considered to be an excellent trade fruit. It is quite hard, multi-breeding, fruiting and even higher fruitful without more care. The Higher water content of most fruits makes them highly perishable and is responsible for postharvest losses in storage, handling and transportation, resulting in economic losses. Transformation to a stable product is thus necessary either by canning, freezing or drying. Unblanched, blanched and blanched with KMS samples were dried at three different Powers (20W, 40W, 60W). Dried samples were evaluated for quality attributes, viz. Vitamin C retention, rehydration ratio, moisture content and drying rate. The samples were heat sealed in high density polyethylene bags and stored at room temperature. The samples were analysed for quality attributes after drying. Results indicated that the initial average moisture content of guava slices was 1389.08% (db). The initial moisture content of pre-treated samples had highest at 20, 40 and 60 W. Drying rate of KMS blanched sample had highest at 20 and 60 W but at 40 W drying rate of blanched sample had highest. Moisture loss increased from guava with increased in power of microwave and time of drying. The pre-treated samples were taken shorter drying time than unblanched sample. Rehydration ratio was found acceptable those samples which were dried at 40W with KMS blanched sample. Rehydration ratio of KMS blanched samples was found 5.056, 7.622 and 5.566 at 20, 40 and 60W respectively. Ascorbic acid content was found acceptable at 20W KMS blanched sample had highest ascorbic acid content 200mg/100g. At 40 and 60W the ascorbic acid content of KMS blanched samples were 143.33 and 116.66mg/100g respectively with desirability factor of 0.50

Keywords: Guava, Drying, Vitamin C, Rehydration ratio, Drying rate and Moisture content

1. INTRODUCTION

Guava (Psidiumguajava L.) in India is considered to be most popular fruit and it is given the name of apple or tropical parts. This is the fourth fruit after mango, banana, and citrus which is most important in area and production. Now guava is considered to be an excellent trade fruit. It is quite hard, multi-breeding, fruiting and even higher fruitful without more care. The Higher water content of most fruits makes them highly perishable and is responsible for postharvest losses in storage, handling and transportation, resulting in economic losses. Transformation to a stable product is thus necessary either by canning, freezing or drying.

The estimated postharvest loss per hectare in India is about 49 % (Sehgal, 1999). Guava prices become very low during main season and sometimes farmers have to pay to throw away their produces because of higher perishable nature of the produce. Fresh guava has 92 to 94% water and it can be stored for 2 to 4 weeks at 0°C (Mudgal and Pandey, 2007). Processing of guava can be an alternate for extending the shelf life. The most serious constraint for shelf-life enhancement is the activity of micro-organisms. Guava is low in fat, low in carbohydrates but high in dietary fiber, folate, water, and vitamin C, possessing a high density. Numerous studies indicate that guava contains many health beneficial phytochemicals. Psidium fruits in general protect humans against lung, gastrointestinal tract and prostrate cancer. Other glucosinolates, Carotenoids (42).Indole-3-carbinol, a chemical that enhances DNA repair (43,44) and acts as an estrogen antagonist (45) slowing the growth of cancer cells. A high intake of Cruciferous fruits has been associated with reduced risk of aggressive prostate cancer there is, therefore, a growing and urgent need for simple, inexpensive processes that would offer a way to save these highly perishable commodities from spoilage and available in off season and can provide at that places where cannot grown. Conventional dehydration and canning processes, have many drawbacks with rigid structures which need rehydration for prolonged periods and generally have texture and flavor inferior to the fresh materials, it is unsuitable due to shrinkage to toughness caused by slow prolonged drying (Jayaraman, 1988). Canned products on the other hand, suffer from the disadvantages of bulk, weight, overcooked texture and flavor, high cost (due to high energy input, cost of tinplate and capital investment) and dependence for safety or wholesomeness on the integrity of the container. Microwave convective and microwave vacuum drying techniques have been investigated as potential methods for obtaining high quality dehydrated food products. Microwave drying is rapid, uniform and energy efficient compared to conventional hot air drying as the microwaves penetrate to the interior of the food causing water to get heated within the food. This results in a
greatly increased vapour pressure differential between the centre and surface of the product, allowing rapid removal of moisture from the food. Some fruits and vegetables have been successfully dried by microwave convective and microwave vacuum drying techniques. But a large-scale industrial application of microwave drying requires the detailed knowledge of various process parameters and proper design of system and equipment. This literature includes the microwave drying characteristics on several food materials, drying process, parameters related to microwave drying and level of microwave power in microwave drying in India. (Sutar and Prasad 2008) The ultimate objective of this literature is to propose mathematical model using microwave drying and also optimize conditions for beetroot slices.

2. MATERIALS AND METHODS

2.1 EXPERIMENTAL PROCEDURE

2.1.1 Selection of raw materials

Good quality fresh guava was purchased from local market in Allahabad damage and immature pieces of guava was removed manually by visual inspection.

2.1.2 Pre-treatment of guava

Guava fresh and good pieces were sliced with help of knife. After the slicing guava was washed in hot water and the sample was drained to remove the excess water for unblanched sample.

2.1.3 Blanching pre-treatment

After washed the sliced guava pieces were blanched by tying them in muslin cloth and dipping the sample in boiling water for 5 minutes. The blanched samples were cooled immediately by keeping them under flowing water to prevent overcooking of the sample and drained to remove the excess water for blanched sample.

2.1.4 Chemical pre-treatment

After washed the sliced guava pieces were blanched with KMS by tying them in muslin cloth and dipping the sample in boiling water for 5 minutes. The blanched with KMS samples were cooled immediately by keeping them under flowing water to prevent overcooking of the sample and drained to remove the excess water for blanched with KMS (1% solution of potassium Meta bisulphate) sample.

2.1.5 Microwave power drying

The pre-treated guava slices were dried in a microwave dryer. Drying was carried out at three different microwave generation power being 2040 and 60W and two pre-treatment. The sample of guava design was dried simultaneously, in order to ensure uniform drying conditions. After the dried guava slices were analysed for different physicochemical analysis. Three replication of each pre-treated samples were performed according to a preset microwave output power.

Fig.2.1 Processing Flowchart for Dehydrated Guava Slices

2.1.2 Physicochemical Analysis

2.1.2.1 Determination of moisture content

Initial moisture content

A standardization procedure of AOAC (1980) was followed to estimate the moisture content of food.

The moisture content of the sample was computed using the following equations.

\[
\text{Moisture content (wb)} = \frac{M_1 - M_2}{M_1} \times 100
\]

\[
\text{Moisture content (db)} = \frac{\text{M.C.(wet basis)}}{100 - \text{M.C.(wet basis)}} \times 100
\]

100 – M.C.(wet basis)

M.C. (lost) = M.C. (current) – M.C. (Previous)

Drying rate = \frac{W_t - W_{t+Dt}}{D_t \times W_d}

Where,

- \(W_t\) = Weight of sample at any time \(t\) g
- \(W_{t+Dt}\) = Weight of sample at any time \(t+Dt\) g
- \(D_t\) = Time interval, min
- \(W_d\) = Weight of bone dry material, g
- M.C. = moisture content of sample (% w.b. and d.b.)
Where,

\[ \text{M}_1 = \text{wt. of sample before drying (g)} \]
\[ \text{M}_2 = \text{wt. of sample after drying (g)} \]

2.1.2.2 Moisture content of sample during drying:

Moisture content of sample during drying was computed through mass balance. For this purpose, weight of the sample during drying was recorded every five minute for one hour after that ten minute for one hour after two hour readings were taken after twenty minute until dehydrated it. Reading was noted after above time interval the following formula was used to calculate moisture content.

**Calculation:**

\[ \text{M.C=} \frac{\text{wt.of sample at anytime} - \text{wt.of bone dry material}}{\text{wt.of sample at anytime \times 100}} \]

Where,

\[ \text{Wt.of bone dried material} = \frac{\text{initial weight of sample} - \text{initial M.C}}{100} \]

2.1.2.3 Drying rate (DR):

Drying rate

\[ \text{Amount of moisture remove(g)} \]
\[ = \frac{\text{Time taken(min)} \times \text{(total bone dry weight of sample in (g))}}{\text{(initial M.C)}} \]

Similarly, the drying rate was approximately proportional to the difference in moisture content between the product being dried and EMC at the drying air state.

\[ \text{DR} = \frac{\text{Mt + dt} - \text{Mt}}{\text{dt}} \]

Where,

\[ \text{Mt} = \text{moisture content at time } t \text{ (% db)} \]
\[ \text{Mt+dt} = \text{moisture content at time } t+dt \text{ (%db)} \]
\[ \text{dt} = \text{time of successive measurement (min)} \]

2.2 PHYSICO-CHEMICAL ANALYSIS

2.2.1 Rehydration Ratio: Five g of dehydrated sample was put into a small container and 120 ml of distilled water was added. Container was cover with a watch glass and the water was brought to boil. Water was boiled gently for 15 minutes. Sample was turn out onto a white dish which surface was covered with a piece of filter paper to soak the excess water and the weight of sample was record and rehydration ratio was Calculate by the following formula

\[ \text{Rehydration ratio =} \frac{B}{A} \]

Where,

\[ B = \text{weight of sample (g) after rehydration} \]

\[ A = \text{weight of sample (g) before rehydration} \]

2.2.2 Vitamin C Determination: Vitamin C of driedguava (Psidiumguajava. var. p.guajava) samples were determined by 2, 4-Dichlorophenol Indophenol dye method.

3. MATERIAL USED FOR PACKAGING

The material use for packaging of dried guava slices were HDPE (High Density Polyethylene). The dried product was packed at room temperature after cooling the products and stored at room temperature away from direct sun light.

4. RESULTS AND DISCUSSION

Experiments were conducted to study the Microwave drying characteristics of guava slices at different power. Guava samples were packed in HDPE bags and stored at room temperature. Studies on quality were based on physicochemical characteristics (i.e., moisture content, drying rate, rehydration ratio, and ascorbic acid content) which were determined for fresh samples. The results of the study are presented and discussed in following section.

4.1 MICROWAVE DRYING CHARACTERISTICS

Guava slices were dehydrated in Microwave dryer at 20,40and 60W to final equilibrium moisture content. The initial average moisture content of guava slices was 1389.08% (db). The relationship between moisture content, drying time. The moisture content decreased very rapidly during the initial stage of drying, as there was fast removal of moisture from the surface of the Product. Decrease in drying rate with respect to time suggests a decreased drying rate with the decrease in moisture content. The drying rate was calculated using equation as discussed in earlier.

4.1.1 Effect of Pre-treatment and microwave power dryer on moisture content of guava during drying process. The initial Average moisture content of unblanched, blanched and blanched with KMS guava samples was 1389.08% fig 4.2.1-3 present the variation in the moisture content as the function of drying time at 20,40 and 60W.It showed that the moisture content decreased continuously with drying time and increasing the drying power. Similar results were also obtained by (Farhang et al.,2010). Different results were obtained in which the pre-treatments affect the drying time. The pre-treated samples were found to be have a shorter time as compared to unblanched sample. It is observed that the drying time required for reducing the moisture content of pre-treated samples were taken different drying time. Thereafter, the moisture content of samples decreased slowly with increase in drying time and attained final equilibrium moisture content. With increasing the drying power level the amount of moisture removed from guava increased and time to achieve final moisture content in finished product was
reduced. The KMS blanched samples at 40 and 60 W took shorter time than other and at 20 W blanched sample took less time.

At 20 watt initial level moisture content of unblanched blanched and blanched with KMS samples were observed about 1206.33, 1369.50 and 1438.46% (db) respectively. Guava slices were reduced to 1.50%, 1.16% and 4.61% (db) at the end of 30, 31, and 30 minutes drying respectively.

At 40 watt initial level moisture content of unblanched, blanched and blanched with KMS samples were observed about 1314.42, 1477.28 and 1471.09% (db) respectively. Guava slices were reduced to 3.04%, 1.156% and 3.87% (db) at the end of 26, 30, and 30 minutes drying respectively.

At 60 watt initial level moisture content of unblanched, blanched and blanched with KMS samples were observed about 1283.12, 1391.42 and 1550.16% (db) respectively. Guava slices were reduced to 2.85%, 1.72% and 7.88% (db) at the end of 26, 33, and 29 minutes drying respectively.

5. CONCLUSIONS

Experiments were conduct to study the Microwave drying characteristics of gauva slices. Effect of different power on guava slices and quality parameters of guava slices just after preparation was studied in these experiments.

The initial moisture content of pre-treated samples had highest at 20, 40 and 60 W in microwave power dryer. The drying rate of KMS blanched sample had highest at 20 and 60 W but at 40 W, drying rate of blanched sample had highest. Moisture loss increased from guava with increased in power of microwave and time of drying. The pre-treated samples were taken shorter drying time than unblanched sample. Rehydration ratio was found acceptable in microwave those samples which were dried at 40 W with KMS blanched sample. Rehydration ratio of KMS blanched samples were found 5.056, 7.622 and 5.566 at 20, 40 and 60 W respectively. Ascorbic acid content was found acceptable at 20 W KMS blanched sample had highest ascorbic acid content 200mg/100g. At 40 and 60 W the ascorbic acid content of KMS blanched sample was 143.33 and 116.66mg/100g.

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