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Testing and Demonstration of Onion Flake Processing Technology in Fogera Area at Rib and Megech River Project

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Abstract

Onion is one of the most cultivated and consumed vegetable in Ethiopia. It is widely grown in several parts of the country especially in irrigated areas. In Amhara region, Fogera woreda is one of the place at which onion is cultivated extensively using irrigation. Although there is high onion blub production in this area, about 40% post-harvest losses observed in the district. Consequentially Onion bulb had extreme variable market price during production and off season. To reduce these post-harvest losses and stabilize market fluctuation during the production and off season, onion drying technology was evaluated. At the time of use the onion flake would be rehydrated using warm water. Physicochemical properties of fresh and dried onion were analyzed by sensory analysis. Panel results confirmed onion flake had similar sensory attributes as compared to that of fresh onion. Finally, this onion processing technology was demonstrated in selected potential farmers and small-scale entrepreneurs in food processing at Fogera district and promising feed-backs were obtained.

Keywords: Onion; Flake; Rehydration; Sensory and physicochemical properties

Introduction

Onion *(Allium cepa L.)* is one of the major bulb crops of the world and is most important commercial vegetable in all countries. Onion ranks the third highest in production in the world among seven major vegetables, namely garlic, green peas, cabbage, onion, tomato cauliflower, and green beans. The four-major onion producing countries in the world are China with largest production of 3.93 million tones, followed by India with 3.35 million tones, USA 2.45 million tones and Turkey 1.55 million tones. In Ethiopian case onion is highly cultivated vegetable in several parts of the country. In Amhara region, Fogera woreda is one of the most onion productive areas of the region by using irrigation systems and onion is also considerably important in the daily Ethiopian diet. All the plant parts are edible, but the bulbs and the lower stem sections are the most popular as seasonings or as vegetables in stews [1]. In Ethiopia, up to 40% of vegetable harvests are reported to be lost due to poor postharvest handling techniques [2]. During peak harvesting seasons, the loss is high and the products are sold at low price because of lack of means to preserve and store fresh onion bulb products. Therefore, in order to prolong the shelf life of the postharvest onion bulb product, employing preservation and processing technologies are necessary. Non-availability of onion bulb during off-season creates major problem in the market and causes price fluctuations, which directly affects the consumer.

The most primitive method employed in preserving onion is that onion flakes are spread on the ground such as wheat, raisins, fig or apricot, exposed to the sun in order to be dried or simply open sun drying. The dried crop can be stored for a considerable period without the fear of its deterioration. An advanced and alternative method to the traditional techniques is greenhouse drying, in which the product is placed in trays receiving solar radiation through the plastic cover, while moisture is removed by natural convection or forced air flow. The rate of drying depends on a number of external parameters (solar radiation, ambient temperature, wind velocity and relative humidity) and internal parameters (initial moisture contents, type of crops, crop absorptive and mass of product per unit exposed area) [3]. Small and medium-scale businesses that produce value-added products from onion will provide opportunities for economic development in of the country. These businesses create jobs and provide much needed incomes for the urban and rural poor. These value-added products, produced from locally sourced raw materials, are not capital intensive, and take advantage of local labor markets, providing decent incomes for those that otherwise would continue to exist in impoverished conditions. In Ethiopia, especially in Fogera district onion bulb production is high in the area, but framers were not much benefited due to its high onion bulb post-harvest loss due to its high perishable nature. High postharvest loss also creates high market fluctuation during production and off season ultimately it costs the local consumer where onion imported from countries such as Sudan. Therefore, to overcome high post-harvest losses of onion bulb, in this research activities onion drying technologies were tested and evaluated at Bahir Dar Food Science and Postharvest Handing Research Center and demonstrated in onion farming farmers of Fogera woreda especially at Rib and Megech River project area.

Objectives of the study

- To reduce onion bulb post-harvest loss and stabilize onion market fluctuation in the production and off season.
- To evaluate and demonstrate onion flake technologies in Fogera woreda at Rib and Megech River project area.
- To analyse some physicochemical attributes of onion flake sensory analysis by taking fresh onion bulb as standard.
- To demonstrate onion flake technology in Fogera district rural women to provide alternative income sources.

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Materials and Methods

Sample collection and preparation

Onion (Bombay red) sample was bought from farmers at Fogera Woreda and then the sample was trimmed to remove diseased, damaged and other extraneous materials in the sample

Physicochemical characterization of onion bulb

Moisture content: Moisture content of the sample was determined according to the standard official method of analysis [4]. The moisture content was calculated as follows:

$$MC(\%) = \frac{W_1 - W_2}{W_1} \times 100 \quad (1)$$

Where,

W_1=Original weight of sample.

W_2=weight of dried sample.

Dry matter content: Dry matter content of onion sample is calculated as follows:

$$DM = 100 - MC(\%) \quad (2)$$

Shape of onion: The vertical and horizontal diameter of onion samples were measured using digital caliper. Then with these dimensions as basic parameter the shape of onion was determined by visual comparison method.

Bulk density: Volume of onion bulb sample was measured by using water displacement method while the weight was weighed using analytical balance. Then bulk density was calculated as usual as bulk mass divided by volume.

Onion drying: Inedible part of onion was first removed and peeled. Then the Peeled onion was sliced with stain less still knife and sprayed uniformly on mesh of solar dryer and dried to a moisture content of 8-10 percent. During drying temperature and relative humidity of ambient and solar dryer during drying was measured using data logger. Finally, onion flake was packed using polyethylene by bag seller.

Sensory analysis: The onion flake was impressed in warm water for 90 minutes. During soaking period, the onion flake absorbs water and became to its original fresh like onion slices. Then sensory attributes assessed were color, texture, flavor, pungency, taste and the overall acceptability. Ten trained panelists were selected from Bahir Dar Food Science and Postharvest Handling Research Center and the panelists were instructed to rate on 9-point hedonic scale ranging from 1=liked extremely to 9=disliked extremely.

Results and Discussion

Physicochemical characterization of onion bulb

Physicochemical property of Bombay red onion bulb is shown in the Table 1 below. The moisture content of Bombay red was found to be 86.24%. The result found was greater than that reported by Girma [5]. The difference may arise due to different agronomic practices employed. The shape of Bombay red onion bulb was globe which matches with the report by Lemma and Shimelis [6]. The bulk density was found 0.3 g/cm^3 while total soluble solid content was 15.5°Brix.

Ambient and solar dryer environment

Temperature and relative humidity of ambient and solar dryer drying environment was shown in the Figure 1 below. The drying environment was found to be in better environment to dry food materials containing volatile compounds. But another possibility to dry vegetables is oven drying. Oven drying can be done all the year around as it is not dependent on the weather conditions. During drying open the oven door a little bit to allow moisture to go out. In addition, a fan put in front of the oven door can be used to increase ventilation and thereby reduce drying time. Special care has to be taken that the vegetables do not get burned in the oven [7].

Properties	Result
Moisture content	0.8624
Dry matter content	0.1376
Shape	Rhombic
Bulk density	0.3 g/cm^3
TSS	15.5°Brix

Table 1: Onion physicochemical property.

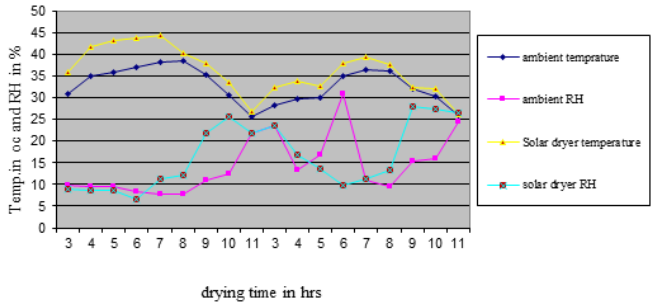

Figure 1: Drying environment of ambient and solar dryer.

Type	Taste	Color	Flavor	Pungency	Texture	Overall acceptability
Rehydrated onion flake	Very good	Very good	Good	Very good	Good	Very good
Fresh onion bulb	Good	Very good	Good	Good	Very good	Very good

Table 2: Summarized sensory evaluation results.

Sensory analysis

The panel test result was shown in the Table 2 below. As it is observed from the result of sensory analysis the taste, color, flavor, level of pungency, aroma and over all acceptability of rehydrated onion flake had no significant effect at ($p<0.05$) from fresh onion bulb of the same cultivar in this case Bombay red. The insignificant of sensory attributes of rehydrated onion flake relative to fresh onion bulb may also be restricted with the above drying environment. So, drying of onion bulb to onion flake under the above recommended drying environment do not had an impact on its physicochemical nature. Sensory analysis of onion flake was conducted for nine months in each three months and the sensory data show remarkable result relative to fresh onion bulb. Insignificant sensory attributes of fresh onion bulb and rehydrated onion flake contributes a lot in the dissemination of onion flake processing technology is demonstrated in Fogera district during popularization phase (Figure 2).

Conclusion and Recommendations

Technical simplicity of onion slice drying by solar dryer will contribute a lot for dissemination of the processing technology to onion producing farmers in Fogera district. The flavor, pungency, color and taste of rehydrated onion flake had similar property with

Figure 2: Sample pictures of technology demonstration in Fogera district.

fresh onion bulb. Onion flake packed with polyethylene stayed for nine months with any significant change in sensory quality of the onion. Comparative advantage of onion flake is having stable shelf-life, so as to stabilize market stability of onion in Fogera district in addition to minimizing onion bulb postharvest loss. Onion flake is also best-suiting with farmers cooking tradition, saving of onion cooking time or "frying stage". In Ethiopia rehydration or humidification is important to use onion flake in "*wott*" preparation. Interested researchers shall conduct a research on to generate quantified data of sulfur compounds and non-structural sugars in dried onion products since these components of both onion flake and fresh bulbs were indirectly investigated by sensory analysis.

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