IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES
ISSN PRINT 2319 1775 Online 2320 7876
 Volume 12, Iss 4 , 2023

A Study on Standardizing the Drying Process for Development of Onion Powder

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Abstract

Onion is a commercial crop of our country, belongs to the family Alliaceae. It is used for both internal consumption and foreign exchange. So an experiment was conducted entitled "A study entitled as "Standardization of drying condition for development of onion powder" was conducted at Division of Food Science and Technology at Sher-e-Kashmir University of Agricultural Sciences and Technology, Shalimar. Three cultivars of onion namely Nasik Red, Red Globe, Yellow Globe were selected for pungency evaluation and basedon pyruvic acid content. The selected variety was first subjected to preliminary operations then subjected to osmotic pre-treatment. The treated onion slices were divided in to two lots and thereafter subjected to two dehydration methods viz. hot air drying (600 C and 700 C) and vacuum dehydration were carried out independently. A constant pressure of 50mmHg was maintained during vaccum dehydration. Dehydrated onion slices were then grinded in a grinder to produce powder. The developed onion powder was evaluated for the physio-chemical characteristics such as moisture content (%), water activity (a w),Dry matter content (%), powder yield (kg/kg of prepared onion slices), true density (g/cm 3), bulk density (g/cm 3), carr's index and hausner's ratio, browning index (420nm), reducing sugars (%), total sugars (%), antioxidant activity (%DPPH Inhibition assay), pungency (µmole/g), phenols (mg GAE/100g) and ascorbic acid (mg/100g).

Key Words: Onion, drying methods, vaccum dehydration, physio-chemical characteristics

Introduction

Onion is a commercial crop of our country, belongs to the family Alliaceae. It is used for both internal consumption and foreign exchange. The more pungent varieties of onion appear to possess the greatest concentration of health promoting phytochemicals i.e. phenolics and flavonoids that have potential anti-inflammatory, anti-cholesterol, anti-cancer and antioxidant properties which protect against stomach and different types of cancers, improve lung function, especially in asthmatics. Besides this, it is a delicate commodity to store because of higher water content and serious losses occurring due to rotting, sprouting, physiological loss in weight and moisture evaporation. Onion powder is an important value-added product. Hence it is widely used in traditional cooking and culinary preparations. The dehydrated onion powder is

ISSN PRINT 2319 1775 Online 2320 7876
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commonly used as ingredient or as a flavor additive in several food products such as soups, snacks, sauces, frozen foods, retorted products, salad dressings, meat products, pickles, pickles relishes. With both culinary and therapeutic benefits, onion is a very important commercial vegetable that is farmed mostly by small and marginal farmers practically everywhere in the india for both local and international trade (Setiya and Muthuselvan, 2018). Onion is rich in nutritive and medicinal properties which play an important role in prevention of various life style diseases (Srivatsava*et al.,* 2015). As a result, vacuum drying allows for increased drying rate, decreased drying temperature, and an oxygen deficient processing environment (Wu *et al.,* 2007). Due to the lack of oxygen, this process results in fewer oxidative changes while preserving the flavour, colour, and texture of the dried products (Zielinska*et al.,* 2013; Geankoplis, 2011; Gunasekaran 1999). Higher quality than the standard convective air drying method at atmospheric pressure can thus be achieved (Jaya and Das, 2003; Kompany*et al.,* 1993). In view of the above the study, entitled "**Standardization of drying condition for development of onion powder**" was undertaken using two different drying methods viz., hot air drying and vacuum drying with the following objectives.

1. To standardize the drying process for development of onion powder.

Material and Methods

The present investigation was carried out in the Division of Food Science and Technology, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir (SKUAST-K), Shalimar during the year (2021-2022). The section enlists the materials used and elaborates the processing techniques, analytical procedures and the organoleptic evaluation methods followed during the research.

Raw material

Three Onions cultivars viz., Nasik red , Red globe and yellow globe of uniform size, vigour and maturity free from diseases and blemishes was procured from Local market and brought to Food Processing Laboratory, Division of Food science and Technology, SKUAST-Kashmir and stored at 3- 4^0C till further use.

Pyruvic acid content (µmole/g)

The pyruvic acid content of fresh onions was determined by method as prescribed by Anthon and Barret (2003). 50 ml of distilled water, 1 ml of extract, and 0.5 ml of Dinitro phenyl hydrazine were added to 3g of onion samples and the mixture was then incubated for 10 min at

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37 °C. After 10 minutes, 2.5 ml of 0.6 Normal NaOH was added to the produced solution, and the absorbance was measured at 420 nm.

Average bulb Weight (g)

Average bulb weight of onions was calculated by first grading the onion bulbs according to their size then selecting five onions from each grade to arrive at a representative sample of fifteen onion bulbs. The onions were then weighed on electronic balance of 0.1 gram sensitivity and average weight of onion was calculated and expressed in grams.

Moisture Content (%)

The moisture content of the sample was determined by weighing 2 g of sample into a pre weighed china dish and drying it in an air forced draft oven at a temperature of 105 ± 5 °C till the constant weight of dry matter was obtained.

Moisture (%) = [Weight of original sample – Weight of dried sample) / Weight of original sample × 100]

Dry matter content (%)

The dry matter content of fresh onions was calculated by the formula as prescribed by Dantata*et al.* (2008) and calculated as

Dry matter content: 100 - moisture content of the sample

Ash Content (%)

Ash content of the fresh onion was calculated by the method prescribed by (AOAC, 1990). The % ash content in the onion sample was calculated as follows:

Ash (%) = (Weight of ash / Weight of sample taken) × 100

Total Sugar (%)

Total sugars were determined by the methods described by Ranganna (1986) with slight modifications. To a known quantity of sample (10 ml or 10 g), 10 ml of 45% lead acetate solution was added and after 15 to 20 min, 5 g potassium oxalate was mixed. The remaining 25 ml filtrate was mixed with 5 ml concentrated HCl and kept overnight. It was then, neutralized with 10% NaOH solution using phenolphthalein as an indicator. The volume of this pink coloured solution was made up to 75 ml and then titrated against Fehling's solutions A and B (5 ml each).

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$$\% \text{ Total sugar (as invert sugars)} = \frac{0.05 \times V_1 \times V_2 \times 100}{T_2 \times W \times 25}$$

Reducing sugars (%)

The reducing sugar of fresh onion was estimated using Lane and Eyon method (Rangana, 1986).

A 250 ml volumetric flask containing 2.5 g of fresh sample was used. 100 ml of distilled water was added, one drop of the phenolphalein indicator, 1Normal NaOH was added drop by drop until a pink color was obtained, 2 ml of lead acetate was added, and the volume was then increased to 250 ml by adding 2 ml of potassium oxalate.

Calculations:

$$\textbf{Reducing sugars (\%)} = \frac{\text{mg of invert sugar (0.05)} \times \text{dilution} \times 100}{\text{Titer value} \times \text{weight or volume of sample} \times 1000}$$

Results:

Effect of cultivars on pyruvic acid content (µmol/g)

Data revealed that pyruvic acid content was found (Table 1) to vary among the cultivars from 2.31 to 9.91 µmol/g with higher mean pyruvic acid content (9.91) reported in case of Nasik Red cultivar, whereas it was recorded lowest for yellow globe (2.31). Based on pungency evaluation Nasik Red with highest pungency value was carried forward for further study. According to Jurgeil*et al.* (2015), Sidhu *et al.* (2017) and Armand *et al.* (2018).

Table 1: Pyruvic acid content (µmol/g) of different onion cultivars

Cultivar	Mean
Nasik Red)	9.91
Red Globe	5.20
Yellow Globe	2.31

Physi-co-chemical Characteristics of fresh onion cultivar (Nasik red)

The physi-co-chemical characteristics of fresh onion (cv. Nasik red) have been presented in Table 2. The average bulb weight of fresh onion was 54.93g, average diameter was 4.31 cm,

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moisture content was recorded as 85.00%, dry matter content as 15.00%, ash 0.47%, total soluble solids as 12.09^0 Brix, total sugar 11.00%, reducing sugar 9.03%, pyruvic acid 9.91µmol/g, ascorbic acid 14.33 mg/100g, antioxidant activity 62.36%, and total phenols as 16.72 mg GAE/100g respectively on wet basis.Misal*et al.* (2020), Armand *et al.* (2018) and Yadav *et al.* (2010).

Table 2: **Physi-co-chemical characteristics of fresh onion (cv. Nasik Red)**

Parameter	Onion
Average bulb weight (g)	54.93 ± 0.56
Average Diameter (cm)	4.31 ± 0.17
Moisture Content (%)	85.00 ± 0.33
Dry Matter Content (%)	15.00 ± 0.23
Ash (%)	0.47 ± 0.03
Total Soluble solids (^{0}Brix)	12.09 ± 0.05
Total sugar (%)	11.00 ± 0.04
Reducing sugar (%)	9.03 ± 0.05
Pyruvic acid (µmol/g)	9.91 ± 0.03
Antioxidant Activity (%DPPH Inhibition)	62.36 ± 0.05
Ascorbic Acid (mg/100g)	14.33 ± 0.09
Total Phenols (mg GAE/100g)	16.72 ± 0.04

Moisture content (%)

Data with respect (Table 3) to effect of salt concentration and temperature on moisture content (%) of dehydrated onion powder has been presented in table 4.3. Perusal of the data revealed influence of both salt and temperature on moisture content (%) of dehydrated onion powder. Similarly interactive effect of salt concentration and temperature was also found to be significant. Mean moisture content (%) was found to vary between 3.79-4.71 % with significantly (P≤0.05) highest moisture content (%) recorded incase of treatment S_1 (4.71%) and lowest recorded incase of treatment S_3 (3.79%). Similarly dehydration temperature was also

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found to have significant influence on moisture content (%) of dehydrated onion powder. Highest moisture content (%) was reported in case of treatment T_1 (4.39%) whereas it was recorded lowest in T_2 (4.14%).Hirave*et al.* (2015) studied eight different red onion cultivars, and the results showed that variety Bhima Red (V8) recorded the highest average fresh weight of bulb (110.95 gm) and cured weight of bulb (99.53 gm). Hirave*et al.* (2015), Yadav *et al.* (2010) and Kandoliya*et al.* (2015) also support.

Dry matter content (%)

Data with respect to effect of salt concentration and temperature on dry matter content (%) of dehydrated onion powder has been presented in table 4.3. Perusal of data revealed influence of both salt concentration and temperature on dry matter content (%) of dehydrated onion powder. Similarly interactive effect of salt concentration and temperature was found to be non-significant. Mean dry matter content (%) was found to vary between 95.28 - 96.21%, with significantly ($P \leq 0.05$) highest dry matter content (%) reported incase of treatment S_3 (96.21%) and lowest recorded incase of treatment S_1 (95.28%).Similarly dehydration temperature was also found to have significant influence on dry matter content (%) of dehydrated onion powder. Highest dry matter content (%) was reported incase of treatment T_2 (95.85%) whereas it was recorded lowest in T_1 (95.61%). Gouda *et al.* (2016), Shoba*et al.* (2017) and Zea*et al.* (2012)

Water Activity (a_w)

Data with respect to effect of salt concentration and temperature on water activity (a_w) of dehydrated onion powder has been presented in table 4.3. Perusal of data revealed influence of both salt concentration and dehydration temperature on water activity (a_w) of dehydrated onion powder. Similarly interactive effect of salt concentration and temperature was also found to be significant. Mean water activity (a_w) was found to vary between 0.259-0.338, with significantly ($P \leq 0.05$) highest water activity (a_w) reported incase of treatment S_1 (0.338) and lowest recorded incase of treatment S_3 (0.259). Similarly dehydration temperature was also found to have significant influence on water activity (a_w) of dehydrated onion powder. Highest water activity (a_w) was reported incase of treatment T_1 (0.304) whereas it was recorded lowest in T_2 (0.284).Dhumal*et al.* (2005), Yadav *et al.* (2010), Kandoliya*et al.* (2015), Gouda *et al.* (2016) and Vikas*et al.* (2018).

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Conclusion

From this study, results revealed on the basis of pyruvic acid content (µmole/g), average bulb weight (g), moisture content (%), dry matter content (%), ash content (%), and total sugar (%) and reducing sugars (%), water activity. Pyruvic acid content was found to vary among the cultivars from 2.31to 9.91 µmol/g with higher mean pyruvic acid content (9.91). The average bulb weight of fresh onion was 54.93g, average diameter was 4.31 cm, moisture content was recorded as 85.00%, dry matter content as 15.00%, ash 0.47%, total soluble solids as 12.09^0 Brix, total sugar 11.00%, reducing sugar 9.03%, pyruvic acid 9.91µmol/g, ascorbic acid 14.33 mg/100g, antioxidant activity 62.36%, and total phenols as 16.72 mg GAE/100g respectively on wet basis.

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Table 3: Effect of salt concentration and temperature on Moisture content (%), Dry matter content (%) and Water activity (a_w) of onion powder

Salt Concentration / Temperature	Moisture content (%)			Dry matter content (%)			Water activity (a_w)		
	T_1	T_2	Mean	T_1	T_2	Mean	T_1	T_2	Mean
S_1	4.84	4.58	4.71	95.15	95.42	95.28	0.360	0.316	0.338
S_2	4.47	4.12	4.30	95.52	95.87	95.69	0.290	0.282	0.286
S_3	3.84	3.73	3.79	96.15	96.27	96.21	0.263	0.255	0.259
Mean	4.39	4.14		95.61	95.86		0.304	0.284	
CD (p≤0.05)									
Salt concentration		0.246			0.252			0.004	
Temperature		0.233			0.228			0.003	
Salt × temperature		0.294			NS			0.006	

S_1= Pretreatment of onion slices with 5% of NaCl concentration: S_2= Pretreatment of onion slices with 10% of NaCl concentration: S_3 = Pretreatment of onion slices with 5% of NaCl concentration

T_1= Dehydration of onion slices at 60^0C: T_2= Dehydration of onion slices at 70^0C

ISSN PRINT 2319 1775 Online 2320 7876
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