Effect of Different Packaging Materials on Chemical Composition of Fried Onion (*Allium cepa L.*): A Comparative Study

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Abstract: Onion is a commonly used vegetable in entire world. The onions have been utilized as a main component in many recipes by different cultures for thousands of years. Due to its significant medicinal properties, nutritional and energy value, onions (*Allium cepa L.*) impart numerous health benefits to consumers. Therefore, a comparative study was conducted to evaluate the effect of various packaging materials (T_1= Polyethylene bags, T_2= Aluminum foil, T_3= Butter paper and $T_{0=}$ without packaging) on physico-chemical characteristics of fried onion. During storageat the Institute of Food Sciences and Technology, Sindh Agriculture University Tandojam. The pH value, titratable acidity (%), moisture (%), ash(%) and total carbohydrates were determined. The results indicated that pH value and total carbohydrates content were significantly affected by storage periods ($P<0.05$); whereas non-significant effects of packaging were found in titratable acidity, moisture, ash content, respectively.

Keywords: Onion, Packaging material, Chemical composition.

INTRODUCTION

Onion (*Allium cepa* L.) is a commonly used vegetable in entire world. Onion is herbaceous biennial plant which is an underground bulb for edible purpose with one or more than one stalks [1]. The onions have been utilized as a main component in many recipes by different cultures for thousands of years worldwide. The edible part can be used in cooking. The flavor of onion is reliant on variety; an onion may have piquant, tangy, razor-sharp, pungent, mild and sweet taste. The local cuisine in Pakistan for everyday life, onions is a vital vegetable [2].

An estimated annual production of onion in Pakistan is about 1674.6 thousand tons cultivated on an area of 130.6 thousands hectares during the year 2015-16 [3]. In sindh province the crop was cultivated for the year 2014-15 have been assessed at 49,934 hectares in area and 666,764 M.Tons in production, as against 52,908 Hectares and 697,276 M.Tons of last year's final estimate, this shows an decrease of 5.62% in area and 4.38% in production [4]. Onion may be consumed in various cuisines owing to its tenderness and may also be consumed in many ways such as raw, ripe, pickled or powdered. The onions can be boiled and may be used in soups and stews. Onion can be fried or eaten raw or added to many dishes as a garnishing medium. It is also preserved in the dried form and also useful for the vinegar production. Fermentation based products systems are being used to produce onion vinegar from the onion juices. Vinegar is a new valuable product from onion [5,6].

Packaging is an effective method of preservation. Food packaging is tool that can protect food products from exterior factors that can badly affects or damage the food. Packaging also provides knowledge of ingredient along with nutritional information [7]. Food packaging is useful against deterioration of product; it retains beneficial effects of processing.

The fried vegetable products are acquiring a great popularity in the world. These products needed to have a longer shelf life from 2 to 3 months. Frying is found to play an essential role in the shelf -life of the food product. The findings presented by Che-Man *et al.* [8] and Sandhu *et al.* [9] revealed the effect of frying media upon flavor, texture and taste of chips. The information regarding the effect of frying media and packaging material on shelf life of fried products is very limited. The fried onion can be preserve for a long time use if are packaged under suitable packaging materials. The aims of our research were to evaluate the effect of various packaging material on chemical composition of fried onions.

EXPERIMENTAL

Chemicals and Glassware

All chemicals of analytical grade were used throughout experimental work. The glassware were

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used soaked in Hypochlorite 0.1% for 8 to 10 hours to remove any debris or dust followed by washing with tap water and finally rinsed with distilled water.

Sample Collection

Onions were purchased from the local market of Tandojam and brought to laboratories of Institute Food Sciences and Technology, Sindh Agriculture University Tandojam, during the year of 2015. The onions were cut into round shaped slices and subjected to frying.

Preparation of Fried Onion

Onions were peeled and sliced in circular rings with stainless steel knife of about 4-6 mm thick. Sliced onions was deep fried in cooking oil under low flame till they become crispy and golden brown. The fried onion was removed from oil and cooled at room temperature. Fried onions were equally distributed into four lots. One lot was served as control (T_0 or without packaging), however, remaining three lots was used to package in different packaging materials (T_1= Polyethylene bags, T_2= Aluminum foil, T_3= Butter paper). Fried onions were stored for 21 days at ambient temperature and were analyzed for chemical attributes at an interval of 7 days.

Determination of pH Content

Fried onions sample of (5g) was homogenized by pestle and mortar in 95ml distilled water then used for measuring the pH value though pH meter. After first reading, the electrode was rinsed with distilled water and dried by tissue paper for next sample.

Determination of Titratable Acidity (%)

The AOAC [10] method was used for titratable acidity (%). About 5 gram sample and 25ml distilled water were mixed and filtered through Whatman filter paper No. 4. and 2-3 drops of phenolphthalein indicator was used into 10ml of this filtrate and titrated with 0.1N NaOH. The results were noted and calculated as follows:

$$Total\ Acidity\ (\%) = \frac{0.1 \times Eq.wt.of\ acid \times Normality\ of\ NaOH \times titer\ value}{10} \times 100$$

Determination of Moisture Content (%)

The percentage moisture was determined through AOAC [10]. The weighed sample of 5g was placed in a hot air oven (70 ºC) till constant weight achieved. After that the sample was transferred to desiccator for an hour and weight of the sample again. The following formula was used for calculation:

$$Moisture\ content\ (\%) = \frac{wheit\ of\ fresh\ sample - Weight\ of\ dried\ sample}{Weight\ of\ fresh\ sample} \times 100$$

Determination of Ash (%)

Ash of samples was calculated by the method of AOAC [10]. 5g of sample was weighed in a crucible and kept within muffle furnace at the temperature for this reason 525^0C for about 5hrs. It was then transferred to desiccator and weight was noted. Ash content was finally determined by using given equation.

$$Ash\ content\ (\%) = \frac{Weight\ of\ ashed\ sample}{Wheit\ of\ fresh\ sample} \times 100$$

Determination of Total Carbohydrate

The carbohydrates were determined by Anthrone method. The standard solution of glucose was prepared in distilled water. Sample solution was prepared by mixing anthrone reagent with sulphuric acid and distilled water. The sample was placed in water bath at boiling temperature for 3 minutes. The absorbance at 620 nm was noted on spectrophotometer. The results were obtained by drawing calibration curve.

RESULTS

pH Value

The results regarding pHvalue of fried onion stored at room temperature with three different packaging materials are presented in Table **1**. The results indicated that the maximum (5.93) pH of fried onion was recorded from the butter paper packaging after 21 days storage period whereas the aluminum foil showed minimum (5.61) after day 1. The data in Table **1** showed that mean pH of storage was relatively higher (5.81) in polyethylene bag packaging, followed by the (5.80) in butter paper packaging and (5.76) aluminum foil packaging reactively. However, there were significant effects observed amongst three packaging material. The results are statistically significant among the treatments at ($P<0.05$) probability level.

Titratable Acidity

The results regarding titratable acidity of fried onion stored at room temperature with three different

Table 1: pH Value of Fried Onions Stored at Room Temperature with Different Packaging Material

Treatments	Duration				Mean
	1 day	7 days	14 days	21 days	
T_0 (control)	5.63	5.77	5.79	5.81	5.75 d
T_1 Polyethylene bag	5.73	5.78	5.84	5.92	5.81 c
T_2 Aluminum foil	5.61	5.69	5.86	5.88	5.76 a
T_3 Butter paper	5.65	5.72	5.91	5.93	5.80 b
Mean	5.65 c	5.74 a	5.84 c	5.86 b	-

Table 2: Titratable Acidity (%) of Fried Onions Stored at Room Temperature with Different Packaging Material

Treatments	Duration				Mean
	1 day	7 days	14 days	21 days	
T_0 (control)	0.25	0.23	0.21	0.17	0.21
T_1 Polyethylene bag	0.26	0.22	0.18	0.15	0.20
T_2 Aluminum foil	0.22	0.19	0.17	0.14	0.18
T_3 Butter paper	0.27	0.25	0.22	0.19	0.23
Mean	0.25abs	0.22abs	0.19 b	0.16 a	-

packaging materials are presented in Table **2**. The results indicated that the minimum (0.14) titratable acidity of fried onion was recorded from the aluminum foil packaging after 21 days of storage period and butter paper packaging also showed maximum (0.27) after 1 day of storage. The results further showed that mean titratable acidity of storage were relatively (0.23) in butter paper packaging, followed by the (0.20) in polyethylene bag packaging and (0.18) in aluminum foil packaging. However there were significant effect observed amongst three packaging material. The results are statistically non-significant among the treatments at (P>0.05) probability level.

Moisture

The results regarding moisture (%) of fried onion stored at room temperature with three different packaging materials are presented in Table **3**. The results indicated that the highest (9.32) moisture was recorded from the open (control) packaging after 21 days storage period whereas the aluminum foil showed lowest (5.35) after 1 day. The data in Table **3** showed that mean moisture of storage were relatively higher (7.17) in polyethylene bag packaging, followed by the aluminum foil packaging (6.98) and (6.33) in butter paper packaging. However, there were non-significant effects observed amongst three packaging material. The results are statistically non-significant among the treatments at (P>0.05) probability level.

Ash Content (%)

The results regarding Ash content of fried onion stored at room temperature with three different packaging materials are presented in Table **4**. The results indicated that the (1.78) Ash content was recorded from the polyethylene bag packaging after 1

Table 3: Moisture (%) of Fried Onions Stored at Room Temperature with Different Packaging Material

Treatments	Duration				Mean
	1 day	7 days	14 days	21 days	
T_0 (control)	6.08	7.34	7.60	9.32	7.58
T_1Polyethylene bag	6.80	6.98	7.16	7.76	7.17
T_2 Aluminum foil	5.53	6.44	7.32	8.63	6.98
T_3 Butter paper	5.67	6.24	6.65	6.76	6.33
Mean	6.02	6.75	7.18	8.11	-

Table 4: Ash Content (%) of Fried Onions Stored at Room Temperature with Different Packaging Material

Treatments	Duration				Mean
	1 day	7 days	14 days	21 days	
T_0 (control)	1.75	1.70	1.68	1.65	1.69
T_1 Polyethylene bag	1.78	1.74	1.72	1.70	1.73
T_2 Aluminum foil	1.69	1.66	1.63	1.61	1.64
T_3 Butter paper	1.74	1.70	1.69	1.67	1.70
Mean	1.74 ab	1.70 a	1.68 c	1.65 b	-

day of storage period whereas the aluminum foil packaging showed (1.61) after 21 days of storage. The result in Table **4** showed that mean ash content of storage were relatively highest (1.73) in polyethylene bag packaging, followed by the butter paper packaging (1.70) in and (1.64) in aluminum foil. However, there were non-significant effect observed amongst three packaging material. The results are statistically non-significant among the treatments at (P>0.05) probability level.

Total Carbohydrate

The results regarding total carbohydrate of fried onion stored at room temperature with three different packaging materials are presented in Table **5**. The results indicated that the lowest (31.69) carbohydrate was recorded from the polyethylene bag after 1 day of storage period whereas the butter paper packaging showed highest (38.92) after 21 days. The result showed that mean (36.58) carbohydrate was observed in butter paper packaging, followed by the (35.47) in aluminum foil packaging and (34.52) in polyethylene bag packaging. However, there were non-significant effect observed amongst three packaging material. The results are statistically significant among the treatments at (P<0.05) probability level.

DISCUSSION

The study was carried out on the physicochemical properties of fried onion stored at room temperature using 3 different packaging materials during the year 2015. Onion is one of the major sources of income of rural population and is a dominate commodity in the international market owing to its quality and longer storage life. In present study fried onions were prepared and quality of the product was evaluated for up to 21 days of storage period.

The system of packaging and handling have been adopted in many countries of the world in order to move products from farm to consumer therefore effective packaging can minimize degradation of products. Good packaging protects the food products from chemically induced changes. The choice of materials for packaging depends on nature of the product, the storage and handling conditions (temperature, humidity, risk of physical deterioration) and various other factors. Packaging materials for food include plastic films, aluminum foils and paper. The type of packaging used goes a long way in enhancing the presentation, maintenance of freshness and shelf life of food products [11]. Present study was conducted to examine the effect of some commonly used packaging materials under a specific storage period for determining quality characteristics of fried onions.

The results indicated that the maximum (5.93) pH of fried onion was recorded from the butter paper packaging after 21 days storage period whereas the aluminum foil showed minimum (5.61) after 1 day. The data in Table **1** showed that mean pH of storage were relatively higher (5.81) in polyethylene bag packaging,

Table 5: Total Carbohydrates (%) of Fried Onions Stored at Room Temperature with Different Packaging Material

Treatments	Duration				Mean
	1 day	7 days	14 days	21 days	
T_0 (control)	34.95	34.73	37.46	38.90	36.52 b
T_1 Polyethylene bag	31.69	33.88	35.29	37.22	34.52 b
T_2 Aluminum foil	33.30	34.85	36.54	37.19	35.47 a
T_3 Butter paper	34.05	36.28	37.08	38.92	36.58ab
Mean	34.49	34.93	36.59	38.07	-

followed by the (5.80) in butter paper packaging and (5.76) aluminum foil packaging reactively. The findings related to pH in agreement with the results of Sabato *et al*. [12] in which variation in pH value within storage time was recorded higher it may changes during ripening process which may contribute to accumulation of sugars. Progressive decrease in titratable acidity sample was observed during the entire storage period of 21 days. All the studied treatments were remained a non-significant ($p>0.05$) for titratable acidity of fried onions. The titratable acidity was found to be higher in the sample of butter paper as compared to sample of Aluminum foil packaging. A subsequent decrease in the titratable acidity observed was might be owing to biochemical interactions such as binding of acid along with the other components. The results of this study are in agreement with findings of Dabhade and Khedkar [13] who observed a gradual mitigation in acid content in the powder of mango during of mango powder during storage at room the temperature (i.e. 25±5 °C). The present study demonstrated moisture content increased till the end of storage period (21days) at room temperature. The moisture increased during storage period and significant difference ($P<0.05$); was observed between the fried onions. Our results are in agreement with the reported literature [14], who reported that low thickness of packaging material is not adequate to protect products from moisture and air passage. These results are in the agreement with Amany *et al.* [15] and Gazmuri *et al.* [16], they reported that water loss increased with increase moisture. Some of the studies claim that an increase in initial moisture may results in an increased in uptake of oil during frying. The present study demonstrated ash content decreased till the end of storage period (21days) at room temperature statistically non-significant among the treatments. Whereas, the total carbohydrate changes of all samples during the storage period were significant ($P<0.05$). Samples packed in butter paper (T_3) recorded the increase in total carbohydrate. An increase in the sugar content is attributed to slow down the inversion of starch and non-reducing sugars into reducing sugars. These findings are in accordance with the findings of the Peter-Ikechukwu *et al*. [17] that total carbohydrate of the chips was higher than the pulp and this corresponds to USDA 1963 report. The higher percentage of total carbohydrate may be due to moisture loss during frying from giving rise to the concentration of soluble matters. The results are further supported by the Sagar and Neelavathi [18] also observed an increase in reducing sugars that could be owing to partial hydrolysis of starch in to sugar during storage period of dehydrated carrots.

CONCLUSIONS

Research studies were conducted to see the effect of packaging material (polyethylene, aluminum foil and butter paper) on the quality of fried onions at ambient temperature for three weeks and it has been observed that observed that aluminum foil is best packaging, for maintain good quality attributes during storage. The results also demonstrated that, pH and total carbohydrate were significantly affected during storage periods ($P<0.05$); whereas the non-significant effect of storage period on moisture, titratable acidity and ash content was noted.

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