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RESEARCH PAPER

Evaluation and quality characteristics of potato powder

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SUMMARY :

Potato, the most valuable tuber crop is produced in 150 countries. In volume of production, it ranks fourth after wheat, maize and rice. Potatoes are a non-fattening, nutrition's and wholesome food, which supply many important nutrients to the diet. Varieties of potato such as Kufri Chandramukhi, Kufri Lauvkar, Kufri Jyoti, Kufri Naveen, Kufri Moti, etc. are in preparation of food item in India. Potatoes were cleaned, washed, peeled, sliced and blanched. Then fluidized bed dryer was used for the dehydration of potato chips. After drying, the slices were grinded in grinder and sieved through 100 mesh screen and packed in aluminum coated LDPE bags. The physical and microbiological qualities were evaluated just after preparation of potato powder and at the interval of 15 days up to 90 days during storage at room temperature. The moisture content of sample decreased slowly with increase in drying time and attained final equilibrium moisture content. The equilibrium moisture content values were higher for sample dried at 60^0C compared to those dried at 70 and 75^0C. Browning index of potato powder increased with storage period and the samples blanched with KMS had lower value of the browning index than the hot water blanched samples. Experiment was conducted to study the fluidized bed drying of potato chips at different air temperature, air velocity and pretreatment combination. Potato powder sample were packed in aluminum coated LDPE bags and stored at room temperature. Studies on quality were based on physical characteristics (*viz.*, moisture content, browning index) and microbiological characteristics (Total plate count), which were determined for fresh and stored sample. The storage studies were conducted at interval of 15 days up to 75 days.

KEY WORDS : Potato, Browning index, Fluidized bed dryer, Total plate count, Potato powder

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Potato, the most valuable tuber crop is produced in 150 countries. Production and area of potatoes in India were, respectively 24.2 million tones and 1.34 million hectares in 1999-2000.Varieties of potato such as Kufri Chandramukhi, Kufri Lauvkar, Kufri Jyoti, Kufri Naveen, Kufri Moti, etc. are in preparation of food item in India. Potato flour has a promising future due to its long shelf life and diverse uses. It can be used as thickener-flavoring agent in soups, gravies, souses and baby foods and also incorporated in the baking of bread to retain freshness. Several value added products such as custard powder, soup thickener, biscuits, bread, cake and weaning food have been developed from different combination of potato flour with potato starch and with other cereal products (Chandrasekhar and Shurpalekar, 1984). Experiments were conduct to study the physical and microbiological qualities were evaluated just after preparation of potato powder and at the interval of 15 days up to 75 days during storage at room temperature. Blanching is an important unit operation for processing of vegetables. The purpose of blanching is to inactivate the enzymes along with destruction of microorganisms so that the product does not deteriorate during dehydration (Lee, 1958). Dehydration of potato is mostly

carried out by hot air either in layer, using cabinet, tunnel or conveyor dryer (Van *et al.*, 1973) or in bed dryer. Gaur *et al.* (1980) observed that enzymatic discoloration was affected by environmental conditions and varieties like Kufri Laukar and Kufri Jyoti showed higher enzymatic browning under diversified environmental conditions. Uppal *et al.* (1978) observed defferent level of enzymatic discoloration in varieties containing identical amounts of phenolic compounds.

EXPERIMENTAL METHODS

Fresh uniform size of potatoes of variety Kufri Jyoti was procured from local market. The entire experimental studies were carried out in the laboratories of Department of Post Harvest Engineering and Technology.

Experimental plan:

Based upon the reported literature, the experimental plan was devised. Potatoes were cleaned, washed, peeled, sliced and blanched. Then fluidized bed dryer was used for the dehydration of potato chips. After drying, the slices were grounded in grinder and sieved through 100 mesh screen and packed in aluminum coated LDPE bags. The physical and microbiological qualities were evaluated just after preparation of potato powder and at the interval of 15 days up to 90 days during storage at room temperature given in Table A.

Quality evaluation:

Moisture content:

Moisture content of sample was determined by the standard hot air oven method as suggested. 5 g (W) of sample was evenly spread over a dish of known weight W_1. The dish with the sample was then kept in a hot air oven, maintained at a temperature of 100°C. after 16 h, the dish was taken out of the oven, and kept in a desiccators. When the dish was cooled to room temperature, its weight was recorded as W_2. The moisture content of the sample was computed by the following formula:

Moisture content (%, wb) = $[(W+W_1)-W_2]$ X 100/W .....(1)

where,

W = net weight of sample taken (g)

W_1 = weight of dish (g)

W_2 = weight of dish plus oven dried sample (g).

Determination of browning index:

Browning index of potato powder was determined by method recommended by Srivastava and Kumar (1994). 5 g of sample was taken in a beaker and 100 ml of 60 per cent ethyl alcohol was added. The sample was soaked in the beaker for 12 hours. After soaking the sample was filtered using whatman filter paper and filtrate was collected. The filtrate was taken in cuvette and optical density of filtrate at 440 nm was measured by spectrophotometer using 60 per cent ethyl alcohol as blank. The recorded value gave the browning index of the sample.

Microbiological analysis:

Micro-biological analysis was done to determine the total plate count of the sample on nutrient agar medium for bacterial count. The procedure is given below:

Preparation of media:

The composition of media is given in Table B.

Table B : Composition of media

Nutrient agar medium (NA)	
Peptone	5g
Agar-agar	20g
Beef extract	1.5g
Yeast extract	1.5g
NaCl	5g
Distilled water	1000ml
Normal saline solution (NSS)	
Distilled water	1000ml
NaCl	8.6g

Sterilization:

All the necessary glass-wares and media like required

Table A: Details of variable/parameter, their levels and description

Sr. No.	Variables/parameter	Level	Description	Quality parameter
1.	Independent dryer parameter			Physico-chemical
	Inlet air temperature	3	60, 70 and 75^{0}C	parameters moisture
	Inlet air velocity	3	8.2, 10 and 12m/s	and browning index
2.	Pre-treatment	2	Hot water blanching	Microbial parameters
			Blanching with KMS	total plate count
3.	Measuring parameter	3	Outlet air temperature.	
			Humidity of outlet air.	
			Energy consumption.	
4.	Storage condition		Ambient temperature	

number of Petridishes, NA media. 9ml of NSS distributed in 7 test tubes, microbial tips (1ml, 0.5 ml), spreader and media were heated for 15 min. in an autoclave maintained at 15 psi for sterilization. The autoclave was then switched off and the stream was allowed to escape.

Pouring:

This is the transfer of medium into Petri dishes. This was done in the laminar flow chamber. The flame was lighted and Petri dishes were slightly opened near the flame and the media was poured in the Petri dishes. The Petri dishes with medium then kept undisturbed for solidification.

Prepatation of sample (Serial dilution):

1g of sample was taken and transferred to the test tubes with 9 ml of NSS. It was marked as 10^{-1} and other as 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5} and10^{-6}. The test tube containing sample was homogenized with the help of cyclomixer. 1ml of sample suspended in saline solution from 10^{-1} test tube was transferred to the test tube marked as 10^{-2} with the help of micropipette and homogenized. 1 ml of sample from10^{-2} marked tube was transferred to 10^{-3} with a sterilized 1ml micropipette. Similarly the sample was transferred till the test tube marked as 10^{-6}.

Inoculation of sample:

This was also done aseptically in the laminar flow chamber. 0.5 ml of the sample suspended a saline solution from 10^{-1} was taken with micropipette and transferred to Petri dish marked as 10^{-1} of NA medium. The microbial tip was discarded and another sterilized tip was used to transfer sample from 10^{-2} saline solution to 10^{-2} NA plates. Precaution were taken in inoculation that contamination should not take place. Similarly all the samples suspended in saline solution were transferred to the respective Petri dishes of NA medium. For each dilution two replicate were taken. A control of NA medium was also kept without inoculation. The inoculated Petri dishes were incubated in a B.O.D. incubator for 48 hours, where the temperature was maintained at 37°C. after 24 and 48 hours, total plate count was taken for NA plates TPC (cfu/g)=No. of colonies x dilution factor x10.

EXPERIMENTAL FINDINGS AND ANALYSIS

The effect of blanching of potato chips with hot water and with KMS solution on quality of potato powder during storage and ambient temperature was also studied. Result are presented in following sections.

Moisture contents:

Moisture content of potato powder samples was determined by equation 3.4 just after preparation and during storage for 15, 30, 45, 60 and 75 days at ambient temp. The values of moisture content before and after storage were obtained. The change in moisture content of samples during storage was noted. From these curves and tables it is clear that the moisture content of the sample increased during storage

Table 1: Effect of storage period on browning index of potato powder prepared from hot water blanched potato chips

Sr. No.	Storage period (days)	B.I.at temp. 60^{0}C			B.I.at temp. 70^{0}C			B.I.at temp. 75^{0}C		
		At 8.2m/s	At 10 m/s	At 12 m/s	At 8.2 m/s	At 10 m/s	At 12 m/s	At 8.2 m/s	At 10 m/s	At 12 m/s
1.	0	0.046	0.033	0.028	0.056	0.048	0.036	0.068	0.054	0.042
2.	15	0.063	0.52	0.043	0.086	0.064	0.057	0.093	0.078	0.068
3.	30	0.087	0.069	0.061	0.108	0.091	0.079	0.117	0.102	0.089
4.	45	0.108	0.096	0.082	0.130	0.112	0.097	0.132	0.114	0.102
5.	60	0.132	0.118	0.104	0.148	0.129	0.113	0.154	0.139	0.122
6.	75	0.171	0.153	0.140	0.183	0.162	0.148	0.195	0.184	0.172

Table 2: Effect of storage period on browning index of potato powder prepared from KMS blanched potato chips

Sr. No.	Storage period (days)	B.I.at temp. 60^{0}C			B.I.at temp. 70^{0}C			B.I.at temp. 75^{0}C		
		At 8.2m/s	At 10 m/s	At 12 m/s	At 8.2 m/s	At 10 m/s	At 12 m/s	At 8.2 m/s	At 10 m/s	At 12 m/s
1.	0	0.031	0.026	0.018	0.046	0.033	0.029	0.053	0.042	0.033
2.	15	0.054	0.043	0.031	0.072	0.056	0.049	0.081	0.067	0.059
3.	30	0.079	0.057	0.049	0.097	0.082	0.068	0.103	0.093	0.077
4.	45	0.097	0.083	0.072	0.117	0.104	0.089	0.123	0.104	0.091
5.	60	0.117	0.109	0.096	0.135	0.118	0.101	0.136	0.123	0.110
6.	75	0.157	0.138	0.124	0.162	0.148	0.132	0.181	0.163	0.154

was noted. It may be because of the permeation of water vapour through the packaging material as the surrounding environment would have higher water pressure than that of product.

It is clear that nearly all the sample dried at 60°C had higher moisture content than the sample dried at 70°C and 75°C. Also it can be seen that nearly all the samples dried at lower air velocities had higher moisture content.

Browning index:

Result of browning index for fresh and stored sample (blanched with hot water and blanched with MKS) are reported in Table 1 and 2 which showed the change in browning index during storage. From Table 1 and 2 it is clear that the sample dried at 75°C and air velocity 8.2m/s had the higher value of browning index in comparison to sample dried at 75°C with air velocity 10m/s and 12m/s. The sample dried at 60°C with air velocity 12m/s had the lower value of browning index in comparison to the sample dried with air velocity 12m/s at 70°C and 75°C. Browning index of potato powder blanched with KMS was less as compared to the same sample blanched with hot water. At the initial stage of storage the browning index of product was mainly due to the non enzymatic browning reaction. However, during storage the increased microbial load led to enzymatic reaction, which caused the browning of product. From the above study it is clear that the browning index of the samples increased during storage and the samples blanched with KMS had lower browning index than hot water blanched samples.

Total plate count (TPC):

Microbial quality was judged by total plate count in fresh and stored samples. TPC was determined by serial dilution method and expressed in term of log cuf /g result of microbial study from fresh and stored samples .The change in TPC during storage, it is clear that the TPC of the sample increased in storage. The samples dried at 60°C had the higher value of TPC than the sample dried at 70 and 75^0C. This may be due to the fact that the samples dried at 60^0C had higher moisture content than the samples dried at 70 and 75^0C, due to the higher moisture content the bacteria grew easily in former samples. The samples blanched with KMS had the lower TPC than the sample blanched with hot water. But in no case the value of TPC increased above 4×10^3 cfu/g. It has been reported that in case of other food namely meat and milk permissible limit of TPC is 10^5 and 10^4, respectively (Rankan, 1995 and Frazier, 1995). Therefore TPC value from present study may be considered under safe limit even after 75 days of storage.

Conclusion:

Moisture content of potato powder sample increased during storage. The entire sample dried at temperature 60^0 C, also the sample dried at lower velocity had higher moisture content.

Browning index of potato powder increased with storage period and the samples blanched with KMS had lower value of the browning index than hot water blanched samples.

In present study, it was observed that microbial load (TPC) increased during storage. However, microbial load was found within permissible limit at the end of 90 days of storage.

The samples blanched with KMS had the lower values of TPC than the sample blanched with hot water.

LITERATURE CITED

Chandrasekhara, S. and Shurpalekar, S.R. (1984). On the quality of bread containing differently processed potato. *J. Food Sci. Technol.,* **21**:234-236.

Gaur, P.C., Josh, K.C. and Verma, S.C. (1980). Variety environment interaction for enzymatic browning in potato. *Indian J. Agric. Sci.,* **50**: 562-565.

Lee, F.A.(1958). The blanching process. *J. Adv. Food Res.*,**8**:63-109.

Morris, T.N.(1947). Dehydration of foods. Chapman and Hall Ltd. LONDON, UNITED KINGDOM.

Salunkhe, D.K., Wu, M.T. and Jadhav, S.J. (1972). Effect of light and temperature on the formation of solanine in potato slices. *J. Food Sci.,* **37** (6) : 969-970.

Srivastava, R.P. and Kumar, S. (1994). *Fruit and vegetable preservation principal and practice.* International Book Distributing Co. Charbag, Lucknow (U.P.) INDIA.

Uppal, D.S., Joshi, K.C. and Verma, S.C. (1978). Effect of storage on enzymatic discolouration and total phenols of potato tubers. *J. Indian Potato Assoc*., **5**:91-94.

Van, B. Copley, M.J. and Morgen, A.I. (1973). *Carrot dehydration Vol. **1***. The AVI publishing Co. Inc. Westport Connecticute 82pp.