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Quality assessment of selected commercial brand of chilli powder in Bangladesh

Abstract

The present study was carried out to reveal the quality assessment of the chilli powder. The samples collected from market used in this investigation were commercial brand of chilli powder in Bangladesh. The quality parameters of moisture content, ash content, acid soluble ash content, refractive index, volatile fat were assessed which are directly related to quality, processing technique, storage condition, packaging, microbial load of chilli powder. The moisture content and ash content of chilli powder were about 4.40-6.00% and 5.28-6.19% respectively. Then microbiological tests such as TPC, mold count, coliform count, and salmonella were accomplished. Total mold count was found ranged from 1.0×103 to 3.1×103. Coliform was also detected, where all samples were free from Salmonella.

Keywords: chilli powder, volatile fat, acid insoluble ash, moisture content, mold count, coliform count

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Abbreviations: CFU, colony forming unit; G, gram; TPC, total plate count; PCA, plate count agar

Introduction

Chilli (*Capsicum annuum*L.) is one kind of vegetable belonging to the family of *Solanaceae*. Chillies are cultivated in all Asian countries, large parts of Africa, U.S.A. and Southern Europe.[1] Chilli is generally found to be used in three forms, namely, as fresh green chillies, red chilli powder and raw red.[2] Chilli powder is prepared from ripe chilli. It is an important spice used as flavorings or condiments, in the tropics and subtropics and an indispensable item in the kitchen for every day cooking in Bangladesh. Chilli is dried to make chilli powder and to store it for both short and long term storage. The most important quality characteristics in chilli are the color and pungency. The red color of chilli is mainly due to carotenoid pigments.[3–

To improve the quality of dried chilli, industrial dryers are used to decrease the drying time and provide uniform and hygienic processing conditions. However, drying chilli with high temperatures leads to the loss of volatile compounds, nutrients and color.[6,7] Chillies have a relatively low volatile content, which is dependent upon species and stage of maturity. The eventual volatile-content of the dried powder, however, may be lower and is dependent upon the drying procedure, the duration and condition of storage.[8]

Color deterioration in chilli powder has been attributed to oxidation of carotenoid pigments which is greatly influenced by moisture content, storage, temperature, atmosphere and light.[9] The moisture content of the chilli powder appears to be critical for color retention during storage. Lower level of moisture leads to the color bleach while at higher levels there was darkening by browning reactions but there was no changes in carotenoid content.[10] High moisture content helps in survival and growth of the mold.[11]

Warm and humid condition is favorable for microbial growth. For this reason spices are easily contaminated by pathogenic microorganisms.[12] Powder needs storage under cool conditions and out of light.[13] Chilli powder shall be free from mold growth, living or dead insects, insect fragments and rodent contamination.[14]

It is essential to reduce the moisture content and provide aeration to the chillies after harvesting to prevent the development of micro-flora and subsequent loss of quality or total spoilage.[15] Many agricultural commodities such as cereals, oil seeds, dry fruits and spices have been reported to be contaminated with toxigenic molds and aflatoxin under faulty storage conditions.[16] Chillies are reported to be contaminated with molds and their toxic metabolites and *Aspergillus flavus*is the predominant mold on chilli samples in several cases.[17]

Materials and methods

Moisture content

The moisture content of the chilli powder was determined by hot air oven method.[18] About 5g of the chilli was weighed into a weighed moisture box and dried in an oven at 100±1°C for 16hours and cooled in a dessicator. The weight of the dried sample was recorded. The moisture content of the sample was calculated by using the formula:

$$\text{Moisture content (\%)} = \frac{W1-W2}{W3} \times 100$$

Where,

W_1=Initial weight of the sample (g)

W_2=Final weight of the sample (g)

W_3=Weight of the dried sample (g)

Ash content

The total ash content of the chilli powder was determined by muffle furnace method.[19] Accurately 5g of the sample was weighed into a crucible (which was previously heated to about 600°C and then cooled). The crucible was placed on a clay pipe triangle and heated first over a low flame till all the material was completely charred, followed by heating in a muffle furnace for about 3-5h at 600°C. It was then cooled in a desiccator and weighed. The percentage of ash was calculated by using the following expression.

$$\text{Total ash (\%)} = \frac{\text{Weight of ash (g)}}{\text{Weight of sample (g)}} \times 100$$

Acid insoluble ash content

The acid insoluble ash content of Chilli powder was determined by Official Method 941.12 (b) Ash of Spices.[20] To the dish containing total ash, 25ml of dilute HCl was added and boiled covering the dish with a watch glass to prevent spattering. Allowed to cool and filtered the contents of the dish through an ashless filter paper (medium fine). Washed the filter paper with hot water until the washings are free from HCl as tested by silver nitrate solution, and returned it to the dish. Evaporated carefully on a water bath and ignited in a muffle furnace at 550±25°C for 1hour. Cooled the dish in a desiccator and weighed. Repeated the operation of igniting for 1hr, cooling and weighing till the difference in weight between two successive weighing is less than 0.001gm. The lowest weight was noted.

Refractive Index

The refractive index of a substance is the ratio of the speed of light in a vacuum to the speed of light in the substance. When light passes through a substance there are a fixed degree of refraction is present for each particular substance. Each substance turns the light in a particular direction and in a particular degree by observing which the substance can be identified. This principle is used during the identification of the characteristics of oil. For most purposes Abbe refractometer is employed, since it requires only a few drops of liquid and the refractive index may be determined directly.

Volatile fat Content

Volatile fat of Chilli powder was determined by Soxhlet method.[20] About 3g of sample weighed in a round bottom flask using thimble. Then the flask is poured with N-Hexen and placed in a Soxhlet apparatus for complete extraction of the volatile fat. After removing N-Hexen from the fat the weight was taken and calculation was done.

Microbiological parameters of chilli powder

Total Plate Count, Mold count, Coliform count and Salmonella were tested for microbial assessment of chilli powder. These tested were done by using PCA, Petri-dish, Incubator, Peptone water. Sample Tested by Pour Plate Technique. All tested accomplished by following standard of FDA, Philippines, 2013-010.[21]

Results and discussion

Moisture Content of four different commercial brand of chilli powder was ranged from 4.40% to 6.00%being lowest for sample 1 and highest for sample 4 (Table 1). The results were more or less similar to those reported by Krishnamurthy et al.[9] who observed that the moisture content of chilli powder should be in the range of 8-10% per 100 gm. Mahadevaih et al.[22] found that moisture content higher than 15 percent in chilli powder was critical with respect to mold growth. Similar observations were also made by Naik et al.[23] According to Indian Standard, maximum moisture content of chilli powder is 11.0%.[14]

Ash content ranged from 5.28% to 6.19% being lowest in sample 3 and highest in sample 2 (Table 1). All samples satisfied Bangladesh Standard (<8.5%) for ash content in chilli powder.[24] According to Indian Standard, maximum ash content of chilli powder is 8.0%.[14] The results were more or less similar to those reported by Raina et al.[25] who noticed ash content ranging from 4.53 to 7.39% in chilli powder. All samples satisfied Bangladesh Standard (<1.5%) for acid insoluble ash content in chilli powder.[24] According to Indian Standard, maximum value of acid insoluble ash content of chilli powder is 1.3%.[14] Refractive Index of sample 3 is different from other samples. It is used to check oxidation and to determine the degree of saturation.

Volatile fat Content of all different commercial brand samples were relatively high ranging from 1.6% to 2.0% being lowest for sample 1 and highest for sample 3 (Table 1). Chilli powder usually contains less than 0.5% of volatile oil.[8] The variations in fat contents might be due to difference in treatments, preparation and drying methods employed. The microbial load of chilli powder samples collected for different brand in Bangladesh was summarized in Table 2. Total Plate Count was found ranged from 2.3×10^3 to $5.7\text{x}10^3$ being higher for sample 4, where reference value for Bangladesh is 1.0×10^3cfu/g. Total mold count was found ranged from 1.0×10^3 to 3.1×10^3. The results were more or less similar to those reported by Tripathi et al.,[11] who noticed mold count at initial days of incubation was 4.2×10^4cfu/g.

Table 1 Quality parameters of chilli powder

Sample name	Moisture content (%)	Ash content (%)	Acid Insoluble Ash content (%)	Refractive index (%)	Volatile fat content (%)
Sample 1	4.4	5.78	1.3	43.6562	1.6
Sample 2	5.56	6.19	1.4	48.7872	1.7
Sample 3	5.88	5.28	1.3	22.1232	2
Sample 4	6	5.95	1.4	47.6345	1.8

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Table 2 Microbiological parameters of chilli powder

Sample name	TPC (cfu/g)	Mold count (cfu/g)	Coliform count (cfu/g)	Salmonella (cfu/g)
Sample 1	4.9×10^3	3.1×10^3	Nil	Nil
Sample 2	2.3×10^3	2.3×10^3	Nil	Nil
Sample 3	5.1×10^3	1.0×10^3	1.8×10^3	Nil
Sample 4	5.7×10^3	2.0×10^3	Nil	Nil

Coliform bacteria were found in one sample which is higher than normally followed in Bangladesh (1.0×10^2cfu/g). According to Indian Standard, Salmonella in chilli powder must be absent.[14] All samples of our study were free from Salmonella. Gallo et al.[26] reported that faulty food handling techniques especially storage of food at improper temperature for long periods of time has been identified as one of the microbial proliferation in contaminated food. The production of these spices by some manufacturer may be under unhygienic environment. The spices may also not be sufficiently dried or contaminated raw materials may be added or final products may be manually packaged. These factors will contribute to the high microbial counts obtained from these products.

Conclusion

From the performed chemical and microbiological test for commercial brand of chilli powder we found that brand products don't match the all quality parameters and don't follow the standard while manufacturing their products that ultimately lead to bad quality products and their consumption lead to various diseases. Chilli powders are high in bacterial count addition with high mold count.

It was concluded that spices may be high risk products as it contained many pathogenic bacteria, Coliform and mold. Packed branded chilli powder samples were less contaminated, so it is clear that the unpacked local spices may be highly contaminated with microorganisms. Therefore, more studies are necessary to find out the ways of contamination and proper preparation processing. Aseptic techniques at all stages of production and processing must be ensured to prevent contamination and quality of chilli powder.

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Conflict of interest

The author declares no conflict of interest.

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