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Research Article

Evaluation of colour value from chillies and chili powder by spectrophotometric method.

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Abstract

Chilli (*Capsicum annuum*) is an important spice and vegetable crop used all over the world in one form or the other. Chillies are widely used as spices, condiments, culinary supplements, medicine, vegetable and ornamental plants too. It forms an important ingredient in day-to-day curries, pickles, *chutneys* and oleoresin (Anon., 2009). Colour in paprika is the principle criterion for assessing its quality value. The pigment content of paprika powder ranges from 0.1 to 0.8%. Colour value of paprika is usually expressed in terms of ASTA colour value (American Spice Trade Association). This is the extractable colour present in paprika. Common paprika ASTA colours preferred in the industry are 85, 100, 120 and 150 (Tainter andGrenis, 1993). All chillies contain a pungent principle made up of capsaicinoids. Dry chillies (or pungent capsicums) are widely used throughout the world to add pungency to food. Chilli oleoresin is usedin the food processing and pharmaceutical industry

Keywords: Chilli, Colour, quality value, ASTA and pharmaceutical industry.

Introduction

Chilli (*Capsicum annuum*) is an important spice and vegetable crop used all over the world in one form or the other. Introduced to India by the Portuguese in 17th century, chilli is also called as hot pepper, red pepper,cayenne pepper, capsicum, etc., which has two important commercial qualities. It is valued for its pungency which is imparted by an alkaloid capsaicin and red colour ducts red pigment capsanthin, capsorubin and capxanthin. Chillies, besides imparting pungency and red colour to the dishes, are a rich source of vitamin A, C and vitamin E (tocopherol) and assist in digestion and are also a source of proteins, minerals, oleoresin and red pigment. Chillies are widely used as spices, condiments, culinary supplements, medicine, vegetable and ornamental plants too. It forms an important ingredient in day-to-day curries, pickles, *chutneys* and oleoresin (Anon., 2009).

India ranks first in the world in terms of production, consumption and exports. Total production of spices is 4.3 million metric tons and the area covered is 2.56 million ha. The total production of chillies during the year 2010- 11 was 10.5 Lakh tons. Out of this Andhra Pradesh contributed 51 per cent, Karnataka 9 per cent, Orissa 4 per cent, Maharashtra 4 per cent, West Bengal 4 per cent, Rajasthan 5 per cent, Madhya Pradesh 11 per cent and others 12 per cent. The average productivity of chillies was 1266 kg ha-1. India has exported 2 Lakh tons of red chillies during 2010-11. Chilli is exported in different forms such as whole chillies, dried, fresh chillies, chilli powder and chilli oleoresin to South Asian countries, USA and Canada. The popularity of chilli is due to its wide range of shape, size and sensory attributes such as colour, pungency and piquancy that make generally insipid bulk nutritive flesh and cereal and vegetable foods more appetizing (Govindarajan *et al.*, 1987) [2]. Chilli with higher colour value and less pungency are preferred in Europe and the West. Chinese chilli is known for cleanliness, very low aflatoxinlevels and good cultural practices. Indian chillies contain about 16% (d.b.) moisture content, while 10-11% (d.b.) is the acceptable limit in the export market.

Pigments

Colour in paprika is the principle criterion for assessing its quality value. The pigment content of paprika powder ranges from 0.1 to 0.8%. Colour value of paprika is usually expressed in terms of ASTA colour value (American Spice Trade Association). This is the extractable colour present in paprika. Common paprika ASTA colours preferred in the industry are 85, 100, 120 and 150 (Tainter andGrenis, 1993). The major colouring pigments in paprika are Capsanthin and Capsorubin comprising 60% of the total carotenoids. Other pigments are Beta-carotene, Zeaxanthin, Violaxanthin, Neoxanthin and Lutein. A spectrophotometric method for analysis of colour using dried chilli powder using isopropanol as solvent was described. Potassium dichromate (0.5 mglml) in 1.8-M sulphuric acid was used as standard and the absorbance was read at 450 nm against isopropanol as blank. (Hort and Fisher, 1971). The carotenoids of red bell peppers were analyzed without saponification by HPLC using octadecyl silica as stationary and methanol-ethyl acetate as mobile phases. Capsanthin accounted for 60% of the total carotenoids. Beta-carotene (1 1%) and capsorubin (20%) were also present (Gregory *et* al., 1987).

Determination of natural colouring matter in paprika using acetone blank was described in IS0 7541, 1989. ASTA method 20.0 described a spectrophotometric method for determination of colour in paprika using an acetone extract and potassium dichromate + cobaltous ammonium sulphate in 1.8 M sulphuric acid as standard. A method for evaluating paprika colour was exemplified based on light reflection using a spectrophotometer. The colour spectra from conventional red varieties were compared with those from dark red varieties with chlorophyll retainer genes (modifying the visually determined colour rating as result of the presence of chlorophyll in ripe fruit). The spectra of the two types of variety could be distinguished from each other at a wavelength of 670 nm (Navarro and Costa, 1991). Paprika colour was estimated using visual estimation of redness, determination of carotenoid and chlorophyll contents, total pigment extraction (ASTA method 20.1) and calculation of tint. Several qualitative differences were established between cultivars, notable differences being in extractable colour (ASTA units), tint and red and yellow carotenoid contents. Correlation between results fiom different evaluation methods showed that it was possible to accurately determine ASTA units on the basis of red carotenoid or total carotenoid content and visual colour assessments (Gomez *et* al., 1997). Different parameters of colour measurements, such as ASTA and tint determination were evaluated. Combination of the 15 information from the ASTA method with that of the carotenoid composition of the red and yellow fractions, acquired by HPLC, enabled greater accuracy in judging both the quality of the final sample and the soundness of the process for obtaining it (Mosquera and Gualez 1998).

Utilization and Demand

All chillies contain a pungent principle made up of capsaicinoids. Dry chillies (or pungent capsicums) are widely used throughout the world to add pungency to food. Chilli oleoresin is usedin the food processing and pharmaceutical industry. Fresh chillies are also an important export item but they are considered a vegetable not a spice. Chilli has two important commercial qualities. If some varieties are famous for red colour because of the pigment casanthin, others are known for biting pungency attributed by capsaicin. India is the only country rich in many varieties with different quality factors. There is wide range of products based on whole or ground chilli entering world trade. The terminology for these products can be confusing, and definitions can vary between and even within markets. Chillies are used in whole dried or chopped form or as a ground powder. Chilli paste and chilli sauce are also frequently sold. Oil and oleoresin is the most important value added product of chillies. The key parameters for any dried chilli products are pungency level (measured in % capsaicin or Scoville Units) and color (measured in ASTA color units). In addition, size and appearance may be important. Producers should be sure that they understand exactly what the market requires.

The red color of chili is mainly due to carotenoid pigments (Howard *et al.*, 2000; Topuz and Ozdemir, 2007) and its pungency results from the capsaicinoids synthesized and accumulated in the epidermal tissue of the chili placenta (Iwai *et al.*, 1979; Suzuki *et al.*, 1980). Some steps used in the processing of dried fruit and vegetables include blanching and drying during preparation; drying especially causes a major loss of color and texture quality of the fi nal product (Vega-Gálvez *et al.*, 2008). To improve the quality of dried chili, industrial dryers are used to decrease the drying time and provide uniform and hygienic processing conditions.

Materials and Methods

2.1Collection samples:-

A total of 52 Chilies samples were collected from Agricultural market yard, Guntur and chili powder were collected from Sri Lakshmi Ganapathi Chilli powder Industries, Guntur. samples were collected between August 2012 to December 2013. These samples were selected randomly and purchased in amounts greater than 0.5 kg. The samples were maintained at 04^0 C until arrival at the laboratory, where all samples were ground into powder and stored in plastic bags at 4^0C until the onset of the analysis. The collected samples were different varieties namely 273,4884,Teja,Dabhi,4884 talu, Teja talu, Mixed talu, 243 and Dabhi talu

2.2 Method for measuring color value in chillies (AOAC 971.26)

2.2.1 Apparatus and Reagents

a) Spectrophotometer- Capable of accurately measuring A at 460nm; with 1cm stoppered cells.

Fig :-01 Double beam UV/VIS Spectrophotometer

b) Glass reference standard-NIST SRM 2030 or 930, glass filter with A specified by NIST in range 0.4-0.6 at 465 nm.

2.3 Determination

Capsicums- Grind capsicums to pass No. 18 sieve. Place accurately weighted sample containing 70-100mg ground capsicums in 100ml, volumetric flask, dilute to volume with acetone, and stopper tightly. Shake flask and let stand 16 h at room temperature in dark. Shake flask again and let particles settle 2 min. Transfer portion of extract to spectrophotometer cell with 10ml piper. Determine A of sample at 460nm, using acetone as blank. Determine A of NIST standard at 465nm.

Fig:-02 A Portion of chilli powder with acetone (100ml)

2.4 Calculations

To correct for instrument and cell variations calculate correction factor, I_f= declared A of NIST standard at 465 nm/actual A of NIST standard at 465nm. Redetermine I_f each time spectrophotometer is turned on. Range of A should be 0.30 to 0.70. Dilute extracts with A>0.70 with acetone to ½ original concentration. Discard extracts with A<0.30 and extract larger sample.

ASTA color value for capsicum= {($A_{extract}$ at 460nm} x (16.4 I_f)}/g sample

ASTA color value for oleoresin= {($A_{extract}$ at 460nm} x (164 I_f)}/g sample

Where 16.4 and 164 are conversion factors to American spice Trade Association (ASTA) color values.

Results and Discussion

Quality parameters of dried chilli and chilli powder:-

The quality parameters of chillies and chilli powder milled by selected milling methods are depicted in 2.2. The quality parameter like colour, capsaicin is very essential. The ASTA Colour is mentioned below Table-01

TABLE 01 :- ASTA COLOUR VALUE:-

.NO	DATE	NAME OF VARIETY AND CHILLIES/CHILLI POWDER	RESULTS(ASTA COLOUR VALUE)
1.	05/08/2013	273 (Chilli powder)	100.69
2	10/08/2013	4884 (chillies)	142.188
3	11/08/2013	273 (chillies)	82.41
4	14/08/2013	TEJA (chillies)	125.0
5	20/08/2013	273 (chillies)	65.92
6	27/08/2013	DABHI (chillies)	143.336
7	07/09/2013	4884 (chillies)	137.924
8	08/09/2013	273 (Chilli powder)	86.674
9	11/09/2013	4884 (Chilli powder)	118.08
10	11/09/2013	273 (Chilli powder)	91.84
11	13/09/2013	4884 (Chilli powder)	117.0
12	16/09/2013	248 (chillies)	133.8
13	19/09/2013	273 (Chilli powder)	138.5
14	19/09/2013	4884 (Chilli powder)	**156.538**
15	19/09/2013	4884 (Chilli powder)	122.01
16	20/09/2013	4884 (chillies)	125.78
17	22/09/2013	4884 TALU (Chilli powder)	126.28
18	24/09/2013	TEJA (Chilli powder)	154.16
19	24/09/2013	TEJA TALU (Chilli powder)	96.268
20	25/09/2013	MIXED TEJA (chillies)	155.472
21	27/09/2013	TEJA (chillies)	89.052
22	28/09/2013	243 (chillies)	61.336
23	04/10/2013	243 (chillies)	144.616
24	04/10/2013	4884 (chillies)	145.632
25	05/10/2013	4884 (chillies)	111.52
26	05/10/2013	243 (chillies)	77.408
27	05/10/2013	4884 (Chilli powder)	95.776
28	23/10/2013	273 (Chilli powder)	95.448
29	26/10/2013	4884 (chillies)	95.202

30	01/11/2013	4884 (Chilli powder)	107.502
31	02/11/2013	243 (chillies)	108.02
32	03/11/2013	243 (chillies)	99.22
33	03/11/2013	TEJA (chillies)	113.116
34	05/11/2013	MIXED TEJA Chilli powder)	105.02
35	09/11/2013	4884 (Chilli powder)	88.56
36	13/11/2013	TEJA Talu (Chilli powder)	**48.708**
37	13/11/2013	DABHI TALU (chillies)	59.86
38	1411/2013	TEJA TALU (chillies)	58.22
39	14/11/2013	243 (chillies)	45.00
40	22/11/2013	4884 (chillies)	87.5
41	23/11/2013	243 (chillies)	91.6
42	23/11/2013	273 (Chilli powder)	98.06
43	05/12/2013	TEJA (Chilli powder)	66.256
44	17/12/2013	DABHI (Chilli powder)	127.92
45	17/12/2013	TEJA (Chilli powder)	95.12
46	17/12/2013	DABHI (Chilli powder)	118.08
47	17/12/2013	4884 (Chilli powder)	71.176
48	17/12/2013	273 (chillies)	102.008
49	17/12/2013	4884 (chillies)	72.816
50	18/12/2013	273 (chillies)	94.464
51	18/12/2013	4884 (chillies)	85.116
52	20/12/2013	273 (chillies)	97.416

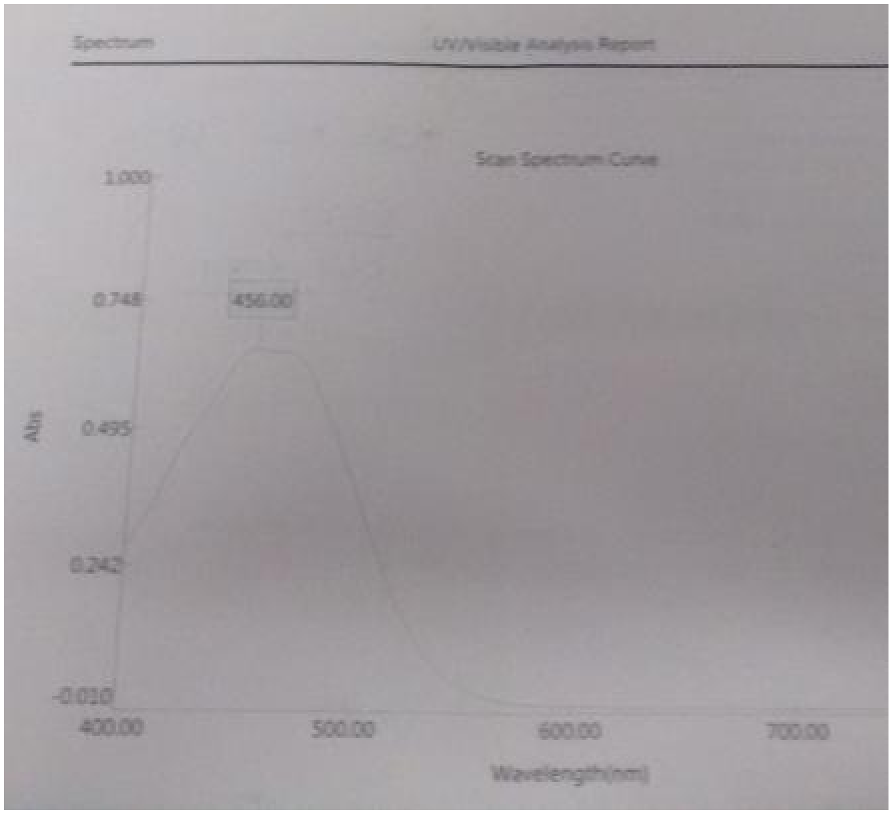

Fig:- 03 the graph showing maximum Absorbance :

After got the O.D values you can change in ASTA formula Model

$$\text{ASTA COLOUR VALUE} = \frac{\text{O.D}}{\text{Weight of the sample}} \times \text{Time of incubation period}$$

1**.** Lowest colour vaule of Teja talu :
ASTA colour value 48.708
2 . *Highest* colour vaule of 4884 :
ASTA colour value 156.538

NOTE :- 1. The ASTA colour value will be high the demand of product also high rate.
2. The ASTA colour value will be low the demand of product also low rate.

Conclusion

Spectrophotometry has proved to be a powerful analytical technique for the estimation of metal ions in different substances. The main objective of the study was to develop simple, specific, sensitive and time effective methods for the estimation of colour value in the given samples.the colour value is very useful for buyers of chilli exporters.

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