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ASIAN JOURNAL OF SCIENCE AND TECHNOLOGY

ISSN: 0976-3376

Asian Journal of Science and Technology
Vol. 10, Issue, 10, pp.10308-10310, October, 2019

RESEARCH ARTICLE

BEETROOT (*BETA VULGARIS*), NATURAL COLORING PIGMENT, NUTRITIONAL BENEFITS AND THEIR USE IN FOOD INDUSTRY

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ARTICLE INFO

Article History:
Received 25th July, 2019
Received in revised form
29th August, 2019
Accepted 27th September, 2019
Published online 30st October, 2019

Key words:

Beetroot, Pigment,
Natural color, Red beet, Betalain, Food industry.

ABSTRACT

Beetroot is a common fruit or vegetable with a unique shape and color. Beetroot is becoming popular for its color and nutritional value. Red beet is a good source for natural color and it is historically used in wine for the color. The coloring power of beetroot is very high it can change any food product color very easily. The coloring responsible for the red hue of the beetroot is a group of a molecule called betalains. Beets contain a big quantity of vitamins A and C and also calcium, iron, phosphorus, potassium, protein and carbohydrate. They are also high in folate, dietary fiber and antioxidants. Today the food industry are mostly preferred the use of natural coloring pigment in their food products because at this time the people are very possessive to their health and preferred the food product which is made with the use of natural color.

***Citation: Sonika Chaudhary and Neetu Singh.* 2019.** "Beetroot (Beta Vulgaris), Natural coloring pigment, Nutritional benefits And Their Use in Food Industry", *Asian Journal of Science and Technology*, 10, (10), 10308-10310.

INTRODUCTION

Beet root is a popular root crop grown for its fleshy roots which are used as cooked vegetable, salad and for pickling and canning. The red color of beet root is due to the presence of red violet pigments of β cyanins and a yellow pigment, β xanthin. The young plants along with the tender leaves are also used as herbs in very long period. It is very popular in USA. Beet root is a rich source of protein (1.7 g/100 g/100 g), carbohydrates (88 mg), calcium (200 mg), phosphorus (55 mg) and vitamin C (88 mg). Leaves are rich in iron (3.1 mg), vitamin A (2100 I.U.), thiamine (110 µ g) and ascorbic acid (50 mg/ 100 g). The Origen of Beet root was originated from Beta vulgaris L. ssp. maritima by hybridization with B. patula. Crop has site of origin probably in Europe. Earlier types of the root with long roots like that of carrot. The Beet root, sugar beet and palak are belong to the species B. vulgaris and are cross compatible. Beetroot is becoming popular for its unique shape, attractive red color and high functional properties. In beetroot a pigment is present named as "betalain". The term "betalain" is come from the Latin name of the common beet (Beta vulgaris), from which betalain were first extracted.

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In betalaine pigment many nutritional factor and antioxidant factor are present which are used in medicines, food colorant pigment and many other uses. The deep color of beets, bougainvillea, amaranth, and many cactuses result from the presence of betalain pigment. Beetroot contains several highly bioactive phenolics, such as rutin, epicatechin and caffeic acid which are also know to be excellent antioxidants (Georgiev *et al*., 2010; Frank *et al*., 2005; Manach *et al*., 2005). Furthermore, nitrite and other NO donors akin to beetroot have been shown to suppress radical formation and directly scavenge potentially damaging Reactive oxygen and nitrogen species (RONS) (Lundberg *et al*., 2011; Wink *et al*., 2001 and Wink *et al*., 2011). Beetroot fiber has been shown to extent the amount of inhibitor enzymes within the body, (specifically one referred to as glutathione peroxidase), still as increase the amount of white blood cells, that are liable for police work and eliminating abnormal cells. Beets are also one of the richest source of glutamine, an amino acid, essential to the health and maintenance of the intestinal tract. Other studies have checked out the result of beetroot juice on Bp level. A reduction in blood pressure is beneficial for the avoidance of heart disease and stroke. Studies state that nitrate made foods like beetroot could facilitate in coronary disease survival. Beetroot juice has gained popularity since Paralympics gold medalist David Weir announced that a shot of the juice was his secret to success (Das *et al*., 2013)

Color is one of the most important attributes of foods, being considered as a quality indicator and determining frequently their acceptance. Many naturally colored foods, such as fruit products, are submitted to color losses during processing, requiring the use of colorants to restore their color. Natural colorants have many disadvantages when compared to synthetic ones, including higher cost in-use and lower stability. However, people have increasingly avoided synthetic colorants, preferring natural pigment, which are considered to be harmless or even healthy. Betanins or betalain are natural dyes extracted from different fruits and vegetables. They are largely used as a food colorants in food products like yogurts, ice-cream and other food products (Zhong *et al*., 2005) and (Stintzing *et al*., 2002).

METHODOLOGY

Materials: Beetroot was purchased from a local wet market of Lucknow city. The betalain pigment was then extracted as described in next section. Bakery ingredients such as refined flour, sugar, butter, milk or egg, baking powder, sodium chloride salt were procured from local grocery store of the Lucknow city.

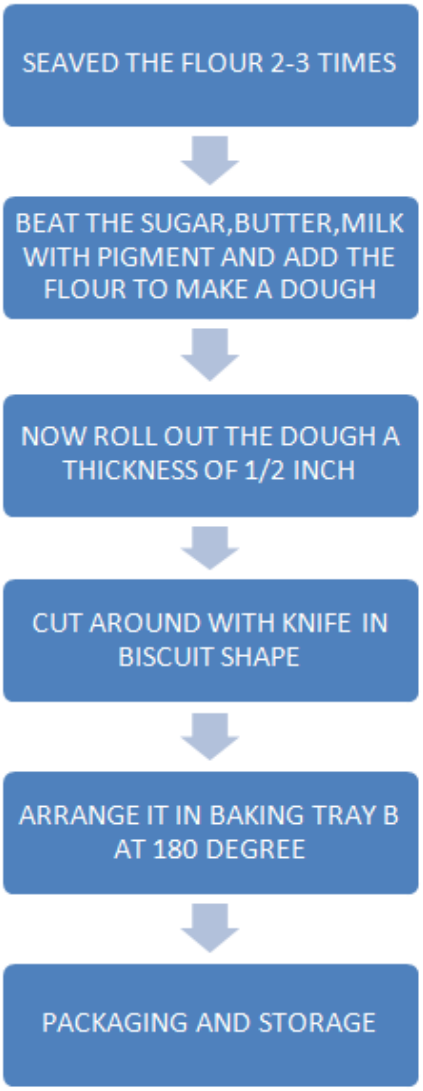
Beetroot nutritional value per 100g:

Energy	180kJ
carbohydrates	9.96g
fat	0.18g
protein	1.68g
VITAMINS:	
vitamin A	2 µg
thiamine B1	0.31mg
riboflavin B2	0.27mg
niacin B3	0.331mg
pantothenic acid B5	0.145mg
vitamin B6	0.067mg
vitamin C	3.6mg
folate	80 µg
TRACE METALS:	
calcium	16mg
iron	0.79mg
magnesium	23mg
phosphorus	38mg
potassium	305mg
sodium	77mg
zinc	0.35mg

µg = micrograms, mg = micrograms

Table No.1. Nutritional value of beetroot

Extraction of betalain pigment: Washed the beetroot from the tap water and chopped it very fine and small pieces it.



Fi. 2. Flow chart of techniques used in cookies preparation

Then, about 300g of red beet was mixed in blender with 1.5 liter of ethanol. Ethanol was acidified with 2% citric acid. The content was mixed for 15 minutes and then was allowed to set for 24 hours. After this the extract was filtered and the liquid pigment was obtained. The obtained pigment was concentrated under vacuum by a rotary vacuum evaporator at 40 C as reported by Francis (2000) and in the last HPLC was used for the identification of pigment.

Cookies preparation: Cookies were prepared according to the normal method with slight modifications. The formula used to produce the cookies is shown in below. Betalain pigment replaces the synthetic color. Beat the sugar, butter, milk with pigment and other dry ingredients (salt, baking powder) and add the flour to make a dough. Now roll out the dough to a thickness of ½ inches and set the rolls in a sequence, cut around with knife in cookies shape. All cookies was baked on greased tray for 12-14 min. at 180 C in an oven. The cookies were cooled at room temperature for 30 min. before packing.

RESULTS AND DISCUSSION

The present study was done on pigment extraction from red beetroot. The result founded, total betalain amount 1gm/250gm on fresh weights lower percentage of betalain pigment were showed in the previous studies reported extraction of betalain pigment was 380mg/100g on fresh

Table 3. Nutritional value of betalain cookies

S.No.	Parameters	Units	Amount
1.)	Moisture	%	3.75
2.)	Ash	%	1.25
3.)	Protein	%	14.21
4.)	Carbohydrate	%	73.29
5.)	Total Energy	K cal	418
6.)	Fat	%	7.5

weights (Zakharova and Petrova, 1997), while as per found that, the total betalain content of red beet were 250 to 850 mg/100g on fresh weight while acco to Delgado *et al*., 2000 red pigment content in red beet was reach 500mg/100g on fresh weight. After the preparation of cookies. The proximate analyses were performed by the rfrac center (Regional Food Research Center), Lucknow. Rfrac is declared as center of excellence in Food safety, testing, and consultancy as well as HRD purposes by the state government. The nutritional composition of cookies is shown in table 3. The result obtained that the betalain pigment cookies are high in protein and carbohydrate and the color of the cookies is also good and attractive. The use of natural color in food product in the place of synthetic is a good option for food industry and good for human health.

Summary and Conclusion

The beetroot is a good source of natural coloring pigment and nutritional values are high in beetroot. The coloring power is also high in beetroot. As compare to normal cookies people where like to eat natural color enrich cookies because they like taste and color of the cookies. The natural color enrich cookies are attractive in look and high in nutrition value. Overall acceptance of the natural color enrich cookies are more like by the people in the place of normal cookies and synthetic color cookies. Beetroot is a good source for the natural coloring pigment in food product and it is also a good medicinal use.

Acknowledgement

I am very happy to express my gratitude to *Prof. Sunita Mishra,* Dean & Head, Department of Food Science & Technology for his kind suggestion and providing me opportunity to work on this project. I am very thankful to my supervisor *Dr. Neetu Singh, Assistant Prof.* Department of Food Science & Technology and *Dr. Bhawana Dayal*. I would like to express my sincere regards and thanks to my parents who support me lot while completing this research and special thanks to research scholars and also to my classmates and friends.

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