



Natural Color Extraction From Amaranth And Beetroot: A Review

KEYWORDS

Amaranth, Beet root, Ultrasonication, Microwave.

Nikhilesh M. Amlepatil

Department of Technology, Shivaji University, Kolhapur 416004.

Satish Y. Miraje

Department of Technology, Shivaji University, Kolhapur 416004.

P. D. Patil

Department of Technology, Shivaji University, Kolhapur 416004.

A. K. Sahoo

Department of Technology, Shivaji University, Kolhapur 416004.

G. V. Mote

Department of Technology, Shivaji University, Kolhapur 416004.

ABSTRACT Now a day's growing demand for eco-friendly/non-toxic colorants, specifically for health sensitive applications such as coloration of food. Recently, dyes derived from natural sources for these applications have emerged as an important alternative to potentially harmful synthetic dyes. Color is one of the crucial factors for the consumer's acceptability of any processed foods. The potential sources of coloring pigments are Betalain and Betacyanins are present in Beet root and Amaranth respectively. Extraction of these natural color used various novel techniques like ultrasonic assisted extraction, Microwave assisted extraction. . Betalain pigment can be used as a natural additive for food, cosmetics and drugs in the form of beet juice as well as beet powder and Amaranth plant can be a good source of antioxidants. Aim of this study is that to how to extract natural color , study various novel techniques of extraction especially ultrasonication and microwave assisted extraction techniques and their efficiency and suitability.

INTRODUCTION:-

Colour is most sensitive part of any commodity it enhances the consumer acceptability. It indicates freshness and safety of the food commodity. The demand for natural source of colorant is increasing day by day because of awareness about the health. Addition of colour in a food having following reasons-

- To impart the colour into colorless food.
 - Supplement the intensity of natural colour where these are weak.
 - To assure the colour uniformity for avoiding seasonal variations.
 - To increase the acceptability of food.
 - To restore natural colour lost of the food commodity during processing and storage.
 - Demand of natural colour is increases day by day due to following reason
 - Having a nutritional value than other colors.
 - Reference for organic food.
 - Globalization of food colour.
 - It having consumer priority.
- (18)

Synthetic colour may cause serious health problems and hazardous effect. It causes diseases like allergy, cancer. So people became health conscious that's why they prefer natural colour. Now days natural colour available in market which is extracted from different plant sources like Beet root , Amaranth, turmeric, chlorophyll, paprika, saffron etc.

AMARANTH

Amaranth is the most common leaf vegetable having genus *Amaranthus* (family *Amaranthaceae*), including quinoa and amaranth species, is a valuable food source of nutrients with high quality proteins, vitamins, minerals and bioactive compounds such as phenolics. Centres of diversity for amaranth are Central and South America, India, South East Asia with secondary centers of diversity in West and

East Africa. Leaf amaranth is a native of india Taxonomists recognize two sections in *Amaranthus*, viz., *Amaranthus* and *Blitopsis*, Section *Amaranthus*, includes important grain types where the inflorescence is terminal. Section *Blitopsis* includes leaf types and flowers are borne in clusters in leaf axils.

Leaves and succulent stem are good sources of iron (38.5 mg/100g), calcium(350-400 mg/100g), vitamin A and vitamin C. Absorption of calcium from amaranth is however poor. The iron availability is only about 15.2 – 53.6% of total iron. High oxalate content (1-2%) and nitrate (1.8-8.8 g/kg dry matter) levels are reported from leaves of various species. Short duration, quick response to manures and fertilizers, high yield, easiness in cultivation and availability of diverse types suited to specific agro-climatic situations make it a favorite crop of farmers to fit in any cropping systems. Both leaf and grain types play a vital role to combat malnutrition of poor people

BEETROOT

Red beet is a rich source of betalain pigments, which can protect against age-related diseases. Betalain pigment can be used as a natural additive for food, cosmetics and drugs in the form of beet juice as well as beet powder. Processing stability in food is most important issue now days. This vegetable is ranked as one of the 10 most potent vegetables, because of its total phenolic content of 50–60 l mol/g dry matter. An essential part of red beet is the edible roots, which contain from 12 to 20% dry matter, including 4–12% sugar, 1.5% protein, 0.1% fat, 0.8% fiber, minerals such as sodium, potassium, phosphorus, calcium, and iron, as well as small amounts of vitamins. In addition, beetroot is a source of water-soluble nitrogenous pigments. These pigments are betacyanins with colour differences from purple to violet and betaxanthins with a range of colour from yellow to orange. Their content in the roots depends on the degree of maturity, variety and climatic conditions. Betanin constitutes 75–78% of the total content of

betacyanin pigments and with isobetanin represents 95% of all red pigments found in beet juice.(7)

It originates from the Mediterranean sea region, and its ancestor is the beet *B. vulgaris* subsp. *maritima*, commonly known as the sea beet. In terms of the Polish climate, beetroot is a biennial plant, which belongs to the Chenopodiaceae family. This vegetable is ranked as one of the 10 most potent vegetables, because of its total phenolic content of 50–60 l mol/g dry matter.

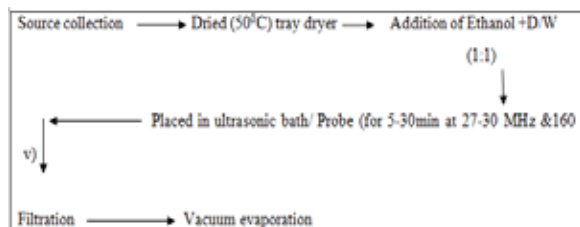
Betalains are water-soluble nitrogen-containing pigments, found in high concentrations in red beet (*Beta vulgaris*) (7) Red color to beet is due to principle coloring pigment Betalains. Which consist of two sub-classes: betacyanins (red-violet pigments) and betaxanthins (yellow-orange pigments) they have antimicrobial and antiviral effects and also can inhibit the cell proliferation of human tumor cells. Betalains can be used as food additives which either avoid the food discoloration or to enrich food. The use of betalains as food colorant is approved by European Union and betalains are labeled as E-162. Betalains are particularly suited for use colouring food products. Although anthocyanins are the most wide spread and mostly used natural pigments covering the red purple color range, betalains are more stable to pH and temperature.(15)

Color Extraction Techniques

Extraction of natural color from Amaranth and Beetroot carried out by some novel techniques like Ultrasonication assisted extraction techniques, Microwave assisted extraction techniques.

Ultrasonication assisted extraction techniques:-

In this extraction method involves the use of ultrasound with frequencies ranging from 20 kHz to 2000 kHz; this increases the permeability of cell walls and produces cavitations. Due to cavitations break down of cell membrane and internal material (color and oil) out.



(Reference- Extraction of natural dye from dahlia varibilis using ultrasound Mishra Pradeep K. et al 2011)

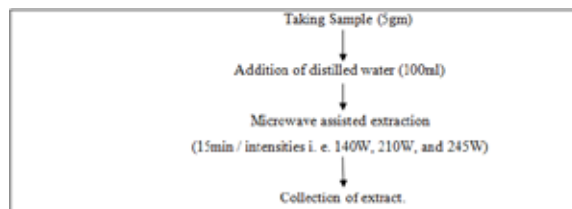
REFERENCE

- Amnah, Alsuhaibani M.A. 2013; " Nutritional, Sensory & Biological study of Biscuits Fortified with Red Beet Roots " Life sciences Journal vol.10(3) | | 2) Cai, Y., Sun, M., and Corke, H. (1998). Colorant properties and stability of Amaranthus pigments . Journal of Agricultural and Food Chemistry, 46, 4491-4495 | 3) Chong, P. H., Yusuf Y. A., Aziz M. G., Mohd. Nazli N., Chin N. L. and Syed Muhammad S.K. 2014. "Evaluation of solvent extraction of Amaranth betacyanins using multivariate analysis". International Food Research Journal vol.21 (4). | | 4) Figiel Adam "Drying kinetics and quality of beetroots dehydrated by combination of convective and vacuum-microwave methods" 2010 Journal of food engineering. | | 5) Hernandez-Ortega Marcela, Kissanguou Guy, Necochea-Mondregon Hugo, Sanchez-Pardo Maria Elena, Ortiz-Moreno Alicia 2013; "Microwave Dried Carrot Pomace as a Source of Fiber & Carotenoids" Food and Nutrition Sciences Vol. 4 | | 6) Jackman, R. L. And Smith, J.L. (1996) Anthocyanin and Betalain in: Natural food colourants .G. A.F.Hendry and J.D.Houghon (Ed).2nd ,Blackie Academic and professional, Great Britain. | | 7) Janiszaska E. "Microencapsulated beetroot juice as a potential source of betalain" 2014 | | 8) Lopez. N., Puertolas, E., Condon, S., Raso, J. And Alvarez, I. (2009). Enhancement of the extraction of beatanine from red beetroot by pulsed electric fields. Journal of Food Engineering, 90, 60-65. | | 9) Mishra Pradeep k., e.tal "Extraction of natural dye from dahlia varibilis using ultrasound" 2011. | | 10) Mitchell, S. C. (2001). Food idiosyncrasies: beetroot and asparagus. Drug Metabolism and Disposition, 29, 539-543 | 11) Neelwarne, B. Red Beet Biotechnology: Food and Pharmaceutical Applications. Springer: New York, 2013; pp. 435-74. | | 12) Netzel, M., Stintzing, F. C. & Quaa, D.et.al. (2005). Renal excretion of antioxidative constituents from red beet in humans. Food Research International, 38, 1051-1058. | | 13) Piattelli. M.(1981). The Betalain :structure, biosynthesis and chemical taxonomy.In E-E. Conn (Ed.), The biochemistry of plants, 7 , secondary plant products (pp. 557-573). New York : Academic Press. | | 14) Psczola, D. E. (1998). Natural colors: pigments of imagination. Food Technology, 52, 70-82. | | 15) Ravichandran K., Nay Min Min Thaw Saw, Mohdaly Adel A.A., et al "Impact of processing of red beet on betalain content and antioxidant activity" 2011 Food research International. | | 16) Selim, K. A. Khalil, K. E., Abdel-Bary, M. S., and Abdel-Azeim, N. A.Extraction, Encapsulation and Utilization of Red Pigments from Roselle (Hibiscus sabdariffa L.) as Natural Food Colourants. Food Science and Technology Dept., Fac. of Agric. Fayoum Univ., Fayoum, Egypt. | | 17) Sikandar Khan Sherwani e tal "Microwave Extraction of Various Commercially Available Types of Camellia sinensis (Tea)", Journal of Pharmacognosy and Phytochemistry, Vol. 1 No. 4 2012 | | 18) Sohi S., Sharma S., Kaur G. and Nanda V. "Biocolorants- A potential food additive" 2014 Indian food industry Mag. | | 19) Tesoriere L, Butera D, Allegra M, Fazzari M, Livera MA (2005)Distribution of betalain pigments in red blood cells after consumption of cactus pear fruits and increased resistance of the cells to ex vivo induced oxidative hemolysis in humans. J Agric Food Chem 53:1266-1270. | | 20) V K Koul (2002)Spray drying of beet root juice using different carriers.Indian Journal of Chemical Technology vol.9, Septemberpp.442-445. | | 21) Venkatasubramanian Sivakumar , Lakshmi Anna J., Vijayeeswari J., Swaminathan G. "Ultrasound assisted enhancement in natural dye extraction from beetroot for industrial applications and natural dyeing of leather" 2009 Ultrasonic Sonochemistry. |

Microwave assisted Extraction

In last two decades, microwave energy has been investigated and widely applied in analytical chemistry to accelerate sample digestion, to extract analytes from matrices and in chemical reactions. Microwave energy is a non-ionizing radiation that causes molecular motion by migration of ions and rotations of dipoles, without changing the molecular structures if temperature is not too high.

Reference- (Sikandar Khan Sherwani et al 2012), Microwave Extraction of Various Commercially Available Types of *Camellia sinensis* (Tea), Journal of Pharmacognosy and Phytochemistry, Vol. 1 No. 4 2012)



USES/APPLICATION OF NATURAL COLOR IN FOOD SECTOR:-

- Natural color like caramel used in cola beverages.
- Color from Beet root & Amaranth used in Dairy products like Ice-cream, Yoghurt, Curd.
- Beet root color also used in Tomato sauces and Ketchups
- Amaranth color used in Ice-cream, Cerels
- Beetroot color also used in Meat and Fish products. (18)

Benefits of Natural color:-

Use of natural colorants are less toxic ,less polluting, less harmful, non-carcinogenic and non-poisonous than synthetic color. It creates gentle, subtle, soft, restful effect. Most of natural colors are water soluble which make them attractive.

CONCLUSION:-

Natural color from plant source like Beetroot, Amaranth will extracted by using novel techniques like ultrasound assisted extraction, microwave assisted extraction techniques. This increases rate of extraction of natural color as compared to other cultural techniques. Natural color is safe to use, nutritious, less polluting. Which create gentle, subtle, soft effect With benefits natural color have some limitations like having less yield, problems like difficulty in the collection of plants, lack of standardization , lack of availability of technical knowledge but also use of natural color increases day by day.