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EXTRACTION, ISOLATION OF MEDICINAL PLANT PIGMENTS FOR NATURAL FOOD COLOURS

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Abstract

Plants are being used for improving the quality of diet and sustaining or regulating good health. Herbal medicines not only provides nutrients but also strengthen and supports the action of digestive system, speeding up the rate of proceeding food and improving the absorption of nutrients. Pigments found in plants play important roles in plant metabolism and visual attraction in nature. Major plant pigments include carotenoids, anthocyanins and other flavonoids, betalains and chlorophylls. They are also rich in flavonoids and other phenolic constituents. Their antioxidant activity makes them chemo preventive and adds various other medicinal values to them. For the present study, a market survey were conducted at Coimbatore city, Tamil Nadu to know about the availability of synthetic food colours in the market. Eight commonly available medicinal plants, namely annatto seeds, madar root, hibiscus flower, grape skin, wheat grass, curry leaves, spinach and tomatoes were selected. Hibiscus flowers and grapes skin colours had the maximum phenolic content of about 2.5 mg/100g followed by madar and wheat grass (1mg/100g each) and annatto seeds (0.4 mg/100g). The antioxidant activity of hibiscus flowers were very high (1720 µg/g) followed by grapes skin (1600 µg/g). Madar root (372µg/g), annatto seeds (360µg/g) and wheat grass (344µg/g) had nominal values. The developed natural food colours were used in selected recipes.

Key words : Medicinal plants, natural food, herbal medicines.

Introduction

The world is endowed with a rich wealth of medicinal plants with global importance. World health organization (2003), estimated that 80 percent of the population of developing countries still depend on traditional medicines. Herbal drugs are prepared from medicinal plants for their minerals and organic matter. Also modern pharmacopoeia contains atleast 25 percent drugs derived from plants.

India is named 'botanical garden' because it is the largest producer of medicinal herbs in the world. About 45,000 plant species are found in the region of Eastern Himalayas, Western ghats and Andaman and Nicobar Islands. In Tamilnadu, 1476 species were found to have medicinal value. About 70 percent of rural population depends on ayurveda. According to All India Ethnobioliogical Survey (2002), about 8000 species of plants being used by the people of India.

Medicinal plant sector has traditionally occupied an important position in the socio cultural, spiritual and medicinal arena of rural and tribal of Tamilnadu (Nair and Henry, 2003). Demand for medicinal plants is increasing in developing and developed countries due to growing recognition to natural products, being non-toxic having no side effects, easily available at affordable prices For meeting the future needs, cultivation of medicinal plants has to be encouraged (www.tnhealth.org).

Flowering plants, roots, bark, fruits and leaves are generally influenced by the perceived medicinal properties of plants and possess pigments in them (Bebber *et al.* 2007). It was realized that many of these pigments play a positive role in human health. Anthocyanins, betalains carotenoids, flavonoids, polyphenolic constituents and chlorophyll abundantly found in plant pigment can be used fields as natural food colourings but they act as antioxidants against free radical to support immune system and prevent diseases (Stinzings, 2006).

Food crops containing carotenoids, anthocyanins chlorophyll and other flavonoids are "Chemopreventers" by providing protection against certain forms of cancer and reductions of cardiovascular diseases. Lycopene, the major pigment of tomato and watermelon has chemoprevention activity because of non-provitamin A carotenoids. The antioxidant properties of carotenoids

which protect plants in photosynthesis apparently may also protect humans from carcinogens and heart diseases. Pigments also contain vitamin C, vitamin E, phenolic acids and organo sulphur compounds.

Colouring matter in foods can also be classified broadly into natural and artificial colours (Mahenrdu, 2000). Use of derived colours of minerals dated from nineteenth century; however some of them caused serious health problems.

We live in a society oriented to the production of consumer goods that are designed to make our lives as easy as possible. Artificial food colours may be easy to use with wide application. The cost too is economically acceptable but from the ecological point of view it is enormously damaging.

Consumers are now aware that synthetic additives often act in the body as irritants and toxins, upsetting the balance of the whole systems, producing side effects that can be lethal. By contrast, the regular and judicious use of herbs to protect and promote health and as medicines to help treat common ailments is an enlightened approach to personal well being. Consumers have turned their attention to products of plant origin and that are safe (Miller, 2002).

Using natural food colours has two common benefits. Natural food colours by nature possess antioxidant, anticancer and antimicrobial qualities. The second benefit is to replace the hazardous synthetic food colours. Many plants with such medicinal properties are abandoned and seem to be under utilized (Kala, 2005). Hence, this study was under taken with the aim to produce natural food colours from selected medicinal plants. These natural food colours would not only be a solution to the phobia of consumers towards synthetic food colours but it would also add pharmacological valve to foods. The investigator also aims in popularizing and utilizing selected under utilized medicinal plants that are commonly available.

Methodology

A. Selection of medicinal plants

The present study aimed to select and extract the pigments from annatto seeds, wheat grass, hibiscus flowers, madar root, grape skin, tomatoes, curry leaves, spinach for their medicinal properties, appeal of colour and easy availability.

Annatto (*Bixa orellana*) the non toxic dye obtained from the seeds can be used for colouring edible matter. They possess antiperiodic, antipyretic and astringent properties (Prajapati *et al.*, 2003). Annatto seeds possess an extremely strong dye which is used commonly for colouring cheese (www.sanjeevani.com).

In India and China the coloured dye of the hibiscus (*Hibiscus rosasinensis*) was extracted from the petals of the red flowers (National Institute of Industrial Research, 2003). In ancient ayurvedic literature flowers of plant hibiscus have been described for its antifertility effect and house hold remedy for controlling excessive uterine bleeding.

The fruit of grape (*Vitis vinifera*) had been employed in folk medicine for treatment of various conditions including cachexia, cancer, cholera, small pox, diarrhoea etc. It is also a rich source of anthocyanins and its skin is being used to add colour to wine.

The Indian madar *(Rubia cordifolia)* is an important component of the ayurvedic system of medicine. It is also used as a natural dye for fabrics (Pandey *et al.*, 2003). The colouring matter in root is purpurin and munjistin. It is being used as a diuretic to treat dyspepsia, flatulence, diarrhoea, diabetes etc.

Lycopene found in tomatoes (*Lycopersicon esculentum*) had been studied extensively in both humans and animals. It is now recognized as a powerful substance in the fight against cardiovascular diseases and various cancers (www.seniorhealth.com).

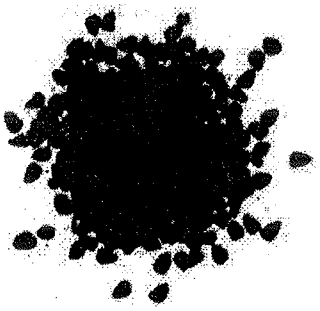
The Indian curry leaf (*Murraya koenigii*) tree is very popular which is found in the back yard of almost every South Indian home. It is commonly used for its high medicinal properties and is rich in chlorophyll. The extracts are being used in the preparation of tonics (Sharma, 2003).

The spinach (*Spinacea oleracea*) is a succulent or fleshy, soft stemmed branched vine with heart shaped leaves. The common green coloured ones are being used in Indian ayurvedha for inflammation alimentary tract infections and gonorrhoea (Kurian, 1995).

Wheat grass (*Triticum avesticum*) contains the maximum amount of chlorophyll at its seventh day and is found to be very stable. It is being used as a laxative, appetiser, for the treatment of flatulence, ulcer and constipation etc. These medicinal plants were selected by judgement sampling method because of the above mentioned medicinal properties and for their colour pigments as shown in fig. 1. Gupta (2004), stated that the choice of sample item depends exclusively on the judgement of the investigator which includes those items in the sample which are typical of the universe with regard to the characteristic under investigation.

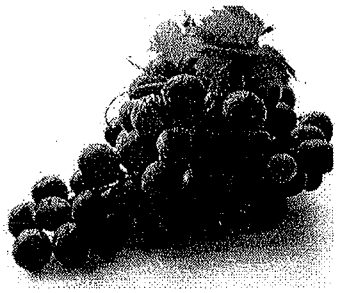
B. Extraction of medicinal plant pigments

For the development of natural food colours from


Annatto seeds

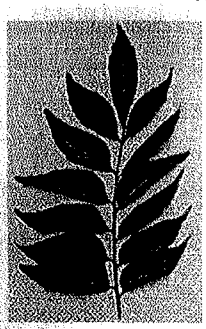

Madar root


Hibiscus flower


Grapes

Wheat grass


Grass Spinach


Curry leaves

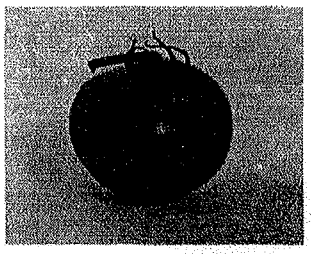

Tomato

Fig. 1 : Medicinal plants selected for the study.

the selected medicinal plants the following methods were adapted to extract the colour plant pigments present in them as shown in fig. 2. The methods were as follows :

1. Maceration

Maceration is the process of breaking down of substance into smaller particles either by manual or mechanical methods. It facilitates the extraction of colour pigments from the selected medicinal plants. Hence, maceration was used for medicinal plants whose active principles are soluble in cold water for several hours, during which time all principles that do not need heat to release them, will be released into the solution (Varier, 1993). Madar root, hibiscus flowers, wheat grass, curry leaves, spinach, tomatoes and grape skin were macerated separately due to its high moisture content. Annatto seeds were not macerated because it does not contain moisture.

2. Extraction

The macerated juices extracted from the selected medicinal plant contain mineral salts and vitamins which can be obtained through cold extraction method (Varier, 1993). The macerated selected samples were subjected to pressure in a sieve and juice was extracted as shown in fig. 2.

3. Sun drying

Sun drying is one of the cheapest methods of drying foods. In sun drying the foods are preserved because the available moisture level becomes low; the micro organism cannot grow and enzyme activity is controlled (Srilakshmi, 2004). Extracts of all the selected medicinal plants were sun dried until they became free of moisture.

Tomatoes, curry leaves and spinach did not have an appealing colour and flavour after the sun drying process. Annatto seeds, madar root, hibiscus flowers, wheat grass, and grape skin were selected for further investigation due to their appeal of colour and acceptable flavour.

C. Antioxidant activity of the extracted medicinal plant pigment

Plants possess medicinal value due to the presence

Fig. 2 : Schematic representation of development of natural food colours.

of phenolic compounds such as flavonols and antioxidants. The developed natural food colours from the selected medicinal plants were analyzed for their total phenols by Folin-ciocalteau reagent method and antioxidant activities by Ferric Reducing Antioxidant Power (FRAP) Assay.

Results and Discussion

A. Antioxidant activity of the extracted medicinal plant pigment

The developed natural food colours were analyzed for their total phenolic contents and antioxidant activities of the developed natural food colours.

1. Phenolic content of the developed natural food colours

Table 1 projects the phenolic content of the developed natural food colours.

Table 1 : Phenolic content.

Medicinal plants	Total phenol (mg/100g)
Annatto seeds	0.4
Madar root	1.0
Hibiscus flowers	2.4
Grape skin	2.4
Wheat grass	1.0

Table 1 shows that among the five developed natural food colours grape skin and hibiscus flowers had the maximum content of total phenols. (2.4mg/100g) followed by madar root and wheat grass (1.04mg/100g). Annatto seeds had 0.44 mg/100g of total phenols.

2. Antioxidant activity of the developed natural food colours

Table 2 shows the total antioxidant activity of the developed natural food colours.

Table 2 : Antioxidant activity.

Medicinal plants	Antioxidant activity (µg/g)
Annatto seeds	360
Madar root	372
Hibiscus flowers	1720
Grape skin	1600
Wheat grass	344

From table 2, it was evident that hibiscus flowers and grape skin had the maximum antioxidant activity of 1720µg/g and 1600µg/g, respectively. Madar root, annatto seeds and wheat grass had nominal values for their antioxidant activity of 372µg/g, 360µg/g, 344µg/g, respectively. The present study also line with Reggis (2000), findings that all medicinal plants are rich sources of antioxidants and it is the main cause for their healing power.

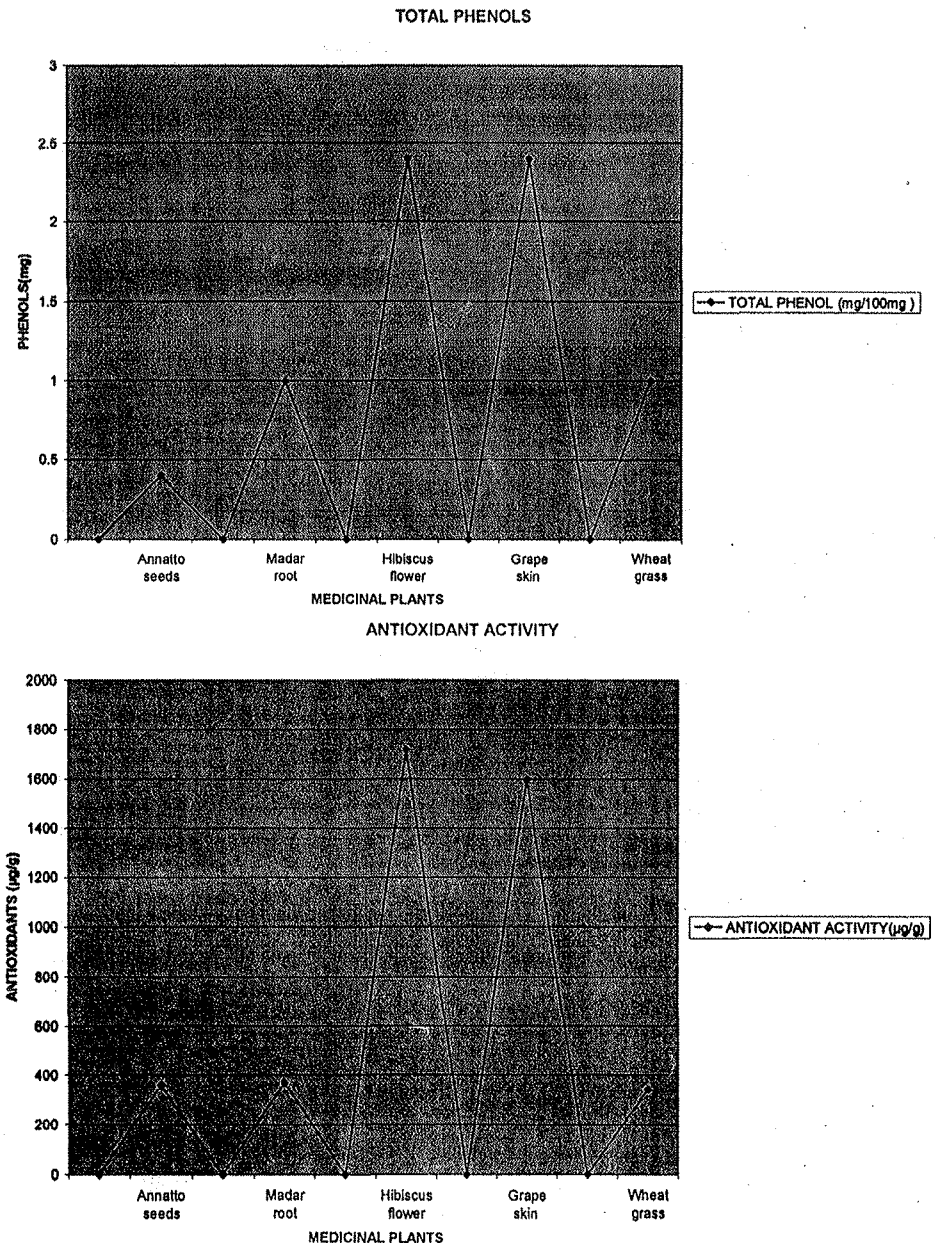


Fig. 3 : Phenols and antioxidant content of the developed natural food colours.

B. Methods adapted for incorporation of the developed natural food colours

The developed natural food colours were added to the selected recipes by various methods as shown in fig. 4.

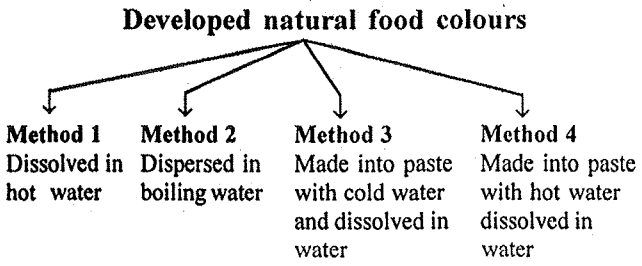


Fig.. 4 : Methods adapted for incorporation in selected recipes.

Methods adapted for incorporation in selected recipes

From the methods shown in fig. 4, maximum colours were obtained for all developed natural food colours when it was dispersed in boiling water.

1. Quantity of natural food colours used in the selected recipes

Amount of developed food colours to incorporated in selected recipes is shown in table 3.

Depending upon the desirable colour and flavours varying quantities (0.5g to 3.0g) of the developed natural food colours were incorporated in every 100g of the standardized recipes. The quantity to be added in every

Table 3 : Quantity to be added for every 100g of recipte.

Medicinal plants	Colours	Quantity (g)	Cost (paise)
Annatto seeds	Orange	1.5	15
Madar root	Red	2.0	20
Hibiscus flowers	Pink	2.0	20
Grape skin	Violet	1.0	80
Wheat grass	Green	1.5	45

100g of the standardized recipes and the cost of each portion was found to be consistent.

Conclusion

Synthetic additives often act in the body as irritants and toxins, upsetting the balance of the whole systems, producing side effects that can be lethal. By contrast, the regular and judicious use of herbs to protect and promote health and as medicines to help treat common ailments is an enlightened approach to personal well being. Consumers have turned their attention to products of plant origin and that are safe for health.

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