International Journal of Basic and Applied Biology
p-ISSN: 2349-5820, e-ISSN: 2349-5839, Volume 6, Issue 2; April-June, 2019, pp. 81-82

http://www.krishisanskriti.org/Publication.html

Evaluation of *Celosia cristata* as a Potential Source of Betalain Pigments

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Abstract—*Color is the main feature of any food item as it enhances the appeal and acceptability of food. Currently, there is increasing awareness among people towards natural dyes and dye yielding plants due to severe health problems. Because of the deficiencies of existing natural food colorants, the demand for natural pigments is repeatedly raised by the food industry. Celosia cristata is commonly known as cockscomb. It is called Mawal in Kashmiri language. C. cristata can offer a more natural and healthy way of coloring food and can be used as a new source of natural pigment i.e., Betalains. Till now, most research has been focused on carotenoids and anthocyanins but betalains have not yet received much attention. So far there is only one single source of betalains that has been extensively used in food industries worldwide and that is the red beet. To meet the high demands of food industries, there is a need for developing natural food colors from sources other than red beets. C. cristata is used mainly as a food color in traditional Kashmiri Wazwan. It imparts a fiery hot color to gravies, without affecting the taste and aroma of the dish, unlike beetroot pigments that impart an earthy flavor to the dishes due to "geosmin". So the betalain pigment extracted from C. cristata could prove to be a better alternative to beet red color developed from beetroot. Therefore, the present study was undertaken to optimize the conditions for the extraction of betalains from cockscomb flower using different solvent systems.*

Keywords*: Cockscomb, betalains, pigment, extraction.*

1. INTRODUCTION

Throughout human history, food color has been a key trait of sensory quality evaluation. With the advent of processed food, food coloring has gained even more importance. Food colorants may be classified into synthetic, Natural- identical, inorganic and natural colorants. Artificial food coloring makes your foods more appealing and desirable. Consumer advocacy groups and recent scientific research, however, have linked these food dyes to a number of potential health problems, most notably certain types of cancer in animals and attention-deficit disorder and hyperactivity in children. In recent years, product designers have been asked to formulate using so-called natural colors with increasing frequency. Natural colorants for food are made from renewable sources. Most often the colorants are extracted from plant material, but other sources such as insects, algae, cyanobacteria and fungi are used as well. They provide a healthier alternative to their artificial counterparts. Betalains constitute an optimum example, displaying not only prominent coloring attributes but also a wide variety of biological properties, namely antioxidant and antiradical, conferring protection against oxidative damages [1-3] antimicrobial [1], anti-proliferative and cytotoxic [1], and [4], radio protective [5], neuroprotective, and also have the ability to ameliorate cognitive deficits [2].

There are several sources of betalains, but the most common and widely known are those belonging to the *Amaranthaceae* (namely *Beta vulgaris* L. and *Amaranthus* spp) and *Cataceae* families (namely *Opuntia* xoconostle. and *Hylocereus* spp). Red beet has been established in the market as the oldest and most abundant red food colorant and has been used to color foods such as yoghurt, confectionery, ice creams, syrups, sausages and processed meats. However, the typical earthy flavor caused by geosmin and high nitrate concentrations associated with the formation of nitrosamines may affect its commercial use. *Celosia cristata*, a deeply hued, magnificient flower, can prove to be an alternative and promising source of betalains pigments. It is commonly recognized as wool flower, common cockscomb, velvet flower, brain celosia, fire-flame bush, foxtail amaranth and wood fordia, belongs to the family *Amaranthaceae*. The betalain pigment extracted from *C. cristata* could prove to be a better alternative to beet red color developed from beetroot. Therefore, the present study was undertaken to optimize the conditions for the extraction of betalains from cockscomb flower using different solvent systems.

2. METHODOLOGY

2.1 Extraction and concentration of betalains pigment from

*C. cristata***:** About 200 g of *C. cristata* was mixed in blender with different solvents for 15 min at room temperature and left for 24 hours. The extract were filtered and concentrated under vacuum by a rotary vacuum evaporator at 40 ^{0}C. The solvents used were distilled water (DW), Ethanol, 70% (EtOH 70) and

95% (EtOH 95), Methanol 70%(MeOH 70) and 95% (MeOH 95).

2.2 Determination of total betalains:

The concentrated extract was diluted with distilled water and measurement was carried out at wavelength of 535 nm and the quantification was expressed as mg betalains/ 100g using the equation as determined by Castellar [6].

3. RESULTS AND DISCUSSION

Food colorants constitute a widespread requirement and industrial key to ensure consumers satisfaction and foodstuffs appealing. Currently, the consumers' satisfaction is not only reached through optimum organoleptic characteristic of food, but also by its ability to act as longevity promoter and health-improving effects. Linked with this, the interest by consumers for healthy foodstuffs, bioactive ingredients, functional foods, and even "super foods" has been largely observed, up to a point that natural ingredients gained the market leadership, Food industry is increasingly focused on the discovery of effective and safer alternatives to many food additives from synthetic origin, once several side effects, and even the occurrence of short-middle or long terms toxicity has been reported. Overall, betalain pigments and corresponding sources have a promissory potential of application, not only in the food industry, but also for cosmetic, pharmaceutical and nutraceutical purposes. So far there is only one single betalainic source that has been extensively used in food industries worldwide and that is the red beet. To meet the high demands of food industries, there is a need for developing natural food colors from sources other than red beets. *Celosia crisata*, which has relatively high betalain content, has a high potential as a natural food colorant and an alternative beet red color. On the basis of spectral and color analysis, 70% ethanol was found to be suitable for pigment extraction (Table 1). This shows that *Celosia cristata* pigments have high potential for use as colorants in food products. In conclusion, the betalain pigments from *C. cristata* in exhibited bright red color characteristics suggesting that they may become a potential new source of water-soluble red colorants for use in food processing. The unexploited potential can be further explored and the flower can be used to extract the natural colorants at a commercial scale.

Table 1: Pigment concentration in different solvents.

Extraction solvent	Pigment Concentration (mg/100)	Color Measurement (Lovibond Units) (1 in cell)
Distilled Water	**120.2**	**403.7**
Ethanol 70	**122.9**	**409.2**
Methanol 70	**113.0**	
Ethanol 95	**Not detected**	**359.2**
Methanol 95	**Not detected**	**NA**
		NA

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