

# Anthocyanin Pigments of Banana Flower Bracts as Food and Pharmaceutical Ingredients

M. Mayil Vaganan and I. Ravi

ICAR-National Research Centre for Banana

Thayanur Post, Thogamalai Road, Tiruchirappalli - 620 102, Tamil Nadu

\*Corresponding Author: [mmayilv@gmail.com](mailto:mmayilv@gmail.com)

The public and consumers are now-a-days increasingly concerned about the adverse health effects of synthetic dyes used as colorants in foods, drinks and confectioneries as they tend to cause adverse behavioral and neurological effects particularly in children. In such scenario, food manufacturers are searching for new sources of natural pigments particularly of plant origin with high tinctorial power, stability and low cost for use as natural food colorants. One of the useful natural colorants is anthocyanin pigments as substitutes for synthetic chemical for food industries. The interest in anthocyanin pigments has increased significantly because of their different bright attractive colors, ready water solubility coupled with potential health promoting effects on the consumers. The capacity of anthocyanins to exhibit varying colors under different pH conditions, the ease for incorporation into aqueous systems due to high water solubility and their greater stability over the higher temperatures is the added advantages of anthocyanins as natural food colorants. For example, anthocyanins provide intense color under acidic conditions, which make them preferable food colorants in moderately acidic foods such as yogurt.

Banana flower bract is a natural abundant source of anthocyanin pigments. Banana flower also called blossom or bell is a male bud of inflorescence after complete opening of female (pistillate) flowers (Fig. 1a & b). Bracts may be of magenta or maroon or purple-red in color depending on the variety (Fig. 2). Male buds are agricultural waste and discarded as residue in abundance in banana culture fields. In India, the florets, after removal of pistil and calyx, are used as main ingredient in preparation of pickle and fritter in Southern part of the country whereas bracts are not used or eaten. However, in The Philippines, Sri Lanka and Zambia and South-East Asian countries like Cambodia, Laos, Thailand and Vietnam, and also

in Brazil, the bracts are used as pie filling and in meat based meals. Dried bract flour is also used in the diet because of high content of minerals such as potassium and dietary fiber.



Fig. 1a: Banana flower



Fig. 1b: Banana flower



Fig. 2: Banana flower bracts

The major anthocyanidins present in bracts of *Musa acuminata* are cyanidin, delphinidin, malvidin, peonidin, and petunidin; that of *M. balbisiana*, *M. velutina* and *M. laterita* are cyanidin and delphinidin; in *M. coccinea* as pelargonidin and cyanidin and as peonidin and malvidin in *M. flaviflora*, *M. ornata* and *M. violascens*. Most of the commercially cultivated banana varieties in the country belong to *M. acuminata*

and *M. balbisiana* and other *Musa* spp. are grown in Northeastern part of the country.

India leads the world in the production of banana with an annual production of 33.1 million tonnes, which is the 30% of global production. It is a fruit food plant cultivated throughout the year in the country and from economic perspective, bracts may be one of the best potential sources of anthocyanins and commercial viability of anthocyanins production is very much possible from the bracts as the bracts are totally unutilized in the country. Red cabbage, which contains only 25 mg/100 g anthocyanins, is used for commercial production of anthocyanin pigments. In a systematic study, it is found that the yield of anthocyanins from bracts of banana flowers varied between 46 to 95 mg /100 g on fresh weight basis and amount of the pigments present in the banana bracts is higher than red cabbage. The bracts of some of the

approximately around one kg of anthocyanins would be obtained from a hectare of banana cultivation.

Further on utilization of anthocyanin pigments extracted from flower bracts Red Banana (Fig. 3), several value-added products were produced, characterized and evaluated for their consumer acceptability. Among the value-added products, the squash (Fig. 4) and ice cream infused with anthocyanins were found to be excellent products and the consumer acceptability to these products were very high.

**Table 1: Total anthocyanins in flower bracts of banana cultivars and genotypes**

Cultivar	Contents (mg/100 g fr. wt.)
Red Banana (AAA)	95
Nendran (AAB)	83
Poovan (AAB)	70
Rasthali (AAB)	69
Pachanadan (AAB)	67
Hill Banana (AAB)	66
NeyPoovan (AAB)	66
Udhayam (ABB)	63
Saba (ABB)	55
Karpooravalli (ABB)	49
Grand Naine (AAA)	46
Genotypes	
Monthan II	350
Bhat Manohar	270
Kallumonthan	200
Calcutta 4	150

banana genotypes like Monthan II, Bhat Manohar, Kallumonthan and Calcutta 4 possess more than 150 mg of anthocyanin pigments per 100 g of bracts (Table). In Indian banana cultivation system, a hectare produces 2,400 male flowers and considering a flower yields 0.5 kg of pigment producing bracts,



**Fig. 3: Anthocyanins extracted from banana flower bracts**



**Fig. 4: Squash infused with anthocyanins from banana flower bracts**

Anthocyanins possess a large gamut of health-promoting effects in animals and human because of their potent antioxidant activities. The foremost health benefit of anthocyanin pigments is that it is a great reliever of oxidative stress. Reactive oxygen species (ROS) like free radicals, singlet oxygen, and peroxides play roles in cell signaling and immune system of the body and if ROS are produced in excess, they cause cellular damage resulting in degenerative problems such as inflammation, aging, cardiovascular, and cancer diseases. The anthocyanins are very effective in quenching the excessive free radicals and terminating the reactions responsible for the oxidative damage. Obesity is a metabolic disorder of excessive accumulation of adipose tissue caused by the

imbalance in energy intake and expenditure. Anthocyanins are found have high anti-obesity effect

by ameliorating the function of adipocyte cells and thus may prevent metabolic syndrome related obesity. Another metabolic disorder is type 2 diabetes, which is a condition that pancreas in the body does not produce normal level of insulin or cells develop resistance to insulin. Long time ingestion of high fat or sugar diets and obesity are possible predisposing factors for type 2 diabetes development. As the anthocyanins have the potential to control obesity and thus, they may consequently prevent type 2 diabetes. Also, the high antioxidant activities of anthocyanins have capacity to protect  $\beta$ -cells from oxidative stress induced by sugars.

Anthocyanins play a significant role in the normal eye vision as normally higher amount of these pigments is found in the eye tissue as compared to brain and liver tissues of the body. Anthocyanins increase the ocular blood flow, prevent the progression of open-angle glaucoma and the impairment of photoreceptor cell function and

inflammation of rhodopsin and have protective effect on visual function during retinal inflammation. Importantly, the pigments decrease the dark adaptation threshold of eyes. Anthocyanins also perform various functions beneficial to the brain health. Anthocyanins improve memory performance and delay the onset of decline of neural functions and improve cognitive and motor performance through inhibition of neuro-inflammation. One more important health-promoting character of anthocyanins is their anti-carcinogenic activity, which occurs due to cell cycle arrest and apoptosis in mutated cells.

Considering the multifunctional positive effects of anthocyanin pigments and consumption of them would be beneficial to human health and also considering the banana flower bracts as agricultural wastes containing very high level of anthocyanins, it would be highly economical to fully exploit bracts as raw materials for extraction of natural colorants of foods as well as for alleviating the human ailments.

\* \* \* \* \*