



## Butterfly Pea Flower: A Natural Colorant and Medicinal Boon

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*Clitoria ternata* belongs to kingdom *plantae*, phylum *tracheophyta*; class of *Magnoliopsida* and family of *fabacea*. It grows widely in tropical regions, including Southeast Asia. Ayurvedic system of medicine is a well-known and oldest system of medicine being used centuries in India. *Clitoria ternata* is an ornamental perennial climber, twining fine stems, up to 2-3 m in height, growing wild and also in gardens, bearing conspicuous blue or white flowers resembling a conch-shell. There are 58 species of *Clitoria ternata* spread all over the world like India, Sri Lanka, Malaysia, Philippine Islands, Australia, Indonesia, South Africa, Australia and around countries in the Indian ocean.

Butterfly pea flowers contain anthocyanins, are present in the form of polyacrylate anthocyanins also known as Ternatins. The plant *Clitoria ternata*, commonly known as 'Butterfly pea,' has a rich history of traditional use in Ayurvedic medicine, where different parts of the plant are utilized to used health concerns like indigestion, constipation, arthritis, skin diseases, liver, and intestinal problems. Anthocyanins helps to prevent skin aging and helps the skin. The blue hue of *Clitoria ternata* flowers is often used as a source of natural coloring in the preparation of various dishes. Flowers have health benefits such as antioxidants, anti-diabetic, anti-inflammatory and anti-cancer agents.

### Nutrients in butterfly pea flower

Butterfly pea flowers are rich in anthocyanin compounds called ternatins, some of the same types found in superfoods like berries, cherries and red wine. Additionally, the plant contains several other antioxidants, including

- Kaempferol:- This compound has been studied extensively for its cancer-fighting properties. Test-tube studies indicate that it may kill off
- p-Coumaric acid:- Some research suggests that p-coumaric acid could have anti-inflammatory, antimicrobial, and antiviral effects, which may help protect against disease
- Delphinidin-3,5-glucoside:- According to one study, this antioxidant may help stimulate immune function and cause cell death in colorectal cancer cells

### Medicinal Activity

Following are the medicinal benefits of butterfly pea flower

1. Anti-inflammatory antipyretic and analgesic effects.
2. Antioxidant effects
3. Antiparasitic and insecticidal effects.
4. Antimicrobial effect.
5. Anticancer effect.
6. Central nervous effect.
7. Gastrointestinal effect.
8. Hypolipidemic effect.

9. Antihistaminic and antiasthmatic effect.
10. Immunomodulatory activity.
11. Diuretic and anti urolithiasis effect.
12. Wound healing effect.
13. Anti-ulcer activity.
14. antidiabetic,
15. anesthetic and analgesic.
16. anti-antidepressant, antistress.
17. anticonvulsant, anxiolytic.

### **Color Extraction from flower**

Extraction procedure of phytochemicals from plant materials is an important step. Conventional and non-conventional extraction methods are available having respective advantages over each other thus careful selection of method should be evaluated depending on the suitability of samples and goals needed to be achieved. Prior to extraction, plant materials are usually reduced in size to increase the surface area for mixing with solvent and the samples used are either fresh, dried, grounded or powdered. Most studies on *C. ternatea* flowers utilized air/oven-dried, fresh flowers or grounded/powdered, dried flowers. Some studies utilized fresh flowers that were cut into smaller pieces, washed and stored in  $-25^{\circ}\text{C}$  freezer and extracted within a month's time or freeze dried followed by grinding.

### **Conventional Extraction**

Conventional extraction methods usually involve the use of different solvents with heat and/or mixing such as soxhlet extraction, maceration and hydrodistillation which though effective can be costly and require long extraction time. Most studies employed extractions using aqueous solvent mixtures of ethanol or methanol rather than water alone with heating to investigate its potential bioactivities and phytochemical content while a number of studies investigated on the optimal solvent and/or extraction parameters.

There are different studies which have used different solvents for extraction of pigments viz., methanol, ethanol, chloroform, ethyl acetate, hexane, water, acetone, acetonitrile, ethyl ether with respect to their research as single solvent alone or in combination for both conventional and non-conventional method of extraction. These solvents can be standardized for extracting at different temperature suited to environment.

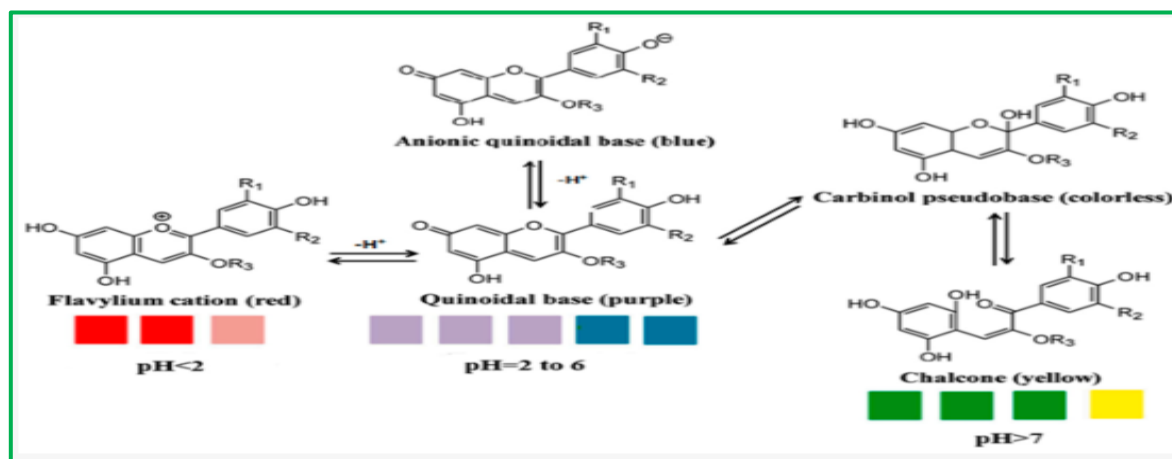
### **Non Conventional Extraction**

Non-conventional extraction methods are newer, highly efficient, safer to the environment having various advantages over conventional extraction method which include methods such as ultrasound assisted extraction, microwave assisted extraction, enzyme assisted extraction, supercritical fluid extraction and pressurized liquid extraction

### **pH Sensitivity of Anthocyanin**

Anthocyanins, water-soluble compounds that can create a broad range of colours (red, pink, purple, and blue), are commonly extracted from flowers, vegetables, cereals, and fruits. It was reported that anthocyanins can be detected in different colours and chemical forms depending on the pH of the solution, and this could be used to track food products over their shelf-life and, eventually, monitor food quality criteria. The source, composition, and structure of anthocyanins are related to the reversible colour characteristics of anthocyanin-rich plants. The ability of anthocyanin to change colour is a unique characteristic. Four different coloured anthocyanin forms can alternately change based on the pH of the solution ranging from 1 to 13. Variations in pH caused variations in the natural color of the anthocyanin extract of the butterfly pea obtained. The types of anthocyanins obtained were peonidin at pH 4-5, delphinidin at pH 6, and petunidin at pH 7. Meanwhile, at pH 8-9, the

greenish color was changed from peonidin with the addition of alkaline substances.. The results obtained from the butterfly pea extract show that at pH 4 it produces a bluish purple color, pH 5 produces a purplish blue color, pH 6 produces a light blue color, pH 7 produces a blue color, pH 8 produces a bluish green color, and pH 9 produces a green color.



### Application in food

In 2021, the FDA approved the commercial use of butterfly pea as a color additive. It is exceptionally heat stable and can be used in a wide range of food and beverage products including sports drinks, ice cream, chewing gum, and yogurt. With this new announcement, butterfly pea flower extract is approved for use in several key application categories in the US, including alcoholic and non-alcoholic RTD beverages, ice cream and frozen dairy desserts, candies, and liquid coffee creamers, both dairy and plant-based.



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