# *Bixa Orellana: Dye Content -An Overview*

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**ABSTRACT**

Annatto extract is a natural food color obtained from the outer coatings of the seeds of the Annatto tree (*Bixa orellana L.). Annatto extract is a natural food color, which is obtained from the outer coatings of the seeds of the Annatto tree (Bixa orellana L) The use of annatto by the New World man dates back to ancient times. The indigenous Amazon people have used "urucum" for body painting for centuries. Seeds and leaves of the annatto tree were used by the Aztecs to prepare remedies for a variety of illnesses such as tonsillitis, asthma, pleurisy, rectal disorders, headache, jaundice, sunstroke, and burns.* Bixin is used both as a spice and a dye since ancient time. Color is the first sensory quality by which foods are judged, since food quality and flavor are closely associated with color. In addition, many colorless convenience foods such as confectionary products, snacks, beverages and gelatin desserts, the food color was added in order to identify the taste and increased the palatability.

## INTRODUCTION

Indians have been considered as forerunners in the art of natural dyeing. Natural dyes find use in the colouring of textiles, drugs, cosmetics, etc. Owing to their nontoxic effects, they are also used for colouring various food products. In India, there are more than 450 plants that can yield dyes. In addition to their dye-yielding characteristics, some of these plants also possess medicinal value. Though there is a large plant resource base, little has been exploited so far. Due to lack of availability of precise technical knowledge on the extracting and dyeing techniques, it has not commercially succeeded like the synthetic dyes. Although indigenous knowledge system has been practiced over the years in the past, the use of natural dyes has diminished over generations due to lack of documentation. Also, there is not much information available on databases of either dye-yielding plants or their products. India harbours a wealth of useful germplasm resources and there is no doubt that the plant kingdom is a treasure-house of diverse natural products. One such product from nature is the dye (Parrota, 2001).

**Development history of Bixa:**

Annatto is a small tree belonging to the family Bixaceae. It was originated in the tropical America and acclimatized in other tropical countries. coloring matter is obtained from the tree when pulpy portion of its seeds is macerated. Pulp is rich in tannin but contain mixture of colorants of carotenoid group. The major colorants are bixin and nor bixin. Bixin is soluble in oil and nor bixin with two carboxylic acid groups in its structure is soluble in water. Colour in one form/another, has been added to our foods for centuries. It is known that the Egyptians coloured candy and wines as long as 400 B.C. The developing food industry had availed a vast array of synthetic colours in the late 1800s. In particular, this was as a result of health concerns over some of the toxic compounds used. An established list of permitted synthetic colours eventually came in to force in most countries early in this century. In the last twenty years, however, consumers have become increasingly aware of the ingredients in their foods and as such they require foods to be as ‘natural’ as possible.

After the accidental synthesis of mauveine by Perkin in Germany in 1856 and its subsequent commercialization, coal-tar dyes began to compete with natural dyes. The advent of synthetic dyes caused rapid decline in the use of natural dyes, which were completely replaced by the former within a century. However, research has shown that synthetic dyes are suspected to release harmful chemicals that are allergic, carcinogenic and detrimental to human health. Ironically, in 1996, Germany became the first country to ban certain azo dyes (Singh, 2001).

The use of natural dyes is the safest way because they are not only eco-friendly but also prevent environmental pollution. Natural dyes are biodegradable, non-toxic, aesthetically appealing and may serve a better alternative to generate employment and utilize the wastelands. Natural dyes are obtained from plant, animal and mineral resources. Nowadays, fortunately, there is increasing awareness among people towards natural products. Due to their non-toxic properties, low pollution and less side effects, natural dyes are used in day-to-day food products (Kapoor and Pushpagandhan, 2002).

The recent ban on production and use of unsubstituted benzedine dyes possessing carcinogenic properties has resulted in a search for an alternative by major dyestuff manufacturers. Annatto (*Bixa orellana*) was traditionally used by indigenous people living

in the Amazon Basin. Early nomadic hunter-gatherer populations must have dispersed annatto seeds within the Amazon region. Later, annatto seed was probably also traded among the indigenous tribes contributing to an even wider dispersion of the species. It would be facilitated to find maximum variability among accessions of annatto. The annatto seeds were used by Brazilian indigenous people to paint their bodies, and to dye their breechcloths (Plotkin, 1993).

**Applications of Annatto in textiles industry:**

Achiote (*Bixa orellana*) has been traditionally used for face and body painting (Paumgartten *et al.*, 2002). Annatto has remarkable affinity for both the protein fibres. Pre application of ferrous sulfate on wool and silk followed by dyeing with annatto produces most balanced improvements in colour uptake, light and wash fastness and colour retention on repeated washing of such protein fibres (Das, 2007).

Annatto is being used increasingly in body care products. European Union rules concerning cosmetic products allows the use of annatto dye in beauty products (Biezen *et al.*, 2006). Annatto oil is an emollient, and its high carotenoid content provides antioxidant benefits on body care products, while adding a rich, sunny colour to creams, lotions, and shampoos. Similarly, annatto paste filters out the ultraviolet rays of sunlight, thereby protecting the skin from excessive sunburn. Dyes for lipstick were also obtained from *Bixa orellana* (Siva, 2007) hence, the name lipstick tree. It is also used as a colouring agent for the preparation of sindoor which is an important cosmetic item for married women, worship and other purposes in India. This safe, non-toxic, eco-friendly natural dye-based sindoor is an efficient option for replacing synthetic dye-based sindoors that is known to cause hair loss, edema, erythema and even skin cancer on its prolonged usage (Kapoor *et al.*, 2008).

**Phenotypic variations of Bixa**

Having been originated from the southwest Amazon the annatto tree *(Bixa orellana*) has one of the longest histories as a dye yielding tree in human history. Trees of the Bixa species belong to the family Bixaceae and can be easily distinguished by the presence of reddish pods. There are 3 types of pods Red, Green and Brown. Annatto has a number of cultigens, including the varieties leiocarpa (Kuntze) and Urucurana and these manifest wide phenotypic variation in the shape and color of capsules and flowers (Arce, 1999). The family Bixaceae is represented by only one genus *Bixa L.*, with six spp. Annatto, *Bixa orellana* L., is a perennial, cultivated shrub and economically exploited species (Paiva Neto *et al.*, 2003).

Bixin is the major pigment, accounting for 80 per cent of the total carotenoid content present in *Bixa orellana* and are the only natural source of bixin (Giuliano *et al.*, 2003). The strong colouring power of carotenoids justifies the wide use of these compounds. Bixin have been used worldwide in the food industry due to its efficiency in physical and chemical quenching singlet oxygen and sensitizers (Stratton *et al.*, 1993), physical quenching involves the energy transferred to the carotenoid and further dissipation by rotational and vibrational interactions. The chemical process results in destruction of the chromophore and formation of oxidation products (Krinsky, 1994).

**Economic importance of Bixin:**

*Bixa orellana* is the only source of the unique C25 apocarotenoid - bixin, a principal coloring constituent of annatto pigment – produced at the aril portions of the seeds accounting for 82 per cent of the total pigment content (Aparnathi and Sharma, 1991). Annatto ranks second in economic importance (next to saffron) and given the color code as E-160B

by codex alimentarious. In general, annatto pigment content of the seeds varies between 5 per cent in hemispheric fruits, 3 per cent - 3.58 per cent in conical types and 1.5 per cent - 2 per cent in oval fruit types. The apocarotenoid bixin is responsible for the reddish orange dye, which is mainly used in dairy industry (Preston and Rickard, 1980).

Bixin is used both as a spice and a dye since ancient time. Color is the first sensory quality by which foods are judged, since food quality and flavor are closely associated with color. In addition, many colorless convenience foods such as confectionary products, snacks, beverages and gelatin desserts, the food color was added in order to identify the taste and increased the palatability. The color generally added to the food is either natural or synthetic food colours. Colouring matter is obtained from Annatto, when pulpy portion of its seeds is macerated. The pulp is rich in tannin but contains a mixture of eight colorants of carotenoid group; major colorants are bixin and nor bixin.

## CONCLUSION:

Natural dyes are nowdays demand not only in textiles but in cosmetics, leather, food and pharmaceuticals. Importance of natural dye is more relevant worldwide in the context of increasing environment consciousness. The non-toxic, biodegradable and eco-friendly properties make them exceedingly popular amongst nature loving and health awarded people. Annatto is mainly valued for its principal colouring component- bixin, which imparts the red colour on food items. Natural dyes are not only having dyeing property but also having the wide range of medicinal properties. Nowadays, fortunately, there is increasing awareness among people towards natural dyes and dye yielding plants. Due to their non-toxic properties, less side effects, more medicinal values, natural dyes are used in day-to-day food products and in pharmaceutical industry. Although worldwide possesses large plant resources, only little has exploited so far. More detailed studies and scientific investigations are needed to assess the real potential and availability of natural dye yielding resources in great demand on the therapeutic formulations of natural drugs commercially. To conclude, there is need for proper methods, documentation and characterization of dye yielding plants for further development of pharmaceutical industry to formulate the natural plant pigments into therapeutically beneficial pharmaceutical formulations/dosage forms for safe use.

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