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## Organic colours for Ayurveda from kokum fruits and rinds

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### Abstract

Kokum (*Garcinia indica* Choisy) is an indigenous and commercially valuable fruit crop. The rich bioactive profile of kokum makes it a highly nutritious and desirable fruit crop. The ripened fruits are used as kokum extract, syrup, nectar, juice etc. The present study was taken up with the objective of extraction and estimation of anthocyanin pigment (mg/100g) from kokum rind (Fresh, dry and sugar rind). Total Anthocyanin Content varied from 79.93, 85.03, 7.83mg/100g in fresh, dry and sugar rind samples respectively. The results highlighted that Sugar rind samples can also be utilized as a source of Anthocyanin. Extracted dye was tested on different fabrics for their applicability and color range from sugar rind samples and compared it with the pigments extracted from fresh and dry kokum fruit rinds in developing organic clothes.

**Keywords:** Kokum, anthocyanin, organic colours, Ayurveda

### 1. Introduction

Ayurveda (Ayurvedic and herbal clothes) is an ancient technique of dyeing textiles with medicinal herbs. It is based on the ayurvedic principle that a regular contact of cloth made from the yarns infused with organic herbs and medicinal plant extracts will enable the medicinal properties permanently being encapsulated to the fabrics [1]. Ayurveda is more effective when the body is most at rest such as during sleep or meditating. When exposed on skin, the herbs are absorbed into the body and provide treatment for a broad range of diseases including diabetes, skin infections, asthma, arthritis and hypertension. They also relieve metabolic disorders, eliminate toxins, improve metabolism, strengthen the immune system and thus thread a new line of healthy living. Ayurveda in the form of sleepwear, bedsheets, towels, meditation clothes and coir mats are being used [2]. The demand for natural and organic dyes for ayurveda has been increasing considerably because of their eco-friendliness, non-toxic and water solubility unlike chemical and synthetic dyes which pollute the environment. Anthocyanins are one such group of organic colors which are natural phenolic pigments or glycosylated polyhydroxy and polymethoxy derivatives, widely distributed in nature and account for colours in several fruits, flowers and vegetables. They are utilized for the color intensity and appearance; improves the visual activity also known for multitude of health benefits [3] 2). The worldwide market of dyes and organic pigments is expected to grow at six percent every year, to reach \$19.5 billion in 2019 from \$14.5 billion in 2014, as per the new Freedonia group report. China is the dominant global consumer of dyes and organic pigments and rapid growth is also seen in smaller Asian markets such as India, Bangladesh and Vietnam.

*Garcinia indica* or Kokum is known to be a rich source of anthocyanin. Cyanidin-3-glucoside and cyanidin-3-sambubioside are the major pigments present in kokum, and is reported to occur in the ratio of 4:1 [4]. *Garcinia indica*, is an indigenous, endemic and underutilized perennial medicinal fruit tree. Commonly known as Kokum, Goa butter tree, Biran, Amsool, Ratamba etc., and distributed mainly in the western Peninsular coastal regions and parts of Eastern India [5]. Kokum, is an antioxidant rich fruit used in the name of Vrikshamba in Ayurveda. The fruits are conical/oblong/pear/spherical in shape, with an average diameter of 1.8-5.51cm and length of 1.19-2.63cm, with 3-8 large seeds being embedded in a red acidic pulp. India produces around 10, 200 metric tons of kokum, with a productivity of 8.5 tons/ha. [6]. Kokum fruits are utilized both in fresh and dry forms; the fruits and fruit rind is valued as a nutraceutical source as it is a rich source of protein, tannin, pectin, total sugars, fat, tannin, starch, crude fat and citric acid. The therapeutic properties such as antioxidant, antibacterial,

antiobesity, anticarcinogenic, neuroprotective and antihistamine properties can be attributed to the presence of Garcinol and Hydroxy Citric Acid(HCA) [7]. The ripened fruits are rich in anthocyanins (2-3%) and the pigments may vary from red to dark purple in color, while the inner rind colour may vary through dark maroon to light maroon, from light red to red to reddish maroon. Fruit rind contains highest concentration of anthocyanin. Thus, the present study was taken up with the objective of extraction and estimation of colour yielding pigments present in kokum rind and the possibility of utilization as an ayurvedic dye in Ayurveda.

## 2. Materials and Methods

### Collection and processing of sample

Kokum fruits were collected from Sanjeevani Vatika, Department of Horticulture, UAS (B), GKVK, Bangalore, in the month of June, 2014. Fresh fruits were washed thoroughly under tap water and rinsed with distilled water. Rind was divided into three parts viz., fresh, dry and sugar rind. First part of the rind was used in fresh form, second part of the fresh rind was subjected to drying in hot air oven for 5days at 50 °C to obtain the dry form, and the third part was the sugar rind, wherein the rind was soaked in sugar for a week and kokum juice was extracted and later dried in hot air oven for 5days at 50 °C.

### Extraction and estimation of Total anthocyanin content

100g of respective sample (Fresh, Dry and Sugar rind) was blended with 100ml of ethanolic HCl (0.1%) in a laboratory blender for extraction of anthocyanin. Extracted anthocyanin was transferred to a glass bottle and stored overnight at 4°C. The samples were filtered through Buchner funnel and the volume was made upto 500ml in a volumetric flask. About 25ml of the filtrate was diluted with ethanolic HCl and incubated in dark for 2hours. Absorbance was measured at 535nm using UV-VIS spectrophotometer and total anthocyanin content was calculated and tabulated [8].

### Extraction of organic colours from Kokum fruit rind

Extraction of organic colours from three different samples of kokum fruit rind (fresh, dry and sugar rind) was carried out. Respective fruit rinds in the ratio of 1:100 (Rind: Distilled water) were boiled in water at 100 °C for one hour. The extracted organic colour were filtered and further utilized for dye purpose on different fabrics [9].

### Evaluation of colour absorption on fabrics

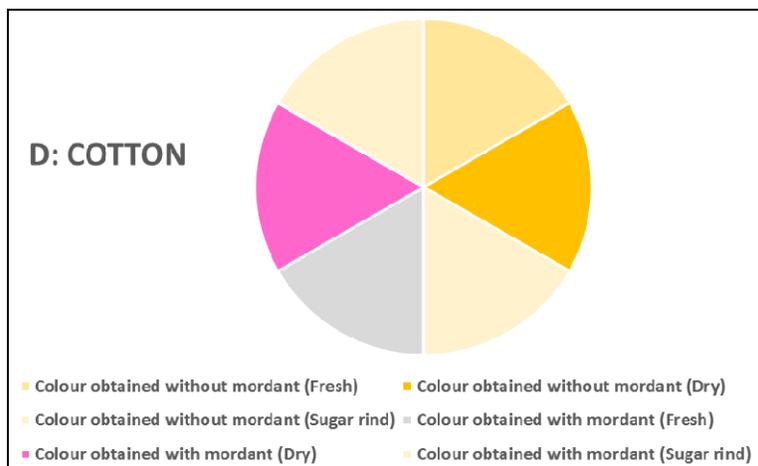
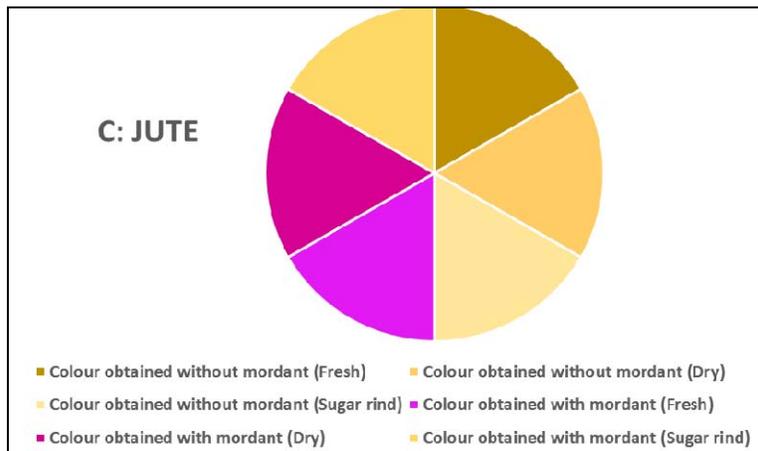
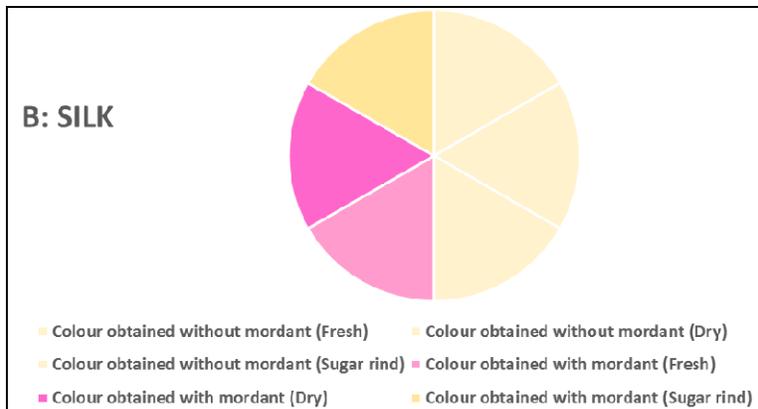
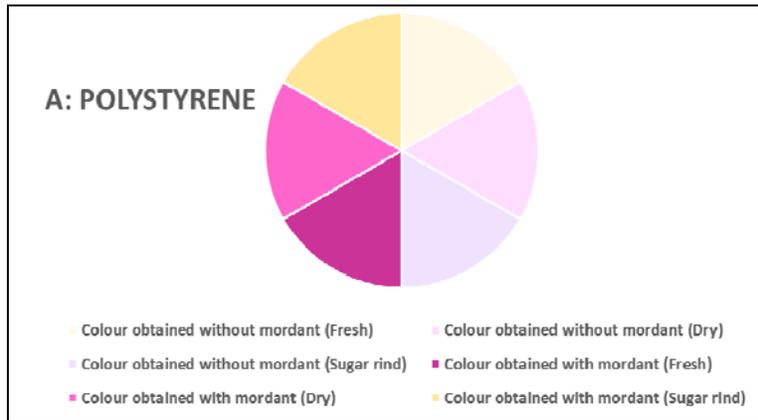
Four types of fabrics viz., Polystyrene, Silk, Jute and cotton (10\*10cm) were dyed to observe the strength of the colour extracted. These fabrics were boiled in 10% NaOH solution for 15min for starch removal and washed with cold distilled water. These fabrics were transferred into 2% ferrous sulphate mordant for 30min, followed by treatment in the dye bath for one hour. Effect of colour absorption on fabrics without mordant was also studied. The fabric was further treated with a color fixative, teepol (0.001%) and dried under sunlight. Dyed fabrics were tested for various colour fastness properties such as washing with soap water (10% w/v), colour change and colour stain, colour, lightness [9].

## 3. Results and Discussion

Anthocyanins are the most common natural pigments that play a vital role in improving and maintaining the overall health of an individual such as improving the visual activity, prevention of neuronal and cardiovascular illness, diabetes and even cancer. Likewise, these pigments as organic colours are also being considered as potential replacements for synthetic colours. Because of their bright and attractive hue and water solubility characteristic that allows their utilization as a dyeing agent in Ayurveda. In the present study, extraction from fresh, dry and sugar rind samples and possibility of utilization as an Ayurvedic dye was taken up. Total anthocyanin content was estimated using UV-Visible spectrophotometer. Results revealed that kokum rind is a good source of Anthocyanins (Table 1). Total Anthocyanin Content varied from 79.93, 85.03, 7.83mg/100g in fresh, dry and sugar rind samples respectively. The kokum rind samples even after extraction of juice also yielded an Anthocyanin content of 7.83mg/100g. The results indicated higher content in fresh and dry rinds, while the content in sugary rinds was in accordance with [10] Joshi *et al.*, 2001, who reported that the anthocyanin pigment of Kokum fruits in Konkan region varied from 7.87-17.03mg/100g. However, [11] Ramachandran, 2014, the Anthocyanin content in Kokum (*Garcinia indica*) varied from 1000 to 2400mg/100g on fresh weight basis. For, [12] Nayak *et al.*, 2010, the anthocyanin content in Roselle (*Hibiscus sabdariffa*) 230mg/100g and in Banana bracts (*Musa paradisiac*) varied from 32 to 250mg/100g. The content and diversity of anthocyanins in fruits are affected by genetic factors, environmental conditions and agricultural practices. Maturity, storage conditions and post-harvest processing methods also affect the content of anthocyanins in fruits [13]. The anthocyanin extracted was assessed for the likelihood of application as an ayurvedic dye. Ferrous sulphate, which was used as a mordant, helped in binding the color on to the fabric. Fig 1 depicts the colour developments of anthocyanin extracted from fresh, dry and sugar rind samples on different fabrics. Color development on fabrics with and without mordant was also studied, wherein, dyeing with mordant gave better shades when compared to dyeing without mordant. Dyeing on fabrics such as Polystyrene, Silk, jute and cotton resulted in sober and appealing colors such as different shades of pink, cream, off white and gray color etc., (Fig 1:A,B,C,D). Kokum dye applicability on fabrics with use of mordants and without mordants were observed. These dyes on different fabrics exhibited variation in shades. Thus, fresh, dry and sugar rind samples can be employed as a source for organic color. Further, the study highlights the utilization of sugar rind, which is used either for direct consumption or considered as a waste product after extraction as an economical source of ayurvedic dye.

**Table 1:** Anthocyanin content from Kokum rinds

Sl.no	Sample	Total Anthocyanin Content (mg/100g)
1	Dry rind	85.03
2	Fresh rind	79.93
3	Sugar rind	7.83



**Fig 1:** Colour developments of anthocyanin extracted from fresh, dry and sugar rind samples on different fabrics

#### 4. Conclusion

Organic colours on fabrics enhance its appeal and value of the therapeutic nature of Ayurveda. The dry kokum sample contained more anthocyanin content followed by fresh and sugar rind sample. The study also showed the possibility of further extraction of dye from sugar rind sample after juice extraction. The application of dye onto different clothes with and without mordant showed that jute cloth could absorb more color. And dyeing with mordant gave better shades when compared to dyeing without mordant. Jute was the best out of the four kinds of fabric, as jute gave the dark pink shades which were similar and closer to kokum fruits. Based on the study on kokum fruit anthocyanin content and dye on fabrics - dye can be obtained from fruits rind and it can be used in ayurveda, anthocyanin source of medicinal property it can be in medicinal and pharmaceutical products.

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