

## Isolation and Extraction of Medicinally Useful Dye from the Heartwood of *Artocarpus integrifolia* Linn. using Different Solvents

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Heartwood of *Artocarpus integrifolia*, an indigeneous tree, is a source of some medicinally useful natural dyes which may vary in their shade and colour depending upon what solvent is used for extraction. They serve the dual purpose—colouring matter and treatment of certain ailments. Extraction in water, aqueous caustic soda, *n*-hexane yields respectively light chocolate solid (aqueous solution orange-red), dark reddish black-brown semi-solid (red-brown solution), light creamish greasy mass (colourless solution). In methanol as well as in ethanol a dark reddish brown semi-solid (red solution) is obtained while the NaOH extract on neutralisation yields a dark brownish black coloured solid; all expected to have varied medicinal value as well.

### INTRODUCTION

Recent years have seen regulations banning the use of synthetic dyes in food and medicines because of their side effects. To find a much better alternative, we have isolated certain natural dyes from the tree *Artocarpus integrifolia*. These are not only good dyes but have altogether certain medicinal value also, instead of the harmful side effects of synthetic dyes. Using the different solvents for extraction, the shade and nature of dye changes.

*Artocarpus integrifolia* or *Artocarpus heterophyllus* (family Moraceas), commonly known as Jack tree or Kathal in Hindi, is an indigeneous large tropical fruit tree grown widely in the equatorial regions. Various parts of the tree have been used against a variety of diseases in Indian medicines<sup>1</sup> as well as in Srilanka<sup>2</sup> by traditional and Ayurvedic practitioners to treat many conditions such as skin disease, diarrhoea, fever, bilious colic and diabetes. Venkataraman *et al.*<sup>3</sup> have explored this plant from the point of view of colouring matter only. Whereas the dye is used for dyeing silk and for general purposes, some efforts have been made to explore the medicinal value of the dye. While the extract of heartwood with alum was used by Buddhist monks for dyeing their robes yellow<sup>4</sup>, the yellow colouring morin, a flavanoid found in *Artocarpus integrifolia*, is reported to have diuretic activity and anti-pregestational activity.<sup>5</sup>

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## EXPERIMENTAL

Authentic heartwood of *Artocarpus integrifolia* was procured from Hardwar, India. It was chipped into small pieces.

*Extraction in water:* 10 g chipped heartwood were boiled with 400 mL distilled water for 1 h. Orange-red coloured extract was separated and the remaining plant material boiled again and again, every time with fresh 400 mL distilled water till the colour of the extract became light. All the collected extracts were mixed and then evaporated to dryness to obtain the dye.

*Extraction in methanol:* (i) *in cold:* 10 g of chips were kept in a Soxhlet extractor with sufficient methanol for 48 h. Red coloured extract was separated and with the solid material the process repeated again and again with fresh methanol till the colour of extract became light. All the collected extracts were mixed and methanol was removed by vacuum distillation.

(ii) *By refluxing:* 10 g chips were refluxed with sufficient methanol for 2 h. The red coloured extract was collected. The process was repeated till light colour. Solutions were mixed and methanol was separated by distillation over a water bath.

*Extraction in n-hexane:* 10 g of chips were kept in a Soxhlet extractor with sufficient *n*-hexane for 48 h. The colourless extract was collected and evaporated at room temperature to obtain the material.

*Extraction in aqueous NaOH:* 10 g chips were kept in a separation funnel with sufficient aqueous decimolar NaOH solution for 48 h. The red-brown solution was separated. The process was repeated till light colour. Evaporation of combined extract yielded a semi-solid dye.

*Acidification of NaOH extract* Similar procedure, as in the extraction in aqueous NaOH, was adopted. A decinormal HCl solution was added to the collected extract drop by drop with constant stirring till a slight excess of acid. A reddish-brown precipitate was formed. The precipitate was filtered and dried at room temperature to obtain the dye.

## RESULTS AND DISCUSSION

The physical appearance and yields of the medicinal dyes obtained by using different solvents are given in Table-1

TABLE-1  
PHYSICAL APPEARANCE AND YIELDS OF MEDICINAL DYES

Heartwood = 10 g

S. No.	Solvent	Yield (g)	Colour and state	Colour of decoction
1.	Water	0.8894	Light chocolate solid	orange-red
2.	Methanol (cold)	1.9642	dark red-brown semi-solid	red
3.	Methanol (reflux)	1.4372	dark red-brown semi-solid	red
4.	Ethanol	1.3230	dark red-brown semi-solid	red
5.	<i>n</i> -hexane	0.0150	light-creamish greasy mass	colourless
6.	Aq-NaOH	5.9816	dark reddish black-brown semi-solid	red-brown
7.	Acidified NaOH extract	1.1336	dark brownish black solid	red brown

The appearance of different colours and shades in the obtained dyes points out towards their different natures. Perkin *et al.*<sup>6,7</sup> isolated morin and cyanoclaclurin from the heartwood of *Artocarpus integrifolia*. Dave and Venkataraman<sup>3a</sup> extracted the heartwood of *Artocarpus integrifolia* in Soxhlet extractor with petroleum ether. The yellow substance deposited on the sides of the extraction flask was dissolved in a little ethanol and then recrystallised from benzene to a yellow coloured solid, to which the name artocarpin was assigned. They<sup>3a</sup> also isolated the same colouring matter through Soxhlet extraction in benzene; a brown semi-solid mass was yielded after evaporation of benzene and successively crystallising from methanol and benzene. Dave *et al.*<sup>3b</sup> isolated two colouring matters, artocarpetin and artocarpanone from the heartwood of *Artocarpus integrifolia* through extraction with benzene. The dyes isolated by us are of different nature and expected to have different medicinal properties, which points out towards the different components in them, work on which is in progress. The yield of dye in water is low while that in methanol is high indicating the presence of water-insoluble but methanol-soluble portion in the dye. The same conclusion is drawn from the yields of other dyes as well.

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