

## Isolation and Extraction of Medicinally Useful Dye from the Roots of *Arnebia nobilis* Rech. f., Using Different Solvents

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Root of *Arnebia nobilis*, a native of Afghanistan but available freely in India, is the source of medicinally useful dyes. It serves as colouring matter as well as for the treatment of certain ailments. Using the various solvents for extraction, viz., water, methanol (reflux and cold), aqueous caustic soda, caustic soda extract neutralized with HCl, and *n*-hexane, the dark brown solid (brownish orange solution), red-black solid (crimson red and maroon solutions), black semi-solid (deep blue solution), chocolate coloured solid (deep blue solution), and dark red viscous substance (dark red solution) respectively are obtained, expected to have varied medicinal value.

### INTRODUCTION

For some decades, the use of synthetic dyes in food and medicines is being discarded due to their side effects. To find much better alternatives, we have isolated certain natural dyes from the plant *Arnebia nobilis*. These are not only good dyes but have altogether certain medicinal value too, instead of the harmful side effects of the synthetic dyes. Using different solvents for extraction, the shade and the nature of the dye changes.

The red dye-yielding root, sold in Indian bazaars under the name Ratanjot, is derived from the plant *Arnebia nobilis* Rech. f. The plant is not a native of India. It grows wild in Afghanistan from where the roots are imported to India<sup>1</sup>. The plant material is used for a variety of ailments<sup>2-4</sup>, as an anthelmintic, in diseases of the eye, in bronchitis, abdominal pain, itch, fever, wounds, etc. The bruised roots are used as an application to eruptions. Several workers have reported anticancer<sup>5</sup> activity of Arnebin-1 (extracted from *Arnebia nobilis* root) and its derivatives.

### EXPERIMENTAL

Authentic root material of *Arnebia nobilis* was procured from Dehradun. Dried root was made to coarse powder.

*Extraction in water:* 10 g of the root coarse powder was boiled with distilled water for 1 h. Brownish orange extract was separated and the solid material repeatedly boiled until the colour became light. All the collected solutions were mixed and then evaporated to dryness to obtain the dye.

*Extraction in methanol by refluxing:* 10 g of root coarse powder was refluxed with sufficient methanol for 1 h. Crimson red extract separated. Process repeated till light colour. Solutions mixed and methanol separated by distillation over water bath.

*Extraction in cold methanol:* 10 g of the root coarse powder was kept in a Soxhlet extractor with sufficient amount of methanol for 48 h. Dark maroon solution was separated. Process repeated till light colour. All the collected solutions mixed and methanol separated by vacuum distillation to obtain the dye.

*Extraction in aqueous NaOH:* 10 g of crushed root was kept in a separating funnel with sufficient aqueous 1 N NaOH solution for 24 h. Deep blue viscous solution was separated. Procedure repeated till light colour. Semi-solid dye obtained by evaporation of the solution.

*Extraction in NaOH followed by neutralization with 1 N HCl:* 10 g of crushed material was kept in a separating funnel with sufficient amount of NaOH. Extract was taken after 24 h. The process repeated till light colour. The total collected solution neutralized with 1 N HCl leading to dark brown precipitate. Precipitate filtered and dried to obtain the dye.

*Extraction in n-hexane:* 10 g of crushed root was kept in a Soxhlet extractor with sufficient amount of n-hexane for 24 h. Dark red extract separated. The process repeated till light colour. The collected solutions mixed. Solvent was removed by vacuum distillation.

## RESULTS AND DISCUSSION

The physical appearances and yields of the medicinal dyes obtained through various solvents are given in Table-1.

TABLE-1  
PHYSICAL APPEARANCES AND YIELDS OF MEDICINAL DYES

Crushed root = 10 g

S. No.	Solvent	Yield g	Colour and state	Colour of decoction
1.	Water	1.8004	Dark brown solid	Brownish orange
2.	Methanol (reflux)	5.1700	Red-black solid	Crimson red
3.	Methanol (cold)	7.2910	Red-black solid	Dark maroon
4.	Aqueous sodium hydroxide	8.0250	Black semi-solid	Deep blue
5.	Aqueous sodium hydroxide neutralized with hydrochloric acid	1.6900	Chocolate coloured solid	Deep blue
6.	n-hexane	0.8540	Dark red viscous material	Dark red

A look at the physical appearances of the obtained samples points out towards their different nature. Khatoun *et al.*<sup>6</sup> extracted the powdered root material with hexane only and obtained a viscous red substance after evaporating the solvent. They have not reported the yield. Moreover they removed the solvent by evaporation while we have removed it by vacuum distillation, thus avoiding high

temperatures as far as possible. The medicinal dyes isolated by us are likely to have different medicinal properties is verified by their different appearances, which points out towards the different components in them, the work on which is in progress.

The yield in water is low while that in methanol is high. It is because of the water-insoluble but methanol-soluble portion in the medicinal dye obtained through methanol. The lowest yield in *n*-hexane points out towards the presence of a component which is soluble in *n*-hexane while other components are insoluble in *n*-hexane. An elementary investigation (m.p. 97.5°C) indicates this to be a single component, and one of the arnebins<sup>7</sup>.

To separate the acidic behaviour portion from the dye, the extraction in aq. NaOH was carried out. This led to the obtaining of a semi-solid material. However, the neutralization of extract with HCl ultimately yielded a solid material in comparatively much low yield. This is the acidic component in the medicinal dye.

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