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# Phytochemical analysis of natural dye yielding plants

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**Abstract:** Phytochemicals are naturally occurring chemical compounds in plants. They are commonly called as secondary metabolites. These compounds respond the medicinal properties and other valuable properties like dyes, milk latex, resins, gums secretion of the plants. The dyes are extracted from plants for various purposes. In this study we have selected fourteen dye yielding plants namely *Lawsonia inermis* L.**,** *Phyllanthus emblica* L.**,** *Indigofera tinctoria* L. *Acacia concinna* DC. *Hibiscus rosa-sinensis* L.**,** *Beta vulgaris* L.**,** *Murraya koenigii* L.**,** *Eclipta prostrata* Roxb. *Citrus sinensis* L., *Aloe vera* L., *Coffea arabica* L., *Camellia sinensis* L., *Cassia auriculata* L. *Syzygium jambolana* L. for the analysis of their phytochemicals. In the results all the plants showed positive response for many qualitative tests.

**Key words:** Medicinal properties, Milk latex, Resins, Gums and *Eclipta prostrata*

## I. INTRODUCTION

Plants produced some chemical compounds for their protection. These compounds have important medicinal properties. They are called as phytochemicals. All the plants in the world contain phytochemicals. The number and nature of phytochemicals may be varied in plant to plant. In plants, these compounds are present in different parts like leaves, stem, fruits, roots and seeds. The phytochemicals exhibit good resistant power against bacteria, fungi and virus. They play a vital role in curing the diseases without any side effect (Shahira and Catherine, 2015). Medicines of herbal sources are readily available, less expensive, safe and effective, and rarely have side effects (Ujwal *et al.*, 2023).

Plants are traditionally used to dye hair, promote growth and prevent aging functions (Amle, 2021). The colouring properties of the plants are determined by the presence of secondary metabolites. Compared to chemical hair colour, which cause skin and other skin related diseases, natural vegetable dyes are preferred. Today herbal remedies are used for healthy hair without side effects. The need for herbal medicines (natural) is growing rapidly due to their natural goodness and lack of side effects. The beauty of skin and hair largely depends on a person's health, diet, habits, work routine, climate conditions and care. Hence evaluation of phytochemicals in dye yielding plants is essential. In the present study we have selected fourteen dye yielding plants and conducted fifteen qualitative analytic tests.

## II. MATERIALS AND METHODS

### Collection of plant materials

Fresh plant materials (Table 1) were collected randomly from the region of Tirunelveli, India. They were washed and then shade dried. Dried materials were powdered using the blender and stored in air tight bottles.

### Methanol extraction

10 g powder of each sample was added to 100 ml of methanol in a conical flask and plugged with cotton wool. After 24 hours the supernatant was collected and the solvent was evaporated to make the crude extract and stored at 4° C.

### Phytochemical analysis

Phytochemical analysis of methanol extracts of different parts of plants was conducted following the standard procedure (Harbone, 1973).

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## III. RESULT AND DISCUSSION

The individual ingredients were subjected to Phytochemical screening to reveal the presence or absence of various phytoconstituents as Carbohydrates, Lipids, Alkaloids, Sugars etc. the result was summarized in Table (2).

**Tannins**

A green precipitate was present in ten extracts of *Lawsonia inermis, Phyllanthus emblica, Indigofera tinctoria, Hibiscus rosa sinensis, Murraya koenigii, Eclipta prostrata , Citrus sinensis, Camellia chinensis, Cassia auriculata, Syzygium jambolana* indicating the presence of tannins in the extracts analysed. Tannin was absent in *Acacia concinna, Beta vulgaris, Aloe vera, Coffea arabica.*

**Flavonoids**

A yellow colouration was observed in the extracts of *Phyllanthus emblica, Acacia concinna, Hibiscus rosa sinensis, Citrus sinensis* indicating the presence of flavonoids in the extracts analysed. Flavonoids was absent in *Lawsonia inermis, Indigofera tinctoria, Murraya koenigii, Eclipta prostrata, Camellia chinensis ,Cassia auriculata, Syzygium jambolana, Beta vulgaris , Aloe vera , Coffea arabica.*

**Terpenoids**

The appearance of deep red colouration indicates the presence of terpenoids in *Acacia concinna, Hibiscus rosa sinensis, Citrus sinensis, Indigofera tinctoria, Eclipta prostrata, Camellia chinensis, Cassia auriculata, Syzygium jambolana, Coffea arabica.* Terpenoids was absent in in *Lawsonia inermis, Phyllanthus emblica, Beta vulgaris, Aloe vera, Murraya koenigii.*

**Saponins**

Persistant frothing on warming the extract *of Lawsonia inermis, Indigofera tinctoria, Acacia concinna, Hibiscus rosa sinensis, Beta vulgaris, Murraya koenigii, Eclipta prostrata, Citrus sinensis, Coffea arabica, Camellia chinensis, Cassia auriculata, Syzygium jambolana* indicated the presence of saponins. It was absent in *Phyllanthus emblica, Aloe vera.*

**Steroids**

A reddish-brown ring at the interface was observed in the extracts of *Phyllanthus emblica, Acacia concinna, Hibiscus rosa sinensis, Coffea arabica, Camellia chinensis, Cassia auriculata* indicated the presence of steroids. It was absent in *Lawsonia inermis, Indigofera tinctoria, Beta vulgaris, Murraya koenigii, Eclipta prostrata, Citrus sinersis, Aloe vera, Syzygium jambolana.*

**Phlobatannins**

Presence of a red precipitate in *Hibiscus rosa sinensis, Beta vulgaris, Coffea arabica, Cassia auriculata* was taken as evidence for the presence of phlobatannins in these extracts. It was absent in other extracts such as *Lawsonia inermis, Phyllanthus emblica, Indigofera tinctoria, Acacia concinna, Murraya koenigii, Eclipta prostrata, Citrus sinensis, Aloe vera, Camellia chinensis, Syzygium jambolana.*

**Glycosides**

A colour changes from **v**iolet to blue to green confirming the presence of glycosides in *Lawsonia inermis, Indigofera tinctoria, Beta vulgaris, Acacia concinna, Murraya koenigii, Eclipta prostrata, Camellia chinensis, Cassia auriculata, Syzygium jambolana.* Glycoside was absent in *Phyllanthus emblica, Hibiscus rosa sinensis, Coffea arabica, Citrus sinensis, Aloe vera.*

**Alkaloids**

A yellow precipitate was observed in the extracts of *Lawsonia inermis, Beta vulgaris, Acacia concinna, Camellia chinensis, Cassia auriculata, Syzygium jambolana, Phyllanthus emblica, Hibiscus rosa sinensis, Coffea arabica, Citrus sinensis, Aloe vera.* Alkaloids was absent in *Indigofera tinctoria, Murraya koenigii, Eclipta prostrata*

**Anthraquinones**

Presence of a pinkish red colouration in ammonical layer indicated the presence of free anthraquinones in *Lawsonia inermis, Beta vulgaris, Acacia concinna, Camellia chinensis, Cassia auriculata, Phyllanthus emblica, Hibiscus rosa sinensis, Coffea arabica, Aloe vera, Indigofera tinctoria, Murraya koenigii, Eclipta prostrata.* Anthraquinones was absent in *Citrus sinensis* and *Syzygium jambolana.*

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**Anthocyanins**

The presence of reddish blue colouration indicated the presence of anthocyanins in the extracts of *Phyllanthus emblica, Hibiscus rosa sinensis, Acacia concinna, Eclipta prostrata, Citrus sinensis, Coffea arabica, Cassia auriculata*, *Syzygium jambolana*. It was absent in *Lawsonia inermis, Beta vulgaris, Camellia chinensis, Aloe vera, Indigofera tinctoria and Murraya koenigii.*

**Leucoanthocyanins**

Presence of red colour in organic layer indicated the presence of leucoanthocyanins in the extracts of *Hibiscus rosa sinensis, Coffea arabica* and *Cassia auriculata.* It was absent in the other extracts such as *Phyllanthus emblica, Acacia concinna, Eclipta prostrata, Citrus sinensis, Syzygium jambolana, Lawsonia inermis, Beta vulgaris, Camellia chinensis, Aloe vera, Indigofera tinctoria and Murraya koenigii.*

**Carbohydrates**

Purple colour was observed in *Lawsonia inermis, Beta vulgaris, Camellia chinensis, Indigofera tinctoria, Cassia auriculata and Murraya koenigii.* It was absent in *Hibiscus rosa sinensis, Coffea arabica, Phyllanthus emblica, Acacia concinna, Eclipta prostrata, Citrus sinensis, Syzygium jambolana, Aloe vera.*

**Proteins**

*Aloe vera* extract only showed the formation of white precipitate thereby indicated the presence of protein. Protein is absent in the extracts of *Lawsonia inermis, Beta vulgaris, Camellia chinensis, Indigofera tinctoria, Cassia auriculata, Murraya koenigii, Hibiscus rosa sinensis, Coffea arabica, Phyllanthus emblica, Acacia concinna, Eclipta prostrata, Citrus sinensis* and *Syzygium jambolana.*

**Emodins**

Presence of red colour precipitate in *Beta vulgaris, Murraya koenigii, Eclipta prostrata, Citrus sinensis, Aloe vera, Cassia auriculata* indicated the presence of emodins. Emodin was absent in *Lawsonia inermis, Camellia chinensis, Indigofera tinctoria, Hibiscus rosa sinensis, Coffea arabica, Phyllanthus emblica, Acacia concinna* and *Syzygium jambolana.*

**Coumarins**

Appearance of yellow colour indicated the presence of coumarins in *Phyllanthus emblica, Acacia concinna, Hibiscus rosa sinensis, Citrus sinensis, Coffea arabica* and *Syzygium jambolana.* Coumarins was absent in *Lawsonia inermis, Camellia chinensis, Indigofera tinctoria, Beta vulgaris, Murraya koenigii, Aloe vera, Cassia auriculata and Eclipta prostrata.*

Monika *et al*., (2013) carried out the qualitative analysis for medicinal dye yielding plants *Emblica officinalis*, *Acacia catechu, Acacia concina* and *Hibiscus rosa-sinensis*, belong to different families. These plants showed that tannins, saponins, flavonoids, terpenoids and alkaloids except phlobatannins that is only present in *Acacia catechu*. The petroleum ether and chloroform extract of *Emblica officinalis* does not show potential for oil and fat components whereas all the extract of *Emblica officinalis* showed positive test for carbohydrates. The identification of colouring chemical constituents of natural products together with their therapeutic properties is discussed. The attractive colours and fragrance produced by the plants is due to specific phytochemicals present in them. They may be tannins, flavonoids, glycosides, saponins, steroids and alkaloids (Monika *et al*., 2013).

Kaleson and Neksumi (2022), assessed the distribution of Alkaloids, saponins, anthraquinones, glycosides, phenolics, terpenoids and flavonoids in ten medicinal plants belonging to different families. They investigated the medicinal plants like cotton (*Gossypium hursitum*), *Cucurbita pepo* (Pumpkin) and velvet bean (*Mucuna prupriens*). The results of the phytochemical analysis showed the presence of major classes of secondary metabolites such as alkaloids, tannins, saponins, flavonoids, glycosides, phytosterols, carbohydrates, proteins, terpenoids and anthraquinones in ethanolic and aqueous extract.

## IV. CONCLUSION

In the present investigation, highest number of phytochemicals are present in *Cassia auriculata* extract. Totally 12 compounds out are present in it. In *Hibiscus* extract 11 phytochemicals are present. In *Lawsonia inermis* 6 compounds are present. In *Phyllanthus emblica* 7 compounds are present. In Indigofera tinctoria 6 compounds are present. In *Acacia concinna* 9 compounds are present. In *Beta vulgaris* 7 compounds are present. In *Murraya koenigii* 6 compounds are present. In *Eclipta prostrata* 7 compounds are present. In *Citrus sinensis* 7 compounds. In *Aloe vera* 4 compounds are present. In *Coffea arabica* 9 compounds are present. In *Camellia sinensis* 8 compounds are present. In *Syzygium jambolana* 7 compounds are present.

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TABLE 1: SELECTED PLANTS FOR HERBAL HAIR DYE PREPARATIONS

| S.No. | Plant species | Family | Local name |
|---|---|---|---|
| 1. | *Lawsonia inermis* L. | Lythraceae | Henna |
| 2. | *Phyllanthus emblica* L. | Phyllanthaceae | Nellikai |
| 3. | *Indigofera tinctoria* L. | Fabaceae | Avuri |
| 4. | *Acacia concinna* DC. | Mimosaceae | Shikakai |
| 5. | *Hibiscus rosa-sinensis* L. | Malvaceae | Chembaruthi |
| 6. | *Beta vulgaris* L. | Amaranthaceae | Beetroot |
| 7. | *Murraya koenigii* L. | Rutaceae | Curry leaf |
| 8. | *Eclipta prostrata* Roxb. | Asteraceae | Karisalankanni |
| 9. | *Citrus sinensis* L. | Rutaceae | Orange |
| 10. | *Aloe vera* L. | Liliaceae | Katraalai |
| 11. | *Coffea arabica* L. | Rubiaceae | Coffee |
| 12. | *Camellia sinensis* L. | Theaceae | Tea |
| 13. | *Cassia auriculata* L. | Caesalpiniaceae | Avarai or Senna |
| 14. | *Syzygium jambolana* L. | Myrtaceae | Jamun |

TABLE 2: RESULTS OF PHYTOCHEMICAL EVALUATION

| S.No. | Name of the test | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Tannins | + | + | + | - | + | - | + | + | + | - | - | + | + | + |
| 2. | Flavonoid | - | + | - | + | + | - | - | - | + | - | - | - | - | - |
| 3. | Terpenoids | - | - | + | + | + | - | - | + | + | - | + | + | + | + |
| 4. | Saponins | + | - | + | + | + | + | + | + | + | - | + | + | + | + |
| 5. | Steroids | - | + | - | + | + | - | - | - | - | - | + | + | + | - |
| 6. | Phlobatannins | - | - | - | - | + | + | - | - | - | - | + | - | + | - |
| 7. | Glycosides | + | - | + | + | - | + | + | + | - | - | - | + | + | + |
| 8. | Alkaloids | + | + | - | + | + | + | - | - | + | + | + | + | + | + |
| 9. | Anthraquinones | + | + | + | + | + | + | + | + | - | + | + | + | + | - |
| 10. | Anthocyanins | - | + | - | + | + | - | - | + | + | - | + | - | + | + |
| 11. | Leucoanthocyanins | - | - | - | - | + | - | - | - | - | - | + | - | + | - |
| 12. | Carbohydrates | + | - | + | - | - | + | + | - | - | - | - | + | + | - |
| 13. | Proteins | - | - | - | - | - | - | - | - | - | + | - | - | - | - |
| 14. | Emodins | - | - | - | - | - | + | + | + | + | + | - | - | + | - |
| 15. | Coumarins | - | + | - | + | + | - | - | - | + | - | + | - | - | + |

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