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# Extraction, Optical And Functional Properties Of Natural Food Colourant From Ixora (*Ixora Coccinea*) And African Tulip (*Spathodea Campanulata*) Flowers

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***Abstract:*** The present study aim to explores the extraction of natural colorants from Ixora and African tulip flowers. Natural pigments found in flowers offer a vibrant and ecofriendly alternative to synthetic dyes. Extracting these color involves separating the pigments from flower petals .The extracted color has the potential to serve as a sustainable and ecofriendly alternative to synthetic dyes. Both ixora and African tulip flower rich in antioxidant and anti-inflammatory compound. The project will investigate on various extraction methods and their optical properties. Natural pigments, including carotenoids, flavonoids and anthocyanidins, determine the attractive color of fruits. It also have health benefits that are seldom levarged by the food industry. Betalains, carotenoids, phycocyanins, and anthocyanins are major food colorants used in the food industry that have documented biological effects, particularly in the prevention and management of chronic diseases such as diabetes, obesity, and cardiovascular disease. In this experimental analysis measurement of the extracted color will be using colorimetry. For phytochemical analysis detection of alkaloids, terpenoids, phenolic compounds, flavonoids, tannins were tested. Antioxidant activity and total polyphenol were also noted

***Index terms:*** Ixora Coccinea, Spathodea Campanulata, Extraction

## I. INTRODUCTION

The application of natural colorants is increasing in the food industry because they are considered safer and healthier than some synthetic pigments. Natural colorants can improve the organoleptic properties of foodstuffs, provide additional benefits such as enhance their nutritional value and/or extend shelf-life. Plants, fungi, bacteria or algae naturally produce different natural colorants, including carotenoids. These compounds are classified into two main groups: pure hydrocarbon carotenes (α- and β-carotenes, lycopene) and oxygenated derivatives of xanthophylls (lutein, zeaxanthin, astaxanthin, fucoxanthin, cryptoxanthin, etc.).

Carotenoids have been related with beneficial properties like antioxidant, antidiabetic, antitumor or antimicrobial, so they are a natural and healthy alternative to the use of synthetic colorants. Thus, it is critical to optimize their extraction, by utilizing novel and green techniques, and their stability through encapsulation processes (Lourenco et al., 2021).

Ixora coccinea Linn is one of the candidates of floral anthocyanins. It belongs to the Rubiaceae family, a large glabrous shrub growing throughout forest lands and also cultivated plant in the garden . It is a native to Asia and commonly known as Jungle of geranium or flame of the woods or vetchi in Ayurveda. It has different flower color; namely dark pink, white, yellow and orange. Flowers are numerous and found to grow in clusters. They are bright red petaled flowers with yellow or light pink at the centre, odorous, in sessile, corymbiform, dense flowered cymes . Ixora coccinea (IC) is grown in many countries essentially for medicinal and ornamental purpose. Depending on the disease, the flowers, leaves, roots or stems may be used to treat various ailments in Indian traditional system of medicine (Patil N, Datar A, 2014). Spathodea campanulata P. Beauvais tree is native to Africa. In tropical Africa it is planted as an ornamental plant, e. g. in Cape Verde, Zimbabwe and Madagascar. It is widely grown in tropical and subtropical regions outside Africa. This plant is also commonly found in India as an ornamental plant.. Spathodea campanulata is traditionally used in the treatment of various disorders. The bark pulp is used in oedemas, skin diseases like herpes and sores. In Gabon, the crushed bark and flowers have been applied to ulcers. The cold leaf infusion is used to treat urethral inflammation and bark decoction has been reported to be used to treat kidney disorders. In Senegal, the bruised leaves and flowers are used in wound treatment and ulcers. The flowers are employed as diuretic and anti-inflammatory, while the leaves are used against kidney disease, urethra inflammation and as an antidote against animal poisons. Also, the leaf decoction has been used for the treatment of gonorrhoea and women‘s pelvic disorders. In Ghana, the bark infusion is used for the treatment of dysentery and stomach ache. (Wagh A. and Butle S, 2018)

## II. MATERIALS AND METHODOLOGY

A dark red variety of Ixora (ixora coccinea) flowers were collected from roadside and a dark yellowvariety of African tulip (Spathodea campanulata) flowers were collected from campus. Fresh flowers like Ixora and African tulip were collected and separated from buds. Then they werewashed and weighed. For the extaction of colour solvent extraction method were used and they are two types,water extraction and ethanol extraction. In water extraction 2 gram of fresh floral petals of ixora and African tulip were dissolved in boiled water of 25ml, 50ml,and 75ml in beaker for the extraction of color from fresh flowers. Similarly the flowers were dried on hot air oven at 45°C for 6 hour and powdered then 2gram of powder dissolved in boiled water of 25ml, 50ml and 75ml in beaker for the extraction of color from powdered flowers. The second method used for extraction was the ethanol extract from flowers. In this method, 2 gram of fresh floral petals of ixora and african tulip were dissolved in boiled water of 25ml, 50ml,and 75ml in beaker for the extraction of color from fresh flowers. Similarly the flowers were dried on hot air oven at 45°C for 6 hour and

powdered then 2gram of powder dissolved in ethanol of 25ml, 50ml and 75ml in beaker for the extraction of color from powdered flowers.Solvent extraction is a separation technique used to extract a desired compound from a mixture using a solvent. It relies on differences in solubility between the compound of interest and other components in the mixture.

Intensity of the colour were measured by uing UV colorimetry. For the analysis of color, 2 gram of fresh floral petals of ixora and african tulip were dissolved in boiled water and ethanol of 25ml, 50ml,and 75ml in beaker for the extraction of color from fresh flowers. Similarly both the flowers were dried on hot air oven at 45°C for 6 hour and powdered then 2gram of powder dissolved in ethanol and boiled water of 25ml, 50ml and 75ml in beaker for the extraction of color from powdered flower. Atlast intensity of the Color extraction of ixora flowers look over at 68nm and African tulip flowers look over at 62nm on colorimeter for every 1 hour of 5 hour.UV colorimetric analysis is a technique that combines the principles of colorimetry and ultraviolet(UV) spectroscopy to determine the concentration of a substance in a solution. When light shineson a colored solution, some wavelengths of light are absorbed by the molecules in the solution, whileothers are transmitted. For the phytochemical analysis Flowers were dried and ground into powder. About 1g of each powder were added in 100 ml of distilled water in beaker and stir it very well. The extracts were filtered through Whatman No.1 filter paper. These extracts were tested for the presence of active chemical compounds. Test like alkaloids, terpenoid, phenolic compound, flavonoid. tannin, carbohaydrate and saponin were tested. Antioxidant activity and total polyphenol of dry flowers were assessed using appropppriate analytical techniques.

## III. RESULTS AND DISCUSSION

### 3.1 UV COLORIMETRY ANALYSIS

The The following table-1 and figure-1 give the effect of ethanol concentration on the colour intensity of the extract from dried Ixora powder.

**Table1 : Effect of ethanol concentration on the colour intensity of the extract from dried Ixora powder**

| Sl. No | Sample Quantity | Conc. Quantity | Reading Time | Reading at 68nm |
|---|---|---|---|---|
| 1 | 2gram | 25ml | 1hr<br>2hr<br>3hr<br>4hr<br>5hr | 0.63<br>0.70<br>0.79<br>0.88<br>0.94 |
| 2 | 2gram | 50ml | 1hr<br>2hr<br>3hr<br>4hr<br>5hr | 0.25<br>0.28<br>0.36<br>0.45<br>0.55 |

| | | | | |
|---|---|---|---|---|
| 3 | 2gram | 75ml | 1hr<br>2hr<br>3hr<br>4hr<br>5hr | 0.16<br>0.18<br>0.24<br>0.28<br>0.32 |

In this table sample solution shows the greatetest intesty of colour compared to other sample solution. Powdered Ixora flower sample in ethanol was found to have great significant influence on the colour intensity of the extract. Color developments and intensity happening fastly when compared to other sample solution. In this sample dilution calorimetric reading was increasing fastly because of ethanol dilution. The use of ethanol as an extractant offers advantages such as high extraction rate, simplicity in process, and low requirements on production equipment.

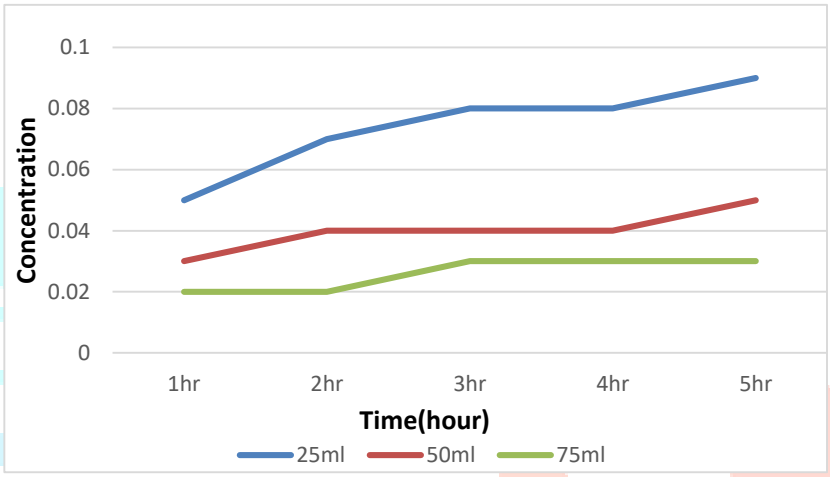


**Figure 1: Effect of ethanol concentration on the colour intensity of the extract from dried Ixora powder**

**Water extraction of colour from dried Ixora**

The following table-2 and figure-2 give the effect of water concentration on the colour intensity of the extract from died Ixora powder

**Table 2: Effect of water concentration on the colour intensity of the extract from dried Ixora powder**

| Sl. No | Sample Quantity | Conc. Quantity | Reading Time | Reading at 68nm |
|---|---|---|---|---|
| 1 | 2gram | 25ml | 1hr<br>2hr<br>3hr<br>4hr<br>5hr | 0.16<br>0.30<br>0.52<br>0.25<br>0.86 |
| 2 | 2gram | 50ml | 1hr<br>2hr<br>3hr<br>4hr<br>5hr | 0.06<br>0.15<br>0.31<br>0.43<br>0.51 |

| | | | | |
|---|---|---|---|---|
| 3 | 2gram | 75ml | 1hr<br>2hr<br>3hr<br>4hr<br>5hr | 0.02<br>0.08<br>0.20<br>0.29<br>0.36 |

In this table clearly states that dilution of sample have less colour intensity of the extract when compared to other ethanol solution. In water diltution color development started slowly than the ethanol solution. And the stability of the color is also less compared to ethanol dilution. When this water dilution sample kept for more days color begin to disappear. The most distinctive indicators of ACN-Men+ formation are the shift of maximum absorption toward longer wavelengths of visible region and increase the iintensity of maximal absorbance intensity, which are accompanied by changes of color solution (Sigurdson et al., 2016).

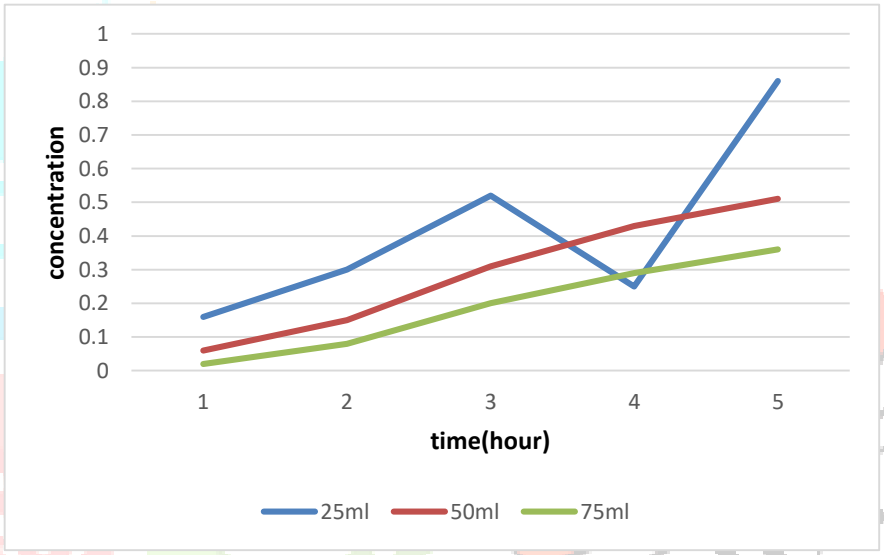


**Figure 2: Effect of water concentration on the colour intensity of the extract from dried Ixora powder**

**Ethanol extraction of the colour from dried African tulip powder**

The following table-3 and figure-3 give the effect of ethanol concentration on the colour intensity of extract from dried African tulip powder.

**Table 3: Effect of ethanol concentration on the colour intensity of extract from dried African tulip powder**

| Sl. No | Sample Quantity | Conc. Quantity | Reading Time | Reading at 62nm |
|---|---|---|---|---|
| 1 | 2gram | 25ml | 1hr | 0.91 |
| | | | 2hr | 1.40 |
| | | | 3hr | 1.95 |
| | | | 4hr | 1.98 |
| | | | 5hr | 1.99 |
| 2 | 2gram | 50ml | 1hr | 0.55 |
| | | | 2hr | 0.80 |
| | | | 3hr | 0.89 |
| | | | 4hr | 1.06 |
| | | | 5hr | 1.15 |
| 3 | 2gram | 75ml | 1hr | 0.35 |
| | | | 2hr | 0.45 |
| | | | 3hr | 0.58 |
| | | | 4hr | 0.70 |
| | | | 5hr | 0.92 |

The table clearly states that dilution of the powdered African tulip flower sample was found to have great significant influence on the colour intensity of the extract. In all the samples, the colour development started earlier than the powdered Ixora sample. The colorimetric reading was increasing fastly in ethanol dilution than water dilution at the end of 5 hours in the sample with 25 ml, 50ml and 75ml sample. This sample has the fast and great colour development than the water dilution.

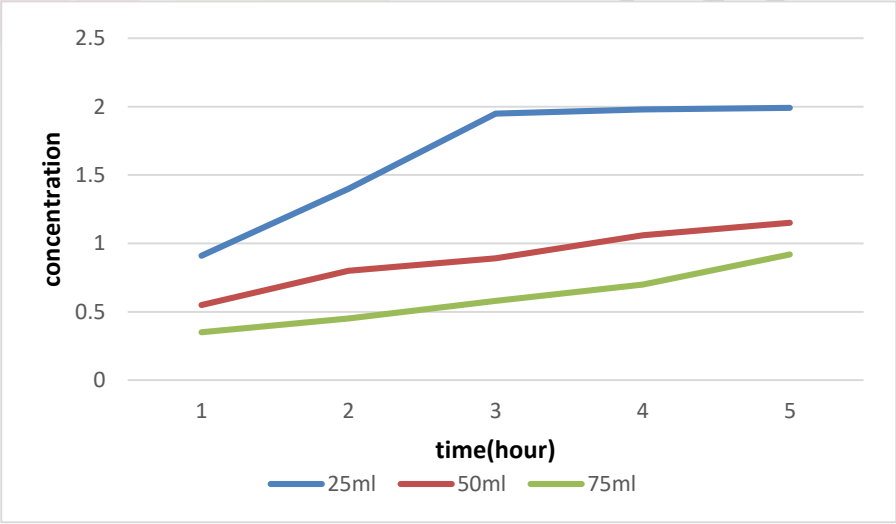


**Figure 3: Effect of ethanol concentration on the colour intensity of extract from dried African tulip powder**

**Water extraction from dried African tulip**

The following table-4 and figure-4 give the effect of water concentration on the colour intensity of the extract from dried african tulip**.**

**Table 4: Effect of water concentration on the colour intensity of the extract from dried african tulip**

| Sl. No | Sample Quantity | Conc. Quantity | Reading Time | Reading at 62nm |
|---|---|---|---|---|
| 1 | 2gram | 25ml | 1hr | 0.25 |
| | | | 2hr | 0.44 |
| | | | 3hr | 0.79 |
| | | | 4hr | 1.03 |
| | | | 5hr | 1.23 |
| 2 | 2gram | 50ml | 1hr | 0.26 |
| | | | 2hr | 0.30 |
| | | | 3hr | 0.68 |
| | | | 4hr | 0.75 |
| | | | 5hr | 0.80 |
| 3 | 2gram | 75ml | 1hr | 0.05 |
| | | | 2hr | 0.14 |
| | | | 3hr | 0.29 |
| | | | 4hr | 0.40 |
| | | | 5hr | 0.46 |

The table clearly states that dilution of the African tulip flower sample was found to have some significant influence on the colour intensity of the extract. In all the samples, the colour development started fastly. The colorimetric reading was increasing 5 hours in the sample with 25 ml, 50ml and 75ml sample. When compared to ethanol dilution water has less color development but better than the ixora sample dilution.

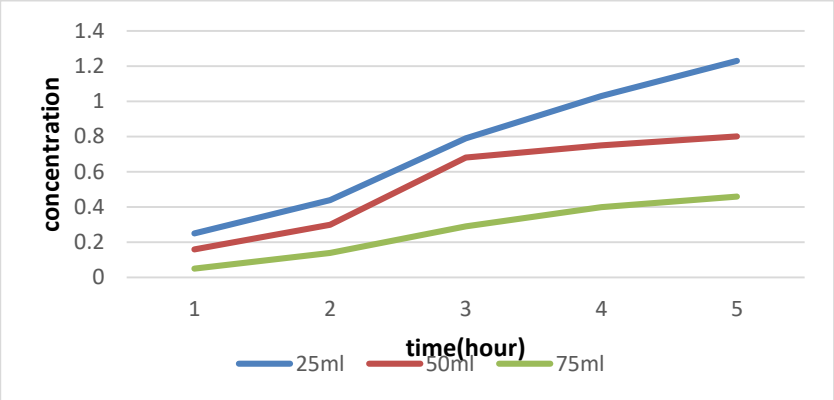


**Figure 4: Effect of water concentration on the colour intensity of the extract from dried african tulip**

The result of colorimetric analysis indicate that flowers dissolved in ethanol have great color intensity. Powdered flower have great intensity and stability than the fresh flower. Also sample in ethanol dilution has great color development than water dilution. In UV colorimetric analysis, a compound that absorbs UV light is used as a reagent. The reagent reacts with the analyte to form a

colored product. UV colorimetric analysis can be a starting point for analyzing flower color extracts, especially for pigment identification based on absorption patterns.

### 1.1. PHYTOCHEMICAL ANALYSIS

The following Table 9 gives the phytochemical composition of Ixora (Ixora Coccinea) and African tulip (Spathodea Campanulata) flower.

**Table 5: Phytochemical composition of Ixora and African tulip flower**

| Sl No | TEST | IXORA | AFRICAN TULIP |
|---|---|---|---|
| **1** | Alkaloids | Positive | Positive |
| **2** | Terpenoids | Positive | Positive |
| **3** | Phenols | Positive | Positive |
| **4** | Flavonoids | Positive | Positive |
| **5** | Tannins | Positive | Positive |
| **6** | Carbohydrate | Positive | Positive |
| **7** | Saponins | Negative | Negative |
| **8** | Glycosides | Negative | Negative |

The result indicate the presence of alkaloids, terpenoid, phenol, flavonoids, tannin and carbohydrate. In the past, edible flowers were consumed traditionally as vegetables and for their medicinal properties whereas recently scientists accentuate on their nutritional and phytochemical profiles (Benvenuti et al., 2016, Huang et al., 2017, Lu et al., 2016, Pinakin et al., 2020).Phytochemicals, is non-nutritive bioactive compounds mainly represented by phenolic compounds, more specifically by flavonoids which strongly minimize the risk of prolonged ailments such as cardiovascular diseases, obesity and cancer (Lu et al., 2016).

## 1.2. ANTIOXIDANT ESTIMATION FOR DRY FLOWER

### African tulip (Spathodea Campanulata) dry flower

The following Table 10 gives the antioxidant activity of dry African tulip (Spathodea Campanulata) flower.

**Table 10: Percentage of scavenging activity in African tulip flower**

| Sl No. | Concentration (µg/ml) | Absorbance (a.u) | % of scavenging activity |
|---|---|---|---|
| **1** | 0.2 | 0.461 | 0.076 |
| **2** | 0.4 | 0.309 | 0.380 |
| **3** | 0.6 | 0.274 | 0.450 |
| **4** | 0.8 | 0.221 | 0.557 |
| **5** | 1.0 | 0.205 | 0.589 |

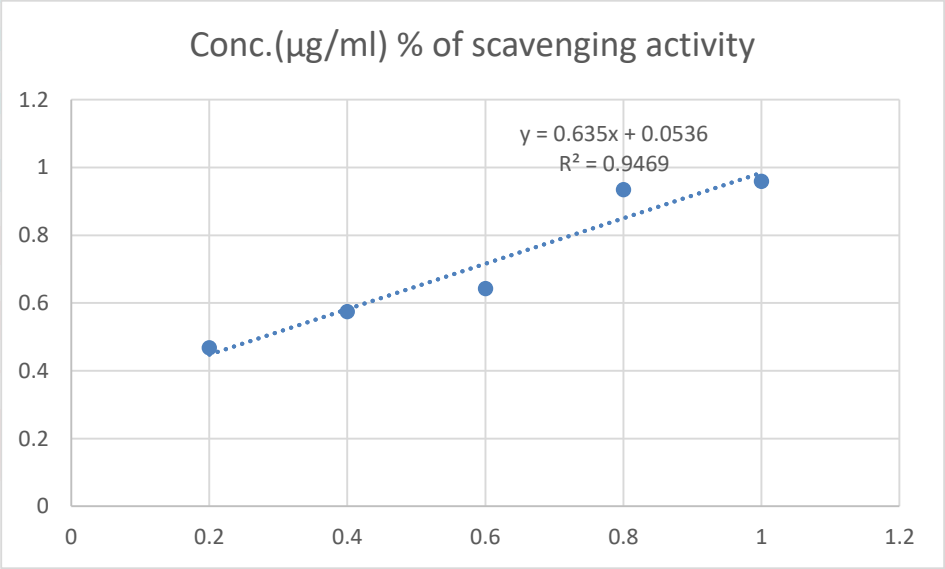


**Figure 5 : standard graph of antioxidant activity in African tulip (Spathodea Campanulata) flower**

Anti-oxidant analysis was done dried african tulip flower sample. The concentration variation of antioxidant activity is analyzed by making graph with absorbance against concentration. The antioxidant activity is calculated from the standard graph. The antioxidant activity of sample is 82%. In flowers, important compounds with antioxidant activities and anti-inflammatory proprieties are represented by polyphenols, carotenoids and vitamin C (ascorbic acid). Polyphenols include more than 10,000 compounds and are among the most important natural antioxidant compounds (Marina Cavaiuolo et al., 2015).

### 1.2.1. Ixora (Ixora Coccinea) dry flower

The following Table 6 gives the antioxidant activity of dry Ixora (Ixora Coccinea) flower

**Table 6: Percentage of scavenging activity in Ixora flower**

| Sl.No | Conc.(µg/ml) | Absorbance (a.u) | % of scavenging activity |
|---|---|---|---|
| **1** | 0.2 | 0.490 | 0.018 |
| **2** | 0.4 | 0.381 | 0.236 |
| **3** | 0.6 | 0.310 | 0.378 |
| **4** | 0.8 | 0.265 | 0.468 |
| **5** | 1.0 | 0.231 | 0.537 |

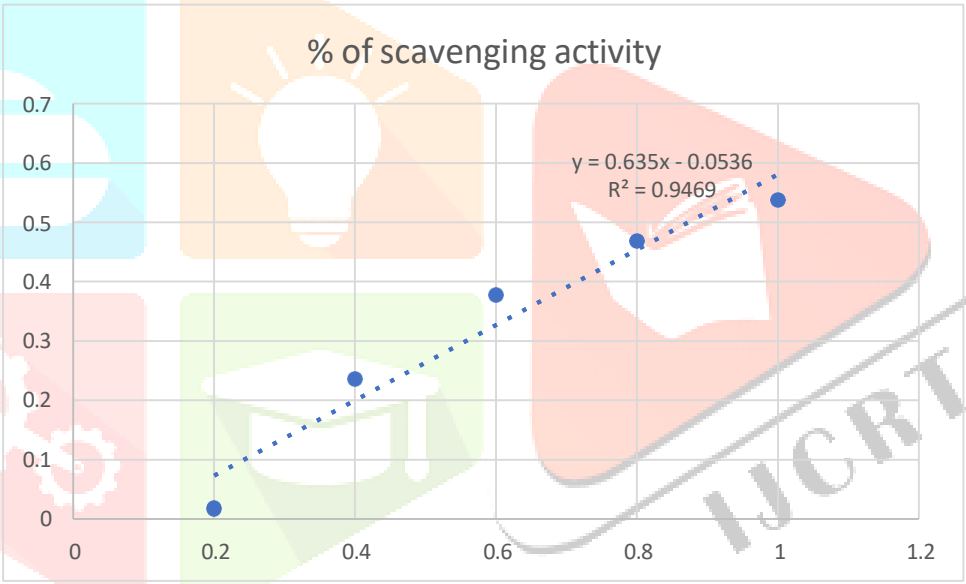


**Figure 7 : standard graph of antioxidant activity in ixora flower**

Anti-oxidant analysis was done dried ixora flower sample. The concentration variation of antioxidant activity is analyzed by making graph with absorbance against concentration. The antioxidant activity is calculated from the standard graph. The antioxidant activity of sample is 77%. coccinea flowers revealed the best antioxidant property, presenting much lower IC50 value ((Angeline Torey et al., 2011) Plants synthesize and accumulate several non-enzymatic antioxidants such as ascorbic acid, glutathione and phenolics. Some of these antioxidants occur constitutively, while others are formed in response to abiotic and biotic stress conditions((Deepak M. Kasote et al., 2015).

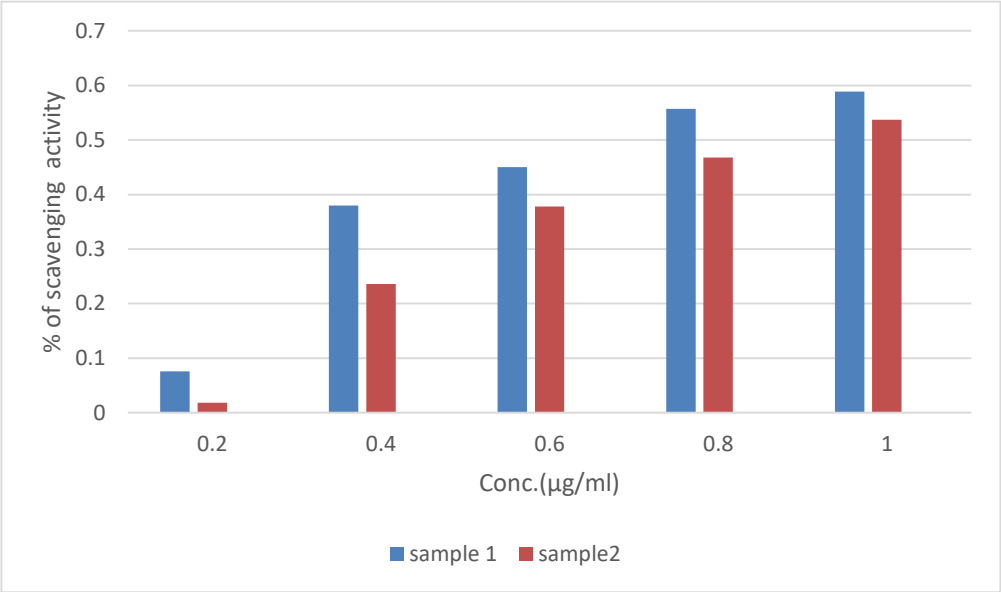


**Figure 7 : Comparison of antioxidant activity of ixora (Ixora Coccinea) and African tulip (Spathodea Campanulata) flower.**

Anti-oxidant analysis was done for selected african tulip flower and ixora flower extraction. The concentration variation of antioxidant activity is analyzed by making graph with absorbance against concentration. The % of scavenging activity of S1 and S2 is 82 and 77% Antioxidant capacity of a plant extract is evaluated based on the reduction of Mo (VI) to Mo (V), which is a green colored complex formed by an antioxidant compound present in the extract, which in turn is directly dependent on the number of polyphenols and flavonoids present. The basic antioxidant mechanisms of these compounds are dependent on their hydrogen donating and metal ion chelating abilities (Annegowda et al.,2014).

### 1.3. TOTAL POLYPHENOL

The following table gives the polyphenol content of the Ixora (Ixora Coccinea) and African tulip (Spathodea Campanulata) flower extract given below in the table:

**Table 7 : Polyphenol content of Ixora and African tulip flower extract given below**

| SAMPLE | POLYPHENOL |
|---|---|
| Sample A ( Ixora) | 0.488% |
| Sample B (African tulip) | 0.209% |

Total polyphenol was done for ixora and african tulip extract. The total percentage of polyphenol content present in African tulip flower is 34% and ixora flower is 92% Phenol compounds participate in plant defence against ultra violet (UV), pathogens, and other predators. Their presence in all plant organs makes

them a vital ingredient of the human diet (Balasundram et al., 2006; Shah et al., 2018).. These results clearly indicate that the ixora possess a high phenolic content, which needs to be tapped to exploit for potential health benefits.

## IV. Conclusion

The successful development of the natural food colorant from color of Ixora and African tulip flowers natural food colourant offers a promising alternative to synthetic colours for consumers**.** It provide a safe, appealing, and potentially nutritious way to enhance the visual appeal of food products. Extracting natural colors from food sources is a viable and safe alternative to synthetic dyes. Natural colorants have emerged as an excellent substitute of the significant health effects and undesirable demand for synthetic colorants. The project demonstrates the potential of natural color from flowers as a good additives which include nutritious and healthy benefits. The findings from this project could pave the way for more natural food colorants from edible flowers or plants on food products, contributing to a more sustainable and inclusive food industry.

## REFERENCES


1. Ressin Varghese and Siva Ramamoorthy, (2023). Status of food colorants in India: conflicts and prospects
2. Subhashish Dey and Bommu Hema Nagababu, (2019). Application of food color and bio preservatives in the food and its effects on the human health.
3. Claudia Novais, Adriana.K.Molina, Rui.M.V.Abreu, Celestino Santo-Buelga, Isabel.C.F.R.Ferreira, Carla Perreira, Lillian Barros, (2022). Natural food colorants and preservatives: A review, a demand, and a challenge.
4. Petra Amchova, Hana Kotolova, Jana Ruda-Kucerova, (2015). Health safety issues of synthetic food colorants.
5. Hanan Mohamed Fathy Abd El-Wahab, Gehan Salah El-Deen Moram, (2014). Toxic effects of some synthetic food colorants and/or flavor additives on male rats.
6. Ravindra B. Malabadi, Kiran P. Kolkar, Raju K. Chalannavar (2022). Plant natural pigment colorants health benefits: Toxicity of synthetic or artificial food colorants.
7. Shalini Saxena, (2023). Hazardous effect of synthetic food color: A review.
8. Maria Manuela Silva, Fernando Henrique Reboredo, Fernando Cebola Lidon, (2022). Food colour additives: Asynoptical overview on their chemical properties, application in food products and health side effects.
9. Ronald.E.Wrolstad, Catherine.A.Culver, (2011). Alternatives to those artificial FD&C food colorants.
10. Robert.R.Maronport, Shim-mo Hayashi, Maria Bastaki, (2020). Synthetic and natural food colorants
11. C.F Timberlake, B.S.Henry, (2004). Plant pigments as natural food colours.
12. U. Wissgott, K. Bortlik (1999). Prospects for natural food colorants.
13. Reshma.V.Jadhav, Santhoshs.Bujbal, (2020).Areview on natural food colorants
14. Gia Han Le, Le Thi Minh Hanh, Huyunh Huu Huy, Phan Thj Ngoc Hoc, (2018). Research on

production of some natural food colorings.

15. Alessandra Durazzo, Márcio Carocho, Sandrina Heleno, Lillian Barros, Eliana B. Souto, Antonello Santini, Massimo Lucarini, (2022). Food dyes and health: Literature quantitative research analysis.
16. Sunday N. Okafor, Wilfred Obonga, Mercy Amarachukwu Ezeokonkwo, (2016). Assessment of the health implications of synthesis and NAtural Food colourants- A critical review.
17. Della B Rodriguez-Amaya, (2015). Natural food pigments and colorants.
18. Mohamad Faizal Mohamad, Daniel Joe Dailin, Sara E. Gomaa, Muktiningsih Nurjayadi, Hesham El Enshasy, (2019). Natural colorant for food: A healthy alternative
19. Chaitanya Lakshmi G, (2014). Food coloring the natural way.
20. Richard S. Blackburn, Tom Coultate, (2018). Food colorants: their past, present and future.
21. M. Y. Kamatar, (2013). Natural food coloruing: A healthier alternative to artificial food colouring
22. Yasmeen Maniyar, Prabhu Bhixavatimath, N. V. Agashikar, (2010). Antidiarrheal activity of Ixora Coccinea Linn.
23. Aadesh Upadhyay, Pronobesh Chattopadhyay , Danswrang Goyary, Papiya Mitra Mazumder, Vijay Veer, (2014). Ixora coccinea Enhances Cutaneous Wound Healing by Upregulating the Expression of Collagen and Basic Fibroblast Growth Factor.
24. Nital Patil, Ajit Datar, (2015). Extraction, stability and separation of anthocyanins of ixora coccinea linn.
25. Monali U. Ghurde, M. M. Padwad, V. R. Deshmukh, S.N. Malode, (2014). Extraction of natural dye from Ixora Coccinea (Linn.) flowers for cotton fabric colouration
26. Gopla krishan Padhy, (2021). Spathodea campanulata P. Beauv. – A review of it ethinomedicinal, phytochemical, and pharmacological profile.
27. Zahid Zaheer, Aniruddha P. Paithankar, Sagar D. Deshpande, Subur Khan, (2011). Optimization extraction process and phytochemical investigations of Spathodea Campanulata flowers.
28. Jyoti V. Vastard, Giridhar Goudar, (2016). Evaluation of phenolic compound and development of chromatographic profiles in Spathodea campunalata Inflorescence by HPTLC.
29. Kanti Bhooshan Pandey and Syed Ibrahim Rizvi, (2011). Plant polyphenols as dietary antioxidants in human health and disease.
30. Vinod Kumar, Anket Sharma, Sukhmeen Kaur Kohli, Shagun Bali, Manik Sharma, Rakesh Kumar, Renu Bhardwaj, Ashwani Kumar Thukral, (2019). Differential distribution of polyphenols in plants using multivariate techniques.