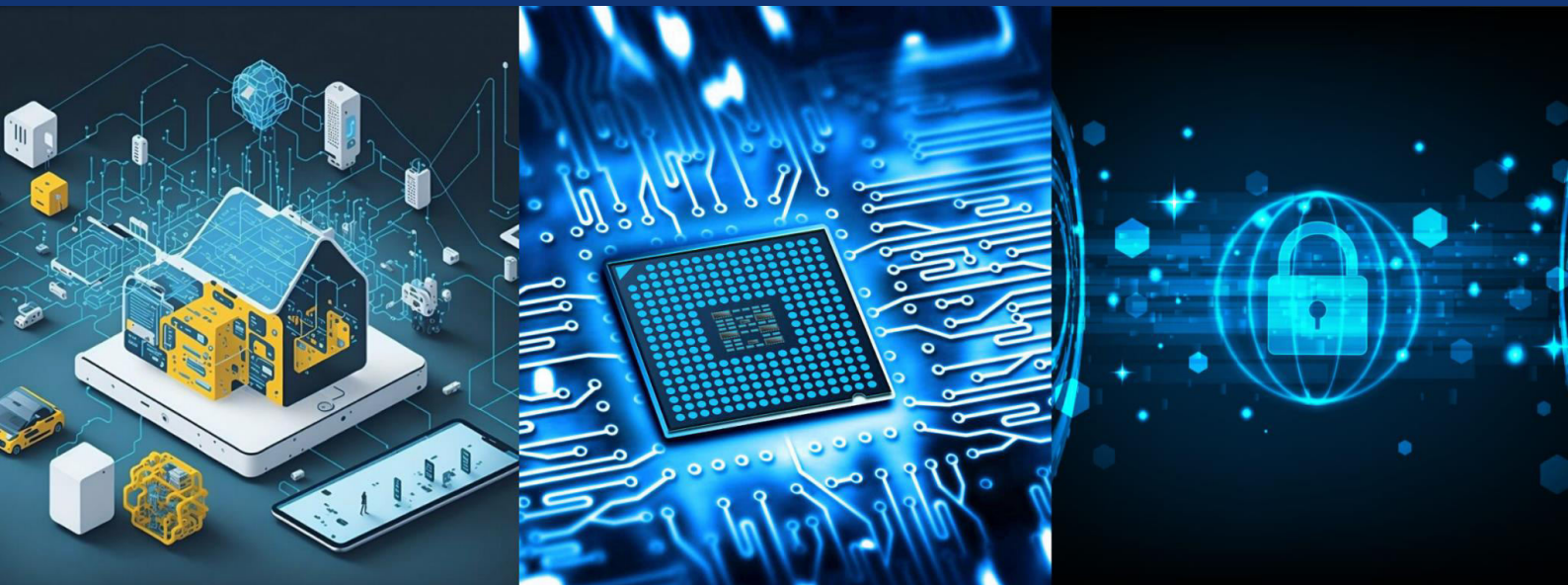
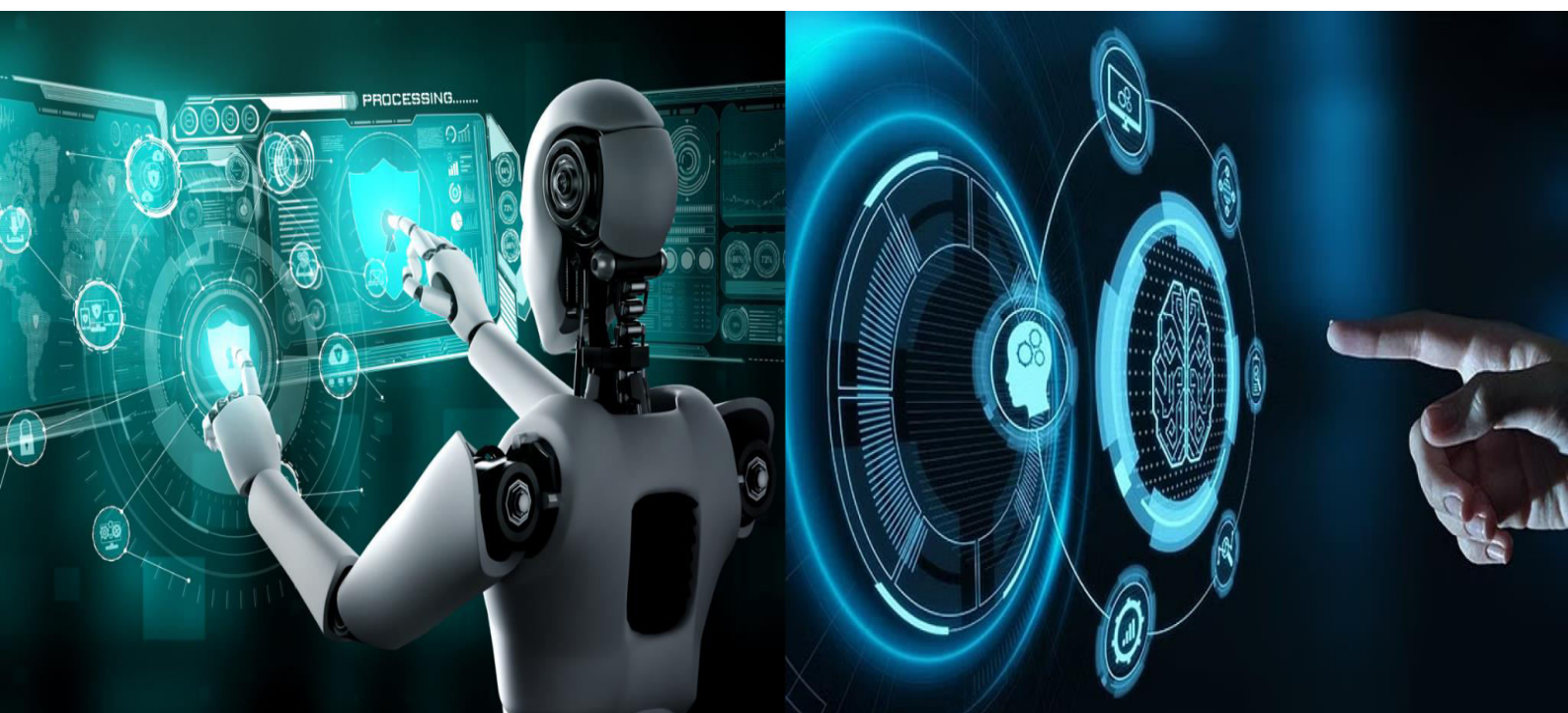




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Development and Evaluation of a Herbal Sherbet Prepared from *Butea monosperma* Flower Extract

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ABSTRACT: The present study focused on the development and evaluation of a herbal sherbet prepared using *Butea monosperma* flower extract, commonly known as Palash or Flame of the Forest. The study aimed to utilize the traditionally underutilized flowers of *Butea monosperma* as a natural source of colour and as a value-added ingredient in a refreshing herbal beverage. Dried Palash flowers were collected, sorted, lightly washed and sun-dried before extraction. The extract was prepared by boiling approximately two dried flowers/petals in 200 mL of water for 5–7 min, followed by filtration. Four formulation trials were developed by varying the sweetening and aromatic ingredients. Initial trials included jaggery and fennel; however, these ingredients affected the sensory characteristics and colour of the beverage. The optimized formulation incorporated sugar and cardamom, with rose water and mint used as optional aromatic ingredients. Sensory evaluation was conducted using a 9-point hedonic scale by five faculty members from the Department of Food Technology. The optimized formulation demonstrated high sensory acceptability, receiving a score of 9 from all five panelists for taste, mouthfeel, colour and overall acceptability, while appearance and aroma also received predominantly high scores. The observed pH of the developed sherbet was 8.57–8.58. TSS, titratable acidity, ash and microbiological analyses were also undertaken during the project; however, complete numerical observations were not available for inclusion in the present manuscript. The product was observed during refrigerated storage for approximately 90 days, during which the optimized formulation showed satisfactory organoleptic stability under the observed conditions. No artificial colour, artificial flavour or chemical preservatives were intentionally incorporated into the formulation. The findings indicate the potential of *Butea monosperma* flowers for value-added herbal beverage development and provide a preliminary basis for further standardized investigation of Palash-based functional beverages. Previous scientific literature has reported diverse phytoconstituents in Palash flowers, including flavonoid compounds, supporting continued investigation of this underutilized plant resource for food and nutraceutical applications.

KEYWORDS: *Butea monosperma*; Palash; Flame of the Forest; Herbal sherbet; Flower extract; Natural colour; Herbal beverage; Product development; Sensory evaluation; Value addition.

I. INTRODUCTION

Herbal and plant-based beverages have gained increasing attention as consumers seek naturally derived, refreshing and value-added food products. In this context, underutilized plant resources, particularly edible and traditionally used flowers, offer opportunities for the development of innovative food products. Flowers may contribute attractive colour, aroma, flavour and bioactive phytochemicals to food formulations. Reviews on edible and tree flowers have highlighted their potential as sources of flavonoids, phenolic compounds and other phytochemicals, while also emphasizing that many indigenous flowers remain underutilized in modern food applications.

Butea monosperma (Lam.) Taub., commonly known as Palash, Dhak or Flame of the Forest, is a deciduous tree belonging to the family Fabaceae and is widely associated with the Indian subcontinent. Its characteristic bright orange flowers make the plant visually distinctive. The flowers have a long history of traditional utilization in India, including medicinal and cultural applications. The flowers of *Butea monosperma* have attracted scientific interest because of their natural colour and phytochemical composition. Research has identified compounds such as butein, butrin, iso-butrin, sulfuretin, medicarpin, liquiritigenin and kaempferol in flower extracts. Recent investigations have also demonstrated antioxidant activity of several isolated flower constituents. Earlier research reported free-radical-scavenging activity in



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aqueous and other extracts of dried *B. monosperma* flowers, further supporting the scientific interest in this plant material. An important food-related characteristic of Palash flowers is their intense orange colour. A recent study demonstrated that dried *B. monosperma* flowers can be subjected to hot aqueous extraction to obtain an orange-coloured natural dye, with identified marker compounds including iso-coreopsin, butrin and iso-butrin. This provides scientific support for investigating Palash flowers as a source of naturally derived colour for food-related applications. Despite these characteristics, the use of Palash flowers in convenient beverage products remains relatively

limited compared with commonly utilized fruit and herbal ingredients. Their seasonal availability and short post-harvest period also make value addition an important approach for improving utilization. Developing a beverage from dried flowers may provide a simple way to extend the usability of this seasonal plant resource. Reviews of tree flowers have similarly identified Palash among traditionally utilized flowers with potential for food, nutritional and functional applications. A sherbet is a refreshing beverage that can be formulated using water, sweeteners and natural flavouring ingredients. In the present study, *B. monosperma* flower extract was incorporated into a sherbet formulation along with sugar and cardamom, while rose water and mint were considered as optional aromatic ingredients. The formulation was developed through four trials, followed by sensory evaluation using a 9-point hedonic scale. The present work therefore focuses on the development and evaluation of a Palash flower-based herbal sherbet, with emphasis on product formulation, sensory acceptability, selected physicochemical observations and refrigerated storage observation. The study also explores the potential of utilizing an underused floral resource as a naturally coloured, refreshing and value-added beverage ingredient.

1.1 Rationale of the Study

The selection of *Butea monosperma* flowers for the present study was based on their distinctive natural orange colour, traditional significance, availability as a seasonal forest resource and potential phytochemical value. The development of a sherbet provides an opportunity to convert the dried flowers into a convenient beverage while avoiding the deliberate use of synthetic colour and artificial flavour. The study also addresses the broader concept of value addition to underutilized plant resources. Instead of limiting Palash flowers to traditional or seasonal uses, their extract can be explored in a modern beverage format that combines visual appeal with refreshing sensory characteristics.

1.2 Objectives

The objectives of the present study were:

1. To develop a herbal sherbet using *Butea monosperma* flower extract.
2. To utilize dried Palash flowers as a naturally coloured ingredient in a beverage.
3. To develop and optimize the sherbet through different formulation trials.
4. To evaluate the sensory characteristics of the developed formulations using a 9-point hedonic scale.
5. To observe selected physicochemical characteristics of the optimized sherbet.
6. To conduct preliminary microbiological evaluation of the developed product.
7. To observe the product during refrigerated storage.
8. To explore the potential of *Butea monosperma* flowers as an underutilized raw material for value-added beverage development.

II. REVIEW OF LITERATURE

2.1 Botanical and Traditional Significance of *Butea monosperma*

Butea monosperma is a member of the Fabaceae family and is commonly known as Palash, Dhak or Flame of the Forest. The plant is widely distributed in India and has considerable cultural and traditional significance. Historical literature describes the use of different parts of the plant, including flowers, leaves, bark, seeds and gum, in traditional practices.

2.2 Phytochemical Potential of Palash Flowers

The flowers of *Butea monosperma* contain several phytochemicals of scientific interest. A recent phytochemical investigation identified medicarpin, sulfuretin, liquiritigenin, kaempferol, butein, iso-butrin and butrin from the flowers. Antioxidant assays including DPPH, ABTS and FRAP demonstrated antioxidant activity among several isolated constituents, with butein showing particularly strong activity in that investigation. Earlier experimental work also investigated aqueous and organic extracts of dried Palash flowers and reported free-radical-scavenging activity. These findings indicate that the flower contains compounds capable of contributing to antioxidant potential, although the



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presence and concentration of such compounds in a particular food product depend on extraction conditions and processing.

2.3 Natural Colour Potential

The intense orange colour of Palash flowers is one of their most noticeable characteristics. Research on food-grade dye from *B. monosperma* flower petals demonstrated that hot aqueous extraction of dried flowers can produce an orange-coloured extract. The study further identified iso-coreopsin, butrin and iso-butrin as marker compounds in the extracted dye material.

This characteristic is particularly relevant to beverage development because colour is an important sensory attribute influencing consumer perception and product acceptance. Therefore, the use of Palash flower extract may provide both a distinctive appearance and an opportunity for natural-colour-based product development.

2.4 Palash and Value Addition

Tree flowers are increasingly being considered for food and nutritional applications because many contain phytochemicals and have traditional food uses. However, seasonal availability and limited post-harvest life can restrict their utilization. Value addition through drying, extraction and incorporation into food products may provide an approach for improving their usability.

Palash is particularly relevant to this concept because its flowers are seasonal and traditionally recognized but comparatively less utilized in contemporary beverage formulations. Development of a Palash-based sherbet can therefore contribute to the exploration of an underutilized floral resource.

2.5 Herbal and Functional Beverage Development

The increasing interest in plant-based beverages has encouraged research into beverages incorporating herbs, flowers, fruits and other botanical ingredients. Such products can provide distinctive sensory properties and may serve as vehicles for naturally occurring phytochemicals. However, claims regarding health benefits should be supported by appropriate analytical and biological evidence. In the present study, the term “herbal sherbet” refers to a beverage prepared using a botanical flower extract and aromatic ingredients. The product was not subjected to clinical or pharmacological evaluation; therefore, any potential health-related significance of *B. monosperma* is discussed only in relation to previously published scientific literature.

2.6 Research Gap

Although scientific studies have investigated the phytochemical composition, antioxidant properties and natural-colour potential of *Butea monosperma* flowers, comparatively limited work has focused on their direct incorporation into a simple ready-to-serve sherbet formulation.

The present study attempts to bridge this gap by developing a Palash flower extract-based beverage and evaluating its sensory acceptability and selected quality characteristics.

III. MATERIALS AND METHODS

3.1 Materials

The principal raw material used in the study was dried *Butea monosperma* flowers/petals, commonly known as Palash or Flame of the Forest. The flowers were collected locally from a forest area, sorted and sun-dried. Other ingredients used for formulation included potable water, sugar, cardamom, rose water and fresh mint leaves as an optional aromatic ingredient.

3.2 Preparation of Dried Palash Flowers

Fresh Palash flowers were collected and manually sorted to remove undesirable foreign matter. The flowers were sun-dried for approximately 3–4 days, depending on the available sunlight and drying conditions. The dried material was stored until required for extract preparation.

Before extraction, the required quantity of dried flowers was lightly washed with water.



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Figure 1. Collection and sun-drying of butea Monosperma (Palash) flowers used for herbal sherbet preparation.

3.3 Preparation of Butea monosperma Flower Extract

Approximately two dried Palash flowers/petals were taken and added to 200 mL of water. The mixture was heated to boiling and maintained for approximately 5–7 min to facilitate extraction of the water-soluble components and colour from the flowers.

After heating, the extract was separated from the floral material by filtration using a strainer. A clean cloth may also be used as a filtration aid where required. The resulting aqueous Palash extract was used for preparation of the sherbet.

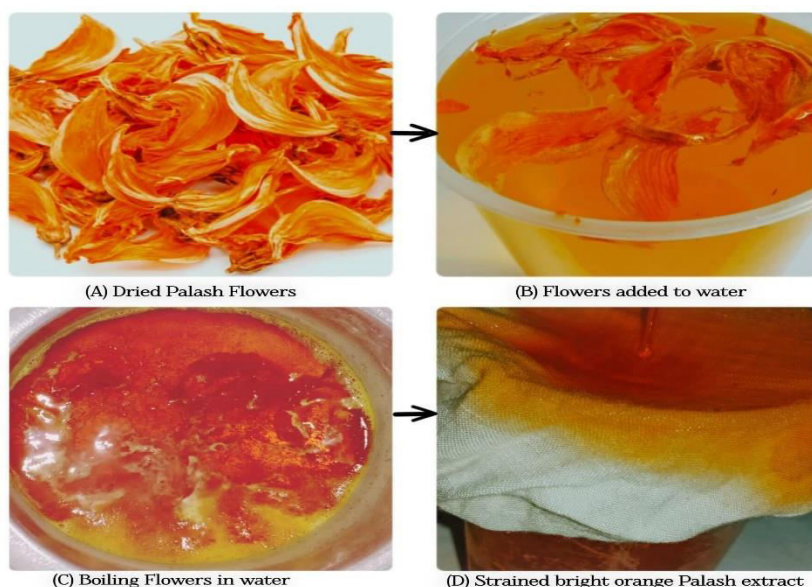


Figure 2. Preparation of aqueous Butea monosperma flower extract used in herbal sherbet development.

3.4 Preparation of Sweetened Aromatic Syrup

Sugar was dissolved in a small quantity of water and heated. Approximately 1–2 crushed cardamom pods were incorporated during heating to impart a mild aromatic character. The mixture was subsequently strained to remove cardamom residues.



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3.5 Preparation of Herbal Sherbet

The prepared Palash flower extract was combined with the sweetened cardamom syrup. Approximately 20 g of sugar was used in the optimized formulation based on the available formulation record and taste adjustment. Rose water (approximately 1–2 mL) and 1–2 small mint leaves were used as optional aromatic ingredients. The mixture was thoroughly stirred, filtered where necessary and transferred into a serving container. The prepared sherbet was cooled/refrigerated before serving and could be served chilled or over ice.

3.6 Development of Formulation Trials

Four formulation trials were developed during product optimization. The formulation development involved modification of sweetening and aromatic ingredients according to observed colour and sensory characteristics. Initial experimentation included the use of jaggery and fennel seeds. Jaggery altered the sensory characteristics of the beverage, while fennel influenced the colour and sensory profile. These ingredients were subsequently excluded from the final formulation. Sugar and cardamom were selected for the optimized formulation because they provided a more suitable sensory profile while retaining the characteristic colour of the Palash extract. Rose water and mint were considered optional ingredients to provide additional floral and refreshing notes without deliberately introducing artificial colour or flavour.

3.7 Sensory Evaluation

Sensory evaluation was conducted for the four developed formulations using a 9-point hedonic scale. Five faculty members from the Department of Food Technology, including the project guide, Head of Department and professors, participated as sensory panelists.

The evaluated sensory attributes were:

- Taste
- Colour
- Appearance
- Aroma
- Mouthfeel
- Overall acceptability

The panelists scored each attribute according to the 9-point hedonic scale, where higher scores represented greater acceptability.

3.8 Physicochemical Evaluation

The developed sherbet was subjected to selected physicochemical observations during the project. The parameters investigated included pH, total soluble solids (TSS), titratable acidity and ash content. The recorded pH of the developed sherbet was approximately 8.57–8.58. TSS and titratable acidity were determined experimentally; however, their numerical readings were not available in the project records. Ash determination was also carried out, but the numerical result was not available for inclusion in the present manuscript.

3.9 Microbiological Evaluation

Microbiological analysis was performed as part of the product evaluation. Total plate count (TPC) and coliform analysis were undertaken. However, the numerical observations from these analyses were not available for inclusion in the present manuscript.

3.10 Storage Observation

The developed sherbet was observed during storage under refrigerated conditions for approximately 90 days. Sensory and visible characteristics such as colour, odour and taste were observed during the storage period. The product was also observed under room-temperature conditions, where environmental temperature was found to influence product characteristics.

The refrigerated storage observation should be considered a preliminary storage observation rather than a fully validated commercial shelf-life study because complete microbiological and physicochemical data throughout the storage period were not available.



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3.11 Packaging

The prepared sherbet was filled directly into clean glass and plastic bottles for storage and observation. Both packaging formats were used during the project.

IV. RESULTS AND DISCUSSION

4.1 Development of Herbal Sherbet

Four formulation trials of *Butea monosperma* flower-based herbal sherbet were developed during the study. The formulation development was carried out by modifying the sweetening and aromatic components while maintaining the Palash flower extract as the principal botanical ingredient. During the initial trials, jaggery was used as a sweetening agent. However, its use influenced the sensory characteristics and colour of the beverage. Fennel seeds were also evaluated as an aromatic ingredient and produced a desirable flavour but affected the colour of the beverage. Therefore, jaggery and fennel were excluded from the final formulation.

Sugar was subsequently selected as the principal sweetener and cardamom was incorporated as the main aromatic ingredient. Rose water and mint were considered optional ingredients to provide additional floral and refreshing notes. The final formulation retained the characteristic bright orange colour of the Palash extract without the addition of synthetic colour. The development process demonstrated that ingredient selection played an important role in maintaining the desirable colour and sensory characteristics of the beverage.



Figure 3. Optimized herbal sherbet prepared from *Butea monosperma* flower extract.

4.2 Sensory Evaluation

Sensory evaluation of the four formulations was conducted using a 9-point hedonic scale by five faculty members of the Department of Food Technology. Taste, colour, appearance, aroma, mouthfeel and overall acceptability were evaluated. The mean sensory scores are presented in Table 1. Trial 1 showed comparatively lower acceptance, particularly for mouthfeel and aroma. Improvement was observed in Trial 2 and Trial 3 following modification of the formulation.

Trial 4 showed the highest overall sensory acceptance, with mean scores of 9.0 for taste, colour, mouthfeel and overall acceptability, followed by appearance (8.8) and aroma (8.4). Therefore, Trial 4 was selected as the optimized formulation.



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Table 1. Mean sensory scores of the four formulation trials

Sensory attributed	Trial 1	Trial 2	Trial 3	Trial 4
Taste	7.0	7.8	8.0	9.0
Colour	7.0	7.8	8.0	9.0
Appearance	7.2	7.8	8.2	8.8
Aroma	6.6	7.6	7.6	8.4
Mouthfeel	6.6	7.8	8.0	9.0
Overall acceptability	6.8	7.8	8.0	9.0

4.3 Physicochemical Characteristics

The developed herbal sherbet was evaluated for selected physicochemical parameters.

Table 2. Physicochemical observations of the optimized sherbet

Parameter	Observation
pH	8.57–8.58
Total soluble solids (TSS)	Determined experimentally
Titrateable acidity	Determined experimentally
Ash	Determined experimentally
Colour	Bright orange

The recorded pH of the optimized formulation was 8.57–8.58. This value represents the actual observation obtained during the project and has therefore been retained without modification. The TSS and titrateable acidity analyses were performed experimentally, but their numerical values were not available in the project records. Similarly, ash determination was carried out but the numerical result was unavailable. Therefore, numerical values have not been fabricated or estimated.

The bright orange colour observed in the product is consistent with published research demonstrating the potential of *B. monosperma* flowers for aqueous extraction of natural orange-coloured material.



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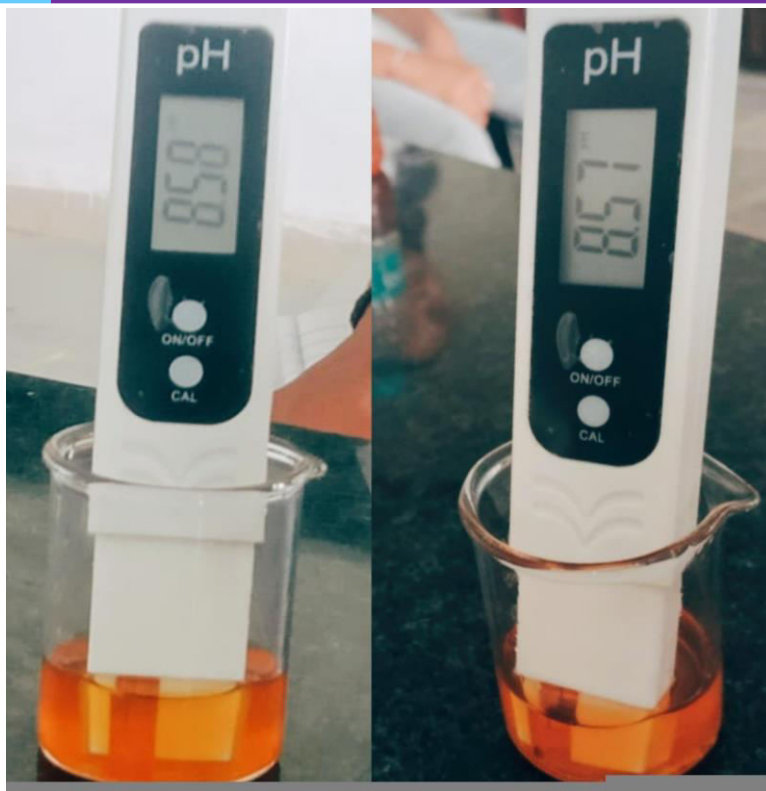


Figure 4. pH measurement of the developed Butea monosperma flower-based herbal sherbet: (A) pH 8.58 and (B) pH 8.57.

4.4 Microbiological Evaluation

Microbiological analysis was performed during the product evaluation. Total plate count (TPC) and coliform analysis were undertaken. However, the numerical observations were not available for inclusion in the present manuscript. Therefore, the microbiological findings are reported only as an analytical activity and are not interpreted quantitatively. Further studies should include complete microbial enumeration with appropriate controls and defined storage intervals to establish microbiological safety and shelf stability.

4.5 Storage Observation

The optimized sherbet was observed during refrigerated storage for approximately 90 days. During the observation period, sensory characteristics including taste, colour and odour were monitored. No obvious undesirable changes were reported during the refrigerated observation period. The product was also observed under room-temperature conditions. Temperature was found to influence the product characteristics, demonstrating the importance of controlled storage conditions for the developed beverage. Because complete microbiological and physicochemical observations were not recorded at each storage interval, the 90-day period should be considered an observed refrigerated storage period rather than a formally validated commercial shelf life.

4.6 Natural Colour and Product Development Potential

One of the notable characteristics of the developed sherbet was its bright orange colour without the addition of synthetic colour. This provides an important product-development advantage because colour is a major factor influencing the visual perception of beverages. Published research has specifically demonstrated the extraction of an orange food-grade dye from *B. monosperma* flower petals using a hot aqueous, solvent-free process. The study identified iso-coreopsin, butrin and iso-butrin as marker compounds in the resulting dye material. The present study used a much simpler extraction approach suitable for small-scale beverage development. Although the present study did not quantify individual colour compounds, the observed orange colour supports the practical feasibility of using Palash flower extract as a naturally coloured beverage ingredient.



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4.7 Functional Potential of Butea monosperma

The potential functional significance of *B. monosperma* flowers is supported by previous phytochemical research. Several flavonoid and related compounds have been identified from the flowers, including butein, butrin, iso-butrin, sulfuretin, medicarpin, liquiritigenin and kaempferol. Recent research also reported antioxidant activity for several isolated constituents.

Earlier research on flower extracts also reported free-radical-scavenging activity, including activity associated with aqueous extracts. However, these published findings should not be interpreted as experimental results for the present sherbet. The present study did not perform DPPH, ABTS, FRAP, total phenolic content or total flavonoid content assays. Therefore, the functional potential discussed here represents a literature-supported research perspective, not a quantified claim about the developed beverage.

4.8 Overall Discussion

The study successfully demonstrated the feasibility of converting dried *Butea monosperma* flowers into a refreshing herbal sherbet through a simple aqueous extraction and formulation process. The product development process showed that the choice of sweetener and aromatic ingredients influenced the sensory properties of the beverage.

The optimized formulation containing sugar and cardamom, with optional rose water and mint, achieved the highest sensory acceptance among the four trials. The final product maintained a bright orange colour without the intentional addition of synthetic colour and demonstrated good sensory acceptance among the faculty panel. The findings are consistent with existing research describing the natural colour and phytochemical potential of Palash flowers. Published investigations have demonstrated that aqueous extraction can recover orange-coloured material from the flowers, while phytochemical studies have identified several bioactive constituents.

Overall, the study provides a preliminary demonstration of the potential for *Butea monosperma* flowers to be used in value-added beverage development. Further research involving standardized extraction conditions, quantitative nutritional analysis, phenolic and flavonoid estimation, antioxidant assays, comprehensive microbiological testing and controlled shelf-life studies would strengthen the scientific and commercial potential of the product.

V. CONCLUSION

The present study successfully developed a herbal sherbet using aqueous extract of *Butea monosperma* flowers. The project demonstrated the potential of Palash flowers as an underutilized botanical resource for value-added beverage development. Four formulation trials were developed, and progressive improvement in sensory characteristics was observed. The optimized fourth formulation achieved the highest sensory acceptance, with mean scores of 9.0

for taste, colour, mouthfeel and overall acceptability, 8.8 for appearance and 8.4 for aroma. The developed beverage exhibited a characteristic bright orange colour without the intentional addition of synthetic colour, artificial flavour or chemical preservatives. The observed pH was 8.57–8.58. The product was also observed under refrigerated conditions for approximately 90 days, during which satisfactory organoleptic stability was observed under the conditions of the study. The study highlights the feasibility of utilizing *Butea monosperma* flowers in a simple herbal beverage and supports their potential for food-product value addition. Published scientific evidence regarding the natural colour and phytochemical composition of Palash flowers further supports the need for continued investigation. However, the present work should be considered a preliminary product-development study. Complete quantitative physicochemical, nutritional, phytochemical and microbiological data were not available. Future research should therefore focus on standardized extraction, nutritional profiling, total phenolic and flavonoid estimation, antioxidant activity, microbial enumeration, packaging optimization and controlled shelf-life studies.

VI. LIMITATIONS AND FUTURE SCOPE

The major limitations of the present study were the absence of complete numerical records for TSS, titratable acidity, ash and microbiological analyses and the lack of quantitative nutritional and phytochemical profiling.



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Future studies may include:

1. Standardization of flower-to-water ratio, extraction temperature and extraction time.
2. Determination of total phenolic and total flavonoid contents.
3. Evaluation of antioxidant activity using DPPH, ABTS and FRAP assays.
4. Complete nutritional analysis of the developed beverage.
5. Quantitative TSS and titratable-acidity measurement.
6. Comprehensive microbiological evaluation including total plate count, yeast and mould, coliforms and relevant foodborne pathogens.
7. Controlled shelf-life studies under refrigerated and ambient conditions.
8. Evaluation of different packaging materials for product stability.
9. Investigation of natural colour stability under different pH, temperature and light conditions.
10. Consumer acceptability studies involving a larger and more diverse sensory panel.
11. Optimization of the formulation for commercial-scale production.
12. Evaluation of production cost, packaging cost and potential market feasibility.

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