



Formulation And Evaluation Of The Herbal Antidiabetic Syrup Using Costus Igneus

Dhanashri B More*1 , Akshay S More*2, Bhagyashree B Randhawan*3

1,2 Student . Arihant College Of Pharmacy , Ahilyanagar

3 Asst.prof. Arihant College Of Pharmacy , Ahilyanagar

Abstract

Plants are the basic medicinal treatment used from ancient history, such medicinal therapies are practiced in the modern era also. It was widely and effectively used against Diabetics around 250 BC. Herbal medicines are treated as traditional since they are used in systems like unani, ayurveda, and Siddha. Conditions like hyperglycemia and hypoglycemia are common medical conditions seen in people nowadays. Herbal therapies and treatments are good medical practices over allopathic treatments to minimize side and long-term effects. The objective of this study is to Formulate and Asses the antidiabetic characteristics of herbal syrup. Plant Costus Igneus is a rare herb in the Ayurvedic system. Bacopa Monnieri (Family: Scrophulariaceae) shows anti-inflammatory activity. The phytochemical constituents like flavonoids, saponins, alkaloids, and steroids show effective antidiabetic activity. In this study, we have ensured the stability and insulin production, sensitivity, and reduction in the glucose level. The evaluation tests are performed on the formulation of herbal antidiabetic syrup, ensuring the proper extraction of bioactive compounds, safety, and stability. The prepared herbal syrup was subjected to various evaluation parameters like pH, density, viscosity, stability, Specific gravity, Sedimentation volume, etc., and comparatively studied with the batches of antidiabetic herbal syrup containing the bioactive compounds of the leaf extract of the Costes Igneus (Family: Costus) and Bacopa Monnieri (Family: Scrophulariaceae). All the studied evaluation parameters are found in limits and show good antidiabetic activity.

Keywords

Herbal Syrup, Bacopa monnieri, Diabetics, Antidiabetic syrup, Costus igneus

Introduction

Herbal medicines, or products obtained from plants or natural resources, have been widely used throughout the history of mankind. Plants and animals are the best resources for natural medicinal treatments. The herbal treatment has been effectively used against the diabetic condition since 250 BC.

Diabetes Mellitus:

Diabetes Mellitus: The chronic metabolic disorder in which the blood glucose level increases

Hyperglycemia: The condition in which blood glucose level is increased

Hypoglycemia: The condition in which blood glucose level is decreased

Diabetes Mellitus (DM) is a type of metabolic disease that affects blood sugar levels. There are many types of DM, including type 1, type 2, juvenile-onset diabetes (MODY), gestational diabetes, childhood diabetes, and other causes of endocrine and systemic diseases. T1DM and type 2 diabetes (T2DM) are usually caused by defects in insulin secretion (T1DM) and/or action (T2DM). While T1DM occurs in children or young adults, T2DM is thought to affect middle-aged and elderly people who suffer from high blood pressure due to poor lifestyle and dietary choices. The pathogenesis of T1DM and T2DM is very different, so each type has different causes, symptoms, and treatment.

Diabetes type 1:

It is the autoimmune disorder in which the pancreatic cell of islet beta cells occurs. The exact etiology of this is known.

Diabetes type 2:

It is an autoimmune disorder in which the insulin level in the body falls .

Herbal treatment used in the treatment of the Diabetes

This review focuses specifically on Ayurvedic herbs and plants used to treat diabetes in India. Diabetes is a major human disease affecting people from all walks of life in many countries. In India, this has proven to be a major health problem, especially in urban areas. Although there are many ways to reduce the negative effects and secondary complications of diabetes, herbal preparations are preferred due to their low side effects and low cost. A list of medicinal plants with proven antidiabetic and related benefits and medicinal plants used in the treatment of diabetes has been compiled.

These include garlic, Eugenia jambolana, Momordica charantia Ocimum sanctum, Phyllanthus amarus, Pterocarpus marsupium, Tinospora cordifolia, Trigonella foenum graecum and Withania somnifera. One of the causes of diabetes and its complications is the damage caused by free radicals, so anti-diabetic drugs containing antioxidants will be more effective. For this reason, information about the antioxidant effects of these medicinal plants is also included.

Metformin is an example of a good oral hypoglycemic agent. It was developed using Galega officinalis in the treatment of diabetes. Goat beans are rich in the blood sugar-lowering compound guanidine. Because guanidine was too toxic for clinical use, alkyl biguanide synthetic protein A and synthetic protein B were introduced as anti-inflammatory drugs in Europe in the 1920s, but they were not used after the widespread reintroduction of insulin.

However, experience with guanidine and biguanide led to the development of metformin. To date, more than 400 herbal remedies for the treatment of diabetes have been published, but only a few of them have been scientifically and clinically evaluated to evaluate their effectiveness. The hypoglycemic effects of some herbs have been demonstrated in humans and animal models of type 2 diabetes. The World Health Organization

Expert Committee on Diabetes recommends more research on herbal medicines. There is a need to conduct clinical research on herbal medicines, develop simple bioassays for biological samples, chemical and toxicological analyses, and develop various animal models for toxicity and safety evaluation. It is also important to determine the active ingredients of this plant.

Herbs used as antidiabetic

1. **Bel (Aegle marmelos)**

Aqueous leaf extracts given to rats with alloxan improved digestion and reduced blood sugar, urea, and cholesterol compared to control. Besides its hypoglycemic activity, the extract also inhibits 1-hour blood sugar levels during oral testing.

2. **Babhul (Acacia arabica)**

It is widely found all over India, mostly in the wild. Plant extracts act as anti-inflammatory agents by secreting insulin as a secretagogue. It caused hypoglycemia in control rats but not in alloxan sized animals. Acacia arabica seed powder (2.3 and 4 g/kg body weight) creates a hypoglycemic effect by increasing insulin release from pancreatic beta cells when administered to normal rabbits.

3. **Onion (Allium cepa)**

Various ether-soluble fractions, including the volatile fraction of onion powder, have been shown to have anti-hyperglycemic activity in diabetic rabbits. Onions also have antioxidant and hypolipidemic properties. Administration of the sulfur-containing amino acid S-methylcysteine sulfoxide (SMCS) from onion (200 mg/kg for 45 days) to alloxan-induced diabetic rats could control blood sugar and lipids in blood and tissue quality and normalize diabetes activity. . When diabetics take 50 grams of onion juice orally, their post-meal diabetes levels are well controlled.

4. **Jamun (Eugenia jambolana:)**

In India, decoction of Eugenia jambolana seeds is used as a home remedy for diabetes. It is also an important component of many herbal medicines used to treat diabetes. The anti-hyperglycemic effects of aqueous and alcoholic extracts, as well as freeze-dried powders, have been shown to reduce blood sugar levels. This is different at different levels of diabetes. It decreases by 73.51% in mild diabetes (plasma sugar > 180 mg/dl), 55.62% and 17.72% in secondary diabetes (plasma sugar > 280 mg/dl) and severe diabetes (plasma sugar > 400 mg/dl) . respectively. Jamun pulp extract showed hypoglycemic activity within 30 minutes of administration in streptozotocin-induced diabetic rats, while seeds of the same fruit required 24 hours. Oral administration of the extract increased insulin secretion in diabetic rats. The study found that incubation of plant extracts with islets isolated from normal and diabetic animals stimulated insulin production. These extracts also inhibit insulinase activity in the liver and kidneys.

Herbs Used :

❖ Bramhi :

Brahmi is one of the oldest Ayurvedic medicines in India. It appeared in India more than 3000 years ago. Brahmi is known for improving memory, cognition, thinking, and other mental functions. Saponins are the main components of Brahmi and are responsible for stimulating the transmission of nerve impulses.

It has been researched for a long time and has been proven to have many medicinal properties and work well. Functional ingredients are foods that have more health benefits than traditional foods. Brahmi has a distinctive, strong herbal taste that leaves a bitter aftertaste. Due to changes in lifestyle and health consciousness, there is a huge demand for food products that are healthy and have certain benefits. Ayurvedic herbs like Brahmi have many benefits.

Bacopa monnieri is a perennial herb from the ginseng family with small leaves and white to purple flowers, widely used in Ayurvedic medicine. Other names for this herb are brahmi, hyssop, thyme leaf and beautiful herb. Brahmi comes from Indian mythology and means "Brahma " or "Supreme Creator".

The word brahmi is used to describe Bacopa monnieri, Centella asiatica (Gotu kola), or a combination of these plants. The leaves have antibacterial properties and contain triterpene saponins (Bacopa saponin A, Bacopa saponin B, Bacopa saponin, D-mannitol, acid A, monellin), alkaloids (bracophylline, nicotine, herpes base, hydrocortin) and

flavonoids(luteolin, apigenin),

glycosides (tanacunosides),

many phytochemicals (betulinic acid, betulinic acid, wogonin, oroxadin, stigmasterol, beta-sitosterol), sapogenins (sapogenin, pseudo sapogenin)) and

Other compounds (brosan, branoside, braminoside, braminoside, braminocyte, braminocyte, braminocyte, braminocyte, braminocyte) have pharmacological effects. It is recorded in the Ayurvedic text Charaka Samhita that it is used in the treatment of various mental disorders.

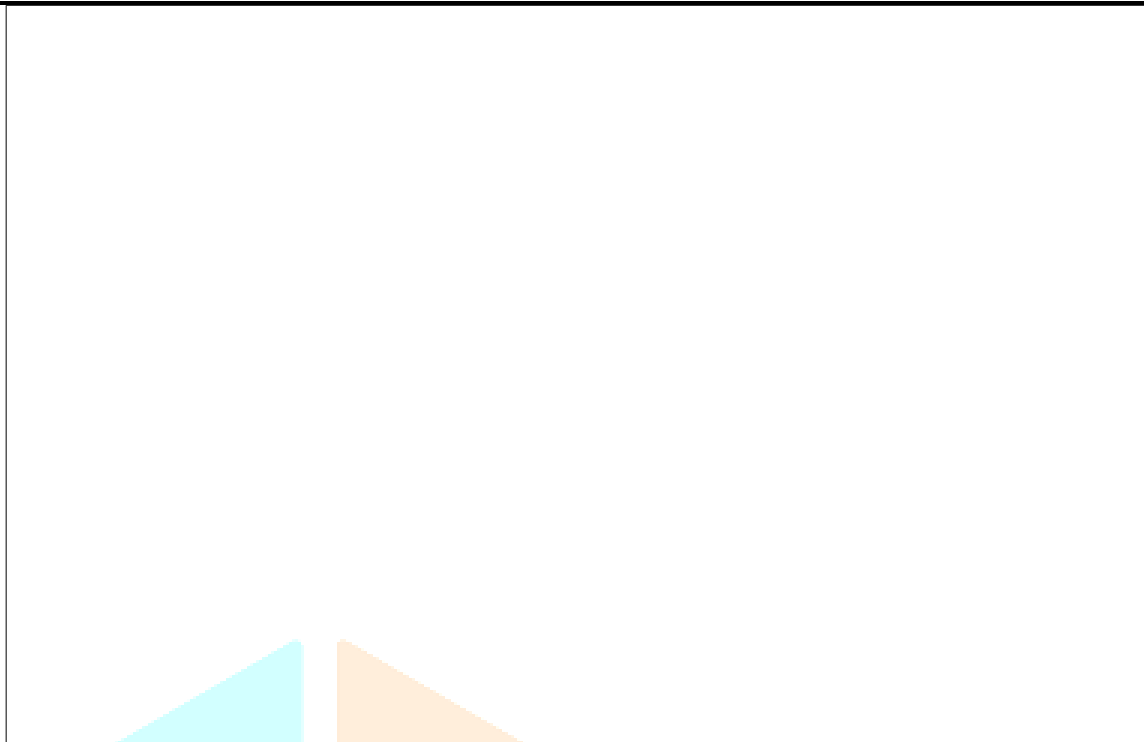


In Ayurvedic medicine, *Bacopa monnieri* is described as "medhya rasayana". It refers to a group of drugs known to improve mood, memory and intelligence, and promote recovery and longevity. Recommended for improving memory and combating insomnia and seizures, many clinical studies have shown that *Bacopa* can improve language learning, word memory, memory, and reduce anxiety. It is described as a calming cognitive enhancer. *Bacopa monnieri* and *Centella asiatica* both have neuroprotective properties and nootropic activity and can be used to treat patients with amnesia.

Centella asiatica is used with other herbs in Ayurvedic medicine and Chinese medicine to combat symptoms of anxiety and depression. , is beneficial for weak memory. The FDA's position is that *Bacopa* products should not be used for any medical purpose, and in 2019 it issued a warning to food stores producing products containing *Bacopa* banned for medical use.

❖ **Costus Igneus :**

Costus igneus Nak and *Costus pictus* D. Don, also known as spiral flag. These plants belong to the Pigeon family and were introduced to India from South and Central America. It is an erect, spreading perennial, up to two meters tall, with spirally arranged leaves and beautiful flowers. It is often grown as an ornamental plant in South India and its leaves are used as a dietary supplement to treat diabetes.



Recently, many studies have been conducted to evaluate the anti-diabetic effect of this plant. It has also been proven to have many medicinal properties such as hypolipidemia, diuretic, antioxidant, antibacterial and anticancer. Additionally, various phytochemical studies have shown the presence of carbohydrates, triterpenoids, proteins, alkaloids, tannins, saponins, flavonoids, steroids and many bacteria. This study attempts to collect and explore the different pharmacological and phytochemical studies reported so far.

Costus igneus Nak (synonyms: *Costus pictus* D. Don, *Costus mexicanus* Liebm ex Petersen or *Costus congenitus* Rowle), often called fire magnius, ladder or spiral flag or insulin plant, is native to Central and South America. This plant was recently introduced to India from the United States for the treatment of diabetes and is commonly known as the "insulin plant".

It is widely grown in gardens as an ornamental plant in South India and is also abundant in the wild. It is used to control diabetes in India, and diabetics are known to eat the leaves every day to keep their blood sugar levels low. Flamingo leaf is a herb known to be effective in treating diabetes among the Koli Hills group of Namakkal district of Tamil Nadu. In Mexican folk medicine, the aerial part of *C. pictus* D. Don is used to treat kidney disease.

Mechanism Of Action

Costus igneus, commonly known as insulin, is a popular herb in traditional medicine for its anti-diabetic properties. Although scientific research on this plant continues, its mechanism of action as an anti-diabetic drug is still unclear. However, many studies have found the underlying mechanism by which rosacea exerts its anti-inflammatory properties:

1. Beta cell regeneration: Fire rosewood can stimulate the regeneration of pancreatic beta cells, which are responsible for insulin production. This innovation can increase the release of insulin, which lowers blood sugar.
2. Insulin-mimicking activity: Some studies have said that certain compounds found in the annatto tree can mimic the effects of insulin or increase insulin secretion in tissues such as muscle and fatty meats. This will improve the sugar in the cells and reduce blood sugar.
3. Alpha-Glucosidase Inhibition: Rosewood extract has been shown to inhibit the activity of alpha-glucosidase, an enzyme involved in carbohydrate digestion. By inhibiting this enzyme, the herb slowly breaks down carbohydrates into glucose, thus lowering blood sugar levels after a meal.
4. Antioxidant activity: Oxidative stress plays an important role in the development and progression of diabetes and its complications. Sequoia contains antioxidants that eliminate free radicals and reduce oxidative stress, which will help protect pancreatic beta cells and improve insulin sensitivity.
5. Immune system: Associated with low blood pressure, insulin resistance and type 2 diabetes. Redwood may contain anti-inflammatory properties that help reduce inflammation in the body, thus improving insulin sensitivity and glucose metabolism.
6. Regulation of glucose metabolism: Aruba extract can regulate various enzymes and pathways involved in glucose metabolism, including glycolysis, gluconeogenesis, and glycogen synthesis. By regulating this pathway, plants can help maintain glucose homeostasis in the body.

However, more research, including clinical trials, is needed to fully understand the herb's effectiveness and safety in treating diabetes. It is also important to consult a doctor before using annatto or other herbs to treat diabetes.

Material and Methodology

Herbal material

1. Brahmi Powder:

Kingdom : Plantae

Order : Lamiales

Family : Plantaginaceae

Genus : Bacopa

Species : *B.monneri*

Synonyms : *Bramia monneri* , *Gratiola monneri*

2. Costus igneus:

Kingdom : Plantae

Order : Zingiberales

Family : Costaceae

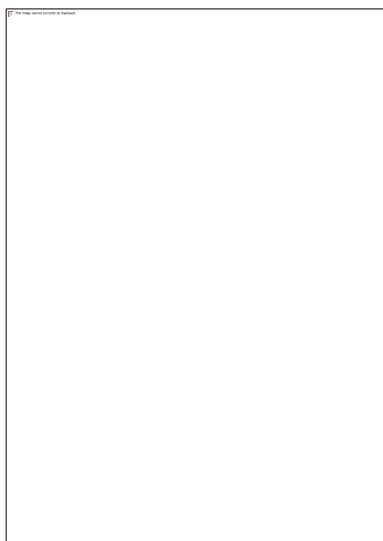
Genus : Chamaecostus

Species : *C. cuspidatus*

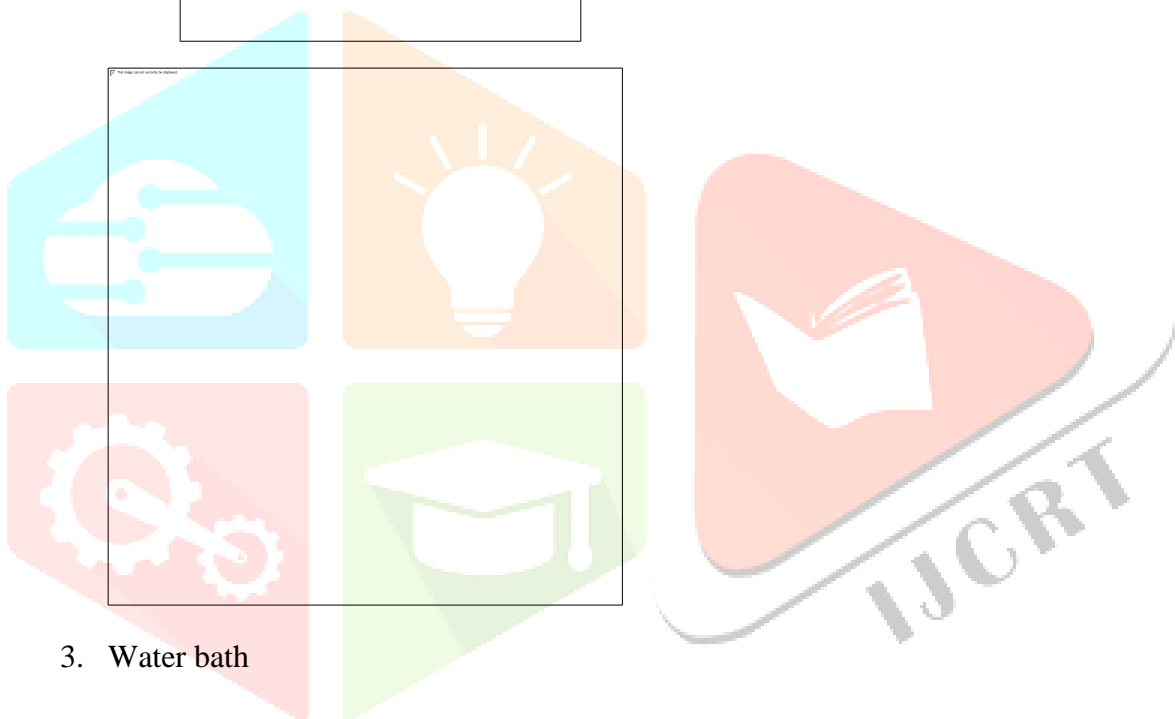
Synonyms : *Costus cuspidatus* , *Globba cuspidatus*

Instruments used

1. Ostwald viscometer

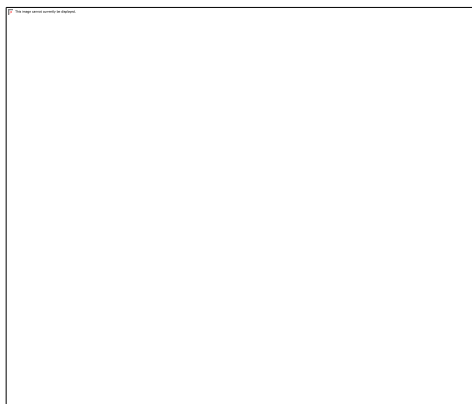


2. Hot air oven

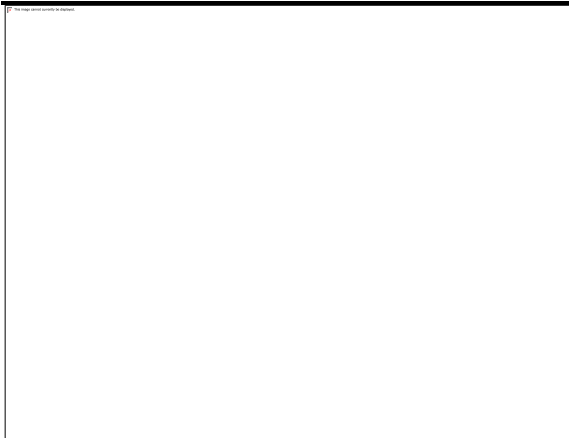


3. Water bath

4. Weighing balance

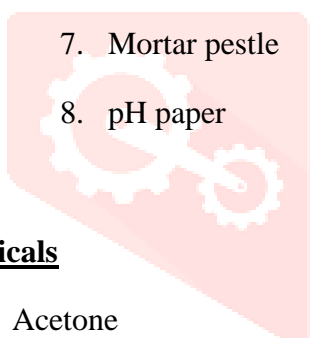
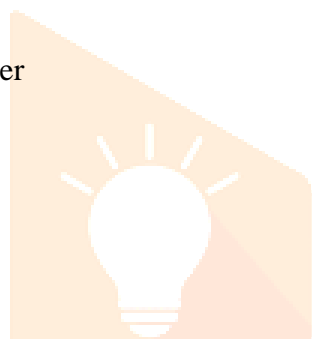
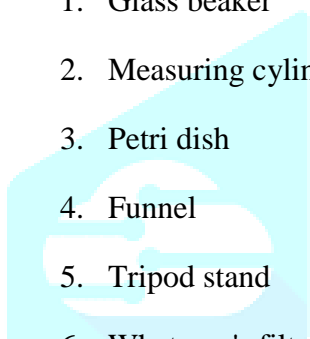


5. Magnetic stirrer



Other material used

1. Glass beaker
2. Measuring cylinder
3. Petri dish
4. Funnel
5. Tripod stand
6. Whatman's filter paper
7. Mortar pestle
8. pH paper



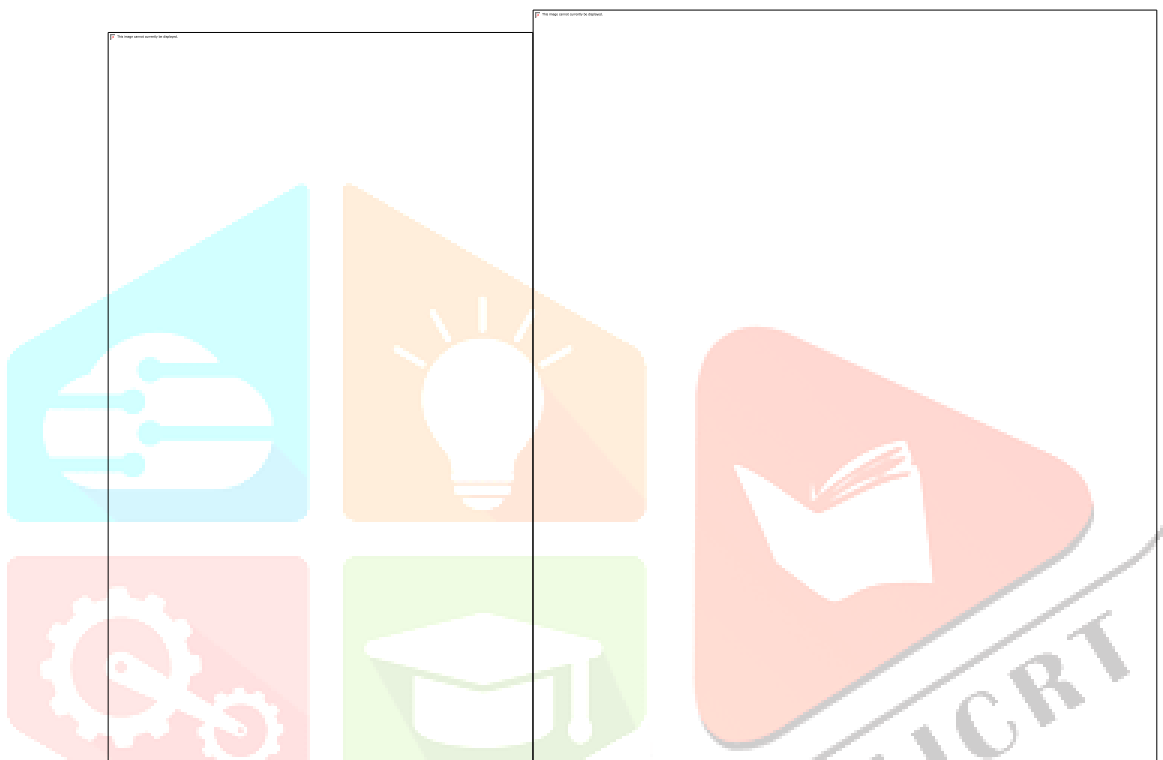
Chemicals

1. Acetone
2. Conc.HCL
3. DIL. HCL
4. Ethanol
5. Sodium benzoate
6. Peppermint oil
7. Mayer's reagent
8. Wagenr's reagent
9. Sodium Hydroxide
10. Dist. Water

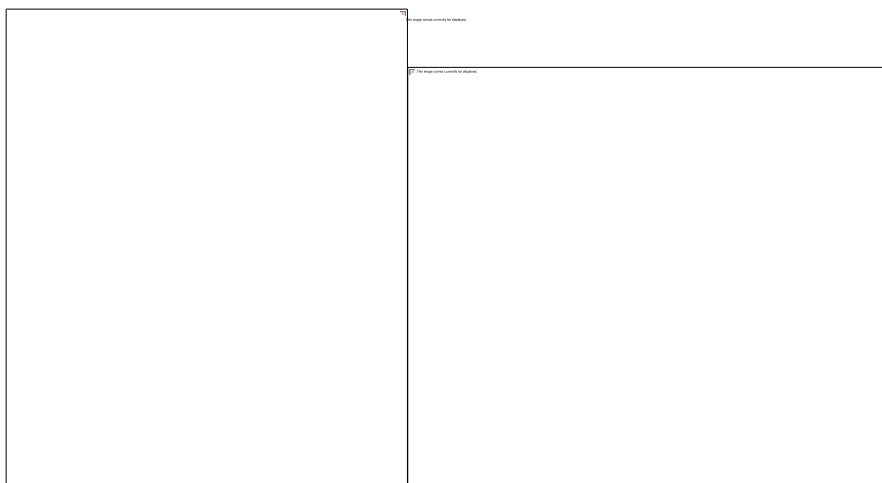
Methods

→ **Extraction of Bramhi**

1. **Ethanolic extract:** The fresh leaves of *Bacopa monnieri* collected from the botanical garden . The collected leaves were dried at room temperature in shade . The dried leaves are powdered using a mortar pestle.10 gm of powdered leaves were added in 150 ml of ethanol in a beaker and kept for extraction for 72 hrs. After 72 hrs the extract is filtered out . The filtrate undergoes maceration using a hot air oven. The filtrate is kept in a hot air oven at 110 degree celsius temp. For 1 hr. After 1hr the ethanolic extract gives green colored crystals like particles of *Bacopa monnieri*.

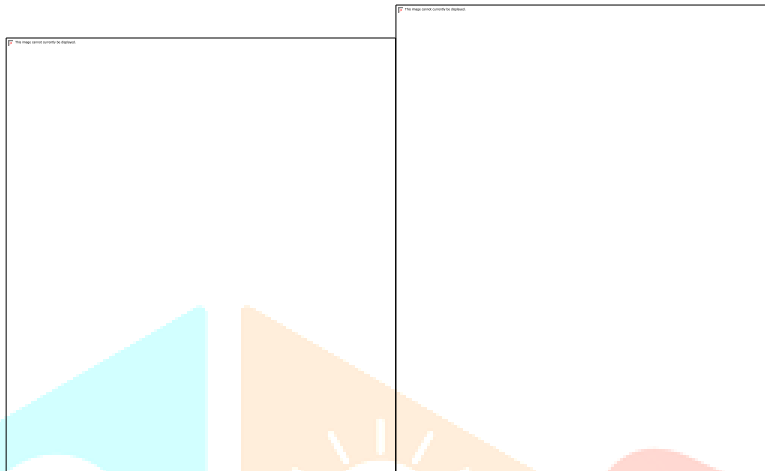


2. **Aqueous Extract:** The fresh leaves of *Bacopa monnieri* collected from the botanical garden . The collected leaves are dried at room temperature in shade . The dried leaves are powdered using a mortar pestle. 10 gm of powdered leaves are added in 150 ml of dist. Water in a beaker and kept in a water bath for extraction at 50 degree celsius temp. After 20 minutes the extract is filtered out . The filtrate is used in formulation.

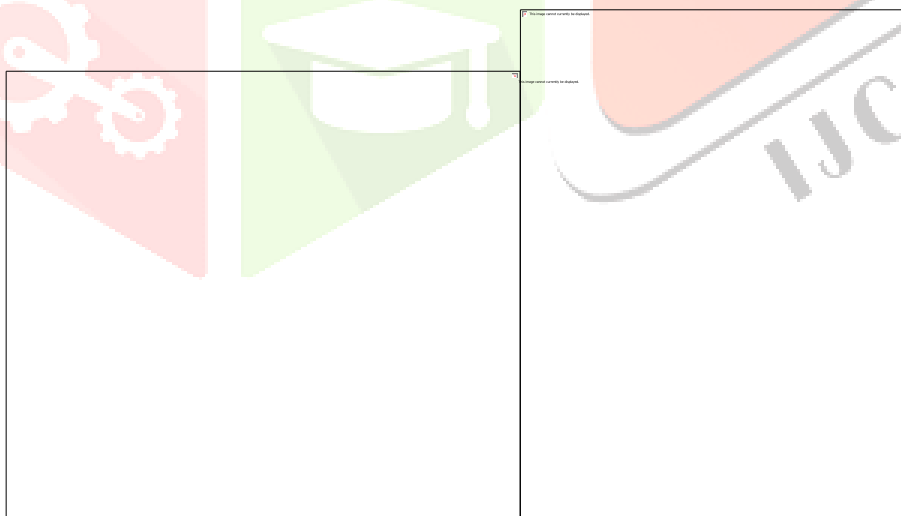


→ **Extraction of Costus igneus**

1. **Ethanolic extract:** The fresh leaves of the C.igneus were washed with distilled water and 15gm of leaves kept in 150ml of ethanol for 72hrs. After 72 hrs the extract is filtered out . The filtrate is macerated in a hot air oven for 1-2 hrs at 110 degree celsius. After the 1-2 hrs ethanolic extract gives the pale yellow colored crystal particles.



2. **Aqueous Extract:** The fresh leaves of Costus igneus collected from the botanical garden . The collected leaves are dried at room temperature in shade . The dried leaves are powdered using a mortar pestle. 10 gm of powdered leaves are added in 150 ml of dist. Water in a beaker and kept in a water bath for extraction at 50 degree celsius temp. After 20 minutes the extract is filtered out . The filtrate is used in formulation.



Methodology

For testing the stability performance and analysis of phytochemical constituents in the formulation, we have prepared two formulations i.e. F1 and F2.

Formulation F1 : It is prepared from the aqueous extract of Bacopa monnieri and Costus igneus

Procedure

100mg of the crystal powder of Bacopa monnieri is weighed in a petri dish and added in 10 ml of distilled water named it as solution A.

100mg of the macerate of Costus igneus is weighed in another petri dish and added in the 10 ml of distilled water named it as solution B.

Both the solutions were mixed. A small amount of Preservative (Sodium benzoate)(0.30gm) is added and stirred using a magnetic stirrer until it completely dissolves in solution.

After the preparation of solution, flavoring agent (Peppermint oil), Coloring agent and taste masking were added.

The final product is labeled and passed for the evaluation test.

Formulation F2: It is prepared from the ethanolic extract of Bacopa monnieri and Costus igneus

Procedure

Both the aqueous extract of the Bacopa monnieri and Costus igneus are measured using measuring cylinder i.e. 10 ml each and mixed. A small amount of Preservative (Sodium benzoate)(0.30gm) is added and stirred using magnetic stirrer until it completely dissolves in solution.

After the preparation of solution, flavoring agent (Peppermint oil), Coloring agent and taste masking were added.

The final product is labeled and passed for the evaluation test.

Formula

Sr.No	Content	Quantity
1	Costus igneus	100mg
2	Bramhi	100mg
3	Sodium Benzoate	0.01gm
4	Peppermint oil	1ml
5	Sterile Water	QS
6	sorbitol	nil

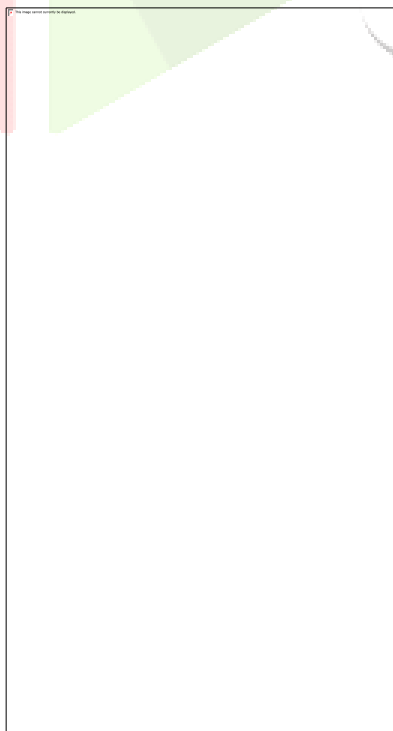
Evaluation Test

1) Alkaloids

The test performed on formulation are as follows

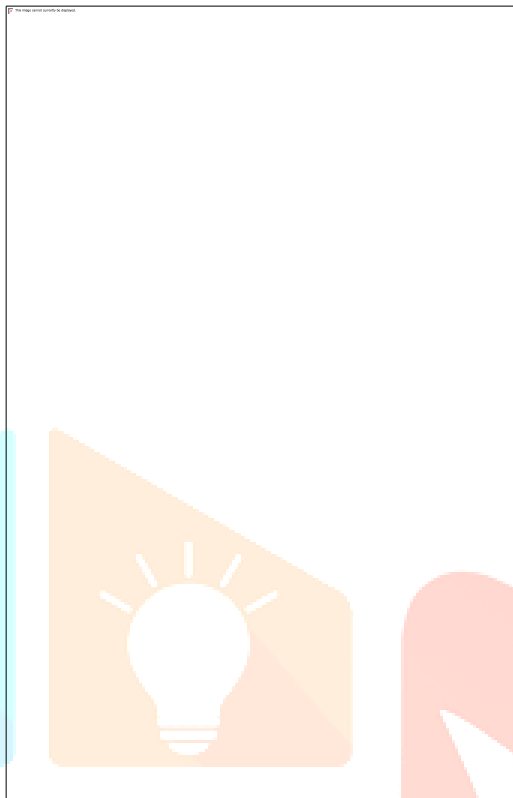
- Mayer's reagent test

Mayer's reagent is an alkaloid precipitation reagent used to detect alkaloids in natural products. Mayer's reagent was freshly prepared by mixing mercuric chloride (1.36g) and potassium iodide (5.00g) in water (100.0ml). Most alkaloids are precipitated from neutral or slightly acidic solutions using Meyer's reagent (potassium mercury iodide solution) giving a yellowish or white precipitate. This experiment was developed by German chemist Julius Robert von Meyer.



- Wagner's reagent test

Wagner's reagent is alkaloid precipitation reagent used to detect alkaloids in natural products. It is the dissolving 2 gm of iodine and 6 gm of potassium iodide in 100 mL of distilled water. The precipitate formed using Wagner's reagent gives reddish brown precipitate.

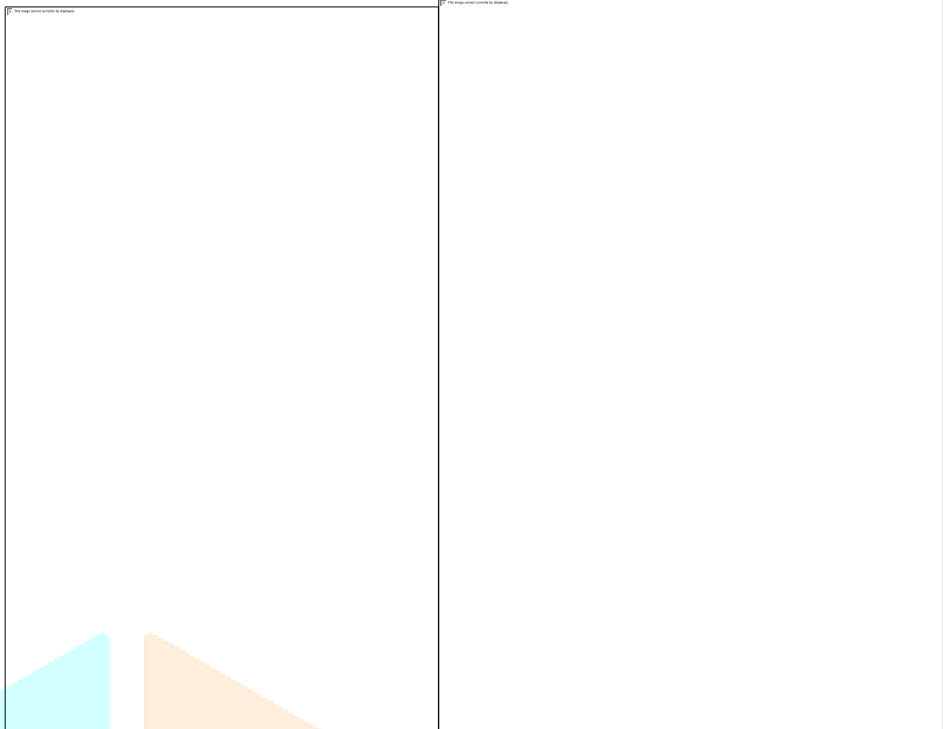


2) Flavonoids

The test performed on the formulation are as follows

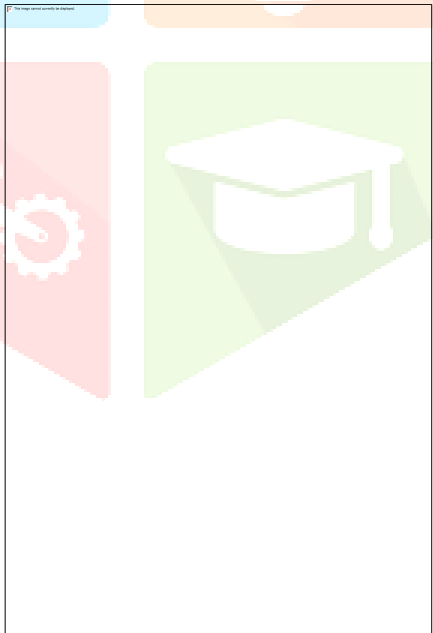
- Alkaline reagent test

Mix 2 ml of 2.0% NaOH with the aqueous crude plant extract; These results indicate the presence of flavonoids. Initially gives yellow color, become colorless on adding dil.HCL drops.



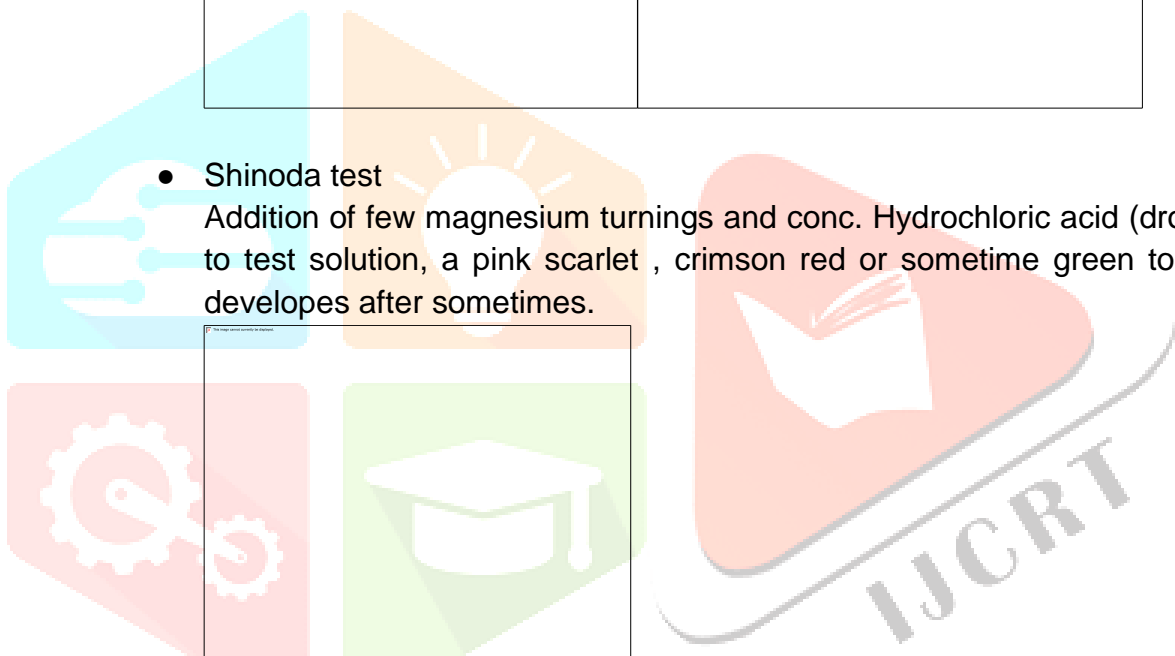
- **Shinoda test**

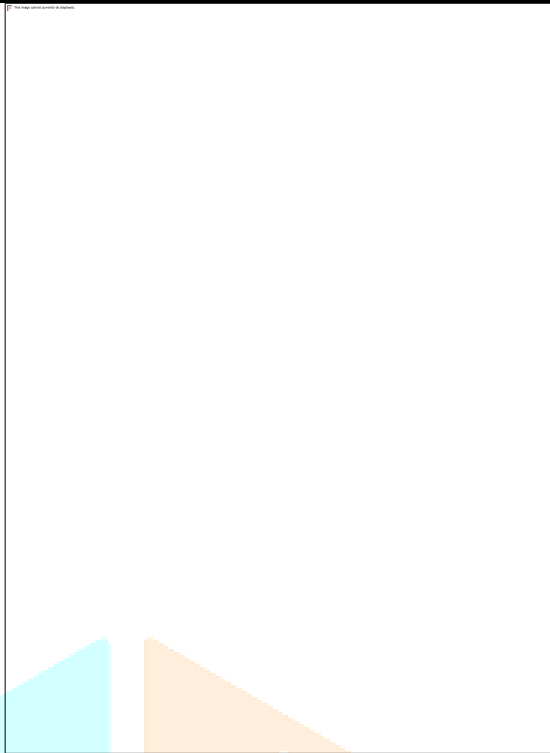
Addition of few magnesium turnings and conc. Hydrochloric acid (drop by drop) to test solution, a pink scarlet, crimson red or sometime green to blue color develops after sometimes.



- **Lead acetate test**

The formation of red color indicates the presence of flavonoids. Lead acetate test - Take 10 mg of tree bark extract and add a few drops of 10% lead acetate solution. The appearance of yellow precipitate indicates the presence of flavonoids.





3) Saponins

The test performed on formulation are as follows

- Foam test

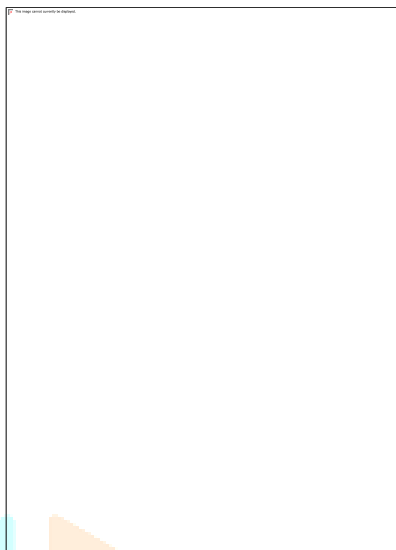
Take 0.5 mg of tree bark extract in a test tube and add a few drops of 5% sodium bicarbonate solution. Shake the mixture well and let it sit for 3 minutes. The formation of cellular foam indicates the presence of saponins.



- Honeycomb test

Mix three milliliters (3 mL) of the aqueous extract solution with 10 mL of distilled water in a test tube. Connect the test tube and shake vigorously

for about 5 minutes, let it sit for 30 minutes and observe the honeycomb foam indicating the presence of saponins.



Evaluation Parameter

1) Viscosity

Clean the Ostwald viscometer using acetone or chromic acid .

Mount the viscometer in the burette stand .

Fill the viscometer upto mark G.

Then count time required to flow the solution from the point A to B.

Repeat the procedure 2-3 times and calculate the mean of all three values.

2) Thermal stability

The formulation is transferred in the glass beaker and kept in a hot air oven for 24 hrs.

After 24 hrs the stability of formulations studied. At 47 degree celsius.

3) Consistency(Thread test)

Dip a wooden spatula tied to thread in boiling syrup.

Take it out and wait for it to cool down.

After cooling touch it with thumb and forefinger and check consistency

We can keep heating it to attain the desired consistency.

4) Density

Clean the gravity bottle using chromic acid.

Wash the bottle with distilled water again.

After drying, weigh the empty bottle .

Then fill the bottle with formulation and clean the bottle and measure again.

Formula : $\text{weight of formulation} / \text{volume of formulation}$

5) Color

Observing the color of 10ml syrup in watch glass against the white background

6) Odour

A small amount of formulation is added to the petri dish and smelled.

7) Taste

Small droplet of the formulation is tasted by a person.

8) Specific gravity:

Clean the specific gravity bottle with chromic acid.

Again wash it with distilled water .

After drying the bottle, weigh the empty bottle.

Again add the formulation in a bottle and weigh it .

Repeat the procedure at least 3 times and calculate the mean of all the values.

9) pH

pH paper strip is dipped in the formulation and dried at room temperature .

10) Appearance

The formulation is seen in daylight .

Result

The herbal antidiabetic syrup using the Bacopa monnieri and Costus igneus is prepared and evaluated .

The results are as tabulated below.

Results Of F1 (Aqueous Formulation)

Test	Results
Determination of Viscosity	The viscosity of formulation was found to be 0.0495 poise for the range of 0.0495-0.03998 poise .
Thermal Stability	Not confirmed
Determination of Consistency	
Determination Of Density	1.07gm
Color	Pale Brown color
Odour	Pungent bitter smell
Taste	Intensive Bitter
Specific Gravity	0.5289gm/L
pH	5.0 - 6.0
Appearance	Clear

Results Of F2 (Extraction Formulation)

Test	Results
Determination of Viscosity	The viscosity of formulation was found to be 0.0492 poise for the range of 0.0492-0.03989 poise .
Thermal Stability	Not confirmed
Determination of Consistency	
Determination Of Density	1.06gm
Color	Pale yellow Color
Odour	Pungent bitter smell
Taste	Intensive bitter
Specific Gravity	0.5195gm/L
pH	5.0-6.0
Appearance	Turbid

The formulated herbal formulation shows the effective therapeutic activity against the alpha amylase . Bacopa monnieri shows the antiinflammatory activity and Costus igneus shows the antidiabetic activity.

The formulation has zero side effects and is used as antidiabetic.

Conclusion

Medicinal plants are still widely used in healthcare in many countries due to traditional practices, social harmony and minimal side effects.

Syrup: Bacopa monnieri leaf extract and Costus igneus leaf extract.

Finally, we can conclude that all tests of herbal syrups prepared within limits show the prevention of diabetes.

Herbal medicine over the allopathy

Natural Healing: Herbs do not interfere with the body's ability to heal itself in any way. Instead, it enhances the biological healing process, thus accelerating the healing process and allowing the body to maintain the optimal internal environment necessary for such healing.

Long-term effects: Many herbs come with specific instructions about diet, rest, and exercise, which enhance the effects of the herbs by preparing the body to respond to the best and best treatments. These changes in diet and lifestyle ultimately help patients bring their bodies back to health.

Better immunity: Herbs help strengthen the immune system by improving the body's natural healing process and correcting bad habits that lead to poor health.

Metabolism and Nutrition: A strong immune system and a healthy diet and lifestyle can improve metabolism, leading to better absorption of nutrients.

Side effects: Contraindications are rare if the herbs are taken as prescribed by the doctor and under the supervision of a specialist doctor.

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