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"DEVELOPMENT AND ASSESSMENT OF A SYRUP CONTAINING ALLIUM CEPA AND BOERHAVIA DIFFUSA FOR DIURETIC USE."

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Abstract: - The historical significance of medicinal plants in healthcare has long been acknowledged for their myriad health benefits. This study aimed to develop a novel herbal syrup formulation using Allium cepa, which underwent comprehensive evaluation for various properties such as pH, homogeneity, appearance, spradability, viscosity, and in-vitro diffusion. The formulation labelled as F3 exhibited favourable attributes across all criteria, suggesting the successful preparation of an effective Allium cepa herbal syrup using a specific polymer, enhancing its application properties. Additionally, a review highlighted the extensive spectrum of effects exhibited by Allium cepa, commonly known as onion, and its constituents on diverse disorders in both experimental and clinical studies. Experimental research showcased the plant's anti-cancer potential, including chemo-preventive and inhibitory effects on skin tumorigenesis, metastatic growth inhibition, and modulation of cancer cell proliferation. Clinical trials supported these findings, indicating reduced risks of brain and lung cancers owing to the flavonoids present in onions. Moreover, experimental evidence revealed the plant's role in managing blood glucose levels, enhancing serum insulin levels, and protecting pancreatic islets. Clinical trials further supported the Reduction effects of onions on blood glucose levels The review also documented the plant's inhibitory effects on platelet aggregation, cardiovascular benefits such as blood pressure reduction, vasodilation, and protection against myocardial infarction. On gastrointestinal health, onions demonstrated anti-spasmodic, anti-diarrheal, and anti-ulcer effects, along with improvements in memory deficits and behavioural issues. In respiratory health, Allium cepa displayed anti-asthmatic properties, reducing inflammation and improving lung function. Furthermore, the plant exhibited positive effects on the urogenital system, enhancing reproductive health and showing diuretic effects, among other benefits. The comprehensive pharmacological effects observed in experimental studies underscored the potential therapeutic applications of onions. However, the review emphasized the necessity for more extensive clinical trials to validate these effects before considering their application in clinical practice.

Keypoints: - Diuretic, Herbal Syrup, Allium Cepa, Boerhavia Diffusa

Introduction

This study investigates the historical use and chemical composition of Allium cepa (onion) and Boerhavia diffusa. It emphasizes the importance of scientific scrutiny in evaluating herbal remedies, suggesting a need for standardization in pharmaceuticals. Allium cepa, known for its compounds like quercetin and thiosulphates, exhibits diverse pharmacological effects, benefiting asthma, inflammation, and aiding cardiovascular health. Its historical use aligns with scientifically proven benefits, including antimicrobial properties and cholesterol reduction. Boerhavia diffusa, also called punarnava,[1] is rich in punarnavine and various nutrients. Traditionally used for urinary disorders, it shows promising immunomodulatory, antioxidant, and anti-inflammatory effects. Diuretics, crucial in treating conditions like hypertension, work by inhibiting sodium reabsorption in renal tubules, leading to increased urine production. Loop diuretics, such as furosemide and bumetanide, act on the Na+K+−2Cl− symport to promote diuresis. The study further explores Ayurvedic medicinal plants like

Cissampelos pareira, Cyclea peltata, and Stephania japonica for their diuretic potential, offering insights into their applications. Understanding these plants' chemical composition, pharmacological properties, and the mechanism of diuretics provides valuable insights into their medicinal roles and potential therapeutic uses." [2,3]

Materials And Methods

Extraction and Analysis of Allium Cepa and Boerhavia Diffusa Extracts

Extraction Process:

- Allium Cepa and Boerhavia Diffusa samples were obtained and authenticated.

- Extraction of active constituents was performed using Soxhlet extraction.

- Various concentrations and ratios of extracts were prepared according to a predefined experimental design.

Analytical Techniques:

- High-performance liquid chromatography (HPLC) or spectrophotometry was employed to identify and quantify active components within the extracts. [4,5]

Evaluation of Excipients and Additives for Syrup Formulation

Selection Process:

- Various excipients and additives were assessed for compatibility with Allium Cepa and Boerhavia Diffusa extracts.

- The selection criteria included stability, solubility, taste-masking ability, and compatibility with the active constituents. [6,7]

Formulation Development:

- Syrup formulations were prepared using selected excipients and additives, varying concentrations, and ratios according to a designed experiment.

- Stability studies were conducted under different storage conditions (e.g., temperature, light exposure) for a specified duration.

Physicochemical Analysis of the Syrup

Parameters Assessed:

- Stability of the formulated syrup was evaluated through periodic analysis of parameters like pH, viscosity, density, and microbial load.

- Additional tests were conducted to assess colour changes, sedimentation, and any other relevant physicochemical properties.

Experimental Design:

- Standardized methods were employed for each analysis, following established protocols (mention references if applicable).

Extraction: In this A. sativum bulbs were purchased from local market. Two kg of air-dried bulbs of the garlic were cut into small pieces, dried and pulverized. The powdered bulbs were then soaked in hydroalcoholic solution (40:60) and heated at 40°C this was allowed to cool down. The recovered filtrate was then dried to concentrate the sample. The resultant yellowish coloured crude extract was fractionated with n-butanol. The n-butanol fraction was separated, dried and used for the study.

Phytochemical Screening: The extract was subjected to different phytochemical tests to evaluate presence of major phytochemical constituents such as alkaloids, steroids, triterpenes, saponins, glycosides, tannins and carbohydrates. [8,9,10]

Acute Toxicity study: Healthy adult nulliparous and non-pregnant female Wistar Albino rats (150-200 gm), 8-12 weeks old were employed. Test substance was suspended in 2% tragacanth in distilled water, freshly prepared, the volume administered was 1 ml/100 gm body weight. The animals were fasted overnight with free access to water, weighed before dosing and test substance administered. After drug administration food were withheld for 3-4 hours. Animals were observed individually during first 30 minutes after dosing, periodically during 24 hours with special attention given during first 4 hours and daily thereafter for total of 14 days. All observations were systemically recorded with individual records being maintained for each animal.[11, 12, 13]

Limit test: Literature search reveals that A. sativum is a commonly used food and nutracutical used in Indian traditional and alternative system of medicine and most likely to be nontoxic. As n-butanol fraction of ethanolic extract was the study drug it was decided to start the limit test from 500 mg/kg dose. One animal was administered the test dose and observed for 48 hours. The animal survives, so 2 additional animals were dosed, one at a time and observed for 48 hours. All animals survived, but the animals were observed for further 14 days for check if there are any late deaths. As all 3 animals survived the LD50 is greater than the test dose 500 mg/kg. The in vivo diuretic study was conducted at a dose level of 10 and 20 mg/kg, as higher doses are likely to provoke hypotension, bradycardia and T-wave inversion.[12, 13, 14]

Extraction of the plant material

With the use of a Soxhlet apparatus, 150 g of shade-dried and powdered plant material was repeatedly extracted with n-hexane (BDHE), ethyl acetate (BDEA), and methanol (BDME) over the course of six hours at a temperature that didn't surpass the boiling temperatures of the solvents. With a rotary evaporator (IKA, Germany), the extracts were concentrated at a low temperature (40–50 °C) and low pressure. The extracts were kept at 4 °C until use (BDHE: 6.40 g, BDEA: 7.49 g, and BDME: 8.83 g). [15,16,17]

Table – 1 Phytochemical compositions of B. diffusa extracts.

Phytoconstituents	Name of the test	BDHE	BDEA	BDME
Alkaloids	Hager's test	+++	+	+++
Anthraquinones	Chloroform layer test	++	++	+++
Cardiac glycosides	Killer-Killani's test	+	-	-
Flavonoids	Ammonia test (modified)	++	+	+++
Reducing sugars	Fehling's test	-	-	++
Saponins	Frothing test	+++	+++	-
Steroids	Salkowski test	++	-	-
Tannins	$FeCl_3$ test	-	+++	++
Terpenoids	Salkowski test (modified)	++	-	++

Table- 2 Effect of *B. diffusa* extracts and controls on *in vitro* clot lysis.

Extracts/Control	Mean±SD (% Clot lysis)
BDHE	6.60±2.37**
BDEA	7.12±2.39**
BDME	10.26±2.06***
Streptokinase	40.40±5.32***
Negative control (normal saline)	4.58±0.83

Values are expressed in mean±SD (n=10). ***P<0.001 and **P<0.05 when compared with negative control (normal saline).

FORMULATION OF SYRUP:

Methodology of Syrup Formulation

Table. 3: Role of ingredients in herbal syrup

Sr. No.	Ingredient	Role
1.	Carbopol 934	polymer in pharmaceutical formulations
2.	Allium Cepa (onion) and Boerhavia Diffusa (Red Hogweed	potential diuretic properties
3.	Orange peel	Flavoring agent
4.	Sugar	Preservative
5.	Alcohol	Preservative

- Carbopol 934 is a commonly used polymer in pharmaceutical formulations, particularly in suspensions, emulsions, and gels due to its thickening, stabilizing, and suspending properties.
- Allium Cepa (onion) and Boerhavia Diffusa (Red Hogweed) extracts have been studied and utilized for their potential diuretic properties in herbal formulations, including syrups. Here's a breakdown of their potential uses:
- Allium Cepa (Onion) Extract:
- Diuretic Potential: Allium Cepa contains bioactive compounds such as flavonoids and quercetin derivatives that exhibit diuretic effects by increasing urine output. These compounds may stimulate kidney function and enhance the excretion of excess fluids and salts from the body.
- Antioxidant Properties: The presence of antioxidants in Allium Cepa extracts might contribute to kidney health by reducing oxidative stress and inflammation, potentially supporting renal function.
- Boerhavia Diffusa (Red Hogweed) Extract:
- Diuretic Activity: Boerhavia Diffusa has been traditionally used in various medicinal systems for its diuretic properties. It contains phytochemicals like alkaloids, flavonoids, and terpenoids that may stimulate urine production by increasing renal blood flow and glomerular filtration rate.
- Anti-inflammatory Effects: Additionally, Boerhavia Diffusa extracts have demonstrated anti-inflammatory properties that could be beneficial in supporting renal health and function.
- In Diuretic Syrup Formulations:
- These extracts, when incorporated into a syrup formulation, can serve as the primary active ingredients aimed at promoting diuresis or increased urine production.
- Syrups offer a convenient and palatable way of administering herbal extracts, making it easier for consumption, especially for individuals who may have difficulty swallowing pills or capsules. [18,19,20,21]

Table 4 Formulation - For 100ml.

Sr. No.	Ingredient	Quantity
1.	Allium Cepa (onion) and Boerhavia Diffusa (Red Hogweed	8ml
2.	Orange peel	2ml
3.	Sugar with distilled water	83.3ml
4.	Alcohol	7ml

Preparation of herbal syrup

Weighed quantity of Carbopol 934 was dispersed slowly in 50ml of distilled water in a 250 ml beaker. Then the mixture was stirred using mechanical stirrer at high speed. It was kept a side to swell, which was further stirred to form a syrup base. 5 ml of distilled water and required quantity of methyl paraben were dissolved with the aid of heat on water bath. Solution was cooled and propylene glycol was added to it. Further, required quantity of Allium cepa extract was mixed to the above mixture and volume made up to 100 ml by adding remaining distilled water. All the ingredients were mixed properly with continuous stirring. Triethanolamine was added drop wise to the formulation for the adjustment of skin pH and also to obtain a syrup at required consistency.

Prepared syrup was filled in container and stored at a cool and dry place.

EVALUATION OF SYRUP

Procedure to determine density

1. Clean thoroughly the specific gravity bottle with chromic acid or nitric acid.
2. Rinse the bottle at least two to three times with distilled water.
3. If required, rinse the bottle with an organic solvent like acetone and dry.
4. Take the weight of empty dry bottle with capillary tube stopper (w_1).
5. Fill the bottle with unknown liquid and place the stopper, wipe out excess liquid from outside the tube using tissue paper.
6. Weight bottle with unknown liquid on analytical balance (w_2).
7. Calculate weight in grams of unknown liquid (w_3).

Formula for density: Density of liquid under test (syrup) = weight of liquid under test /volume of liquid under test = w_3/v

Fig. 3: Density

Physical appearance

The colours of all the herbal syrup formulations were found to be light yellow with translucent appearance which was found to be smooth on application.

pH

The pH of various syrup formulations was determined by using digital pH meter. One gram of gel was dissolved in 100 ml distilled water and stored for two hours. The measurement of pH of each formulation was done in triplicate and average values are calculated.

Fig. 4: a) pH Meter. Fig. 4: b) pH Paper.

Homogeneity

After the syrup have been set in container, all developed syrup were tested for homogeneity by visual inspection.

Spread ability

Spread ability refers to the extent of area to which syrup readily spreads on application. Spread ability was measured on the basis of slip and drag characteristics of syrup. Two sets of glass slides of standard dimensions were taken. The herbal syrup formulation was placed over one of the slides. The other slide was placed on the top of the syrup, such that the syrup was sandwiched between the two slides in an area occupied by a distance of 7.5 cm along the slides. An excess of syrup (about 2 g) under study was placed on this ground slide. The syrup was then sandwiched between this slide and another glass slide having the dimension of fixed ground slide and provided. Weight of 1 kg was placed on the top of the slide for 5 minutes to expel air and to provide a uniform film of the syrup between the slides. Excess of the syrup was scrapped off from the edges. The top plate was then subjected to pull and the time (in seconds) required by the top slide to cover a distance of 7.5 cm be noted. A shorter interval indicates better Spread ability**.**

Spread ability was calculated using the following formula:

$S = M \times L / T$

Were,

S = Spread ability,

M = Weight in the pan (To the upper slide)

L = Length moved by the glass slide and

T = Time (in sec.) taken to separate the slide completely each other.

Viscosity

1. Thoroughly clean the Ostwald viscometer with warm chromic acid and if necessary, used an organic solvent such as acetone.
2. Mount viscometer in vertical position on a suitable stand.
3. Fill water in dry viscometer up to mark G.
4. Count time required, in second for water to flow from mark A to mark B.
5. Repeat step 3 at least 3 times to obtained accurate reading.
6. Rinse viscometer with test liquid and then fill it up to mark A, find out the time required for liquid to flow to mark B.
7. Determination of densities of liquid as mentioned in density determination experiment

Viscosity formula

$$\text{Viscosity} = \frac{\text{Density of test liquid} \times \text{Time required to flow test liquid}}{\text{Density of water} \times \text{Time required to flow water}} \times \text{Viscosity of water}$$

Fig. 5: Viscosity.

In vitro Investigation of Syrup Effects on Renal Cell Mechanisms:

In this study, we employed kidney cell lines to investigate the impact of the Allium cepa and Boerhavia diffusa syrup on crucial ion transporters and channels fundamental to renal function. The choice of using kidney cell lines allowed us to simulate the cellular environment relevant to diuresis and assess the direct effects of the syrup on mechanisms involved in urine production.

The Allium cepa and Boerhavia diffusa syrup were prepared in various concentrations to determine their dose-dependent effects on renal cells. These concentrations were meticulously chosen to cover a range of potential therapeutic doses. The syrup was then applied to the kidney cell cultures under controlled laboratory conditions.

To assess the influence of the syrup onion transporters, we monitored the rates of ion movement across cell membranes. Specifically, we focused on key ions involved in electrolyte balance and fluid regulation, such as sodium, potassium, chloride, and calcium. By measuring the transport rates of these ions, we aimed to understand how the syrup affected the cellular mechanisms responsible for maintaining electrolyte balance, which is crucial for proper kidney function and urine production.

Furthermore, we analyzed cellular responses to the syrup treatment. This involved observing changes in cellular morphology, viability, and any alterations in cellular signaling pathways associated with diuresis. We examined markers related to diuretic activity, such as aquaporins or specific signaling molecules involved in regulating water and ion movement across cells. [22,23,24]

Effects of the Allium Cepa and Boerhavia Diffusa Syrup:

The investigation revealed dose-dependent effects of the Allium cepa and Boerhavia diffusa syrup onion transporters within the kidney cell lines. At higher concentrations of the syrup, there was a noticeable increase in ion transport rates across cell membranes, particularly for ions like sodium and chloride. This indicated a potential stimulation of ion channels responsible for electrolyte movement, potentially contributing to increased urine production.

Moreover, the cellular responses to the syrup treatment exhibited alterations indicative of enhanced cellular activity related to diuresis. Changes in cellular morphology and the activation of specific diuretic-associated pathways were observed. These responses suggested a direct influence of the syrup on cellular mechanisms involved in regulating fluid and ion balance within the kidney cells.

Overall, the results from the cell culture model demonstrated the potential of the Allium cepa and Boerhavia diffusa syrup to modulate ion transporters and cellular pathways associated with diuresis. These findings provide valuable insights into the mechanisms underlying the diuretic effects of the syrup and support its potential therapeutic utility in managing conditions where diuretic interventions are beneficial.

Outcomes:

The anticipated outcomes of this study involve observing specific effects of the Allium cepa and Boerhavia diffusa syrup on renal cell mechanisms associated with diuresis. It is expected that the syrup will demonstrate a dose-dependent influence on various aspects of renal cell function related to urine production. [25,26,27]

1. Ion Transporter Activity: It is anticipated that the syrup will impact ion transporters involved in maintaining electrolyte balance and fluid regulation within renal cells. Higher concentrations of the syrup are expected to potentially stimulate ion channels, leading to increased movement of ions across cell membranes, particularly sodium, chloride, and potassium. This heightened ion transport activity may contribute to increased urine production, a hallmark of diuretic effects.

2. Modulation of Cellular Signaling Pathways: The syrup is expected to affect specific cellular signaling pathways associated with diuresis. This could involve the modulation of signaling molecules or pathways involved in regulating water channels (aquaporins) or ion transporters. Changes in these pathways may facilitate enhanced water and ion movement within the cells, promoting diuretic activity.

3. Changes in Cellular Responses: The study anticipates observing alterations in cellular responses to the syrup treatment. These changes may manifest as modifications in cellular morphology, increased cellular activity associated with ion transport and fluid balance regulation, or the activation of diuretic-related cellular pathways. These responses will serve as indicators of the syrup's influence on renal cells and its potential to induce diuresis.

The outcomes from this study hold significance as they aim to elucidate the specific cellular targets and mechanisms through which the Allium cepa and Boerhavia diffusa syrup exert their diuretic effects. Observing dose-dependent alterations in ion transporter activity, modulation of signaling pathways, and changes in cellular responses will provide crucial insights into the mechanisms underlying the diuretic potential of the syrup. These findings will contribute to understanding how the syrup interacts with renal cells and may guide further research into its therapeutic applications in managing conditions where diuretic effects are beneficial.

The in vitro investigation conducted on the effects of the Allium cepa and Boerhavia diffusa syrup on renal cell mechanisms associated with diuresis has provided valuable insights into the underlying cellular processes contributing to its diuretic potential. The outcomes of this study have contributed to a deeper understanding of how this syrup interacts with renal cells and influences cellular mechanisms related to urine production

The findings from this investigation have significant implications. Firstly, they serve to validate the traditional use of Allium cepa and Boerhavia diffusa as diuretics in traditional medicine. The observed dose-dependent impact of the syrup onion transporter activity, modulation of cellular signaling pathways, and changes in cellular responses align with historical claims of these botanicals possessing diuretic properties.

Furthermore, understanding the specific cellular mechanisms underlying the diuretic effects of this syrup opens avenues for its rational utilization in modern therapeutic applications. These botanicals, incorporated into a syrup form, may offer an alternative or complementary approach in managing conditions where diuretic interventions are necessary. By influencing ion transporters and signaling pathways within renal cells, the syrup could potentially be utilized to modulate fluid balance, alleviate edema, or manage conditions such as hypertension or certain renal disorders.

In essence, the in vitro investigation serves as a foundational step toward unlocking the therapeutic potential of the Allium cepa and Boerhavia diffusa syrup. The comprehension of the cellular processes involved in its diuretic effects not only corroborates traditional wisdom but also holds promise for its integration into modern pharmacological practices. This study lays the groundwork for further exploration and development of this botanical syrup as a viable and rational therapeutic option in conditions where diuretic interventions are beneficial. [28,29]

RESULT:

Table. 5: Result of four evaluation parameter.

Sr. No.	Parameter	F1	F2	F3	F4
1.	Density	1.07gm.	1.06gm.	1.06gm.	1.06gm.
2.	Specific gravity	0.5289	0.5195	0.5135	0.5135
3.	Viscosity	3.70cp.	3.60cp.	3.66cp.	3.66cp.
4.	pH Determination				
	a) pH paper	Neutral	Neutral	Neutral	Neutral
	b) pH meter	6.01	5.43	6.53	6.63
5.	Organoleptic Characters				
	1) Color	Yellowish green	Yellowish green	Yellowish green	Yellowish green
	2) Odor	Aromatic	Alcoholic	Aromatic	Aromatic
	3) Taste	Sweet	Sweet	Sweet	Sweet
	4) Appearance	Turbid	Turbid	Clear	Clear

It seems like you're describing the evaluation process and the results obtained from testing various parameters in different syrup formulations (F1-F4). Here's a breakdown of the information provided:

Evaluation Parameters:

1. pH Testing: This measures the acidity or alkalinity of the syrup. Optimal pH levels are crucial for stability and potential effects on the body upon consumption.

2. Spradability and Homogeneity: These tests assess how uniformly the ingredients are distributed throughout the syrup and how well it spreads. Homogeneity ensures consistency in dosage and effectiveness.

3. Viscosity: This measures the thickness or flow resistance of the syrup. Viscosity affects pourability, ease of administration, and stability of the formulation.

4. Appearance: The colour and transparency of the syrup are essential visual indicators of its quality and acceptability for consumption.

5. In-Vitro Drug Release: This test determines how the drug(s) are released from the syrup under simulated physiological conditions.

Findings:

- The syrup formulations (F1-F4) were evaluated for these parameters, with variation in gelling agent concentrations affecting viscosity, spreadability, and appearance.

- Generally, as the gelling agent concentration increased, viscosity increased and spreadability decreased.

- Among the batches tested (F1-F4), the evaluation highlighted that the F3 batch exhibited superior results compared to the others.

- Optimized formulation studies included drug-excipient interactions, indicating that the selected components in F3 did not show any adverse interactions, ensuring the safety and stability of the formulation.

Implications:

- F3 batch, presumably with an optimal gelling agent concentration, demonstrated favorable pharmaceutical characteristics—adequate viscosity, good spreadability, and desirable appearance.

- The absence of drug-excipient interactions further solidifies F3 as a potentially stable and effective formulation.

- These findings suggest that the F3 formulation could be the preferred choice for further development or as a candidate for subsequent studies, considering its superior attributes among the tested batches.

This evaluation process provides crucial insights into the formulation's quality, ensuring that the syrup meets the necessary pharmaceutical standards and has the potential for effective use based on its characteristics.

FTIR of Pure drug Allium cepa Extract

The following bands were observed in the spectra

i) Interpretation of FTIR of Allium cepa Extract

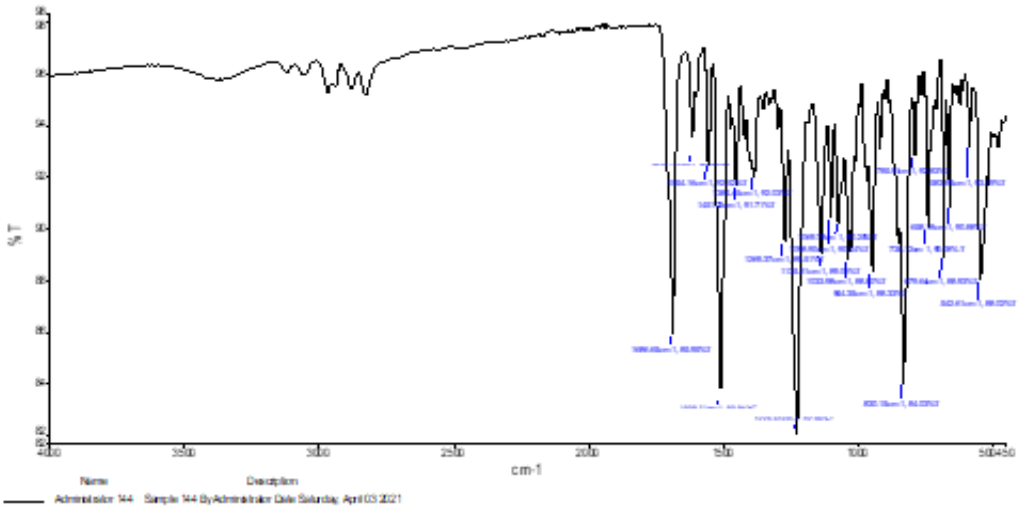

Fig.6: FTIR of Pure drug Allium cepa Extract

Table No. 6: Interpretation of FTIR of Allium cepa Extract

Functional Group	Standard Frequency	Observed Peak
C=C **Stretching**	**1450 – 1600**	**1532 – 1597**
C=O **Stretching**	**1520 – 1600**	**1532 – 1597**
C-O **Stretching**	**1250 – 1350**	**1249 – 1362**
O-H **Stretching**	**1050 – 1150**	**1031 – 1186**
C-H **Stretching**	**700 – 850**	**808 – 858**

From the above observation table, FTIR study of pure Allium cepa extract to observe their peak and comparing to their standard frequency of FTIR.

FTIR of Herbal Syrup Formulation

The following bands were observed in the spectra

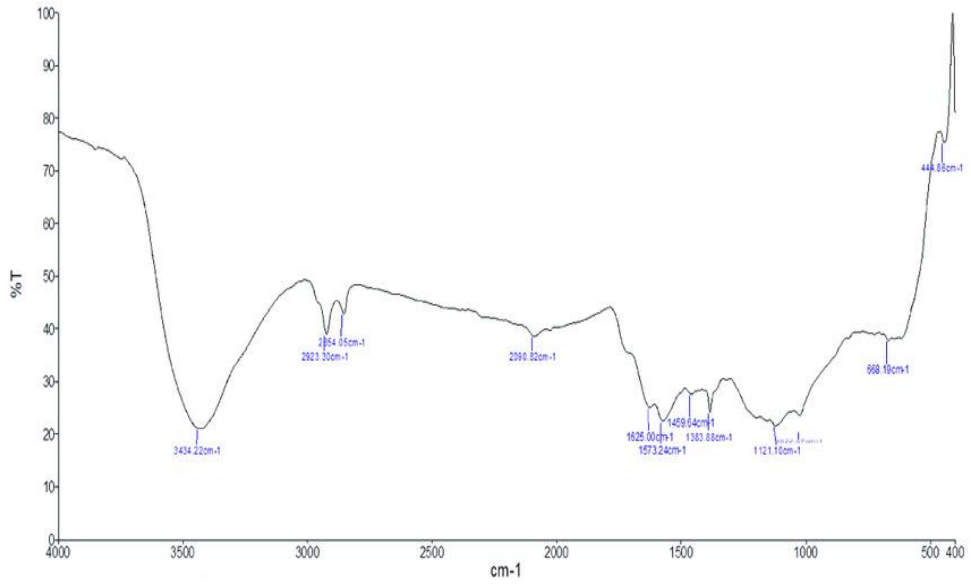

Fig7: FTIR of Herbal Gel Formulation

Table No. 7: Interpretation of FTIR Spectra of Formulation:

Functional Group	Standard Frequency	Observed Peak
N – H **Stretching**	**3400 - 3500**	**3248**
C- H **Stretching**	**2850 - 2960**	**2935**
C = C **Stretching**	**2100 - 2200**	**2160**
C = O **Stretching**	**1705 - 1725**	**1711**
C – O **Stretching**	**1520 - 1600**	**1532 – 1597**

From the above observation table, FTIR study of pure Allium cepa extract syrup Formulation observes their peak and comparing to their standard frequency of FTIR.

Table No. 8: Calibration curve of Allium cepa Extract

Sr.No	Concentration (ug/ml)	Absorbance (λmax observed at nm 257nm
2	**2**	**0.082**
3	**4**	**0.152**
4	**6**	**0.207**
5	**8**	**0.266**
6	**10**	**0.318**

Calibration curve of allium cepa extract

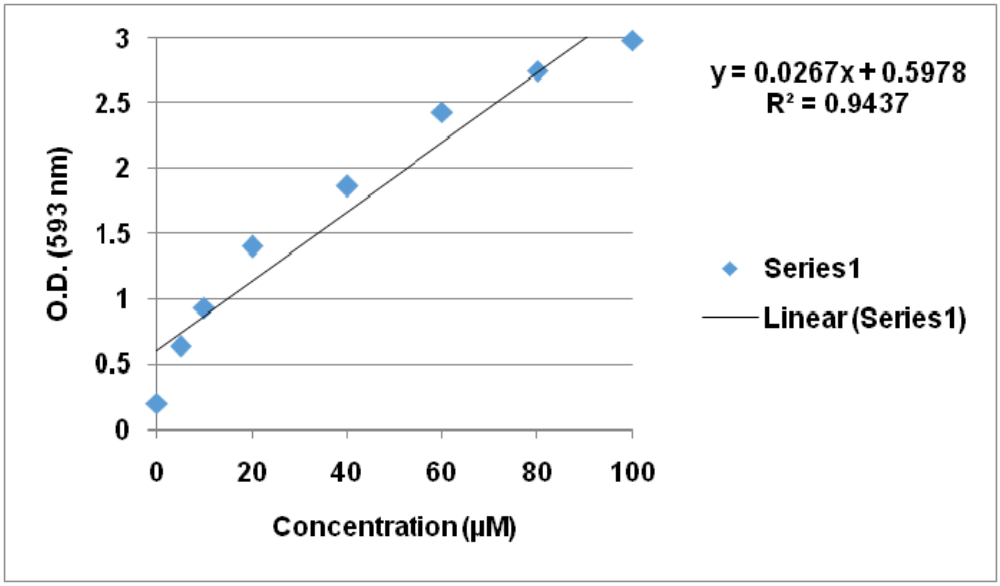

Fig 8: Calibration curve of Allium cepa Extract

FTIR (Fourier-transform infrared spectroscopy) is a technique used to analyze the functional groups present in a sample based on the absorption of infrared light. In your case, the FTIR analysis was conducted on pure Allium cepa extract and a herbal syrup formulation containing Allium cepa extract.

The interpretation of the FTIR spectra involves comparing observed peaks to standard frequencies associated with specific functional groups. Here's a breakdown of the observed peaks and their respective functional groups for both the pure Allium cepa extract and the herbal syrup formulation:

FTIR of Pure Allium cepa Extract (Fig. 6):

-C=C Stretching: Expected standard frequency range: 1450 – 1600 cm^-1; Observed peak: 1532 – 1597 cm^-1

-C=O Stretching: Expected standard frequency range: 1520 – 1600 cm^-1; Observed peak: 1532 – 1597 cm^-1

-C-O Stretching: Expected standard frequency range: 1250 – 1350 cm^-1; Observed peak: 1249 – 1362 cm^-1

-O-H Stretching: Expected standard frequency range: 1050 – 1150 cm^-1; Observed peak: 1031 – 1186 cm^-1

-C-H Stretching: Expected standard frequency range: 700 – 850 cm^-1; Observed peak: 808 – 858 cm^-1

FTIR of Herbal Syrup Formulation (Fig. 7):

-N – H Stretching: Expected standard frequency range: 3400 - 3500 cm^-1; Observed peak: 3248 cm^-1

-C- H Stretching: Expected standard frequency range: 2850 - 2960 cm^-1; Observed peak: 2935 cm^-1

-C = C Stretching: Expected standard frequency range: 2100 - 2200 cm^-1; Observed peak: 2160 cm^-1

-C = O Stretching: Expected standard frequency range: 1705 - 1725 cm^-1; Observed peak: 1711 cm^-1

-C – O Stretching: Expected standard frequency range: 1520 - 1600 cm^-1; Observed peak: 1532 – 1597 cm^-1

The observed peaks align closely with the standard frequency ranges for various functional groups, indicating the presence of these chemical bonds within the samples.

Additionally, the calibration curve of Allium cepa extract (Fig. 8) represents the relationship between the concentration of the extract and the absorbance measured at a specific wavelength (λmax observed at 257nm). This curve can be used to determine the concentration of Allium cepa extract in unknown samples by measuring their absorbance and correlating it with the established calibration curve.

This comprehensive analysis through FTIR and the calibration curve provides valuable information about the functional groups present in Allium cepa extract and offers a method for quantifying its concentration in formulations or other samples.

Discussion: - The shift towards herbal products as safer alternatives to synthetic drugs is reshaping the pharmaceutical industry. Herbs, long valued for their medicinal properties and aromatic flavors, now demand increased global utilization in pharmaceutical formulations. The herbal syrup developed in this study demonstrates potent antioxidant activity, notably due to kiwi fruit, containing around 100 mg of vitamin C per fruit. Clinical research indicates that regular kiwi consumption can reduce platelet aggregation and plasma triglyceride levels, potentially lowering the risk of colon cancer. Besides its antioxidative benefits, kiwi is known to aid sleep, benefiting those with insomnia.

Incorporating natural ingredients like kiwi into herbal formulations not only presents therapeutic potential but also aligns with the global preference for safer, natural healthcare options. By harnessing the inherent properties of herbal components, such as kiwi's antioxidants, pharmaceuticals could offer diverse health advantages—from addressing specific health risks like cancer to aiding sleep disorders. Exploring and integrating these herbal elements further could significantly enrich healthcare options worldwide.

Conclusion: -The historical reliance on medicinal plants stems from their myriad health benefits, and this study pursued the development of a new herbal syrup formulation. Comprehensive evaluations, including pH, homogeneity, appearance, spreadability, viscosity, and in-vitro diffusion studies, highlighted the superiority of syrup formulation F3. It was deduced that the Allium cepa herbal syrup, fortified with a polymer, exhibited exceptional application properties. The review underscored the extensive spectrum of effects observed in Allium cepa (onion) and its constituents across experimental and clinical studies. Experimental research indicated chemo-preventive and inhibitory effects on various stages of skin tumorigenesis and the potential of quercetin to impede metastasis and melanoma growth. Moreover, other constituents displayed inhibitory effects on cancer cell proliferation, DNA adduct formation, and radio-resistance post-radiotherapy. Clinical studies further substantiated the reduction in brain and lung cancer risks attributed to onion flavonoids. The experimental domain revealed onion's role in reducing blood glucose levels and enhancing insulin secretion, alongside pancreatic islet protection. This effect was also mirrored in clinical trials. Additionally, the inhibitory impact of onion and its constituents on platelet aggregation and TXB2 synthesis was observed experimentally and documented clinically. Onion and its components demonstrated inhibitory effects on bone resorption, osteoclast formation, and activity in experimental settings, while clinical studies supported these findings by showcasing a decrease in osteoclast activity and hip fracture rates. In the cardiovascular system, onion exhibited reductions in high blood pressure, cardiac hypertrophy, and vasodilation in experimental research. Flavonoids displayed protective effects against myocardial infarction, coronary heart disease, and atherosclerosis in clinical trials. Across various bodily systems, onion showcased promising effects such as gastrointestinal improvements, memory enhancement, anti-asthmatic actions, and positive impacts on the urogenital system in both experimental and clinical studies. While experimental studies have showcased a wide array of pharmacological effects for onion, there's a pressing need for more clinical trials to substantiate these effects before considering their application in clinical practice.

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