JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

"EXPLORING CARICA PAPAYA SEEDS EXTRACT AS A HERBAL JELLY FOR HELMINTHIASIS TREATMENT: A COMPREHENSIVE ANALYSIS"

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ABSTRACT

In many areas of the world, helminthiasis, a parasite illness brought on by numerous species, is still a serious public health issue. The major method of therapy has been conventional anti helminths medication; nevertheless, the growth of drug resistance and unfavorable side effects necessitated the investigation of alternate therapeutic approaches.

The purpose of this study is to look into the possibility of using Carica papaya seeds as a herbal jelly to treat helminthiasis.

The common papaya plant, Carica, has long been utilized in folk medicine for its anthelmintic qualities. Alkaloids, flavonoids, phenolic compounds, and carpaine, among other bioactive compounds abundant in papaya seeds that have demonstrated potential antiparasitic effects in prior research. To improve their platability and convenience of administration, papaya seeds were processed into a jelly formulation for this investigation.

Experiments conducted in vitro and in vivo are part of the research design. Using standardized laboratory procedures, the papaya seeds jelly's effectiveness against several helminthic species will be assessed during the in vitro phase. This evaluation will look at how the Jelly affects helminthic viability, motility, and egg hatching.

The formulation with the highest efficacy will be chosen for additional in vivo investigations after the positive invitro evaluation. Papaya seed jelly will be administered to helminth-infected animal models in order to evaluate its therapeutic potential. To assess the effectiveness and safety of the therapy, variables like worm burden reduction, fecal egg count, and histological analyses will be examined.

The results of this investigation should shed important light on the possible application of carica papaya seeds jelly as a substitute therapy for helminthiasis. If successful, this herbal Jelly might provide a sustainable, affordable, and accessible solution for the population impacted by helminthic infection, especially in regions with restricted access to sources. To clarify the underlying mechanism of action and improve the formulation for therapeutic usage, more study is necessary.

KEYWORDS: Carica papaya, helminthiasis, anthelmintic, herbal jelly, bioactive compounds, natural alternatives, parasitic infection, synthetic drugs, clinical efficacy, safety.

INTRODUCTION

Helminthiasis, a group of parasitic illnesses caused by several types of helminths (worms), affects millions of people globally, primarily in developing countries.

These infections have the potential to cause significant morbidity and death, especially in young infants and those with compromised immune systems. The conventional therapy for helminthiasis includes the use of medications. Resistance and negative side effects have highlighted the need for alternate treatment strategies.

The use of herbal medicine as a complementary therapy for a number of ailments, including parasitic infections, has gained popularity in recent years. Traditional medicine has traditionally utilized the papaya tree, or Carica papaya, a tropical fruit.

The compounds have the power to obstruct helminth formation, growth, and survival. If the therapeutic potential of carica papaya seeds for the treatment of helminthiasis is to be completely realized, it is imperative to develop an appropriate formulation that ensures the efficient delivery of the active components.

Improved palatability, ease of administration, and the possibility for sustained engagement with intestinal parasites are all advantages of a herbal jelly formulation.

A soft, semi-solid preparation with both big and tiny drug particles is referred to as "jelly" in this context. Jelly candies are now especially well-liked by children because they like chewing them and because they provide an alternative to solid and liquid dosage forms. They might also be utilized as the preferred means of administering medications.

Oral administration is preferred because it is simpler to administer and results in better patient compliance. According to the dose plan, which was designed precisely for the patient's lifestyle, the medication is given as directed. Adherence can be decreased with a low-dose regimen (one tablet, once day).

Orally ingested medications travel through the GIT before being discharged in a solution at or close to the location where drug absorption is most likely to occur.For the absorption and dissolution of drugs, the amount and velocity of GI fluid might vary dramatically. Additionally, transit times in various parts of the GIT may vary based on the size of the person and geographical circumstances.

These infections can significantly increase morbidity and death, especially in young people and those with compromised immune systems. The conventional method of treating helminthiasis includes the use of drugs. Growing interest in herbal medicine as a complementary therapy for many illnesses, including parasite infections, has been observed in recent years.

MATERIALS AND METHODS:

INSTRUMENTS LISTS:

S.NO	EQUIPMENTS	SUPPLIER
1	Digital Balance	Shree Ji Instruments
2	IR Spectrophotometer	Perkin Elmer Spectrum Two
3	UV-VIS Spectrophotometer	Aligent Technologies
4	Magnetic Stirrrer	HixonInstrument,Grover Enterprises
5	Melting Point	Nutronics
6	Viscometer	Dve viscometer (USA)
7	Sonicator	Sonar (INDIA)
8	pH meter	Elico (JAPAN)
9	Dissolution Apparatus	Electro Lab

CHEMICALS LISTS:

S.NO	MATERIALS USED	MANUFACTURING SUPPLIER
1	Papaya Seeds	Near By Market
2	Glycerine	Central Drug House pvt.ltd
3	Propylene glycol	Central Drug House pvt.ltd
4	Gelatine	Central Drug House pvt.ltd
5	Sugar	Central Drug House pvt.ltd
6	Citric Acid	Central Drug House pvt.ltd
7	Methanol	Central Drug House pvt.ltd

METHODOLOGY:

► Pre formulation study related to Dry Seeds Extract Powder

- Organoleptic Properties
- Melting Point
- Solubility Studies
- Identification of Pure Drug

- Standard Curve Of Benzylisothiocynate Polyconstituent Present In The Extract

► Selection Of Co-Formulating agent for Formulation Development

►Prepared Oral Jelly

► Evaluation Of Oral Jelly

- Organoleptic properties
  1. Appearance
  2. Texture
  3. Sugar crystallisation
  4. Stickiness and grittiness
- Viscosity
- Spreadability
- Weight Variation
- Taste Analysis
- Drug Content Uniformity
- In Vitro Drug Release
- Ph

RESULT AND DISSCUSION:

Chemical tests of high quality for anthelmintic drug extracts.

Constituent	Aq.Extract
Flavonoids	+
Tannins	+
Alkaloids	+
Steroids	+
Glycosides	-

+(Present) –(Absent)

Organoleptic Properties:

S.no	Properties	Result
1	Description	Solid
2	Colour	Brownish Black
3	Odour	Pungent

Discussion; Using physical and optical methods, the organoleptic qualities of a herbal powder were studied. The provided standard observed data were matched with the observed attributes.

Solubility Studies:

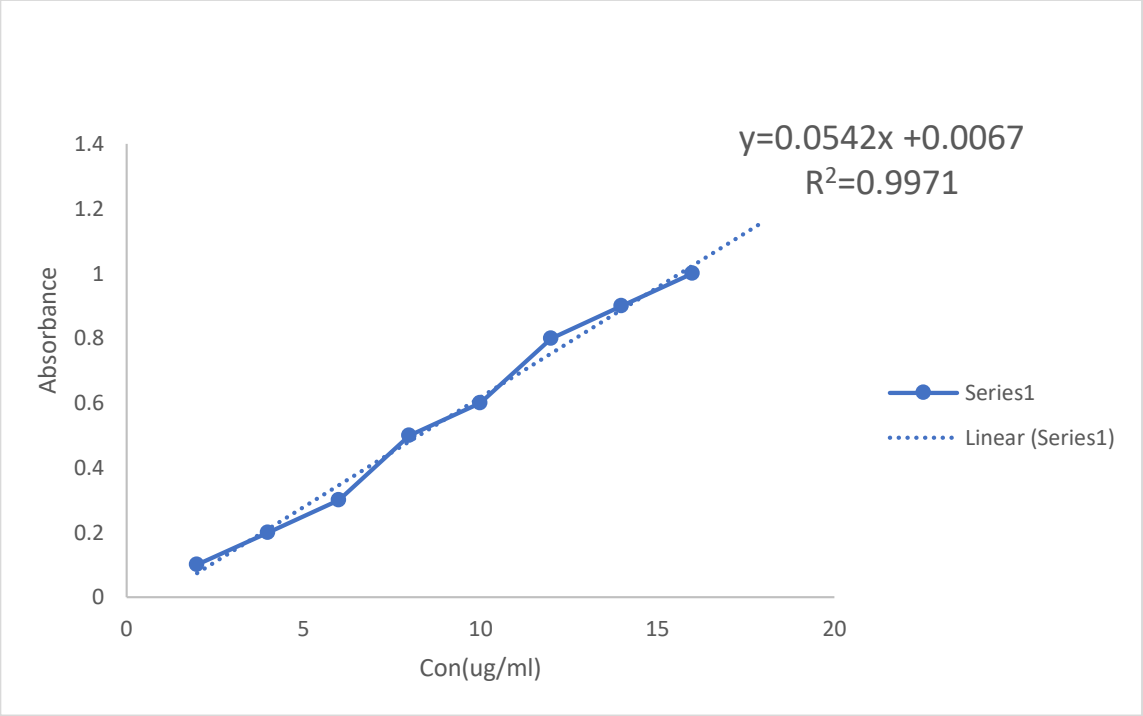
S.no	Solvents	Concentration	Report
1	Water	12.5033	Sparingly soluble
2	Ethanol	65.4014	Soluble
3	Phosphate Buffer 6.8	44.415	Soluble

Discussion: According to observation, herbal powder is only weakly soluble in water, ethanol, and phosphate buffer 6.8.

Calibration Curve Of Herbal Powder

Herbal powder standard calibration was made in phosphate buffer 6.8.

S.no	Concentration	Absorbance (nm)
1	2	0.1181
2	4	0.2243
3	6	0.3252
4	8	0.4520
5	10	0.5481
6	12	0.6295
7	14	0.7875
8	16	0.8730

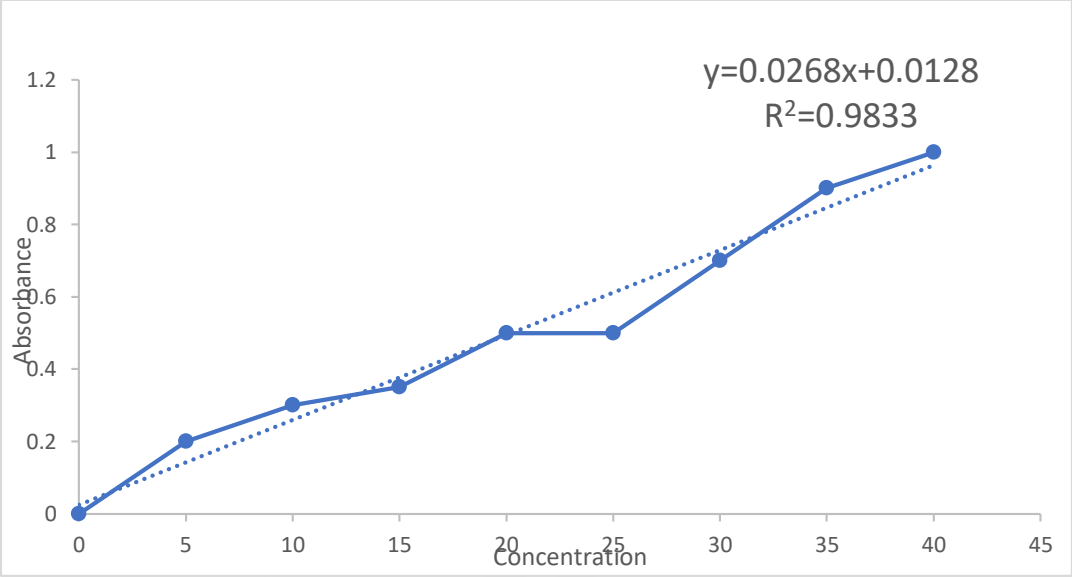


Curve of calibration for phosphate buffer

Discussion: Between concentration and absorbance is a standard curve. R2 was determined to be 0.9971 in value.So, more calculations may be made using the equation.

The standard calibration of herbal powder was prepared in water

S.no	Concentration (ug/ml)	Absorbance (nm)
1	0	0
2	5	0.2156
3	10	0.2864
4	15	0.3586
5	20	0.5314
6	25	0.6340
7	30	0.8522
8	35	0.9820

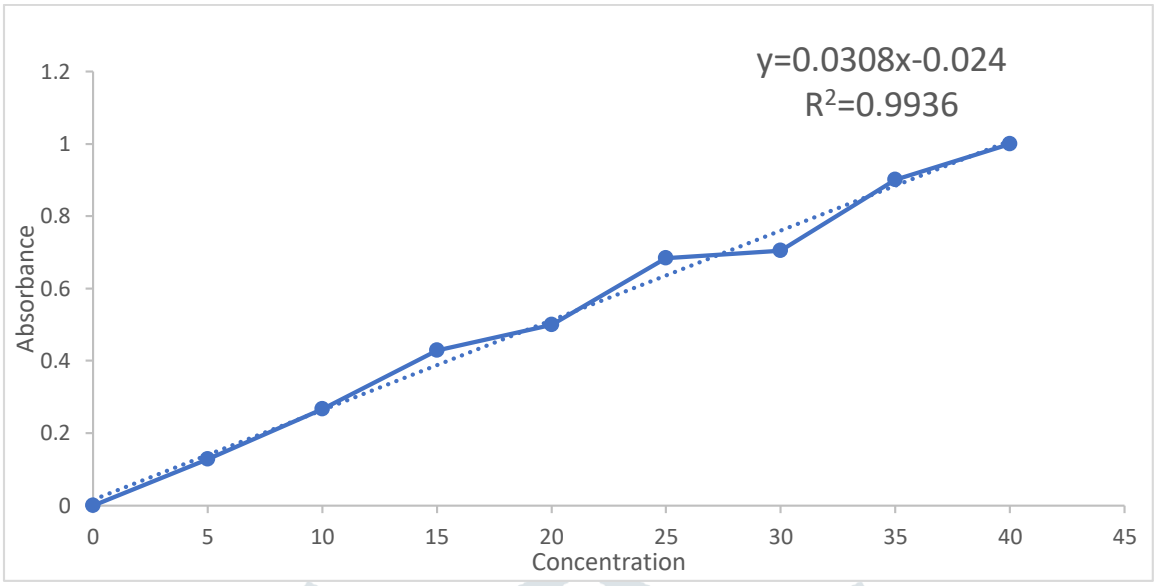


Curve of calibration for water.

Discussion: Between concentration and absorbance is a standard curve. R2 was determined to have a value of 0.9833.Therefore, more calculations may be made using the equation.

Herbal powder standard calibration was made in ethanol:

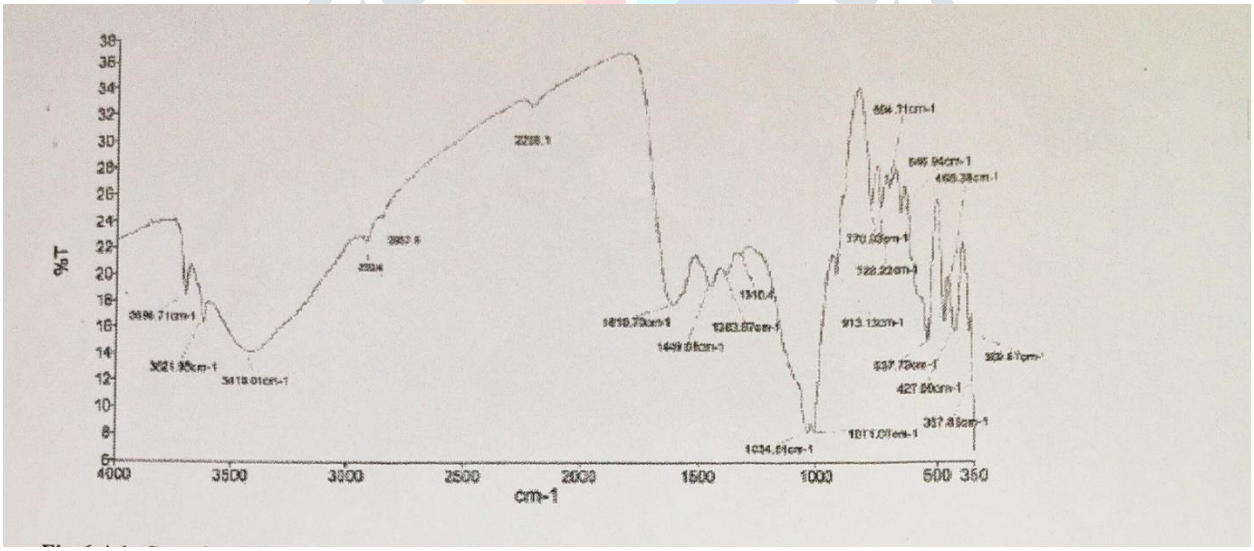
S.no	Concentration (ug/ml)	Absorbance (nm)
1	0	0
2	5	0.1270
3	10	0.2659
4	15	0.4287
5	20	0.6201
6	25	0.6838
7	30	0.9168
8	35	1.0801



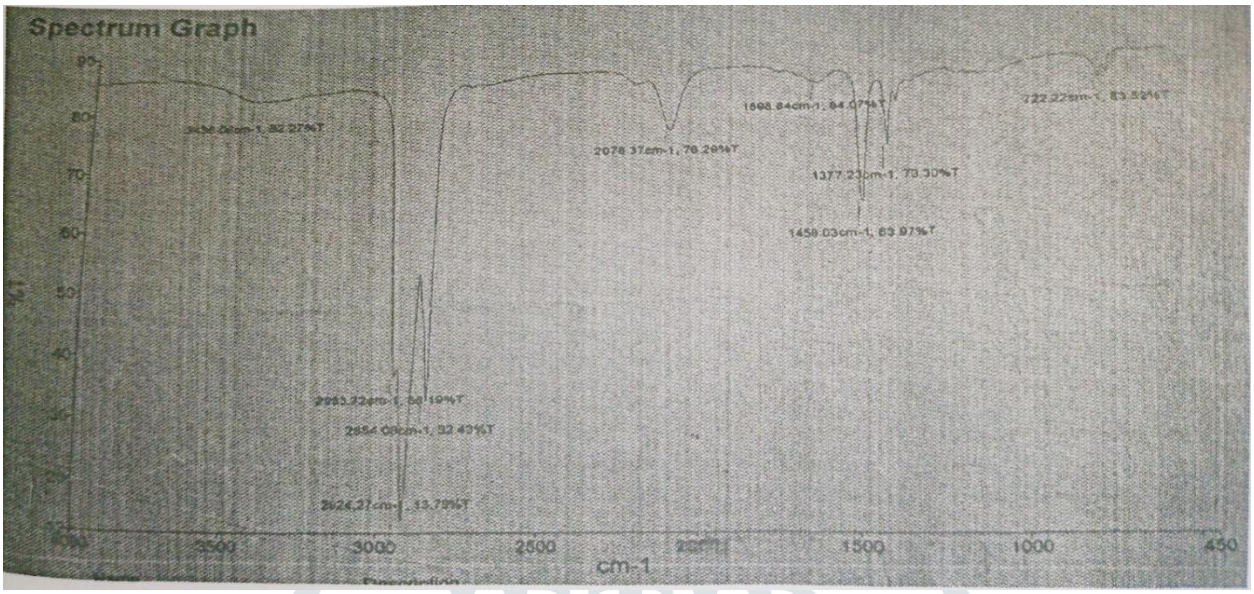
Curve of calibration for ethanol.

Discussion: Between concentration and absorbance is a standard curve. R2 was determined to have a value of 0.9936.Therefore, more calculations may be made using the equation.

FTIR is used to determine the presence of the active ingredient (Benzyl isothiocynate) in the herbal powder.



Standard FTIR Of Papaya Seed Extract



Co-formulating agent selection for formulation development

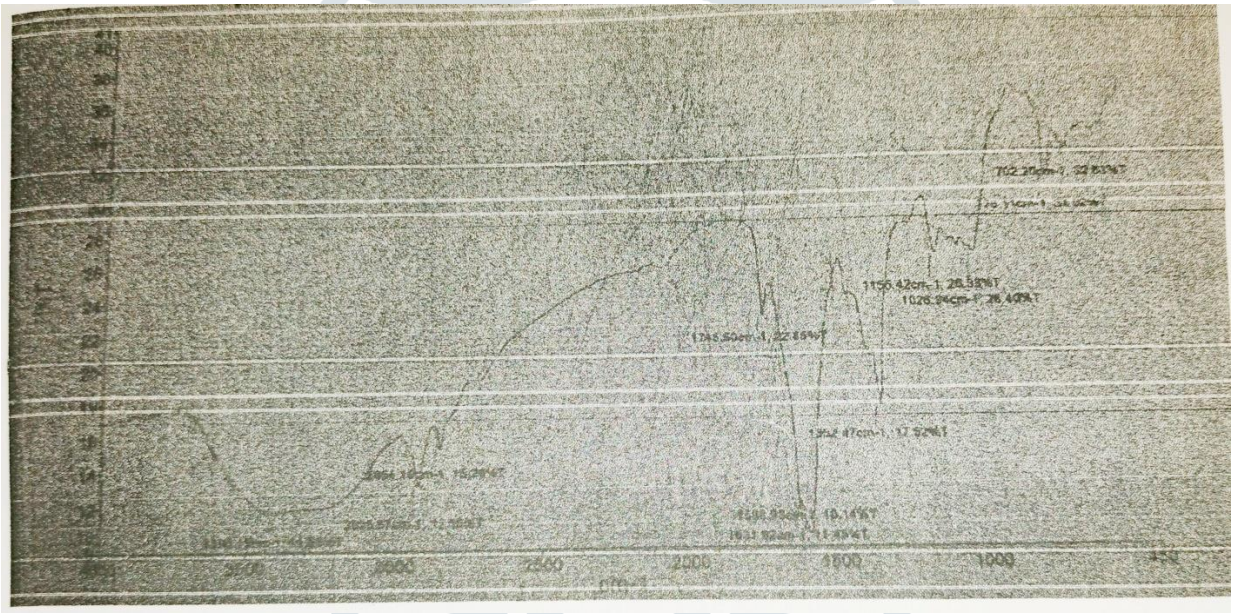
Ingredients	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8
Herbal extract (ul)	10	10	10	10	10	10	10	10
Pectin (%)	2	3	-	-	-	-	-	-
Carrageenan (%)	-	-	2	3	-	-	-	-
Gelatine (%)	-	-	-	-	2	3	-	-
Sodium alginate(%)	-	-	-	-	-	-	2	3
Glycerine (ml)	2	2	2	2	2	2	2	2
Citric acid (%)	1	1	1	1	1	1	1	1
Dextrose (%)	60	60	60	60	60	60	60	60
Distilled Water	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s
Propylene Glycol (ml)	3	3	3	3	3	3	3	3

Observation And Result:

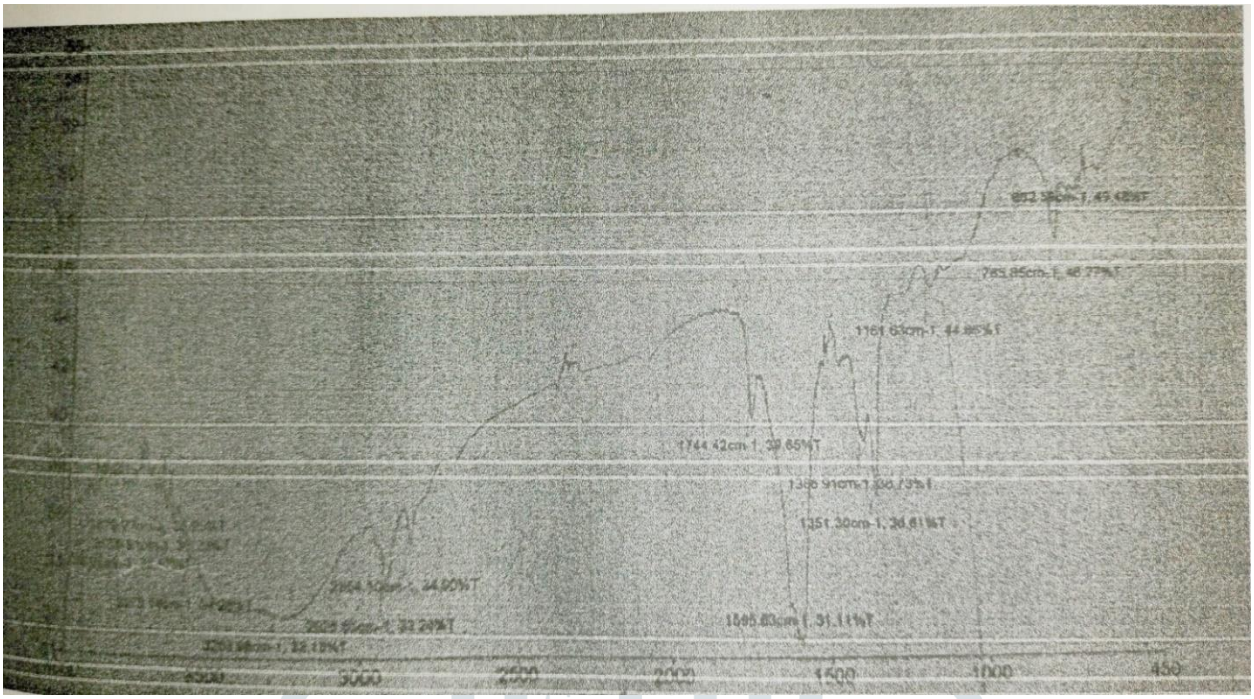
Trials	Observation	Result
Trials 1	Not formed due to improper consistency	Not Selected
Trials 2	Do not have satisfactory stability	Not Selected

Trials 3	Not formed due to excessive accumulation of water droplets and too sticky	Not Selected
Trials 4	Too thick and undesirable texture	Not Selected
Trials 5	Formed but not soluble	Not Selected
Trials 6	Satisfactory stability and consistency	Not Selected
Trials 7	Not formed due to excessive accumulation of water droplets and too sticky	Not Selected
Trials 8	Not formed due to presence of excessive fluid	Not Selected

Study of the Relationships Between Herbal Powder And Excipients.



FTIR Of Herbal Powder And Sodium Alginate



FTIR Of Herbal Powder And Gelatine

Interpretation data:

S.no	Herbal Powder	Herbal Powder +gelatine	Herbal Powder +sodium alginate	Standard frequency range cm^{-1}	Interpretation
1	1598.84	1595.63	1598.98	1600-1200	Alkyl compound
2	722.22	776.11	765.85	950-600	Aromatic bending c=c
3	2924.27	2925.65	2924.67	3000-2850	C-H

Discussion: The compatibility of drug excipients was studied using FTIR.There is no discernible difference between the peaks of the herbal powder and polymer when the primary peak of the medication is matched with those of the polymers. Therefore, it may be said that there was no potential for medication and polymer interaction.

Various Herbal Oral Jelly Evaluation Criteria

Organoleptic Properties:

Formulation Code	Appearance	Texture	Sugar Crystallization	Stickiness and Grittiness
S1	Translucent but water bubbles are found	Smooth	No	Slightly sticky &gritty
S2	Translucent with uniform consistency	Smooth	No	Non-sticky & less gritty
S3	Translucent uniform consistency	Smooth	No	Non-sticky & less gritty
S4	Translucent but Slightly thick	Smooth	No	Non-sticky & less gritty

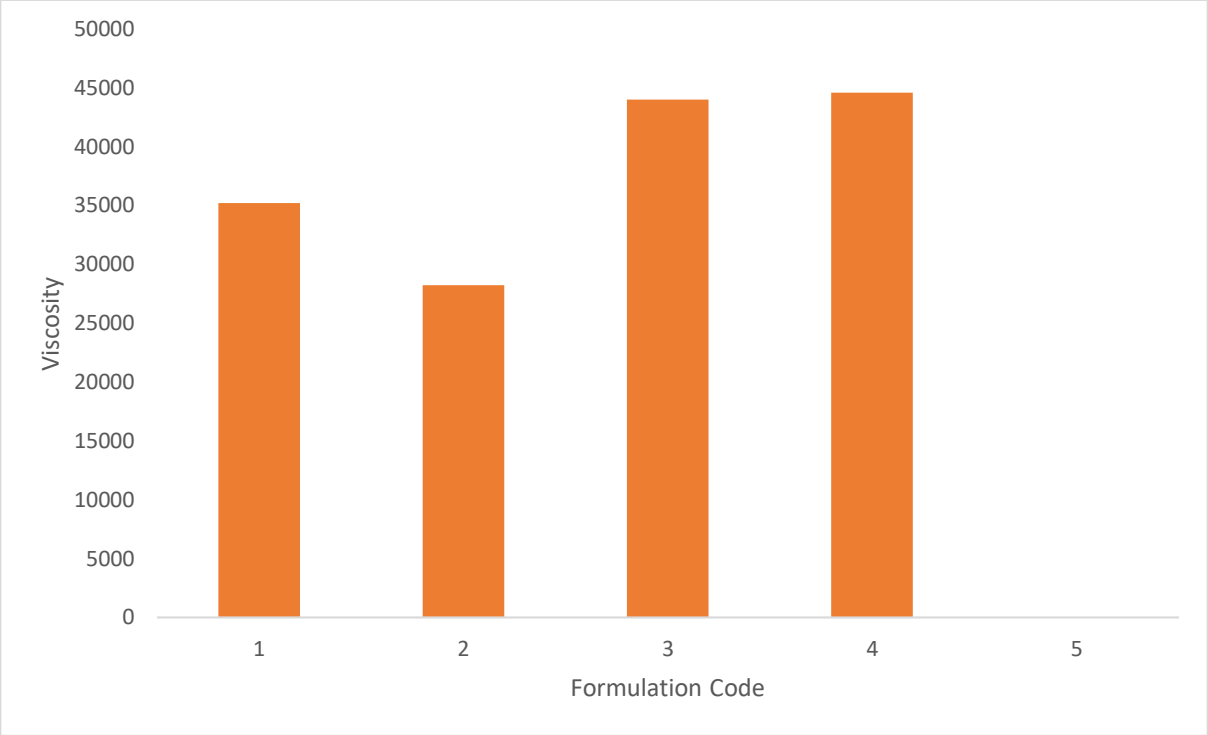
pH

Formulation Code	pH ± S.D (n=3)
S1	7±0.404
S2	6.8±0.321
S3	6.7±0.267
S4	6.9±0.503

Dicussion: The pH range for jellies, which impacts their flavor and stability, is 6.90.503 to 7.40.404, which is close to neutral. at order to maintain pH, citric acid is only supplied at the bare minimum.

Viscosity:

Formulation Code	Viscosity (cps)
S1	35200
S2	28200
S3	44000
S4	44600

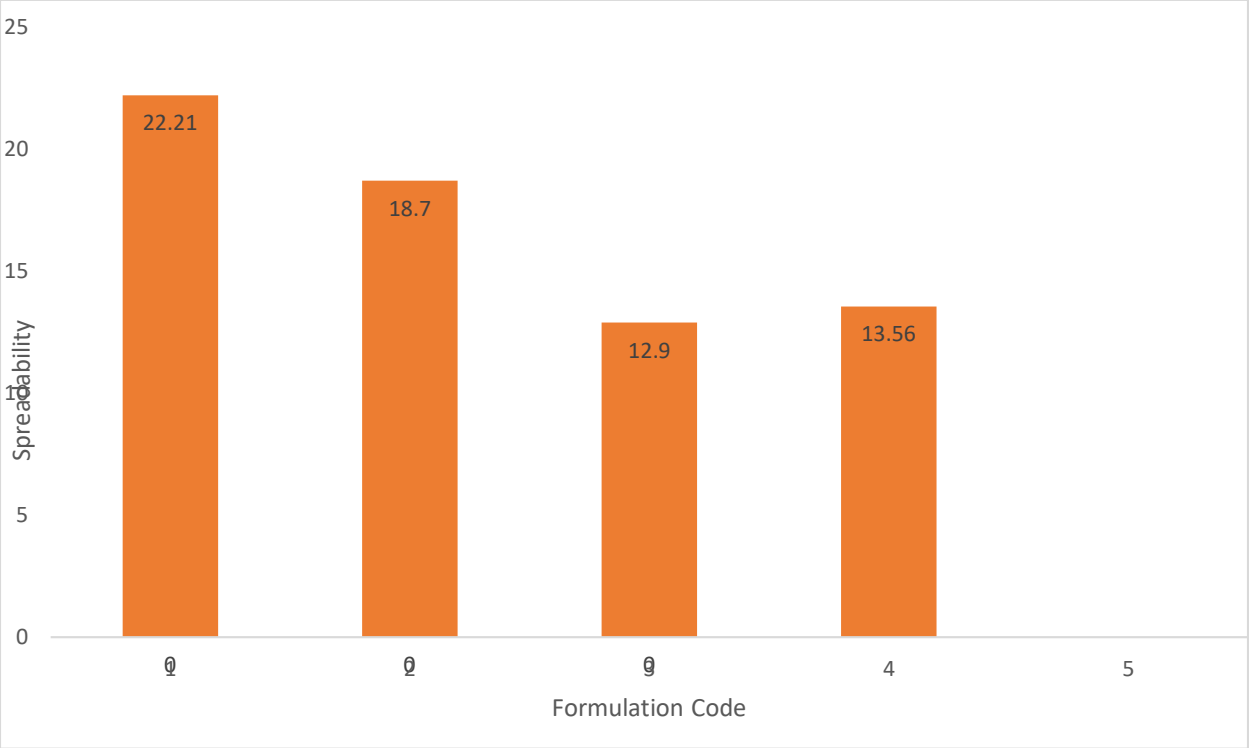


Shows the viscosity determination of different formulation.

Discussion: The range of the viscosity was 44600–28200 cps. The drug flow rises as the viscosity decreases.

Spreadability:

Formulation Code	Spread ability ± S.D (n=3)cm^2
S1	22.21 ± 0.15
S2	18.70 ± 0.09
S3	12.90 ± 0.12
S4	13.56 ± 0.14

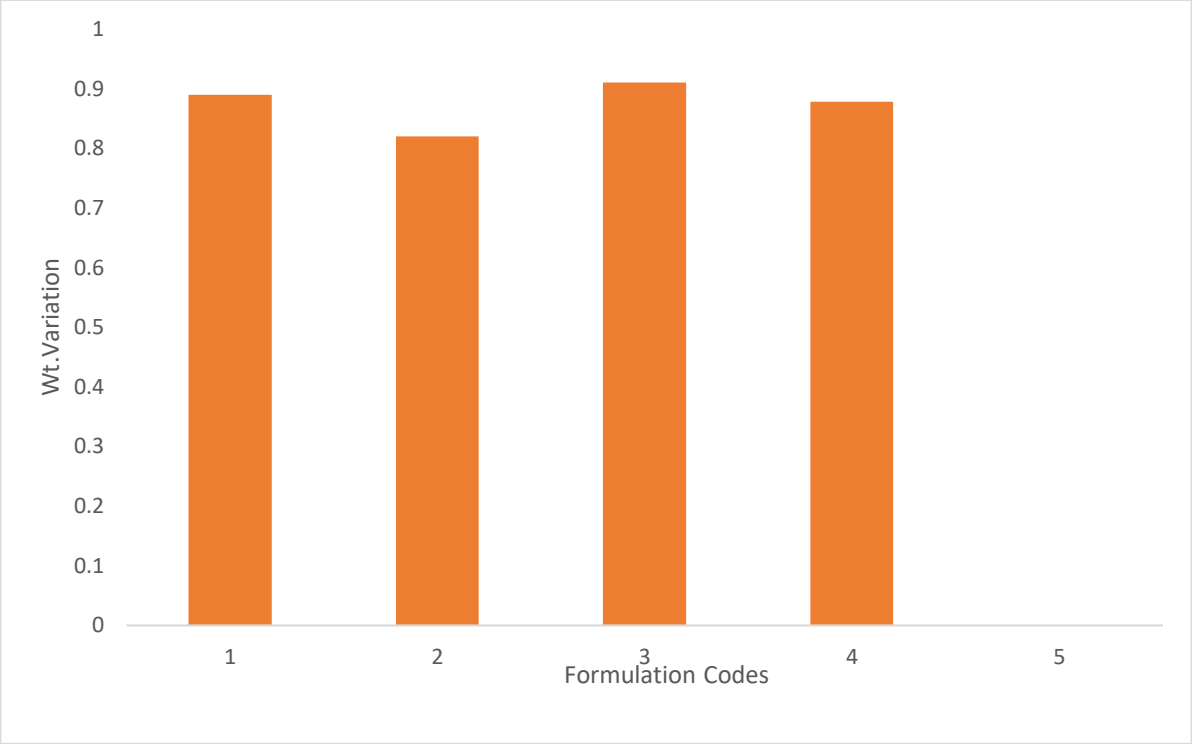


Displays the determination of viscosity for several formulations.

Discussion: With an increase in gelling agent concentration, it was discovered that the formulation's spreadability decreased.

Weight Variation:

Formulation Code	Weight Variation ± S.D (n=3)
S1	0.87 ± 0.0222
S2	0.82 ±0.0385
S3	0.91 ±0.0308
S4	0.878 ± 0.025



Displays the weight fluctuation among several formulations.

Discussion: The range of Weight Variation Varies From 0.82gm to 0.91gm.

Syneresis:

Formulation Code	Synergies
S1	No
S2	No
S3	No
S4	No

Discussion: At the given temperature, no synergies were found in the improved formulation.

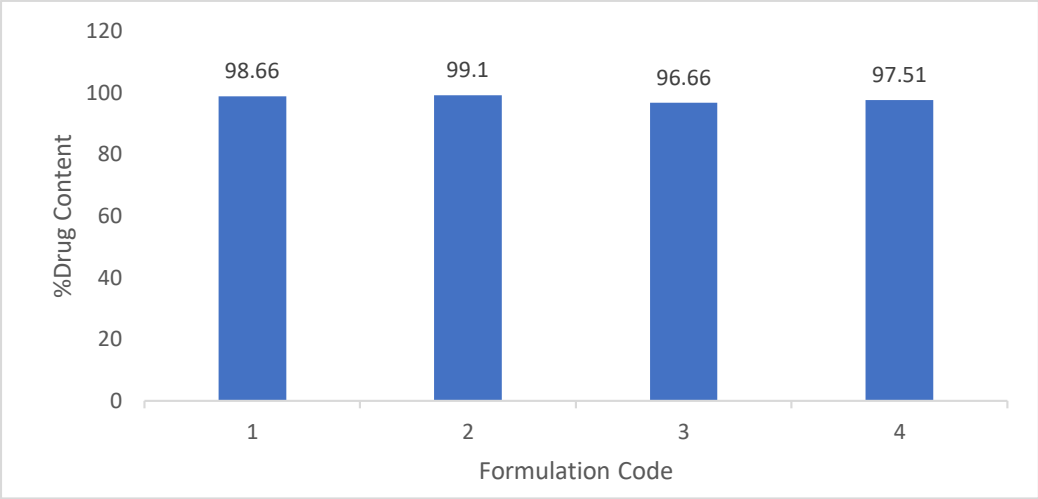
Taste Analysis:

Formulation Code	Taste Analysis
S1	1.82%
S2	0.97%
S3	0.92%
S4	0.87%

Discussion: The range of the taste determination, which falls between the scales of no bitterness and threshold bitterness, is between 0.87% and 1.82%. Therefore, it may be connected to flavor and sensation.

Drug Content Uniformity:

Formulation code	Drug content ± S.D(n=3)
S1	98.66±0.428
S2	99.10±0.502
S3	96.66±0.297
S4	97.51±0.492



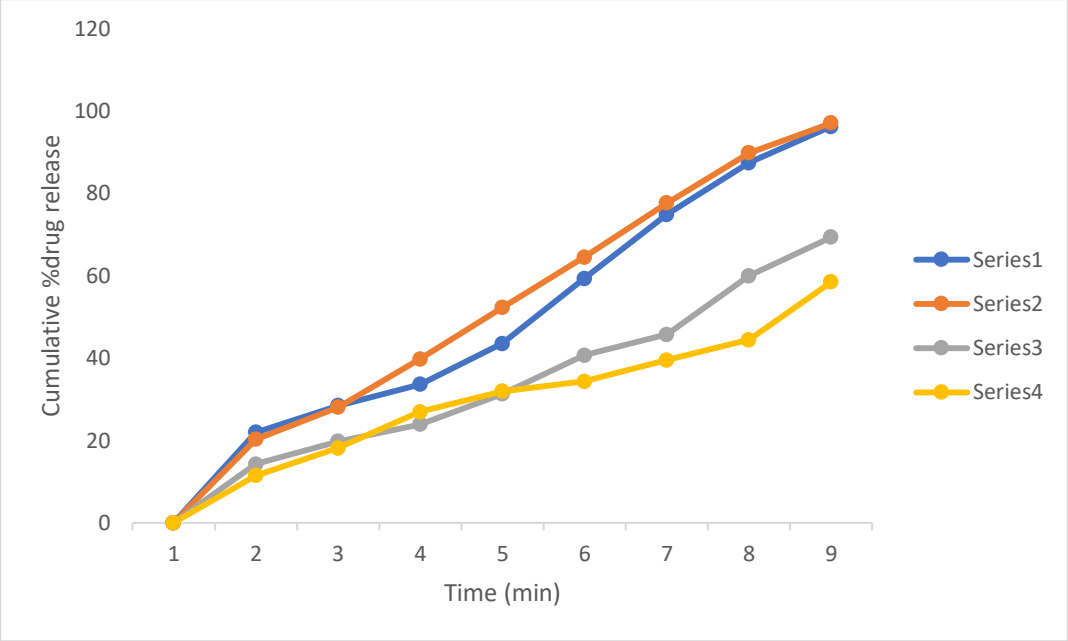
Showing Percent Drug Content

Discussion: The formulation's medication content was discovered be 99.1%.

In-Vitro Drug Release Studies:

S.NO	Time	Cumulative Percent Drug Release (%C.R)			
Formulation Code - >		SF1	SF2	SF3	SF4
1	0	0	0	0	0
2	5	23	20.28	14.28	11.5
3	10	28.43	27.04	18.8	18.14
4	15	32.64	38.61	23.94	26.94

5	20		42.57	52.26	30.28	31.94
6	25		59.33	62.50	40.71	32.20
7	30		74.85	77.62	45.71	38.54
8	35		85.44	89.81	58.99	44.42
9	40		96.21	96.08	69.39	58.52



%CR And Time Relationship Of The In-Vitro Drug Release Model.

Discussion: The drug release of formulations SF1 to S4 in vitro was investigated. The levels displayed by each formulation vary, ranging from 58.52 to 97.08%.It has been determined that the considerable drug release of SF1 and SF2 (96.21% and 97.08%) is shown by the low concentration of the gelling agent. The SF1 and SF2 formulations include the least amount of gelling agent.

Kinetic Studies:

Formulation SF1:

S.NO	Time	Square Root of time	Log Time	Cumulative Percent Drug Release	Log cumulative percent drug release	Log Cumulative percent drug remaining
1.	0	0	0	0	0	0
2.	5	2.23	0.698	23	1.36	1.886
3.	10	3.16	1	28.43	1.453	1.854

4.	15	3.87	1.17	33.65	1.526	1.821
5.	20	4.47	1.301	43.57	1.639	1.751
6.	25	5	1.397	59.33	1.726	1.609
7.	30	5.47	1.477	74.85	1.874	1.400
8.	35	5.91	1.544	87.44	1.941	1.098
9.	40	6.32	1.620	96.21	1.983	0.578

Formulation SF2:

S.NO	Time	Square Root of time	Log Time	Cumulative Percent Drug Release	Log cumulative percent drug release	Log Cumulative percent drug remaining
1.	0	0	0	0	0	0
2.	5	2.23	0.698	20.248	1.3070	1.901
3.	10	3.16	1	28.04	1.4477	1.857
4.	15	3.87	1.17	39.81	1.599	1.779
5.	20	4.47	1.301	52.26	1.718	1.678
6.	25	5	1.397	64.50	1.809	1.550
7.	30	5.47	1.477	77.69	1.890	1.3484
8.	35	5.91	1.544	89.81	1.953	1.008
9.	40	6.32	1.620	97.08	1.9871	0.465

Formulation SF3

S.NO	Time	Square Root of time	Log Time	Cumulative Percent Drug Release	Log cumulative percent drug release	Log Cumulative percent drug remaining
1.	0	0	0	0	0	0
2.	5	2.23	0.698	14.28	0.1072	1.933
3.	10	3.16	1	19.8	1.296	1.904
4.	15	3.87	1.17	23.95	1.379	1.881
5.	20	4.47	1.301	31.28	1.495	1.837
6.	25	5	1.397	40.71	1.609	1.772

7.	30	5.47	1.477	45.56	1.658	1.735
8.	35	5.91	1.544	59.99	1.7749	1.602
9.	40	6.32	1.620	69.39	1.8412	0.465

Formulation SF4:

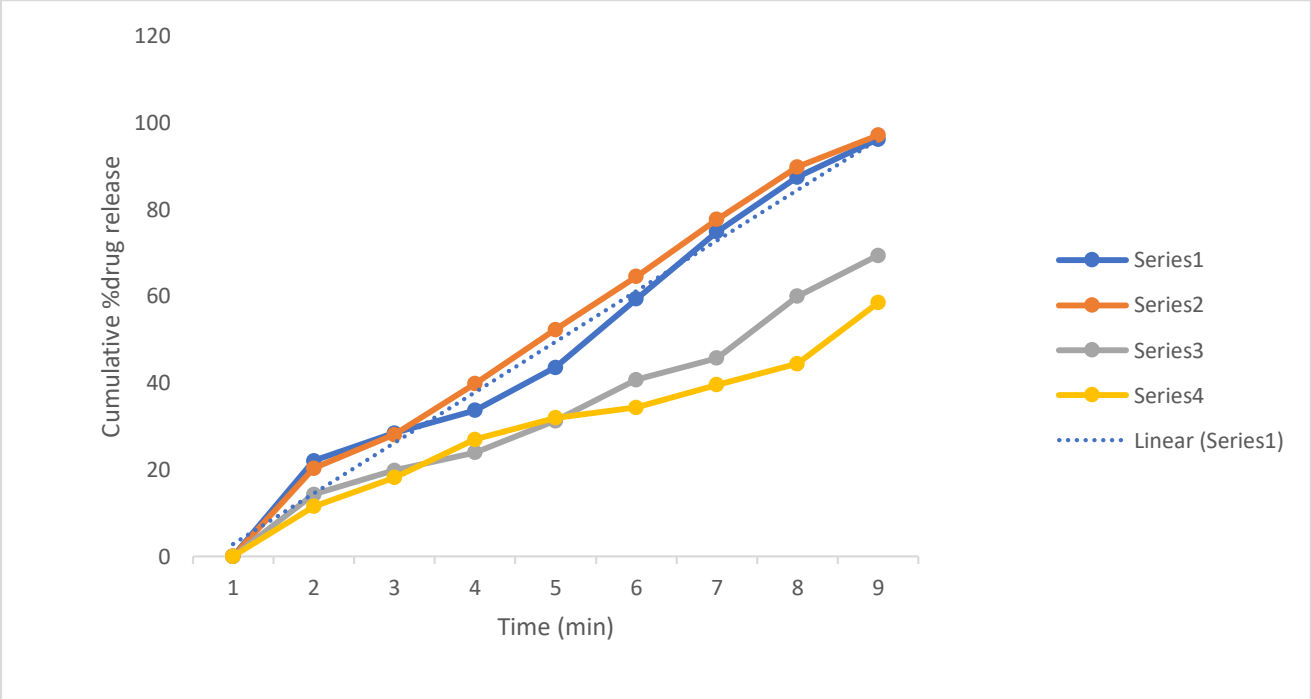
S.NO	Time	Square Root of time	Log Time	Cumulative Percent Drug Release	Log cumulative percent drug release	Log Cumulative percent drug remaining
1.	0	0	0	0	0	0
2.	5	2.23	0.698	11.5	0.1060	1.946
3.	10	3.16	1	18.14	1.258	1.913
4.	15	3.87	1.17	26.94	1.430	1.863
5.	20	4.47	1.301	31.94	1.504	1.832
6.	25	5	1.397	34.32	1.535	1.816
7.	30	5.47	1.477	39.54	1.597	1.781
8.	35	5.91	1.544	44.44	1.6477	1.744
9.	40	6.32	1.620	58.52	1.7673	1.617

Drug Release Kinetic With Model Fitting

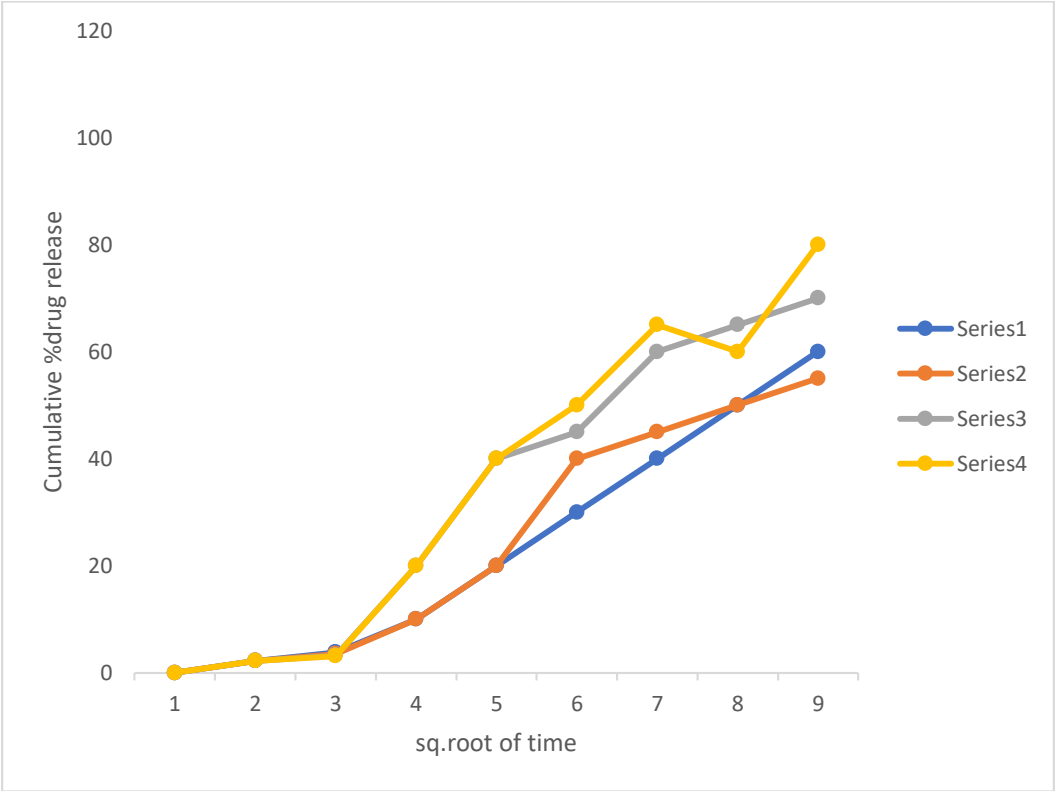
Formulation Code	R^2			n value	Best fit model	Mechanism of release
	Zero order	First order	Higuchi matrix			
SF1	0.9813	0.8291	0.9026	0.727	Zero order	Non-fickian diffusion

SF2	0.9944	0.8586	0.937	0.795	Zero order	Non-fickian diffusion
SF3	0.9814	0.9182	0.8963	1.681	Zero order	Supercase II transport
SF4	0.9686	0.9209	0.9376	0.73	Zero order	Non-fickian diffusion

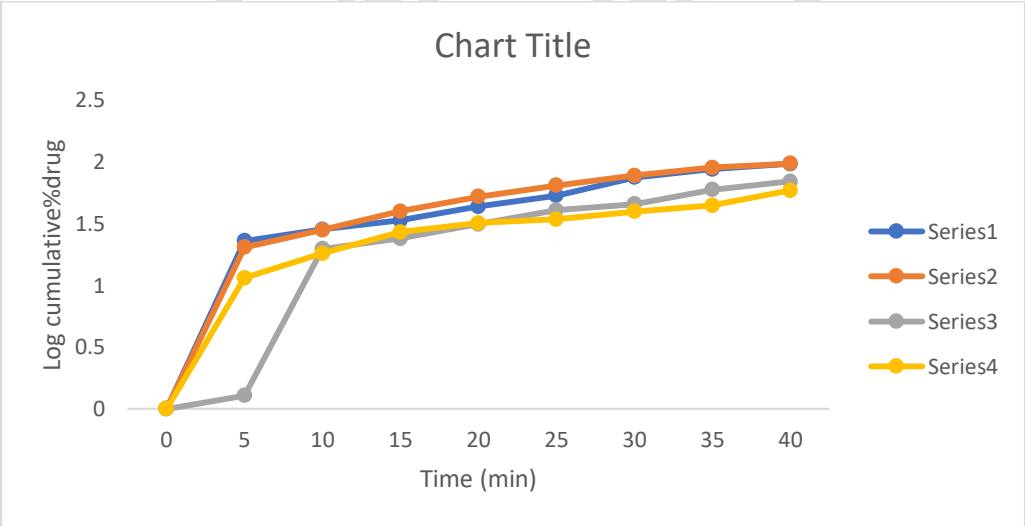
Cumulative %Drug Release and Time Kinetic Release Model of Zero Order Release.



Model of Kinetic Release With Zero Order Between Cumulative Drug Release Percentage And Time.



Log Cumulative% Drug Release And Time Kinetic Release Model Of First Order Release.



Discussion: The drug release pathways are shown using drug release kinetic models. To determine the best fit model, different models, including zero order, Higuchi, and first order, are utilized to calculate the R2 value and n-value. By comparing the n-value, which comes from the Korsemeyer-Peppas model, for all the formulations, the R2 value was determined to be the best match model. An equation was used to describe the release mechanism.

CONCLUSION

A papaya seed polyherbal extract was used to test and make jellies. The study's focus was on benzylisothiocynate, an important phytonutrient present in papaya seeds. The jellies were examined for numerous properties, including pH, viscosity, and medication release, among others. They were created using different gelling agents and multi plant extracts.

To encourage patient compliance, herbal jellies were produced in a variety of shapes and sizes, and they have shown some potential taste-masking qualities.

Spreadability tests are performed to make sure the jelly is not brittle, hard, or gritty in any other manner. It was shown that the spreadability of the formulation diminishes as the gelling agent concentration rises and should spread to the oral cavity as the thickness lowers.

From 0.910.0306 g to 0.8120.0385 g are lost in weight. The new formulation did not display syneresis, which causes the de-swelling, at the specified temperature. The taste assessment ranged between threshold bitter and no bitterness, or 0.87% to 1.82%. It is straightforward for pediatricians to give and might thus be connected to enhanced taste and sensation.

Investigations into the invitro drug release of formulations S1 to S4 revealed that formulation S2 contained a 99.12% drug content. Each formulation's drug release levels range from 58.52 to 97.08%.S1 and S2 drug releases are significant at low gelling agent concentrations, according to assessments (96.21% and 97.08%, respectively).

The least quantity of gelling agent is included in the S1 and S2 formulations. there are many different kinetics models, such the Higuchi and first order The best-fitting model for the Korsmeyer Peppas model is determined by its highest R2 value, and the drug release mechanism is determined by its n value.

The collected data shows zero-order release in all formulations, or medication release independent of concentration. Formulas S1, S2, and S4 exhibit non-fickian diffusion, but S3 exhibits supercaseII transport, which is dependent on the drug's release and the degradation of the polymeric chain.

The newly created herbal anthelmintic jelly is more delicious and alluring than any previous oral pharmaceutical administration system. Patient compliance is improved by regulating the gelling agent's viscosity, the rate of medication release, and the drug's plasma level.

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