



## Formulation and evaluation of antiinflammatory gel from the leaves extract of *Acalypha indica*

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### Abstract

Topical application of gel at pathological sites offer great advantage in a faster release of drug directly to site of action, independent of water solubility of the drug as compared to cream and ointments. Some of these systems are as clear as water in appearance, visually aesthetically pleasing as in gelatin deserts and other are turbid. The clarity range from clear to a whitish translucent. The polymer are used between 0.5 – 15% and in most of the cases they are usually at the concentration between 0.5 – 2%. Gels are usually clear transparent semisolid containing the solubilized active substances. Thus facts have clearly indicated that a formulation and development of a gel based topical dosage from Anti-inflammatory drug will be proved to be worth life. Hence a study on formulation and evaluation of gels for a new antibacterial drug *Acalypha indica* was selected as The principle object of this work. The main aim of the present study was to formulate and evaluate a natural anti-inflammatory gel by using different polymers. The *Acalypha indica* gel formulation was optimized on the basic of different physical parameters. Studies mainly carried out for pH, viscosity, Spreadability, Extrudability, in vitro and stability studies. Various formulation of *Acalypha indica* leaves extract gels were formulated by using various polymers such as CMC Na, HPMC K100, HPMC K4M, and Carbomer 940. Thus by the addition of suitable neutralizing agents both formulations are made more elegant and applicable for skin pH.

**Keywords:** *Acalypha indica*, carboxy methyl cellulose sodium, hydroxy propyl methyl cellulose

### Introduction

Gels are semisolid systems in which a liquid phase is constrained within a three dimensional polymeric matrix consisting of natural or synthetic gums in which a high degree of physical (or sometimes chemical) cross-linking has been introduced. Topical application of gel at pathological sites offer great advantage in a faster release of drug directly to site of action, independent of water solubility of the drug as compared to cream and ointments. Some of these systems are as clear as water in appearance, visually aesthetically pleasing as in gelatin deserts and other are turbid.

The clarity range from clear to a whitish translucent. The polymer are used between 0.5 – 15% and in most of the cases they are usually at the concentration between 0.5 – 2%. Gels are usually clear transparent semisolid containing the solubilized active substances. A colloid in which the disperse phase has combined with the dispersion medium to produce a semisolid material, such as a jelly. A continuous solid network enveloped in a continuous liquid phase, the solid phase typically occupies less than 10% volume of the gel.

Gels can be classified in terms of the network structure. The network may consist of agglomerated particles (formed, for

example, by destabilization of a colloidal suspension a "house of cards" consisting of plates (as in clay) or fibers; polymers joined by small crystalline regions; or polymers linked by covalent bonds.

### Advantages<sup>[3]</sup>

- Avoidance of first pass metabolism
- Convenient and easy to apply
- Avoidance of the risks and inconveniences of intravenous therapy and of the varied conditions of absorption, like pH changes, presence of enzymes, gastric emptying times etc.
- Achievement of efficacy with lower total daily dosage of drug by continuous drug input.
- Avoids fluctuation in drug levels, inter- and inpatient variations.
- Ability to easily terminate the medications, when needed.

### Materials and Extraction

#### Materials used

*Acalypha indica*, Carboxy methyl cellulose Sodium, Hydroxy propyl methyl cellulose, Propyl Paraben, Glycerin, Ethyl Acetate, Try ethanolamine

### Preparation of the *Acalypha indica* extract

The Leaves of *Acalypha indica* were dried under shade and then powdered with a mechanical grinder. The powder was passed through sieve no. 40 and stored in an airtight container for further use. 100 gm of the coarse exhaustively and successively with various solvents in an increasing order of polarity viz, petroleum ether (60-80) and ethanol in Soxhlet apparatus. The ethanolic extract was concentrated in vacuum under reduced pressure using rotary flash evaporator. The aqueous extract by cold maceration process. It was further concentrated and dried in desiccators.

### Compatibility Studies

#### FT-IR spectra

IR spectra of drug in KBr pellets at moderate scanning speed between 4000 – 400 cm<sup>-1</sup> was carried out using FT IR (Perkin Elmer Spectrum one). The comparison of the test spectra with reference spectra of the drug shows similar peaks.

#### Drug excipients

The compatibility studies were carried out to investigate and predict Physio-chemical interaction between drug and excipients and therefore to select suitability of chemically compatible excipients.

#### Procedure

*Acalypha indica* and excipients are to be thoroughly mixed in predetermined ratio and passed through the sieve no 40. The blend was to be filled in glass vials and are closed with gray rubber stoppers and sealed with aluminum seal and charged in to stress condition at 2 - 8°C and 60°C and

40°C/75%RH. Similarly Extract also kept at all condition as per samples to be withdrawn for analysis.

#### Physical observation

Physical observation of the sample was done at every week for any colour change or lumps formation and flow. There is no colour change but slightly lumps observed in sample charged at 40°C/75%RH for 1 month. Results at Table No: 4

#### FT-IR spectroscopy

FT-IR Spectroscopy was used for analysis of drug and mixture of drug and excipients. The drug and excipients were passed through the sieve no: 60 and mixed in ratio. The drug alone and mixture of drug and excipients was taken and IR spectra of drug in KBr pellets at moderate scanning speed between 4000 – 400 cm<sup>-1</sup> was carried out using FTIR (Perkin Elmer Spectrum) and obtained were observed for any interaction. The comparison of the test spectra with reference spectra of the drug shows similar peaks.

#### UV spectrophotometric analysis

UV Spectrophotometer is used for analysis of drug by its absorption Peak at the specific wave length ( $\lambda$  max). The aqueous extract was diluted to the concentration of ( $\mu$ g) level by using water as solvent and run through photometric mode in UV Spectrophotometer to find the ( $\lambda$  max). With the ( $\lambda$  max) the extract is serially diluted in conc. of 10( $\mu$ g), 20( $\mu$ g)... . And measured the absorbance at spectrum mode Table No: 7 and Figure No: 6

### Composition of ACALYPHA INDICA gel formulation

**Table 1:** Composition of formulation F1-F6

S.N	Ingredients	F1%	F2%	F 3%	F4%	F5%	F6%
1	Ethyl Acetate Extract Of <i>Acalypha indica</i>	3	3	3	3	3	3
2	Sodium CMC	2	3	-	-	-	-
3	Carbopol 940	-	-	2	3	-	-
4	HPMC K 4 M	-	-	-	-	2	3
5	Glycerin	12.5	12.5	12.5	12.5	12.5	12.5
6	Ethanol	2.5	2.5	2.5	2.5	2.5	2.5
7	Methyl Paraben	0.3	0.3	0.3	0.3	0.3	0.3
8	Propyl Paraben	0.5	0.5	0.5	0.5	0.5	0.5
9	Triethanolamine	q. s	q. s	q. s	q. s	q. s	q. s
10	Purified Water	77.2	76.2	77.2	76.2	77.2	76.2

#### Evaluation of formulated gel

Appearance, pH, Viscosity, Spread ability, Extrudability, In-Vitro drug diffusion study.

#### In-vitro drug diffusion study

##### Arrangement of assembly

Six Franz Diffusion Cells are interconnected to each – other in crisscross motion, for maintaining the temperature 32°C. The Franz Diffusion Cells are interconnected by nylon tube and the both ends of these tubes are connected to the chiller. The one end of the chiller provides water of 32°C temperature to outer jacket of cell and another end recycles the water to the chiller.

#### Result and Discussion

##### Pre formulation study

In the preformulation study of *Acalypha indica* Linn leaves Ethyl Acetate extract was characterized for organoleptic

properties. Identification of active ingredients was done by UV-visible spectrometer and IR spectrum does *Acalypha indica* Linn Ethyl Acetate extract. Results are shown in Table No 6 Figure no: 5

#### Compatibility study

Compatibility study was performed using IR spectrophotometer. The IR spectrum of pure drug and physical mixture of drug and polymers were studied. Results are shown in Figure no: 1 to 4

#### Physical evaluation

The values of physical observation, appearance, gelling and pH. were shown in Table no: 5, 4 and Figure no: 6

Viscosity of formulation was determined by the spindle no. S-06, 10 rpm. The selection of spindle and rpm was done on the basis of validation method for all formulations. So on the basis of validation method for all formulations. So on

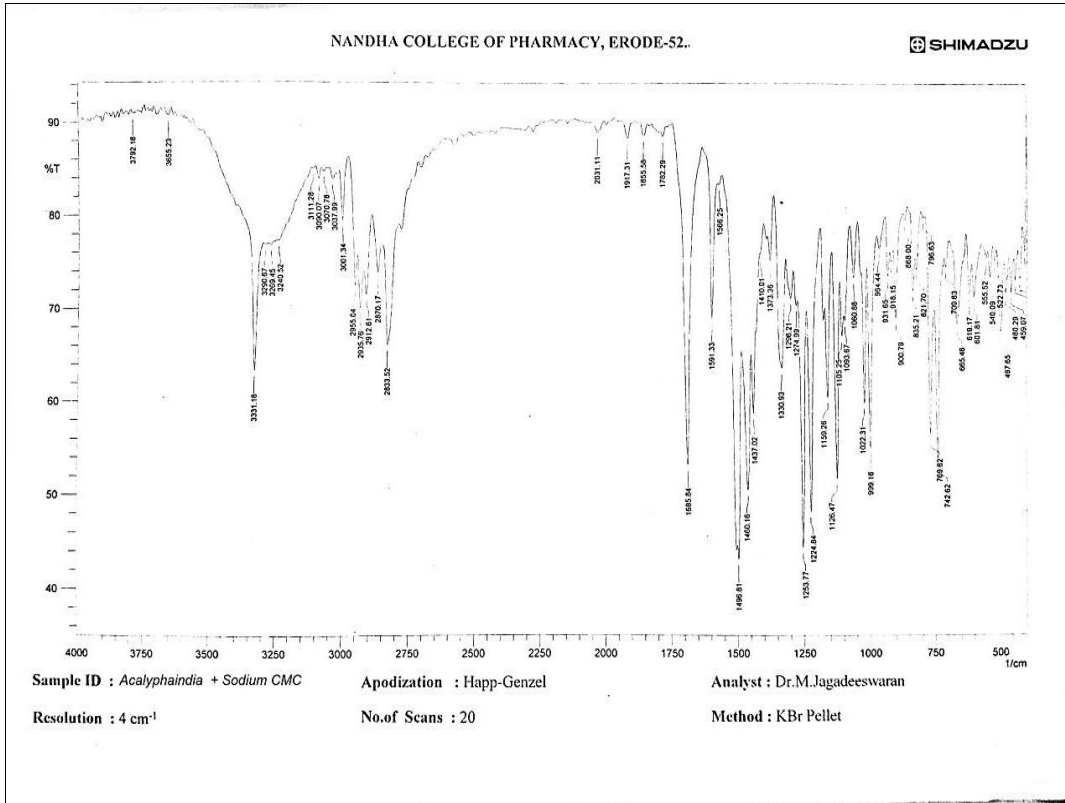
the basis of validation it found that this spindle is an appropriate one for all formulations. Results were shown in Table no: 7

**Stability study**

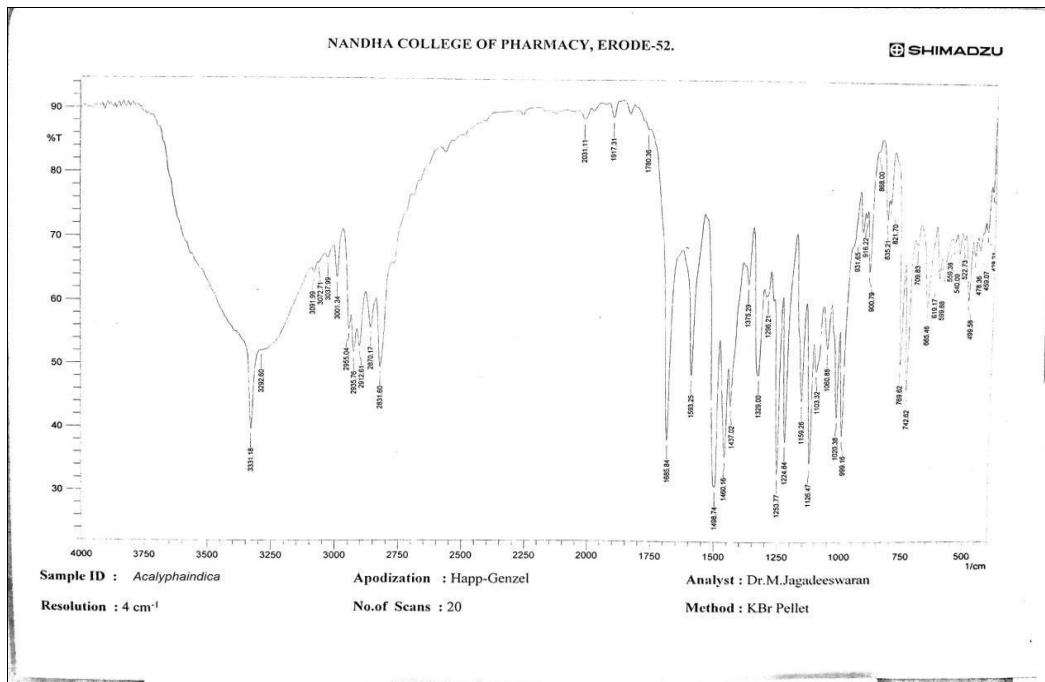
Stability study was carried out for optimized formulation according to ICH guide lines at 40<sup>0</sup> C/75%RH for 1 month.

The results showed that there was no significant change in physical chemical parameter of the gel, hence the formulation (F4) as found to be stable. Results were shown in Table no: 9

**Ir spectra of *Acalypha indica* ethyl acetate extract**



**Fig 1:** Ir spectra of extract with Na CMC



**Fig 2:** Ir spectra of extract with carbopol 94

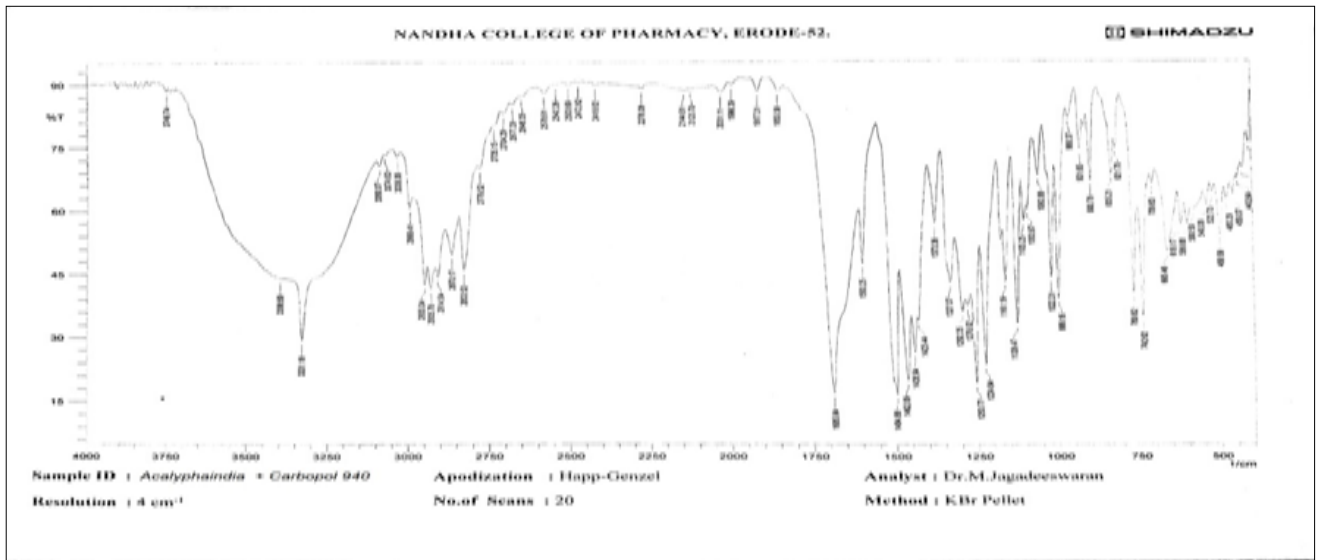


Fig 3: Ir spectra of extract with HPMC K 4M

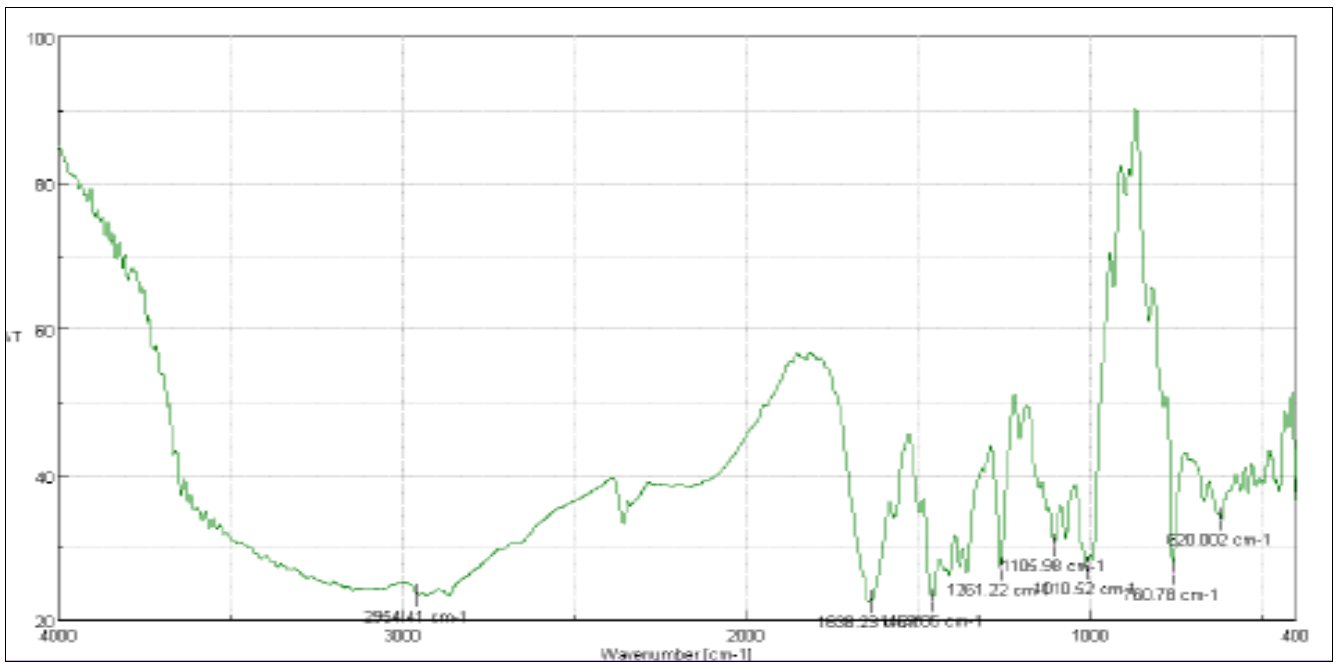


Fig 4

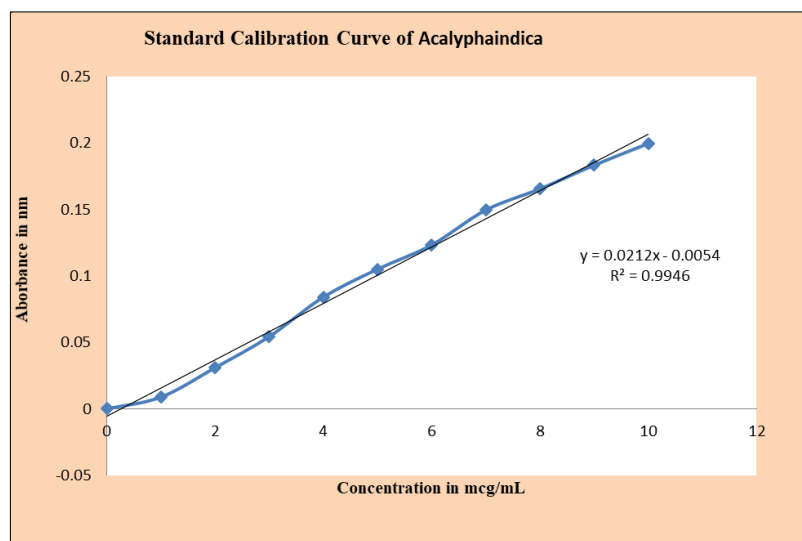


Fig 5: *Acalypa indica* extract ( $\lambda$ - max) and standard graph

**Preliminary Drug Degradation, mineral oils, lipogels, Forced, Organic solvent etc.**

**Phytochemical Screening of Drug Leaves of *Acalypha indica***

**Table 2**

S. No	Phytochemical constituents	Identification test	Ethyl acetate
1	Alkaloids	Mayers test	-
		Hagers test	-
		Dragendroffs test	-
		Wagners test	-
2	Glycosides	Borntragers test	-
		Legals test	-
3	Flavanoids	Sulpuric acid	+
		Alkaline reagent test	+
4	Carbohydrates	Molish test	+
		Felhings test	+
5	Saponins	Foam test	+
6	Fixed oil and fats	Spot test	-
		Millions test	+
7	Protein and amino acids	Nin hydrin test	+
		Biuret test	+
		FeCl <sub>3</sub> test	+
8	Tanins	Alkaline reagent test	+
		Lead acetate	+
		FeCl <sub>3</sub> test	+
9	Phenolic compounds	Lead acetate	+
		Ppt with 90% alcohol	-
10	Gum and mucilage	Ppt with 90% alcohol	-
11	Sterols	Libermann burchad test	+

**Table 3: Results of Organoleptic Properties**

Properties	Results
Description	Hygroscopic
Odour	Intense
Colour	Dark green

**Table 4: Results of Physical Observation**

Batch No	Initial	40° C/75%RH			
		1 <sup>st</sup> week	2 <sup>nd</sup> week	3 <sup>rd</sup> week	4 <sup>th</sup> week
A	Dark green	+	+	+	+
B	Dark green	+	+	+	+
C	Dark green	+	+	+	+
D	Dark green	+	+	+	+

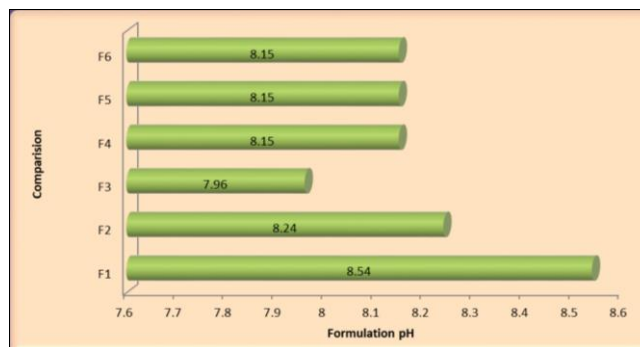
Where: + Good, ++ Very good, +++ Excellent

**Table 5: Physical Evaluation: Appearance: Gelling**

Formulation	Appearance	Feel on Application	Gelling
F1	Dark green	Smooth	++
F2	Dark green	Smooth	++
F3	Dark green	Smooth	++
F4	Dark green	Smooth	+++
F5	Dark green	Smooth	+
F6	Dark green	Smooth	++

**Table 6: Comparison OF PH**

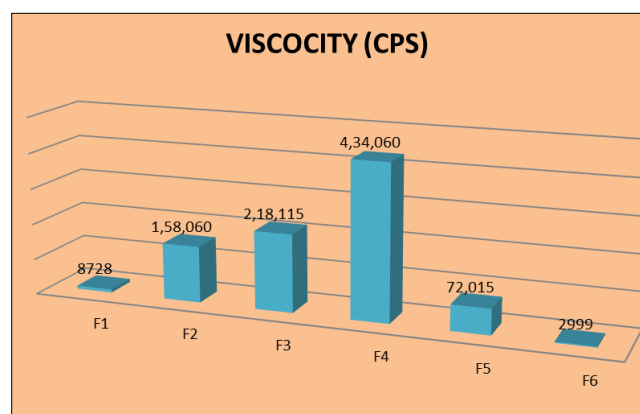
S. No	Formulations	pH
1.	F1	8. 54
2.	F2	8. 24
3.	F3	7. 96
4.	F4	8. 15
5.	F5	8. 15
6.	F6	8. 15



**Fig 6: Comparison of pH**

**Table 7: Comparison of viscosity extrudability and spreadability**

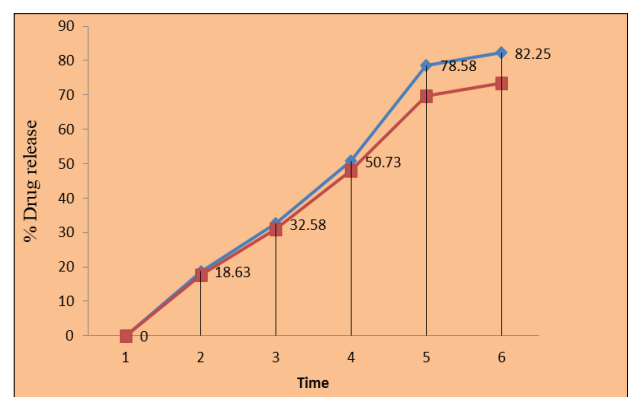
Formulations	Viscosity (CPS)	Extrudability	Spreadability
F1	8728	++	17. 62
F2	1, 58, 060	++	18. 78
F3	2, 18, 115	++	19. 24
F4	4, 34, 060	++	20. 53
F5	72, 015	+	15. 42
F6	2999	++	15. 49



**Fig 7: Comparison of Viscosity**

**Table 8: Cumulative % drug release of formulations**

Time	F4	F3
0mins	0	0
30mins	18. 630	17. 68
1 hour	32. 58	30. 93
2 hours	50. 73	47. 92
4 hours	78. 58	69. 63
6 hours	82. 25	73. 52



**Fig 8: Cumulative % Drug Release of Formulations**

**Table 9:** Stability Parameters of Formulation F4.

S. No	Parameters	Control	After 1 Month 40/75°(C/RH)
1	Appearance	Dark green	Dark green
2	Feel on application	Smooth	Smooth
3	pH	6.95	6.95
4	Viscosity	4, 34, 060	4, 35, 570

### Conclusion

The main aim of the present study was to formulate and evaluate a natural anti-inflammatory gel by using different polymers. Preformulation was carried out initially and the results were directed for the further source of formulation with different batches with polymers by using selected excipients. The leaves of *Acalypha indica* was collected from ABS Botanical garden, Karipatty and was dried under shade for one week. The drug was extracted using soxhlet apparatus using ethanol for 72 hours. The extract was formulated into gel by using different polymers. The *Acalypha indica* gel formulation was optimized on the basis of different physical parameters. Studies mainly carried out for pH, viscosity, Spreadability, Extrudability, in vitro and stability studies. Various formulations of *Acalypha indica* leaves extract gels were formulated by using various polymers such as CMC Na, HPMC K100, HPMC K4M, and Carbomer 940.

The F4 shows greater drug release 82.25% which is complied with F3 drug release which is 70.52% in 6hrs, other parameters such as pH of F4 formulation is 8.15 viscosity of F4 formulation is 4, 34, 060cps, Spreadability of F4 formulation is 20.53

The pH of F4 was 8.15 which was basic in nature and by the future addition of 3-4 drops of HCL the pH was brought to neutral level i.e., 6.95. Also the pH of F3 was 5.06 with acidic nature which might have caused skin irritation. The addition of 4-5 drops of NaOH solution, thereby the pH range was brought to 7.2. Thus by the addition of suitable neutralizing agents both formulations are made more elegant and applicable for skin pH.

Stability study was conducted for optimized batch F4 at 40°C / 75% RH for 1 month. Gels were evaluated for appearance; feel on application, pH, Viscosity after 1 month. It concluded F4 was stable. Results of all physical parameters of the formulation concluded that formulation F4 was the most promising formulation.

Based on the above parameters, the formulation F4 was concluded as most promising formulation and can be directed for further studies.

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