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# FORMULATION AND EVALUATION OF ANTI- RHEUMATOIDARTHRITIS POLYHERBALGEL

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## ABSTRACT

Herbal medicine, one of the oldest healthcare systems, continues to play a significant role in modern therapeutics due to its accessibility, affordability, and holistic approach. This study focuses on the formulation and evaluation of a polyherbal topical gel incorporating diclofenac sodium along with extracts of Ailanthus excelsa, Zingiber officinale (ginger), and Tinospora cordifolia (Giloy) for the management of rheumatoid arthritis (RA). RA is a chronic autoimmune disorder characterized by inflammation, joint pain, and progressive joint destruction, often associated with elevated inflammatory mediators such as TNF-α, IL-1, and IL-6. The selected herbal ingredients possess well-documented anti-inflammatory, antioxidant, and immunomodulatory properties, which may enhance therapeutic efficacy through synergistic action. Diclofenac sodium, a nonsteroidal anti-inflammatory drug (NSAID), was incorporated to provide immediate analgesic and anti-inflammatory effects, while herbal extracts aim to support long-term management and reduce adverse effects. The polyherbal gel was formulated using Carbopol-934 as a gelling agent, along with suitable excipients such as propylene glycol, glycerine, and triethanolamine. Plant extracts were prepared using Soxhlet extraction with ethanol. The formulation was evaluated for various physicochemical parameters including pH, viscosity, spredability, homogeneity, and stability. The prepared gel exhibited desirable characteristics such as smooth texture, good homogeneity, acceptable pH (within skin-compatible range), viscosity of 2900 cps, and Spreadability value of 27.77 g·cm/sec, indicating suitable topical application properties. No signs of irritation, syneresis, or instability were observed during the study period.

**KEYWORDS:** Anti-Rheumatoid Arthritis Gel, Diclofenac Sodium, Polyherbal Gel, Traditional Remedies.

## 1. INTRODUCTION

### A. Herbal Medicine

Herbal medicine is a practice of using plants and products derived from them in the prevention, management, and treatment of diseases.[1] This method of managing health dates back thousands of years ago and remains one of the earliest known methods of providing healthcare services among people.[1] In ancient times, traditional medical practices like Ayurveda practiced in India, Traditional Chinese Medicine practiced in China, and Unani medicine practiced in the Middle East heavily used herbs in the promotion of good health and treatment of illnesses.[2] Even up to date, there are millions of people around the world who use herbal medicine as their main form of healthcare, particularly in developing nations where other forms of medicine may not be available.[1] Herbals are made up of various parts of plants like leaves, roots, stems, bark, seeds, flowers, and fruits.[2] Different plant parts might contain different kinds of chemical components that make the medicine have certain medicinal benefits.[2] Some of the bioactive components of herbs include alkaloids, flavonoids, glycosides, tannins, saponins, terpenoids, and essential oils.[3] Alkaloids may be characterized by their powerful effects when used pharmaceutically, flavonoids are effective antioxidants, while tannins are astringents and antimicrobial.[3] All these components together in one plant create what is called synergy, where the medicinal value becomes more beneficial than if the single components were considered separately.[3] However, the methods used to prepare herbal medicines may be quite diverse, depending on both traditional procedures and

modes of administration.[2] The common modes include decoction (plant is boiled in water), infusion (the plant is brewed in hot water), tincture (plant extracts are made using alcohol), powder, capsule, oil, ointment, and gel form.[2] When dealing with pharmaceutical studies, the process of standardizing herbal extract is very common since it ensures quality, safety, and effectiveness.[4]

One of the major benefits offered by herbal medicine is the perception of safety and reduced risk of experiencing any form of adverse effects as compared to chemical-based drugs.[1] A number of herbal medicines are known to be safe to take over a long period of time, particularly in cases where chronic diseases have to be managed, for example, arthritis, diabetes, high blood pressure, and various skin ailments.[1] Plants like ginger, turmeric, and Giloy are common choices due to their anti-inflammatory properties. Nonetheless, it should be understood that the term "natural" does not necessarily imply safety.[4]

Traditional herbs have also played an important part in drug discoveries.[4] Most pharmaceuticals currently in use were first derived from plants.[4] Some examples include aspirin, which was made by the breakdown of salicin contained in willow bark, and morphine, which is derived from the opium poppy.[4] These examples illustrate the value of plants as a rich source of drugs.[4] Scientists have continued to study traditional herbs to discover unique chemical compounds that may become new drugs against diseases such as cancer, infectious diseases, and autoimmune diseases.[4]

There is an emerging interest in the field of herbal medicine in recent times owing to the awareness regarding the side effects of chemical medications and the importance of holistic methods of treatment.[1] People are becoming more interested in using herbs to improve overall well-being and increase immunity against diseases.[1] The demand for herbal products such as supplements, cosmetics, and food products is steadily increasing worldwide.[1] Such developments have resulted in the formulation of guidelines and regulations on the usage and application of herbal medicine.[4]

However, the field of herbal medicine faces various challenges despite having numerous benefits.[4] The first challenge that herbal medicine faces is the absence of proper quality control procedures.[4] There may be a considerable difference in terms of the species used for herbal products, growth conditions, extraction processes, and other factors.[4] Moreover, the effectiveness of many herbs used as herbal products needs to be supported scientifically in order to facilitate their acceptance in mainstream treatment methods.[4] Therefore, scientific studies and research need to be conducted to ensure that herbal products are reliable and effective.[4]

The third benefit of herbal medicine is its use in personalized and preventative care.[2] Most traditional medicine systems focus on balancing the body and prevention of disease rather than treating only the symptoms of diseases.[2] Herbal medicine treatments are usually given according to the patient's constitution, lifestyle, and environment.[2] Thus, personalized care is another advantage of herbal medicine which is also becoming more prominent in contemporary medicine.[2] In addition to treatment, herbal medicine also emphasizes other aspects of health, such as diet, lifestyle, and psychological well-being.[2]

The development of new dosage forms and drug delivery systems can be one of the benefits of using herbal medicines.[4] For instance, herbal gel and cream formulations have been created for treating arthritis, inflammatory processes, and dermatological issues.[4] Transdermal patches may be developed as well to ensure the effective delivery of active substances.[4] Moreover, the combination of herbal medicines with pharmaceutical excipients can increase the bioavailability of drugs.[4]

Moreover, using herbal medicine contributes to biodiversity conservation and sustainable development as well.[2] Plants used for medical purposes constitute valuable natural resources, and thus the cultivation and conservation of medicinal plants are crucial to have a constant supply of raw materials.[2] Sustainable harvesting, cultivation of plants, and conservation of habitats are necessary measures for preventing their depletion and extinction.[2] Additionally, herbal medicine can generate economic benefit for rural communities engaged in the cultivation and manufacturing of medicinal plants.[2]

To summarize, herbal medicine is an ancient and valuable healthcare tradition, which continues to be highly important for modern medicine despite numerous controversies.[1] Herbal medicine utilizes natural substances of plants together with traditional medicine and the findings of modern science to offer a novel and promising method for the prevention and therapy of many diseases.[1] Although herbal medicine possesses such strengths as low cost and accessibility, safety and efficiency still require strict regulation and high standards.[4] Thanks to further studies, technology development, and innovations in this field, herbal medicine may become an even more valuable source of healthcare products in the future.[4]

### B. Rheumatoid Arthritis

Rheumatoid arthritis is an autoimmune, chronic, and systemic condition that affects mainly the synovial joints causing inflammation, pain, swelling, and joint destruction. The condition happens when the body's defence mechanism acts against itself, targeting the synovial membranes lining the joints. This leads to thickening of the synovium, producing inflammatory factors, eventually damaging the cartilage and bones. Rheumatoid arthritis predominantly affects the smaller joints, for instance, those found in the hands, wrists, and

feet, and it occurs symmetrically in both sides of the body. The disease mostly affects women, and the incidence tends to increase between the ages of 30 and 60 years. However, the exact etiology of rheumatoid arthritis is not well known; there is a genetic component together with immune mechanisms that lead to the pathogenesis of the disease.[5]

Pathophysiological mechanisms underlying RA include the activation of immune cells including T-cells, B-cells, and macrophages. Activation of these immune cells results in the secretion of inflammatory cytokines including TNF-α, IL-1, and IL-6 among others. Chronic inflammation eventually causes the development of pannus, which goes on to damage cartilage and bones in the joint. In terms of clinical presentations, RA manifests with joint pain, swelling, stiffness, and restricted movement. In many instances, RA affects joint mobility leading to joint deformations including ulnar and swan-neck deformities. Additionally, RA affects other parts of the body including anaemia, pulmonary complications, myocardial dysfunction, and eye conditions.[5]

Along with other forms of pharmacological treatment, alternative approaches in the form of herbal medicine have emerged as an adjunctive therapy option in the management of rheumatoid arthritis. Herbal drugs display a number of biological properties such as anti-inflammatory, analgesic, and antioxidant activity that could be used to alleviate symptoms in RA patients. Zingiber officinale (ginger) possesses a variety of active substances that display potent anti-inflammatory properties due to their capability of blocking prostaglandin and cytokine production. Another medicinal plant, Tinospora cordifolia (Giloy), is extensively utilized in Ayurveda due to its immunomodulatory and anti-inflammatory activities. Withania somnifera (ashwagandha) is yet another valuable herb that could be useful due to its anti-inflammatory effect and potential to relieve stress.[6]

Herbal oils and topical medications can be used for symptom relief as well. For instance, herbal medicines prepared from plants containing active compounds, such as extracts from Curcuma longa, have shown high efficacy in alleviating inflammatory processes due to their strong anti- inflammatory and antioxidant properties. The effectiveness of curcumin from turmeric occurs due to the inhibition of the inflammatory pathway NF-κB and decrease of oxidative stress, thus reducing pain and swelling of the joints. In addition, herbal medicines can be effectively combined with the main methods of treatment of RA as an additional therapy aimed at minimizing adverse effects caused by long-term administration of synthetic medications.[6]

Rheumatoid arthritis usually involves such medications as nonsteroidal anti-inflammatory drugs (NSAIDs), corticosteroids, and disease-modifying antirheumatic drugs (DMARDs), including methotrexate. Also, physical exercises and physiotherapy can play an important role in the improvement of health condition in patients with RA. Thus, herbal medicines can be used along with the above-described methods of therapy, providing a holistic way of managing RA and reducing inflammation in joints.[7]

### C. GEL

A gel refers to a semisolid substance, whose characteristics include the presence of small or big molecules dispersed within a liquid substance. The liquid is given a jelly-like characteristics by adding a substance known as the gelling agent or the gelator. Typical gelling agents include proteins, starches, gelatine, cellulose derivatives such as carboxymethyl cellulose, among others. Low molecular weight molecules can also serve as gelling agents.[8, 9]

Definition: Gels refer to semi-solid substances that have restrained movement of the dispersing substance because of the presence of three-dimensional networks of interlacing particles or solvated macromolecules of the dispersed phase.[8]

In some cases, gels are considered colloidal dispersions because of the presence of particles whose size ranges between 1 nm and 0.5 µm. Structurally, gels consist of a liquid substance entrenched within a polymeric matrix that contains highly cross-linked chemical or physical structures. Twisted, matted strands are bonded together using strong van der Waals forces, forming crystalline or amorphous areas within the gel structure. Examples of gels include those consisting of tragacanth or carboxymethyl cellulose (CMC).[8,10]

The hardness of the gel can be attributed to the network formed by the linkages formed among the particles, due to the gelling agent. The properties of the gel depend on the type of the particles and the forces leading to such linkages. During the process of gelling, swelling is achieved due to penetration of the solvent resulting in the stretching of the polymer network and taking up of shape while entrapment of the drug particles. Viscosity plays an important role in gel formation.[8,9]

### D. Classification of Gels

Gels are mainly categorized in two classes depending on the phases of the colloid.[11]

- Single Phase (Organic)
- Double Phase (Inorganic)

1) Single Phase (Organic)

Such gels contain organic macromolecules which are evenly distributed in the liquid. As a result of this, no clear boundaries can be seen between the dispersed macromolecules and the liquid medium. This category includes the carbomers or tragacanth as gelling agents.[11]

2) Two Phase System (Inorganic)

In this case, the particle size of the dispersed phase is

relatively large and they make a 3D structure in the gel. In this system, the particles making up the gel are small rather than having big molecules. Such gels are usually unstable and show thixotropy, hence exist as a semi-solid under rest condition and become a liquid when agitated. Examples of such gels are aluminium hydroxide gel and bentonite magma.[11]

**E. Characteristics**

I. Swelling

II. The process where the liquid occupies the space within the volume is known as swelling. Liquids that are capable of solvating a gel will cause swelling. The process in which the gel absorbs the liquid causing swelling is a characteristic of gels. It is regarded as the first stage of dissolution.[9]

III. Syneresis: Syneresis takes place when the interstitial liquid gets exuded forming a pool on the surface of the gel.[9]

IV. Ageing: Spontaneous aggregation is observed in many colloidal systems and it is known as ageing. In case of gels, the gelling agent undergoes ageing resulting in the development of a denser network.[10]

V. Thixotropy: thixotropy involves the reversible gel to sol transformation without any change in volume or temperature.[8,10]

**F. Desired Characteristics of Gel Formula**

I. Ideally, the gelling agent needs to be non-reactive, safe, and should not react with other ingredients in the formulation.[12]

II. The gelling agent forms a rational solid-state during storage that easily breaks under shear forces when the tube is squeezed or shaken or when the gel is applied topically.[12]

III. Suitable antimicrobial agents.

IV. The topical gel should not be sticky.

V. The Ophthalmic gel should be sterile.

VI. The viscosity of the gel is directly proportional to the effective cross-link density of the gel.[8]

VII. Every constituent is continuous in the system.

VIII. Gels exhibit uniformity even after standing and do not settle readily.[8]

**G. Advantage**

Synergistic Effects: Mixing different herbs could boost their effectiveness and generate.[9] Multi - targeted approach: Polyherbal gels can address several skin issues or problems simultaneously.[9]

Natural and holistic: The use of herbs as active ingredients offers a holistic way of skin care.[9]

Higher efficiency: The use of herbs in combination with complementary actions might increase overall efficiency.[9]

Customization: Polyherbal gels can be customized based on the type of skin or particular problem.[9]

**H. Disadvantages**

Complex nature: Polyherbal gels are complex products, which makes it difficult to forecast their interactions.[9]

Interactions: Herbs can interact with themselves, other substances like pharmaceutical drugs, or other products.[9]

Quality control: Controlling the quality of herbs is a complex process that may be problematic at times.[9]

Sensitivities: Certain people might be sensitive to certain herbs used in the preparation.[9].

Regulatory difficulties: Regulating polyherbal gels may be hard because of the presence of herbs and their possible interactions.[9]

Shelf life and stability: Polyherbal gels might exhibit some shelf life and stability problems because of their natural nature.[9]

## 2. AIM AND OBJECTIVE

**A. Aim: To Formulate and evaluate the anti-rheumatoid arthritis gel**

**B. Objective**

- To develop a polyherbal topical gel using diclofenac sodium, Ailanthus excelsa, ginger extract, and Giloy extract for the treatment of rheumatoid arthritis.
- To increase the efficacy of the formulation through the combination of a synthesized drug (diclofenac sodium) with herbs that have been proven to provide anti-arthritic effects.
- To test the physical characteristics of the formulation such as pH, viscosity, spredability, homogeneity, and stability.
- To determine the drug release rate from the gel formulation of diclofenac sodium.
- To investigate the synergistic action between herbs (Ailanthus excelsa, ginger, and giloy) and diclofenac sodium in providing antinflammatory and pain-relieving actions.
- To reduce the systemic adverse effects of orally administered NSAIDs by using topical formulation technology.
- To carry out safety evaluation and test the irritancy of the formulation.

## 3. MATERIALS AND METHODS

**A. Chemical**: Diclofenac Sodium, Carbopol-934, Sodium benzoate, Triethanolamine, Glycerine, Propylene glycol, Distilled water, Rose water

**B. Instrument**: Soxhlet Apparatus, viscometer, Ph meter, Weighing balance, ultrasonicator

**C. API:** Diclofenac Sodium

Diclofenac sodium is an effective NSAID that efficiently helps reduce pain, inflammation, and fever by blocking prostaglandin production; however, diclofenac sodium should be administered with care due to possible side effects such as stomach problems and heart disorders.

Molecular weight: 318.13 g/ml Molecular formula: C14H10Cl2NNaO2 Uses.

1. Pain relief: used for alleviating mild to moderate pain (e.g., toothache, headache,

postoperative pain).

2. Anti-inflammatory: aids in reducing inflammation associated with rheumatoid arthritis, osteoarthritis, ankylosing spondylitis, etc.
3. Antipyretic: used for reducing fever.
4. Musculoskeletal disorder: sprains, strains, back

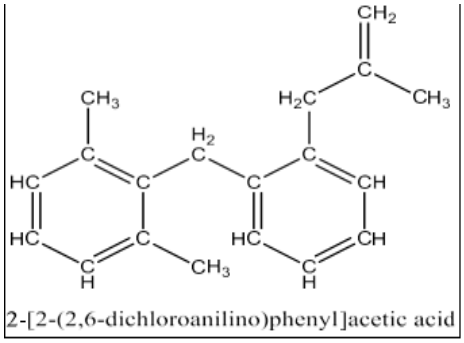



**Fig No. 1 Chemical structure of Diclofenac.**

**D. Plant Material**

1. Ailanthus excelsa.[13] Kingdom: Plantae
Subkingdom: Trophobiont (Vascular plants) Super division: Spermatophyta (Seed plants) Division: Magnoliophyte (Angiosperms) Class: Magnoliopsida (Dicotyledons) Subclass: Rosidae
Order: Sapindales Family: Simaroubaceae
Genus: Ailanthus
Species: Ailanthus excels

**Fig.no.2: Ailanthus Excelsa.**

Biological source: It is obtained from the bark of stem, bark of root, and leaves of Ailanthus excelsa Roxb.
It is a large deciduous tree popularly known as "Tree of Heaven" that is found abundantly in India and other parts of Asia.
Chemical constituents: Oleanolic acid, Caftaric acid, Arachidonic acid, Glaucarubinone

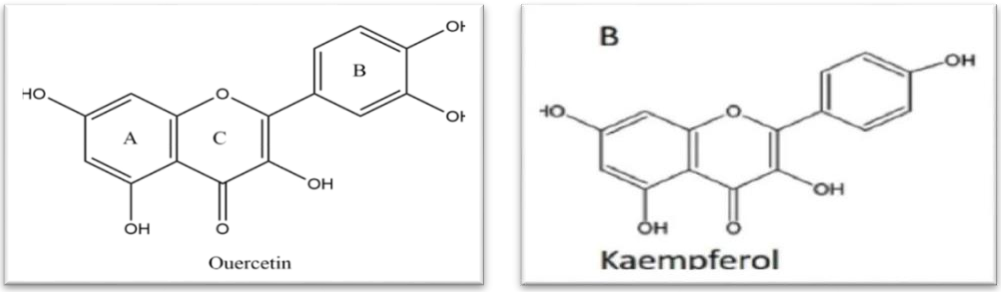



**Fig No.3 Anti-inflammatory constituents of Ailanthus Excelsa.**

2. Ginger.[14]
Kingdom: Plantae
Subkingdom: Tracheobionta (vascular plants)
Division: magnoliophyte (angiosperms)
Class: Liliopsida (monocotyledons)
Order: Zingiberales
Family: Zingiberaceae
Genus: Zingiber
Species: Zingiber officinale

**Fig.no.4: Zingiber officinale**.

Uses: Anti-inflammatory, Anti-nausea and antiemetic, Analgesic, Antioxidant activity antimicrobial properties, Antidiabetic effect

Biological source: The ginger herb is extracted from the underground stem of the plant named Zingiber officinale, which is a member of the Zingiberaceae family. is commonly grown in tropical and subtropical climates like India, China, and Southeast Asia.
Chemical constituents: it contains volatile and non-volatile compound which contain 6-gingerol, zingiberene, etc.

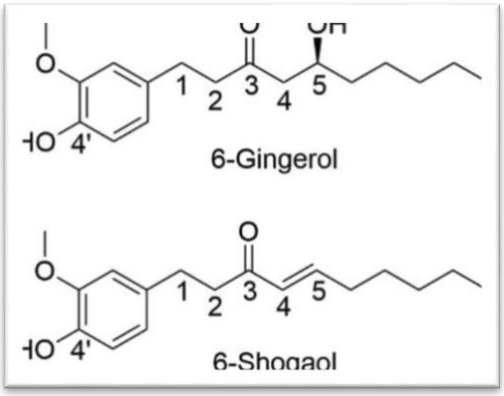



**Fig. No. 5: Analgesic and Anti-inflammatory constituents of Ginger.**

3. **Giloy.**[15]
Kingdom: Plantae
Subkingdom: Trophobiont (vascular plants)
Super division: Spermatophyta (seed plants)
Division: Magnoliophytes (flowering plants)
Class: Magnoliopsida (dicotyledons)
Order: Ranunculites
Family: Menispermaceae
Genus: Tinospora
Species: Tinospora cordifolia

**Fig. No. 6: Tinospora Cordifolia.**

Uses: Immunity Booster, Antipyretic, Anti-inflammatory, Digestive Health, Liver Protective, Skin Disorder.
Chemical constituents: Giloy contains a variety of bioactive compounds such as alkaloids, Glycosides, Diterpenoids lactone, steroids, polysaccharides, etc.

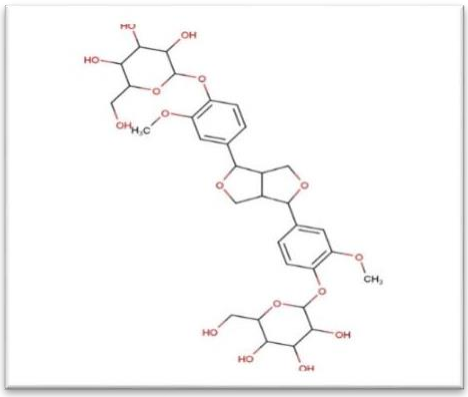


**Fig. No.7: Tinocordiside.**

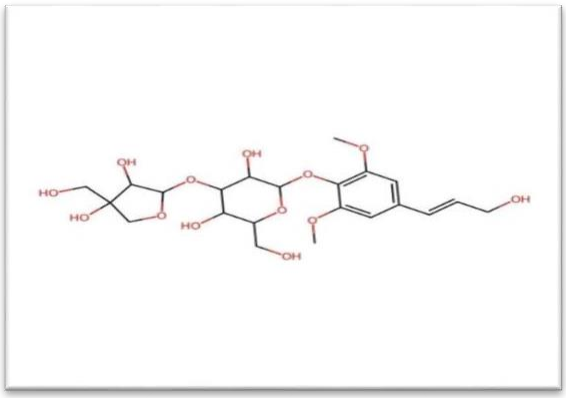


**Fig. No.8: Cordioside.**

**E. Excipient Profile.**

**Table No.1: Excipient profile.**

| Sr. No. | Excipient | Use |
|---|---|---|
| 1 | Carbopol 934 | Gelling agent |
| 2 | Propylene glycol | Permeation enhancer |
| 3 | Sodium Benzoate | Preservative |
| 4 | Methyl paraben | Preservative |
| 5 | Triethanolamine | pH adjuster |
| 6 | Glycerine | Clearing agent |
| 7 | Rose water | Soothing agent |
| 8 | Distilled water | Solvent |

**F. Materials**: The Raw material used for preparation of polyherbal Formulation were Extract of leaves of ailanthus excelsa, Giloy, and roots of ginger, including diclofenac sodiu1, Carbopol 934, sodium.

**G. Collection and Authentication of crude drug**

The required plant leaves and roots of crude drug were collected from the local garden. The plant material were authenticated by Dr. S. P. Giri and verified by Dr. A. S. Wabale, Research Guide, Principal & Head of department of Botany and Research centre PVP college, Loni [Ref. No./PVPC/Bot/2025/512-1]

**H. Preparation of Ethyl alcohol extract of Plant Drug**

- Plant drugs such as ailanthus excelsa leaves, Giloy leaves, and ginger are dried and ground into a coarse powder.[16, 17]
- These powders are packed into a porous thimble which is made from filter paper.[16]
- This thimble is placed inside the Soxhlet extractor chamber.t[16]
- Ethyl alcohol is added to the round-bottom flask.[16, 17]
- Round-bottom flask is connected to Soxhlet extractor and condenser.[16]

- It is confirmed that all joints are fixed.[16]
- The solvent present in the round-bottom flask is heated up to 80°C with a heating mantle.[17]
- Start the water supply in the condenser.[16]
- The vaporized solvent cools in the condenser to form a liquid.[16]
- This solvent drops on the sample in the thimble.[16]
- The chamber will be filled with a solvent for extracting compounds from the sample.[17]
- When it reaches the required volume, the solvent is collected and filtered and used as plant extract..[17, 18]
- Similarly, the extract of giloy leaves and ginger extract is prepared.[17, 18]

**Fig. No.9: Extracted Samples.**

**Fig. No.10: Sohxlet Extraction.**

**H. Preparation of Gel base**

- A 1 gm of carbapol-934 powder is weighed and dissolved in 20 ml of distilled water and kept aside for 15 mins of absorption, then stirred continuously for 1-2 hours to get the gel base.[19, 20]

**I. Preparation of Poly herbal Gel**

- Take 250 mg of Diclofenac Sodium in 5 ml of water and incubate in sonicator for 30 minutes at 27° C.[29]
- The polyherbal gel was prepared by mixing the prepared solution of Diclofenac sodium with various concentrations of plant drugs extract with a preformed gel base with constant stirring to maintain uniformity. Permeation enhancer 2 ml was taken separately in one beaker, and then the preservative was dissolved completely in it.[21]
- After dissolving it, the prepared solution is slowly added to the plant drugs-containing gel base by continuous stirring, and the total volume of the preparation is made to 50 ml by adding distilled water. If necessary, EDTA can be added as a chelating agent.[22]
- PH is neutralized using a triethanolamine solution, keeping stirring continued throughout the preparation process. Later on, glycerine was added as a humectant to increase the consistency of the formulation.[23]
- The prepared gel was checked visually, and its physical appearance came out to be smooth, sparkling, transparent, and light yellowish.[19, 21]

**J. Formulation Table**

**Table No. 2: Formulation Table.**

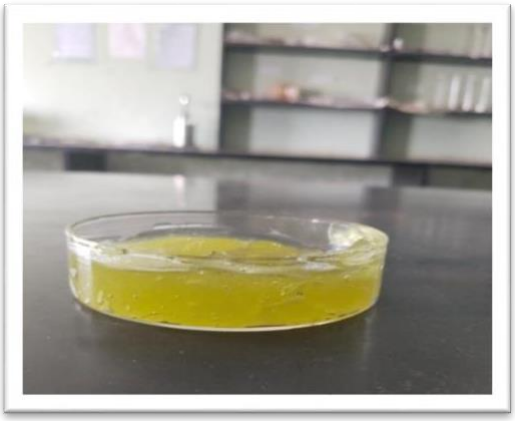
| SR. No. | Ingredients | F1 | F2 | F3 | F4 |
|---|---|---|---|---|---|
| 1 | Extract of Ailanthus excelsa leaf | 1 ml | 1ml | 1 ml | 2 ml |
| 2 | Extract of ginger | 2 ml | 2ml | 2 ml | 3 ml |
| 3 | Extract of giloy leaf | 2 ml | 2ml | 2 ml | 2 ml |
| 4 | Diclofenac sodium | 500 mg | 500 mg | 250 mg | 250 mg |
| 5 | Carbopol 934 | 1 gm | 1 gm | 1 gm | 1 gm |
| 6 | Propylene glycol | 4 ml | 2 ml | 2 ml | 2 ml |
| 7 | Sodium benzoate | 1 gm | 0.5 gm | 0.5 gm | 0.5 gm |
| 8 | Triethanolamine | 0.5 ml | 0.5 ml | 0.5 ml | 0.5 ml |
| 9 | Glycerin | 4 ml | 4 ml | 6 ml | 6 ml |
| 10 | Rose water | 2 ml | 2 ml | 2 ml | 2 ml |
| 11 | Distilled water | Q. S to 50 ml | Q. S to 50ml | Q. S to 50ml | Q. S to 50ml |

Formula 1 :(FAIL)
This formula was failed due to excess amount of propylene glycol and sodium benzoate that make gel in two phases.

Formula 2 :(FAIL)
This formula was failed due to excess amount of diclofenac sodium that gives undesired consistency to gel

Formula 3 :( FAIL)
This formula was failed due to undesirable colour of the gel that makes gel undesirable.

Formula 4 :(SUCCESS)
The gel was successfully formulated due increased quantity of plant extract and glycerine.



## 4. Evaluation Parameter

### A. Physical Examination

1) Homogeneity and Appearance
All the prepared gels were placed into containers for testing On their homogeneity through visual examination. The appearance and Aggregates of the gels were observed.[24]

2.Color, Smell, Visual and Tactile Properties
The prepared gel was assessed visually for its colour and also
Whether there was any blockage. For tactile sensation, the prepared gel Was applied to the skin surface.[24, 25]

### B. pH Value (Standard Range 5-7)

pH value was determined using pH paper. Paper was dipped into the gel, and the colour obtained was matched with the chart available along with the paper.[25]


**Fig.no. 11: pH determine.**

### C. Viscosity Measurement (Normal Rang 2000-4000 cps)

The viscosity of individual and polyherbal gels was Measured by Brookfield viscometer (Model RVTDV II) at 100 Rpm using spindle no 6.[24, 26]

| | |
|---|---|
| Viscosity | 2900 cps |

### D. Spreadability (Range: 18.14 – 33.91 g*cm/sec)

The gel, when applied or rubbed onto the skin surface, should have enough spredability property. To test the spredability of the gel, a 1 gm sample of gel was kept on one glass slide. Another glass slide of similar size was kept over it and a weight of 50 gm was kept over it. In doing so, both slides were separated. The time elapsed between the separation of two slides was noted down.
It was calculated by using the following formula: [25, 26]
S = M × L ÷ T
Where,
S = Spreadability
M = Mass kept on the upper glass slide L = Length of the glass slide
T = Time taken to separate the two slides Calculation:
M = 50gm, L = 15 cm, T = 27
: 50×15÷27
S=27.77

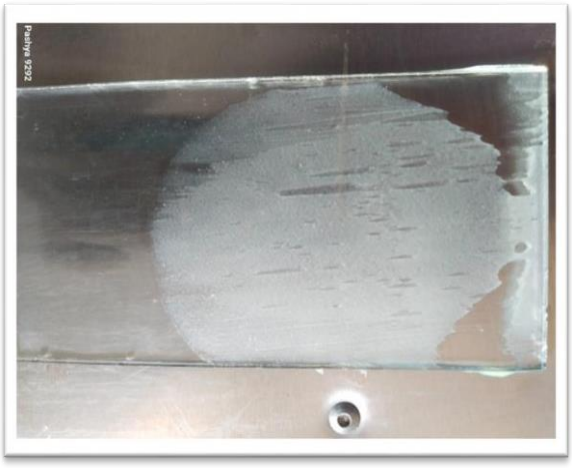


**Fig.No.12: Spreadability measure.**

**E. Washability**: The formulation was applied on the skin, and then ease and efficiency of washing with water were manually evaluated.[27]

**Fig. No.13 After application of the gel.**

**Fig. No. 14 After washing the skin**

**F. Skin Irritancy Test**

Gel was applied to the dorsal side of the right hand of 1 sq. cm area and examined at equal intervals for 24 hrs For irritancy, redness, and oedema.[27, 28]

**Fig. No.20: No signs of irritation when applied on the skin.**

**G. Swelling and Syneresis**

Swelling and Syneresis of all the formulations were studied. Sample was collected in cylinder from each formulation of 5 gm weight and the volume was made 100 ml by adding water, samples were studied for a month time period. Neither swelling nor syneresis could be observed in any of the formulations.[28]

**Fig. No.21: Formulation Gel.**

## 5. RESULT

Gels, known for their semisolid characteristics in the administration of drugs, are considered excellent pharmaceutical dosage forms. The demand for herbal gels is on the rise owing to their safe and efficacious nature. Studies have shown that the leaves of Ailanthus excelsa possess anti- inflammatory properties, those of Giloy leaves Immunomodulatory properties, and those of ginger extract possess analgesic and anti-Inflammatory properties. Hence, the purpose of this experiment was to formulate an herbal Analgesic gel, which contains ethanolic extracts of the leaves of Ailanthus excelsa, Ethanolic extracts of Giloy leaves, and Ginger extraction. The preparation used Carbopol. As the gelling agent along with rose water flavouring. The formulation of the 50g gel Involved 2ml of each drug extract, 2ml of Rose water, and 1g of Carbopol 934.The final gel product was analysed for different parameters and was found to be yellowish green in colour, homogeneous in nature, smooth, easy to spread, with a Neutral pH, similar to that of normal skin. A skin irritation test was carried out for 24hours and it was evident that there were no irritations. Microscopic evaluation showed the absence of any

particulate matter in the gel.

## 6. CONCLUSION

The purpose of this study was to create an anti-rheumatoid arthritis drug using the herbs Ailanthus excelsa, Zingiber officinale, and Tinospora cordifolia. The gel formulation was made using Carbopol 934, which did not irritate the skin. The prepared herbal gel was analysed for several physical characteristics such as pH, viscosity, Spreadability, Washability, and skin irritation. Brookfield viscometer was used to determine the rheological behaviour of the gel formulations, where the obtained results showed consistent viscosity, neither too viscous nor too low viscosity.

Formulation F3

Had the best features among other gel formulations. Consequently, formulation F3 was considered as the best gel formulation. From the above discussion, it can be concluded that the herbal anti- rheumatoid arthritis gel is a useful preparation, exhibiting all the characteristics required for a gel, including easy applicability and lack of skin irritation. Moreover, since the anti-rheumatoid arthritis gel is an herbal preparation, its chances of producing side effects are relatively low. Further studies will consider a comprehensive phytochemical screening and evaluation of anti- inflammatory effects to enable the preparation of the gel for human application.

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