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# Review on development and evaluation of ibuprofen gel by using natural polymer

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## Abstract

The investigation focuses on developing and review of a topical gel that contains the painkiller Ibuprofen a nonsteroidal anti-inflammatory medication NSAIDS propylene glycol and Alovera gel or Guar gum were used as penetration enhancers to promote penetrate into the skin and as a gelling agent in the preparation of the gel to guarantee strength physical characteristics such as ph viscosity and appearance were assessed experiments on the releasing of substances within the body using flow-through diffusion cell demonstrated a prolonged release profile and experiments on skin permeation demonstrated efficient absorption tests for stability verified that the gel kept its characteristics under many circumstances the findings imply that this transdermal gel formulation presents a viable substitute for Ibuprofen delivery improving patient compliance by means of non-invasive administration more in vivo research is advised to confirm the therapeutic efficacy and safety of this intervention the investigation focuses on developing and review of a topical gel that contains the painkiller Ibuprofen a nonsteroidal anti-inflammatory medication nsaid propylene glycol and Alovera gel or Guar gum were used as penetration enhancers to promote penetration into the skin and as a gelling agent in the preparation of the gel to guarantee strength physical characteristics such as ph viscosity and appearance were assessed experiments on the releasing of substances within the body using flow-through diffusion cell demonstrated a prolonged release profile and experiments on skin permeation demonstrated efficient absorption tests for stability verified that the gel keptits characteristics under many circumstances the findings imply that this transdermal gel formulation presents a viable substitute for Ibuprofen delivery improving patient compliance by means of non-invasive administration more in vivo research is advised to confirm the therapeutic efficacy and safety of this intervention.

**Keywords:** Ibuprofen; Formulation of Gel; Topical Analgesic Application; Mechanism of gel formation; Factor affecting actual drug distribution

## 1. Introduction

### 1.1. Drug information

Ibuprofen is the nonsteroidal anti-inflammatory drug [1]. It is a propionic acid derivative having a p-isobutylphenyl group at the 2-position [2].

- Molecular formula:$C_{13}H_{18}O_2$
- Molecular weight:206.28g/mol.

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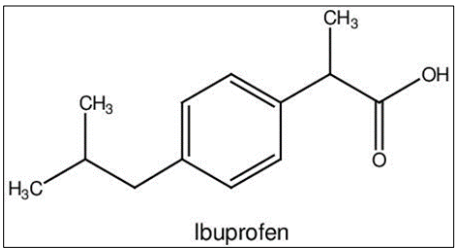
### 1.2. Structure



Ibuprofen

*1.2.1. Synonym*

- Ibuprofen
- Motrin
- Mufen[3].

### 1.3. Polymer Information

Herbal polymers are composed of a large macromolecular structure, formed by the repeated arrangement of smaller units. The arrangement of the chemical structure of the polymer determines how the subunits are connected through covalent bonds. Whether the polymer's nature is natural or artificial. In contrast to the survey, we will analyze that the availability, biodegradability, economic and non-toxicity of herbal polymers in pharmaceutical instruction are very common [4].

### 1.4. Natural polymers

E. g., Alove gel Gum acacia, gum tragacanth, Alginic acid, Carrageenan, chitosan, Guar gum, gellan gum, pectin, sodium hyaluronate, xanthan gum, xyloglucan, etc. [5].

Topical medications are applied directly to the skin to treat specific conditions or symptoms. Curing Different Illnesses. Typically, a topical. The drug delivery system is applied to the skin, where it can be absorbed into the bloodstream. The medications either target only the specific region or area of the body. Application or is absorbed into the bloodstream through. The second layer of skin. Topical drug delivery systems are designed to target specific areas of the body. A drug delivery system has been developed for the targeted delivery of therapeutic agents to specific locations within the body. Dermatologists use agents applied to the skin to treat various skin conditions. These are the main points of our research. Systems are typically employed for the treatment of localized skin infections. The: Formulations are available in various forms, such as tablets, capsules, and liquids. The substance transitioned from a solid state to a semi-solid state, eventually melting into a liquid form. [6].

### 1.5. Goal

The goal is to create a topical gel with a specific composition. Ibuprofen, alove gel or gum tragacanth, or gum acacia are all effective options for pain relief. For topical application.

### 1.6. Mechanism of gel formation

Three different forms of cross-linking create gels. [7,8].

- Chemical cross-linking
- Physical cross-linking
- Ionic cross-linking

### 1.7. Ideal features of the topical gel: [9].

- The gel should be uniform and transparent.
- When shear or force is applied while shaking the container, the gel should be easily.
- The gel must have an inert composition.
- The gel should not be sticky.
- The gel should never come into contact with any other component of the formulation.
- The gel should be trusted.
- The skin or any area where the gel is applied must not be irritated .

### 1.8. Gel preparation process[10].

There are 3 ways to prepare the gel.

- Fusion method:- In this method, tools, gelling agents, additives and drug are mixed at a high level. temperature until a semi-solid texture is formed.
- Cold method: - In this method all the ingredients except the drug or the active pharmaceutical ingredient are it is heated and mixed simultaneously, then the temperature of the formulation is lowered, then the drug is added and the mixture is resumed until no gel is formed.
- Dispersion method: In this method, the gelling agent is mixed with water until it bends and then the drug is dissolved in the medium and introduced into it. Add the buffer solution to adjust the pH of the gel if necessary.

### 1.9. Additive utilized in formulation [11].

- Preservatives

Preservatives are used to extend the life of the gel and prevent it from spoiling. For example, methylparaben and propylparaben, etc.

- Drug solubilizer

Drug solubilizer is used in case of poorly soluble drug. Some medicines are in short supply soluble in the environment, so the drug solvent helps the dissolution of the drug in the environment. For example:triethanolamine

- Stabilizer

Some gels contain heavy metals and agents stabilized by a chelating agent, such as E.D.T.A. (ethylenediaminetetraaceti

### 1.10. Formulation of Gel [12].

*1.10.1. Preparation of Gel Base*

Polymer Preparation

- Weigh a specified amount of Alovera gel or guar gum based on desired formulation (e.g., 1% w/v for each polymer).
- Slowly disperse the weighed polymers in distilled water in a beaker with continuous stirring using a magnetic
- stirrer for about 1-2 hours until a uniform gel is formed.
- Hydration
- Allow the mixture to hydrate for several hours or overnight to ensure complete dissolution of the polymers.

*1.10.2. Incorporation of Active Ingredient*

Ibuprofen Dissolution

- Weigh the appropriate amount of Ibuprofen (e.g., 2% w/v).
- Dissolve Ibuprofen in a small volume of methanol or ethanol to enhance solubility.
- Mixing
- Gradually add the dissolved Ibuprofen to the hydrated polymer gel while stirring continuously. Ensure that the
- drug is uniformly dispersed within the gel matrix.

*1.10.3. Addition of Plasticizers and Preservatives*

Plasticizer Addition

- Incorporate glycerin and propylene glycol into the gel formulation (e.g., 5% w/v of each) to improve skin permeability and flexibility.

Preservative Inclusion

- Add a suitable preservative (e.g., propyl parabenor methyl paraben) at recommended concentrations (e.g., 0.1% w/v) to ensure product stability.

*1.10.4. pH Adjustment*

- Measure the pH of the gel using a pH meter.
- Adjust the pH to a physiological range (5.5-6.5) using triethanolamine if necessary. Stir well to ensure uniformity.

*1.10.5. Viscosity Measurement*

Use a viscometer to measure the viscosity of the gel. The viscosity should be within a range suitable for application (e.g., 5000-10000 cP).

## 2. Evaluation [13]

The following parameters were used to evaluate the gel

### 2.1. Homogeneity

All developed gels were tested for homogeneity by visual inspection after the gels are placed in the container. They are tested for the appearance and presence of aggregates. Severity All formulations were evaluated under a microscope for this presence of particles, if any, without particles visible is not observed under an optical microscope. Therefore, the preparation of the gel obviously meets the material shortage requirement particular and desired granularity for any real preparation.

### 2.2. Extrudability study

A good gel optimal extract from the gel with a light applied pressure. Extrudability of formulations from collapsible aluminum tubes were defined with a universal tube filling machine. Collapsible aluminum tubes filled with 10 g of gel were held between two clamps. A blow was compressed and the extrudability of the formulation was defined in terms of weight in grams required for extrusion a 0.5 cm gel tape in 10 seconds.

### 2.3. Skin irritation studies

Albino rats of both sexes that weighed from 20 to 22 g were used for this test. Intact skin was used. Hair was removed from the mice 3 days before the experiment. The animals were divided into two groups and each group was divided again into two groups. The gel containing the drug was used on test animals. A piece of cotton soaked in a saturated solution of the drug was placed on the back of the albino rats. taken as a witness. Animals were handled daily for seven days and finally the treated skin was examined visually to detect erythema and edema.

### 2.4. pH measurement

The pH of the gel formulations was determined using a Digital pH meter. One gram of gel is dissolved in 100 ml of water distilled and stored for two hours. provision The pH of each formulation was made in triplicate and mean values were calculated.

### 2.5. Drug content

The content of the drug was determined using a spectrophotometric method measuring the absorbance.

### 2.6. Study of viscosity

The viscosity of the prepared gel was measured with a Brookfield viscometer. Gels rolled in 20 and 30 rpm with spindle no. 64. At any speed, The reading of the corresponding number was noted.

### 2.7. Spreadability

One of the criteria for a gel to meet the ideal amounts is that there is a good spread. This is the term expression to determine the extent of the frosted area it spreads easily when applied to the skin or affected area. effectiveness The therapeutic effect of a formulation also depends on it spread the value. Spreading capacity is expressed in terms of time

in seconds with two blades to break away from the gel and put between the blades under the direction of a certain load, less time needed to separate the two blades is long, the better the ability to spread. him calculated with the formula:

$$S = M. L / T$$

Where
M = weight attached to upper blade
L = length of glass slats
T = time required to separate the blade

*2.7.1. In vitro diffusion studies*

They can be carried out in a Franz diffusion cell, to study the release by dissolution of the gel through a cellophane membrane. 0.5 g of gel sample was collected on a cellophane membrane. Diffusion studies were performed at 37 ± 1°C with 250 ml of phosphate buffer (pH 7.4) as a means of dissolution.

## 3. Factors affecting the actual distribution of drugs [14-16]

The success of the actual drug administration depends on the interaction between several factors:

- Physiological factors
- Physicochemical properties of the herb
- Components of the formulation and their interactions

Physiological factors are primarily related to skin properties, such as thickness, hydration level, and hair follicle density. These properties can vary greatly among individuals depending on age, sex, race, anatomical location, general health, and environmental conditions such as temperature and humidity. To minimize the effects of this physiological variability, the rate-limiting step in the administration of topical drugs should reside in the formulation rather than the biological barrier. The physicochemical properties of a drug almost invariably affect the ease of its diffusion through the local environment, as well as its penetration through the skin or mucosal surface. Properties of great importance include molecular size as reflected by molecular weight, the skin partition coefficient of the vehicle, melting point, stability, and chemical functionalities that affect the ionization potential, binding affinity, and solubility of the drug in the vehicle. The role of the formulation of the device is evident due to its effect on the drug as well as on the site of application. The effect of the drug includes drug diffusion, thermodynamic activity, stability and ionization rate of weakly acidic or basic drugs. The effect at the application site is associated with the modification of the barrier properties due to chemical changes caused by the simultaneous absorption of the formulation components and physical closure. These processes promote skin hydration or changes that enhance drug penetration. The formulation factor also influences the consistency and viscosity of the vehicle, which, in turn, determines the adherence and properties of the vehicle. Current vehicles can be classified as liquid, semi-solid and solid. Crescents are the most widely used form of current devices. These properties were important to ensure the retention of the vehicle at its application site for effective drug delivery.

## 4. Application

- Pain Relief: It is effective for treating mild to moderate pain, including headaches, toothaches, menstrual cramps, and muscle aches.
- Inflammatory Conditions: ibuprofen is often prescribed for conditions like arthritis (osteoarthritis and rheumatoid arthritis), ankylosing spondylitis, and tendinitis.
- Fever Reduction: It can be used to lower fever in various conditions.
- Gout Attacks: Ibuprofen can help relieve the pain and inflammation associated with gout attacks.

## 5. Conclusion

In Conclusion The development and evaluation of the ibuprofen gel by using natural polymers Demonstrated promising result In terms of delivery and therapeutic efficacy. The formulation effectively incorporated ibuprofen ensuring adequate release And Permiation through the skin. Stability study indicate that the gel maintain its physical and chemical integrity over time, Making it viable option for sustained drug delivery.

The evaluation metrics include viscosity, spreadability and skin irritation study Confirm that gel suitable for application. The permiation study highlighted a significant enhancement in bioavailability compare to conventional oral administration suggesting the improve potential for patient compliance and reduce side effect. disclosure of conflict of interest.

## Compliance with ethical standards

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*Disclosure of conflict of interest*

No conflict of interest to be disclosed.

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