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A Critical Review on Aceclofenac Topical Nanoemulgel

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ABSTRACT

Because of its versatility in delivering both hydrophilic and lipophilic medicines, nanoemulsions are gaining popularity in the biopharmaceutical and cosmetics industries. Nanoemulgel is a gelling agent combined with a nanoemulsion. This study was focused on the physicochemical properties of Nanoemulgel, preparation method, evaluation parameters, and merits. This review consists of an extensive survey of literature from Scopus, PubMed, Springer Nature, and other international reputed sources. The oil phase was mixed with the aqueous phase, which contained soybean oil and Piper betle essential oil in various ratios, as well as tween 80 as a surfactant and glycerol as a co-surfactant (distilled water). Aceclofenac is a non-steroidal anti-inflammatory medication (NSAID) with excellent analgesic, anti-inflammatory, and antipyretic properties. (2-[(2,6- dichlorophenyl) amine] or phenylacetone acetic acid] is its chemical name. Nanoemulgel is prepared only after the preparation of nanoemulsion. They are evaluated for various parameters such as rheological studies, pH measurements, in-vitro drug release, skin irritation studies, etc. Nanoemulgels have better physiological and physicochemical properties. This dosage form has numerous advantages over other topical dosage forms in terms of controlled release, better patient compliance, and many more. In conclusion, it confirms that due to a variety of pharmaceutical/ topical dosage form ability, better absorption ratio, and patient compliance, it may be promising to deliver the drug in a controlled manner in numerous diseases.

INTRODUCTION

Because of its versatility in delivering both hydrophilic and lipophilic medicines, nanoemulsions are gaining popularity in the biopharmaceutical and cosmetics industries. They can be used as a drug delivery method for a variety of systemic routes, including topical, oral, and others. Goods containing nanoemulsions can be semisolid, such as creams and balms, or fluid, such as lotions, liniments, and other products. Nanoemulsions are colloidal dispersions made up of nanoparticles. Oil, water, and emulsifier, with droplet sizes ranging from 20 nm to 500 nm (Pople et al. 2006). The emulsifier aids in the formation of tiny droplets by reducing the interfacial tension between the oil and water phases of the nanoemulsion (Gupta et al. 2016). W/O nanoemulsion (water in oil) although it has great emollient properties, customers do not accept it because of the high price of oil content and oily texture (Silva et al. 2020).

Nanoemulgel is a gelling agent combined with a nanoemulsion. The oil phase was mixed with the aqueous phase, which contained soybean oil and Piper betle essential oil in various ratios, as well as tween 80 as a surfactant and glycerol as a co-surfactant (distilled water). Because of its twin characteristics of nanoemulsion and gel base, nanoemulgel is regarded as one of the best choices for medication delivery to the skin. Nanoemulgel has good patient acceptability due to the benefits of both nanoemulsion and gel (Thanushree et al. 2017). Nanoemulgel is frequently used in the pharmaceutical industry. Numerous studies and investigations have been conducted on nanoemulgel formulations and development for a variety of delivery routes, including transdermal, vaginal, ophthalmic, oral, and nose to the brain for the treatment of various local and systemic disorders (Hira et al. 2017).

Aceclofenac is a non-steroidal anti-inflammatory medication (NSAID) with excellent analgesic, anti-inflammatory, and antipyretic properties. (2-[(2,6- dichlorophenyl) amine] or phenylacetone acetic acid] is its chemical name. In contrast to 75 mg diclofenac, aceclofenac (100 mg) demonstrates a supported COX-2 barricade in vivo but just a moderate COX-1 restraint. Aceclofenac is viable and well-tolerated in patients with osteoarthritis, rheumatoid joint discomfort (RA), and spondylitis, according to certain controlled clinical preliminary studies (anky-losing) (Singh & Sangeeta, 2021).

Aceclofenac is a popular COX-2 inhibitor with sedative and pain-relieving properties. Aceclofenac also inhibits glycosaminoglycan production, resulting in chondroprotective effects. It produces more consistent gastrointestinal symptoms such as dyspepsia, stomach

ache, and nausea. Aceclofenac is also effective at reducing pain and increasing functional capacity in people suffering from severe low back pain. However, when compared to Aceclofenac, a cost-viability analysis revealed Etoricoxib to be a more cost-effective intervention (Jagannathan et al. 2020).

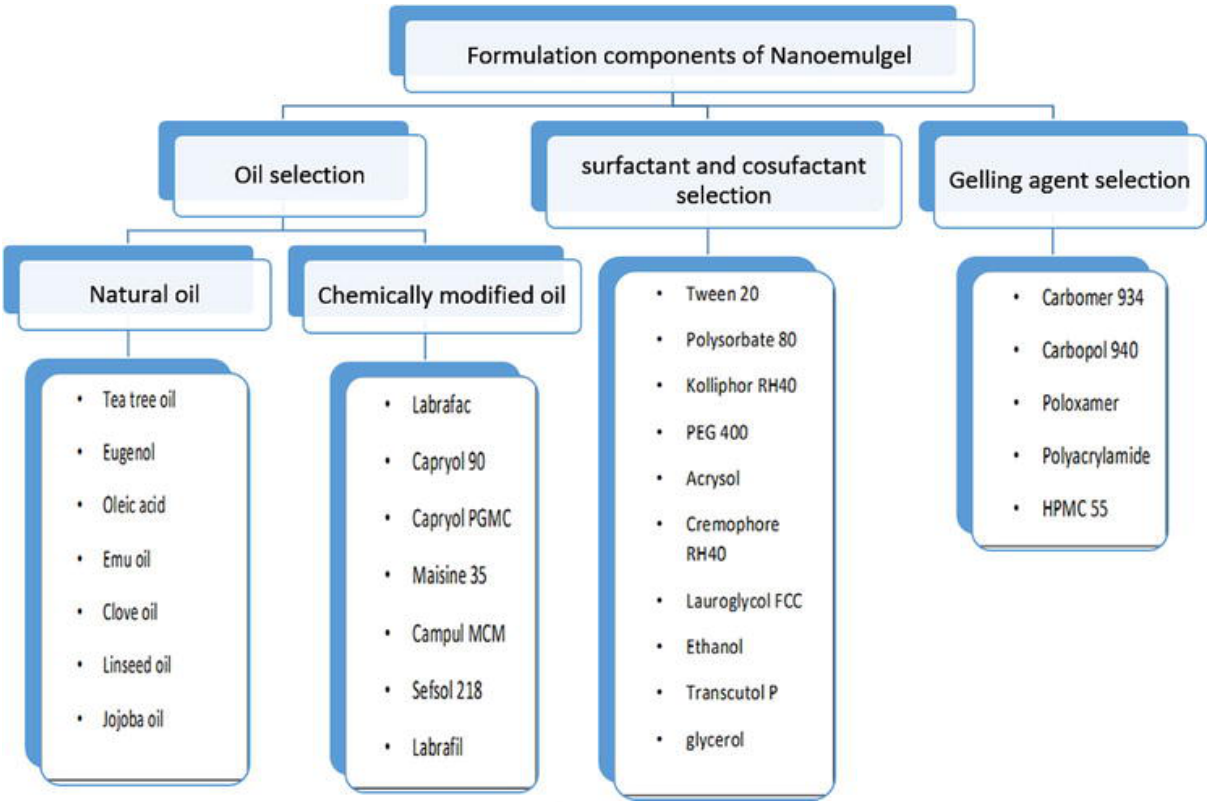

Figure No. 1: Components for the Nanoemulgel

Nanoemulgel has the potential to overcome both technologies' limitations. The lipophilic drug is dissolved in the oil phase of nanoemulsion, which is then added to the hydrogel foundation to produce nanoemulgel (Eid, 2014), allowing the lipophilic drug to be incorporated into a hydrogel while also enhancing nanoemulsion viscosity.

Nanoemulgel works as a drug reservoir in transdermal medication delivery. The medicine is released first from the inner phase to the outer phase, then into the skin surface. When nanoemulgel was applied to the skin, oily droplets were produced from the gel matrix, which subsequently penetrated deep into the skin via the stratum corneum, directly delivering the drug moiety (Mou et al. 2008).

Method of Preparation ((Jivani et al. 2018)

Nanoemulsion

The medication is then dissolved in oil and added to Nmix, which is subsequently diluted with water to create a Nanoemulsion of the provided drug.

Nanoemulgel

1g of Carbopol is dissolved in the needed amount of water to make the gel basis. After 24 hours of swelling and dispersion of the Carbopol solution, the produced Nanoemulsion is gently added while stirring continuously. The use of Triethanolamine results in uniform gel dispersion. Finally, distilled water is used to modify the remaining half.

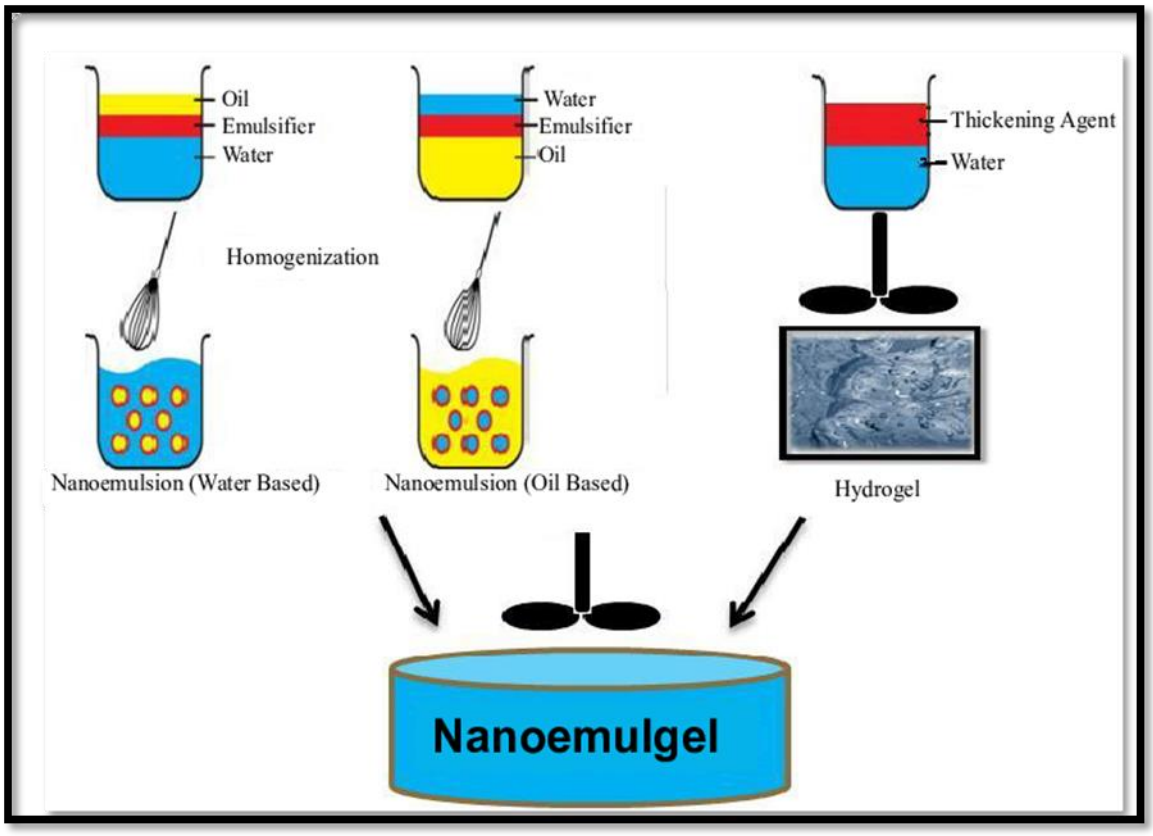

Figure No. 2: Process of preparation of Nanoemulgel

Estimation parameters

Stability and physical appearance

Different nanoemulsion and nanoemulgel samples were made. The color, transparency, and capacity of the sample to remain unseparated were used to assess its stability and physical appearance.

Droplet size determination

Dynamic light scattering (DLS), one of the most prevalent measuring methods for size particle investigation in the nanometre range, was used to examine the droplet sizes of nanoemulsions with and without essential oils.

In-vitro skin permeation study

An in vitro skin permeation investigation was conducted on male albino rat skin (shaved dorsal skin). The rats were slaughtered, and the dorsal hair was removed before the skin was surgically removed. After washing with phosphate buffer solution, the excised skin was kept at 20°C. Franz diffusion cell (9 mL) with high diffusion area of 1.76 cm2 was employed for the skin permeation research. The dermal edge was scraped of fat and other subcutaneous tissues, and the processed patch was inserted between the receptor and donor compartments of a cell, with the dermal layer facing the receptor compartment and the stratum corneum (horny layer) facing the donor compartment. On the epidermal skin side, one mL of each test formulation was applied. The receptor chamber was filled with PBS (pH 7.4). The magnetic bead was rotated at a set speed of 300 rpm at 37 0.5°C after the Franz diffusion cell was placed on the magnetic stirrer (Elmataeeshy et al. 2018). After adequate dilution, samples were obtained at predefined time intervals for the next 24 hours and evaluated spectrophotometrically at 251.5 nm wavelength. After each sampling, an equal volume of fresh dissolving medium was replenished.

Solubility studies

The excess drug was added to 2 mL of each excipient, vortex mixed for about 2 minutes, and settled for 72 hours in a reciprocating shaking water bath at 37°C and 100 rpm. The resulting mixture was then centrifuged at 3000 rpm for 5 minutes. 0.45 um membrane filters were used to extract the undissolved drug component. The clear supernatant was then mixed with

methanol and spectrophotometrically examined at 251.5 nm using methanol as a blank (Bashir et al. 2021).

Spreadability test

After one minute, the spreading diameter of 0.5 g of the sample between two horizontal glass plates was measured to estimate the spreadability of several nanoemulgel formulations. The upper plate was then given a 5g weight. Each composition was tested three times to ensure that the results were accurate and consistent (Ting et al. 2020).

pH estimation

A digital pH meter was used to determine the pH of the nanoemulgel. To match the skin state, the pH of the test sample should be around 6-7.

Rheological studies

The viscosity of 20gm of Nanoemulsion-gel in a 25ml beaker was measured using a Brookfield viscometer with Spindle number S64 (Bonacucina et al. 2009).

Skin irritation test

0.25 gram Each location (two sites per rabbit) is treated with nanoemulgel. After 24 hours, the rabbit skin location is cleansed and sanitized, and any changes in color or morphology that are undesirable are documented and evaluated.

In-vitro diffusion studies

The diffusion of produced nanomeulgel is studied using the Franz diffusion cell. A cellophane membrane is employed for the investigation, and 0.5g of sample is put to the membrane, followed by 8 hours of diffusion at 371°C using phosphate buffer (pH 7.4). 1 ml pg sample is collected every 1 hour and replaced by a new buffer solution. The collected materials are examined using the most appropriate analytical method (Tanwar & Jain, 2012).

Factors affecting absorption

- Physiological (Kalia et al. 2001; Ayub et al. 2007)

➢ The skin's lipid content acts as a barrier to drug absorption, and reducing this barrier feature increases penetration.

➢ Different skin layer thicknesses - The greater the thickness, the lower the penetration rate; for example, the palm and sole have a larger diffusion rate than other surfaces.

➢ Density of hair follicles - substantial store, roughly 10-12 times that of SC.

➢ Skin pH

➢ Skin hydration

➢ The number of sweat glands

➢ Skin inflammation disrupts the stratum corneum, which increases permeability.

➢ Blood circulation

➢ The body's temperature

❖ Physiochemical (Ajazuddin et al. 2013)

➢ Absorption is caused by a greater log p-value in the partition coefficient.

➢ The most efficient absorption through the skin is provided by hydro alcoholic gel.

➢ Ionization degree

➢ Molecular ass less than 400

Merits of Nanoemulgel (Jivani et al. 2018)

- The dispersion of oil droplets in the Gel foundation improves Nanoemulsion stability, while the drug's affinity for oil dictates stability.
- Additionally, good skin adherence combined with high solubilizing power results in a high concentration gradient, which increases medication penetration as it travels down.
- Furthermore, these formulations aid in the distribution of lipophilic and weakly water-soluble medicines while also improving patient compliance.
- Nanoemulgel can also assist with the regulated release of medications with a shorter half-life.
- The spreadability of the formulation is better than creams.

- Nanoemulgel is non-irritant and non-toxic.
- Better patient compliance
- When compared to other formulations, the drug loading is better.
- Increase permeability of the skin and drug deposition

CONCLUSION

Topical Nanoemulgels have proven to be a more effective and convenient method of medication administration. Patient compliance is higher thanks to the gel and non-greasy qualities, and the lack of an oily basis allows for better medication release than other formulations. With the incorporation of Nanoemulsion into the gel matrix, problems like creaming and phase separation that are linked with traditional emulsions are overcome, as is increased spreadability. In conclusion, it confirms that due to a variety of pharmaceutical/ topical dosage form ability, better absorption ratio, and patient compliance, it may be promising to deliver the drug in a controlled manner in numerous diseases.

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Nil

CONFLICT OF INTEREST

None.

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