

A Review of the Diverse Applications of Herbal Emulgel

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Abstract

Herbal medicine has recently experienced a boom in popularity. Topical drug delivery methods use a wide range of formulations, but each has a unique set of limitations. The gel is a revolutionary type of formulation that delivers the medication more swiftly but the inability to incorporate hydrophobic medications in a gel limit their significance. The creation of an emulgel reduces the bulk of these problems and has proven to be the most practical, superior, and efficient delivery method throughout the literature review. Topical medicine delivery will be used often in the upcoming years to increase patient compliance. This paper focused on an overview of herbal emulgel formulations targeting different conditions or having different pharmacological activities. Emulgel is a novel topical drug delivery system that is effective with hydrophobic drugs. because it can enhance extrusion, adhesion, spreadability, and viscosity.

Keywords: Emulgel, Herbal, Topical drug delivery, Emulsions.

1. INTRODUCTION

Traditional medicine often focuses on the patient's overall health rather than the specific illness or disease and the use of herbs is a vital component of all traditional medical systems[1]. 35,000 and 70,000 plant species have been evaluated for their pharmacological activity to date Herbal medications are more accessible, less expensive, time-tested, and deemed safer than the majority of contemporary synthetic treatments. Natural ingredients were used to make more than half of today's best-selling medications[2]. Approximately 75–80% of people still use herbal medicine as their primary source of healthcare. Herbal medicine took a hit when modern medicine came along, but in the last two or three decades, advances in phytochemistry and the discovery of plant compounds that are effective against certain diseases have brought herbal therapies back into the spotlight. According to data, more than half of all medications used in the previous 30 years were of natural origin[3]. Herbal medications have recently grown in popularity due to their decreased risk of side effects and problems when compared to synthetic treatments [4]. The use of crude substances gives a key hint in drug development. Plants include a wealth of rich, sophisticated, and diverse structures that are unlikely to be manufactured in a lab. As a result, phytopharmaceutical research has grown in popularity across the world to better identify and understand their medical properties [5].

In contrast to ointment, cream, or lotion, the gel is a revolutionary type of formulation that delivers the medication more swiftly but the inability to incorporate hydrophobic medications in a gel limit their significance. One of the downsides of conventional topical formulations is their stickiness on the skin, they need rubbing and are less spreadable which decreases patient compliance. To get around these limitations, an emulsion-based method was suggested. The advantages of emulsion and gel are combined in a unique way for topical delivery of medicine

called emulgel. Emulgels /creamed gel/quasi emulsion/gelled emulsion are o/w or w/o emulsions that are combined with a gelling agent to form a gel. Along with having the benefits of gels, emulgels also make it possible to include lipophilic drugs that have been previously deemed unsuitable for delivery in a gel base. Since they incorporate the advantages of both emulsions and gels, they have a high degree of patient acceptability. As a consequence, they are now used to deliver a variety of drugs to the skin as well [6,7]. Emulgel has several advantages, including being thixotropic, greaseless and having a pleasing presence [8,9]. Emulgels are very cheap, which makes them good for both small-scale and large-scale production, and they are also easy to make. The production of emulgels does not need the use of sophisticated machinery. The other advantages are ease of application, patient compliance controlled drug delivery, avoiding first pass metabolism [10]. There are some disadvantages like skin irritation, allergic reaction etc. [11]

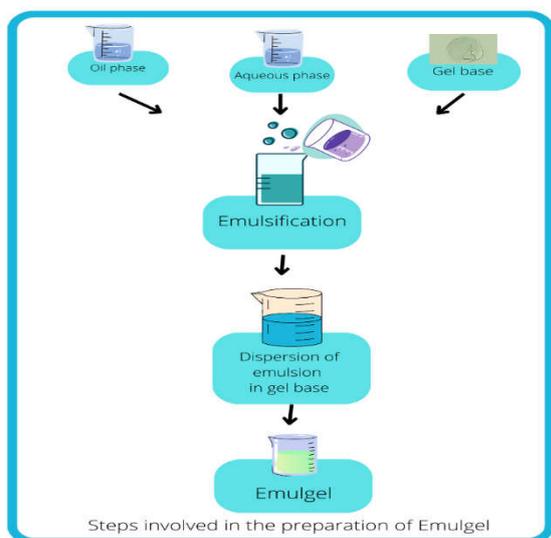


Fig.1. Preparation of emulgel

II. Emulgel for Acne

Acne is more prevalent among adolescents and young adults. Symptoms range from blackheads that are not inflamed to pus-filled zits or large, red, and tender bumps. *Camellia sinensis* (Green Tea), a plant native to China and Southeast Asia is incredibly significant to people of all ages. The topical application of GTE is advantageous for the treatment of acne without creating substantial adverse effects, however, oral GTE consumption has limited effects. About 4% of the caffeine is found in fresh leaves in addition to similar substances like theobromine. Due to the differences in the chemical makeup of different leaf ages, different leaf ages result in diverse tea characteristics [12,13]. Green tea leaves were used to make the green tea extract (GTE). An emulgel formulation containing 20 % green tea extract and 5% avocado oil was designed as a result of pre-formulation studies. It was reported that the F2 formulation was the most effective of the other formulations in terms of antiacne activity. In vivo studies on twelve female subjects were evaluated by using non-invasive skin bioengineering techniques. In vivo studies showed a positive result that helped cure acne in the affected skin region. According to the results, the green tea extract and avocado oil

emulgel formulation were determined to be the best in terms of application and stability. It has an anti-acne impact on human skin [14,15].

Cocos nucifera long coconut palm tree produces its first fruit in 6 to 10 years and achieves optimum productivity in fifteen to twenty years [16-19]. Vitamin B, nicotinic acid (B3, 0.64mg/mL), pantothenic acid (B5, 0.52mg/mL), biotin (0.02mg/mL), riboflavin (B2, 0.01 ng/mL), folic acid (0.003mg/mL), together with trace amounts of vitamins B1, B6, and C, pyridoxine, thiamine, folic acid, amino acids, L-arg. Furthermore, the majority of the oil recovered from solid albumen contains lauric acid and alpha-tocopherol [20,21]. The lauric acid in *Cocos nucifera* Linn., which has antibacterial properties against *Propionibacterium acnes*, is reported to lessen the severity of pimples. The Kopyor coconut's *C. nucifera* L. extract was used to prepare an anti-acne mask. *P. acnes* ATCC 11827 was investigated for antibacterial properties of extract emulgel. In this study, peel-off anti-acne emulgel masks with carbomer 940 (1 and 1.5%) in various concentrations and *C. nucifera* L. extract of 1 and 5 % were created. The viscosity, pH, drying time, spreadability, and antibacterial activity of the *C. nucifera* L extract peel-off emulgel mask were assessed. of carbomer 940 (1%) and *C. nucifera* extract (5%) containing mask was chosen as the best antiacne mask. The chosen formula produced a mask with suitable skin pH, good dispersion, and sufficient viscosity. Moreover, it had high antibacterial activity. The researcher recommended the long-term stability study of peel-off masks in future [22,23].

III. Emulgel for wound healing

A wound is a breach in the epithelial barrier of the skin caused by physical, chemical, or microbial stress. There are three phases of wound healing namely inflammation, proliferation and remodelling. On rats with cutaneous excision wounds, the wound-healing properties of basil (*Ocimum basilicum*) were studied. Honey combined with *Ocimum basilicum* (OB) alcoholic leaf extract and solcoseryl-jelly enhanced the healing of wounds compared to honey alone. The Carbopol-934, Tween 80, and propylene glycol were used during the wound healing study of OB emulgel. The OB extract mixed well with the chosen polymer and other additives, demonstrating the compatibility of those materials for making topical emulgel. The OB emulgel that was created has good physical characteristics and drug release profile, releasing $81.71 \pm 1.7\%$ of the medication in 250 minutes. In-vivo wounds healing activity revealed that OB emulgel had the highest percentage of wound contraction that was comparable to the commercial entity ($p > 0.05$). In comparison to the control, this action was statically important ($p > 0.05$). After 16 days of OB emulgel therapy, the histopathological evaluation revealed a significant enhancement in the skin's histopathological composition. One may also argue that this work illustrates a more powerful method for creating emulgels with significant wound healing potential. To reach a conclusive level, more study is required to synthesize an emulgel with isolated components responsible for the action that heals wounds and to standardize the drug using both simple and complex phytochemical analytical approaches [24-26].

Hibiscus rosa-Sinensis is a dense, perennial shrub. The blossoms of *Hibiscus rosa-Sinensis* included 0.171 mg/g of flavonoids, 0.092 mg/g of total phenolics, 0.073 mg/g of tannins, 0.356 mg/g of carbs, 0.247 mg/g of protein, 0.072 mg/g of thiamine, 0.075 mg/g of niacin, 0.0339 mg/g of ascorbic acid, 0.087 mg/g of riboflavin [27,28]. *Hibiscus rosa-Sinensis*

possessed antimicrobial, antiparasitic, dermatological, anti-diabetic, hypolipidemic, antioxidant, anti-inflammatory, antipyretic, analgesic, immuno-modulatory, anticonvulsant, memory-enhancing, cytotoxic, hepatoprotective, neuroprotective, and numerous other effects. Amminbavi and Lakshmi prepared emulgel of methanolic extract of Hibiscus leaves for wound healing. The emulsions were created utilizing various oils, including liquid paraffin (LEG), coconut oil (CEG), and olive oil (OEG), as well as variable amounts of Tween80 and Span80, Using varied quantities of gelling agents such as Carbopol934. They reported that within 5 hours, 82.52% drug release was discovered from OEG emulgel and showed improved stability. Therefore, promoted for in-vitro wound healing investigations. The cytotoxicity of OEG on L929 cells was evaluated using the MTT [3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide] test, which demonstrated that OEG had no harmful impact and the highest concentration (200g/mL) resulted in 74.5 percent cell viability. To test the wound healing characteristics of OEG, an in vitro scratch experiment was done. The scratch assay revealed substantial concentration-dependent migration and closed the gap by 24.16 percent, 51.66 percent, and 86.72 percent in 12 hours, 24 hours, and 48 hours correspondingly. In comparison, Standard (Cipladine) demonstrated 9.35 percent, 49.6 percent, and one hundred percent wound closures[29].

Araceae's *Pothos scandens* is a scrambling tree found in tropical forests. Whole plants grounded in a paste are used to treat muscle catches and sprains. In Thailand, people take aerial parts of the plant in the form of tea to treat cancer. *P. scandens* gel-treated animals were observed to epithelise in 22 days, but the solvents reference and untreated rats epithelised in 35 and 40 days, respectively, according to investigations on the healing of wounds using ethanolic extract. In comparison to other preparations, the one containing 1.5% w/w carbopol 934 has superior physicochemical properties, stronger pharmacological effects, and is more stable.[30] In another study emulgels of ethanolic extract of *P. scandens* were created using carbopol 934, carbopol 940, and HPMC K4M as gelling agents. The generated emulgels' physical characteristics, pH, viscosity, spreadability, in vitro drug release, pharmacological efficacy, and stability were evaluated. The formulation F1 with 1% w/w Carbopol 940 was found to be a more promising formulations as it shows better physicochemical characteristics and higher pharmacological activity compared to other formulations. The author concluded that *Pothos scandens* ethanolic extract herbal emulgel is a great choice for healing burn wounds[31,32].

Senna consists of trees, shrubs, and plants [33]. It is widely employed in folk medicine for the treatment of skin ailments (Sofowora, 1993). The Igbos and Yoruba-speaking tribes of Nigeria recognise the leaves for their antigonorrhoeal and purgative effects, as well as their ability to treat guinea worms and wounds [34]. According to phytochemical screening, the hydro-ethanolic extract of SP leaves included alkaloids, saponins, tannins, cardiac glycosides, flavonoids, anthraquinones, and phenols[35]. The main constituents of the oil were 1,2-benzenedicarboxylic acid, mono (2-ethylhexyl) ester phthalate (26.6%) and β -elemene (27.9%). There were significant amounts of caryophyllene oxide (7.3%) and urs-12-en-24-oic acid, 3-oxo-methyl ester (5.5%) [33]. *Senna podocarpa* (SP) leaves are applied to wound surfaces as poultices to treat burns and wounds. Because no comprehensive research has been done on this plant's ability to heal wounds. In their study, Issac et al. prepared *Senna podocarpa* emulgel by mixing the emulsion phase and gel phase in a 1:1 ratio to create the 2.5

percent SP emulgel (F1) and 7.5 percent SP emulgel (F2) formulations. F2 formulation in Hematoxylin-eosin and Verhoff-Van Gieson staining demonstrated the accumulation of fibroblasts, gland cells, epidermal cells, and collagen in the wound healing process of mice damaged with hydrochloric acid. The percentage of wound contractions in mice treated with F1, F2, and SP leaf poultice was 64, 87, and 50, respectively, indicating that SP emulgel possesses superior wound healing properties to SP leaf poultice[36,37].

IV. Anti-inflammatory Emulgel

Inflammation consists of a cascade of cellular and microvascular processes that help to eliminate injured tissue and produce new tissue. It is the primary mechanism available for tissue healing following injury. The cascade consists of increased permeability in microvessels, attachment of circulating cells to vessels at the damage site, migration of many cell types, cell apoptosis, and development of new tissue and blood vessels. Mounika and Sundari used different oils, including coconut oil (CEG), olive oil(OEG), and light liquid paraffin(LEG), to create the emulgel of the methanolic extract of Hibiscus. Gelling agents like Carbopol 934, HPMC E15, NaCMC in different ratios together with variable amounts of Tween80 and Span80 used in emulgel. Based on their physicochemical properties and percentage drug release, the generated emulgel formulations were optimised. Using a model of rat paw oedema caused by carrageenan, the anti-inflammatory effect of the optimised formulation OEG4 was assessed. In this study, generated emulgels are characterised physicochemically in terms of their spreadability, viscosity, drug content, in vitro diffusion experiments, and stability investigations. According to ICH requirements, the stability investigations were carried out over a period of three months at two distinct conditions, namely room temperature (25°C/75°F/5% RH). For 90 days, the drug content of the improved formulation OEG4 was observed. To assess the anti-inflammatory effect, the improved emulgel formulation OEG4 was contrasted with Diclofenac sodium, a reference medication. At 4 hours after delivery, the improved formulation demonstrated a maximal inhibition of 85.46 percent. In comparison to normal emulgel, there was a statistically significant decrease in paw oedema caused by the test gel ($p < 0.01$). According to the findings of the investigation, hibiscus emulgel may have anti-inflammatory properties [38].

Leea indica (Burm. f.) Merr. (Leeaceae) is a big evergreen shrub or small tree native to tropical Asia, Australasia, and the Pacific that is cultivated mostly in Bangladesh, India, China, Bhutan, and Malaysia. The anti-inflammatory, thrombolytic, and hair growth-promoting activities of the n-hexane fraction of the methanol extract of *Leea indica* (NFLI) leaves were studied[36]. In one study *L. indica* (Burm.f.) Merr. Leaf extract was used to create an anti-inflammatory herbal emulgel that was more effective, affordable, and safe. All herbal emulgels containing 70% aqueous acetone leaf extract from *L. indica* had much higher in vitro anti-inflammatory and antioxidant effects as compared to the reference commercial formulations. They were further evaluated for in vitro anti-inflammatory and antioxidant properties using the Human Red Blood Cell membrane stabilisation assay and the 2, 2-diphenyl-1-picrylhydrazyl (DPPH) assay, respectively. With the best in vitro anti-inflammatory and antioxidant activity of all of them, Fg5 emulgel was discovered to be the most stable and effective formulation. At a dosage of 12.5 mg/mL, Fg5 inhibited heat-induced

hemolysis of erythrocytes by 93.73 0.90 percent, and it's in vitro antioxidant activity was 3.39 0.01 mmol Trolox per 100 g of emulgel.[39]

Table 1. Plant-based emulgel formulations

S.no	Plant name	Oil	Polymer	Pharmacological activity	References
1.	Avena sativa	LightLiquid paraffin	Carbopol 934, Sodium Carboxymethylcellulose,HPMC,HPMC K15 M	Anti-pigmentation	Asrar et al.,(2019)[40]
2.	Lemongrass	LightLiquid paraffin	Carbopol 934,Sodium Carboxy methylcellulose	Antifungal	Bhute et al.,(2021)[41]
3.	Coriandrum sativum	Sesame oil	Carbopol 940	Antimicrobial and Anticancer	Ahmad et al.,(2021)[42]
4.	Zingiber officinale	Liquid Paraffin	Carbopol 940	Antibacterial	Sowemimo et al.,(2018)[43]
5.	Commiphora mukul	Light Liquid Paraffin	Carbopol 934	Anti-Inflammatory/ Analgesic	Raut et al.,(2007)[44]
6.	Saussurea lappa	Liquid Paraffin	Carbopol940	Wound healing	Ahsan et al.,(2020)[45]
7.	Lantana camara	liquid Paraffin	Carbopol 934 NaCMC,HPMC,HPMC K15	Wound healing	Sultana SSet al (2016)[46]
8.	Pothos scandens	Liquid Paraffin	Carbopol 934, Carbopol 940 HPMC K4M	Wound healing	Haneefa et al.,(2014)[47]
9.	Psidium Guajava	Clove oil	Carbopol 934	Anti-bacterial, Antimicrobial	Ahmad et al.,(2021)[48]
10.	Cocos nucifera	Polyvinyl Alcohol	Carbopol 940	Antibacterial	Hariyadi DM et al.,(2020)[49]
11.	Leea indica	Menthol Eucalyptus Oil, Castor oil	Carbopol 940	Antiinflammatory, Antioxidant	Srilal TL et al.,(2021)[50]

V. Conclusion

It is concluded that topical medication delivery devices will play a key role in ensuring patient compliance in the future. Emulgels are popular among topical formulations because of their

improved spreadability, low viscosity, non-greasy feel, and glossy look. To improve patient compliance, topical medication administration will be employed widely. Emulgel is a new topical medication delivery method that works well with hydrophobic medicines. because it can improve spreadability, adhesion, viscosity, and extrusion. They will become a prominent method of medicine delivery. Furthermore, they will be used to load hydrophobic medicines into a water-soluble gel foundation. Throughout the project, the literature review shows that the emulgel is the most convenient, best, and most effective delivery technique. The incorporation of an emulsion into the gel creates a dual control release mechanism, which helps to tackle the difficulties even further. Herbal Emulgel may be a potential natural dressing for treating burn wounds, acne, and inflammation, among other things.

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