A REVIEW ON THE DEVELOPMENT AND EVALUATION OF PLANT BASED EMULGEL FORMULATIONS

Santhosh Anasuri¹, Pavani Sriram², Amritpal Singh³, Gurpal Singh⁴, Ashish Suttee¹*

¹School of Pharmaceutical Sciences, Lovely Professional University, Punjab-India 144411.
²Vaagdevi College of Pharmacy, Warangal, Telangana State
³Shri Dhanwantri Ayurvedic College, Chandigarh
⁴University Institute of Pharmaceutical Sciences, Panjab University, Chandigarh

ABSTRACT:
Emulgels are the novel drug delivery systems meant for the enhanced and controlled delivery of drugs in general and hydrophobic drugs in specific. Being the unique combination of gels and emulsions, these possess several merits over conventional dosage forms like creams and ointments like thixotropic, nongreasy, non-adhesive, etc. Several natural drugs from plant origin are reported in the literature for their potential to cure skin diseases but most of them are not formulated into a novel drug delivery systems due to several reasons. If formulated these are useful to the people, government and industry in the process of eradication of such deadly diseases like Leprosy and Psoriasis. These are safe, effective and also economical in nature. The present review focussed on the recent scientific advances related to the development and evaluation of emulgel formulations with plant- based drugs and related products.

Key words: Emulgel, Natural drugs, Topical, controlled, enhanced drug delivery

1. INTRODUCTION
Emulgels cab be defined as the novel topical drug delivery systems that can be formed by incorporation of gel into the water phase of an emulsion and possess the advantages both as gels and emulsions. Therefore, these are the combination of both gels and emulsions. It is also useful in the formulation of both hydrophilic and hydrophobic drugs for their enhanced and controlled delivery through skin.

Emulgels possess several merits over conventional semisolid dosage forms as these are leading to dual and controlled and enhanced release of drugs from both the phases, thixotropic, greaseless, easily spreadable, easily removable, emollient, non-staining, transparent, pleasing in appearance, suitable in the delivery of both drugs and cosmetics, shows better stability, have grater loading capacities for drugs etc., [1-6].

At present, several drugs which belonging to the categories of non steroidal anti inflammatory drugs, anti microbial agents etc., are successfully formulated and some of which are also marketed as Emulgels[7-8]. Certain natural drugs are also successfully formulated and evaluated as emulgel formulations [9-11].

These are the dosage forms which are prepared by combination of both emulsion and gels. Possess advantages of both to deliver both hydrophilic and hydrophobic drugs in topical drug delivery systems[1-2].

These can be prepared by using aqueous materials like water and alcohol, vegetable oils like, castor oil, emulsifying agents like polyethylene glycol for improving stability, gelling agents like, carbapol 940 for consistency and thickness and skin permeation enhancing agents like oleic acid etc., [3-4].

The formulation of emulgels usually involves the following steps: Preparation of either oil in water or water in oil emulsion, preparation of gelling agent, mixing both under suitable conditions with stirring.

The emulgel obtained above can be evaluated for different parameters like, physical appearance, rheological properties, spreadability, skin irritation test using rats etc., In-vitro release study by using Franz diffusion cell, extrudability by tube test, swelling index, PH, stability studies, drug content etc., [5-6].
2. STUDY OF DRUG-EXCIPIENT COMPATIBILITY / PREFORMULATION STUDIES: The compatibility between the selected drugs and the excipients to be assessed by FTIR analysis of the 1:1 mixture of the drug and excipient samples using K Br pellet method. It can also be confirmed with DSC studies. Drug Physico – Chemical Properties like colour, odour, taste, solubility, pH, Ash, Extractive values, Preliminary Phytochemical constituents also be evaluated.

2.1. Fabrication of Emulgel

The emulgel formulations of different doses of drugs and standard reference compound to be prepared which involves the following steps: a. Preparation of emulsion by mixing oil and aqueous phases under controlled conditions. b. Mixing the drug with either aqueous or oil phase of emulsion before mixing both. c. Preparation of gel base. d. Mixing of both gel and emulsion under suitable conditions in the ratio of 1:1 to form an emulgel. e. Different types/ concentrations of excipients like gelling agents can be used in different formulation. f. Optimization by changing the composition of the ingredients according to the response in evaluation tests.

2.2. Excipients

The following excipients can be used based on literature review, can be used for the formulation of emulgels subjected to the results of drug-excipient compatibility studies: a. Oil Phase: Span 80 in liquid paraffin/ Olive/ Coconut oil/ any suitable fixed oil. b. Aqueous Phase: Tween 80 in hot water. c. Gelling agents: Carbopol 940 and Carbopol 934 in hot water. d. Preservatives: Methyl and Propyl parabens in Propylene glycol. e. Others: Triethanolamine to adjust pH.

2.3. Evaluation of the formulations

The above prepared formulations are characterized and evaluated for several parameters which are as follows: a. Physical appearance like colour, extrudability and phase separation etc., b. pH of the prepared formulations to be determined by using digital pH meter and adjusted to suit the human skin to prevent skin incompatibility of the preparations. c. Drug excipient compatibility studies to be studied by methods of their detection like FTIR spectroscopy, HPLC. d. Viscosity of the preparations to be determined by Brookfield’s viscometer. e. Spreadability of the prepared formulations to be evaluated by glass slide test f. Extrudability is tested by using standard tube test. g. Drug concentration in each of the prepared formulation can be determined by using methods like UV-Visible spectrometry by using standard graphs of the respective drugs. h. In-vitro drug release of each formulation can be evaluated by using Franz diffusion cell method and drug content by UV spectrophotometer. i. Skin irritation test of each formulation can be evaluated by animal models like rats and rabbits. j. In-vivo evaluation of Biological activity: By using standard animal models of animals like rats/mice can be used. k. In-vitro evaluation of Biological activity: In-vitro methods like, agar well disc diffusion method for anti-microbial activity can be used. l. Stability studies: To be carried out according to the ICH guidelines for three weeks and the periodically collected samples to be evaluated for various parameters like appearance, pH, drug content, viscosity etc.,

3. RECENT ADVANCES IN FORMULATION OF PLANT BASED EMULGEL

Asrar Md et.al., 2019 formulated a stable emulgel formulation with Phytoconstituents derived from ethanolic extract of Avena sativa and evaluated for their effect on various facial parameters like antipigmentation effect and found that the preparation is novel, stable and effective[12].

Gayathri Guntupally et.al. 2019 formulated and evaluated the emulgel with the leaf extract from the plant Coccinia grandis and reported that all the formulations prepared are found to be stable and effective and exhibited good anti-bacterial activity against skin pathogenic Bacteria[11].

Mohite Shradhha et.al., 2019 prepared and evaluated emulgel based formulation with seed oil of the plant Coriandrum sativum and reported that the formulation as optimized and possess better results both In-vitro and In-vivo and possess good anti-inflammatory activity[9].

Sekhar Mahendran et.al., 2019 prepared and evaluated an emulgel based formulation with a natural active Pharmaceutical ingredient called Embelin and concluded that the formulations F1 and F2 shown promising results In-vitro and recommended the detailed evaluation for its standardization and In-vivo evaluation[13].
Desai Prabhat et al., 2019 formulated and evaluated the emulgel with the methanolic extract of the medicinal plant Zingiber officinalis and reported that the formulation F3 which was prepared with 5% sodium CMC shown better results and also 98% increased antimicrobial activity[14].

M. Mounika Reddy et al., 2019 Designed and evaluated by In-vitro characterization of the emulgel with Guggulu and Babchi oil and concluded that the formulation E3 exhibited better results for both formulation related and for the treatment of Psoriasis[15].

B. Mounica et al., 2019 developed and evaluated an emulgel preparation with the methanolic extract of Hibiscus rosa-sinensis and reported that, the formulation OEG 4 was the optimized one and possess maximum anti-inflammatory activity and a potential formulation among all prepared ones[16].

Tariq Maqlam et al., 2019 formulated and evaluated emulgel and cream based formulations with the ethanolic aquatic extracts of the medicinal plant Kigelia Africana fruits and reported that both the formulations are safe, effective and stable and In-vitro drug release is more for emulgel than cream formulation by 3%. Emulgel is better than cream[17].

Aitzaz Ashsan et al., 2019 prepared emulgel with the methanolic extract of the medicinal plant Saussaria lappa and evaluated for phytochemical profile, formulation stability and wound healing activity. Reported that the prepared emulgel shows an increased wound healing activity and controlled drug release and better stability[18].

Amina Ahmadi et al.; 2019 prepared and evaluated the emulgel based sunscreen with the selected extracts of selected Afghani medicinal plants and concluded that the formulations with 6% EAPE (Ethanolic extracts) were found to be stable, highly sun protective with respect to sun protection factor and recommended further detailed investigation for its safety in In-vivo profiling[19].

Shamim et al., 2019 designed and evaluated a novel emulgel with the selected Unani drugs and reported that Aak, Bakayan, Band injjeer and Dhalura based formulations are Phytochemically and Pharmacologically stable and concluded with the further recommendations for the need for detailed clinical evaluation of the prepared emulgel formualtions[20].

Glicerio Leon Mendez et al., 2018 Designed an emulgel based cosmetic of essential oils from Thyme, Cinnamon and Clove and evaluated for Pharmacokinetic and Pharmacodynamic parameters and finally reported that the emulgel formulation had enhanced the both profiles of the selected drugs and improved their antioxidant potential[21].

Dinanath Tukarma Gaikwad et al., 2018 Designed and evaluated the emulgel formulation containing extract from the bark of the medicinal plant Terminalia arjuna for improving its transdermal delivery and reported that it is successfully useful in the treatment of relevant cardiovascular disorders like hypertension[22].

Jamal Basha D et al., 2018 formulated an emulgel with the methanolic extract of the whole plant Polycarpea aurea and evaluated it for phytochemical profile and In-vitro antibacterial activity finally concluded that the formulation F3 shown better drug release profile (96%) and In-vitro anti bacterial activity that is comparable to the standard reference drug taken with respect to zone of inhibition of the growth of the selected microorganisms[23].

Gehan Fathy Balala et al., 2018 formulated and evaluated an emulgel with Propolis and reported that the formulations F1 and F6 are better with respective to the parameters evaluated[24].

Md Sohali et al.,2018 formulated and evaluated an emulgel with Lycopene an active constituent from the medicinal plant Solanum lycopersicum with an intention to enhance its drug delivery and stability and reported that the prepared formulations are stable at temperatures as high as 40 degrees Celsius and relative humidity upto 75%[25].

Md Shadab et al., 2018 formulated and evaluated emulgel with Unani formualtion Safoof-e-baris to enhance its drug delivery for the treatment of Vitiligo and reported that the optimized formulation Safoof shown better stability and In-vitro drug release profile[26].

Santosh V Gandhi et al., 2018 formulated and evaluated a phyto constituent based emulgel with Rutin and Quercetin and concluded that the optimized formulation shown to possess enhanced drug release in sustainable and controlled manner without any skin irritation reactions[27].
K Suganya et al., 2017 formulated and evaluated the emulgel with the ethanolic extract of the leaves of the medicinal plant Cardiospermum helicacabum for anti arthritic activity and reported that the prepared formulation is an effective way to improve the drug delivery of hydrophobic drugs like what taken in the study[28].

Shwetha V Padher et al., 2017 formulated and evaluated emulgels with the essential oils containing Gingerol and Piperine and concluded that its an effective way to improve the topical drug delivery of the same[29].

Nithya G et al., 2017 developed and evaluated emulgel with the extracts from the selected medicinal plants Phylanthes emblica, Centella asiatica and Cucurbita sepo as a preventive hair care medicated formulation and reported that its an effective and ideal product based on the In-vitro and In-vivo parameters evaluated[30] Rizwana Kausar et al., 2017 formulated and evaluated an emulgel with the strawberry fruit extract for various skin parameters and finally concluded that the emulgel formulation with 4% extract shown better results like improved skin tecture , skin whitening without and skin reaction like irritation[31].

A Sumathi et al., 2016 formulated and characterized the emulgel based preparation with Aloe using rice husk as excipient and concluded that the Silicon Dioxide present in rice husk is responsible to enhance the drug delivery for the treatment of hair problems as emulgel based formulated haircare products[32].

SK Shaheda Sultana et al., 2016 formulated and evaluated the emulgel with the ethanolic extract of the leaves of the medicinal plant Lantana camera for wound healing activity in diabetic rats and reported that the optimized formulation EGF with 1-2% Sodium CMC shown better drug release (93%) and Pharmacological potential[33].

Susheel Thakur et al., 2016 formulated and evaluated In-vitro the emulgel with the Curcumin and Tinospora cordifolia extract for the treatment of rheumatid arthritis and reported that the optimized formulation shown and enhanced drug release In-vitro for both the drugs taken for evaluation (91-92 %)[34].

A Kumari et al., 2015 formulated and evaluated Lycopene based emulgel and reported that the optimized formulation F1 made up of 1 % carbapol 934 P as excipient shown promising results both In-vitro and In-vivo[35].

Mrs Pingali Prasuna Sundari et al., 2014 formulated and evaluated emulgel based formulations with Guggulosterones, Liquorice extract and Serratipeptidase as drugs and reported that among the optimized formulations F1, F2 and F3 , F3 shown better results with enhanced Pharmacological potential to inhibit arthritis 70%[36].

Effionora anwar et al., 2014 formulated and evaluated gel and emulgel with chili (Capsicum fruitiscence) to enhance its topical drug delivery and reported that the drug release from emulgel is more than gel by about 20% but both are found to be stable formulations of the selected drugs[10].

Suvidha Patil et al., 2014 formulated and evaluated an emulgel with the extract from the seeds of the medicinal plant Cucurbita pepo as a novel cosmeceutical product for skin care and reported that all the formulations shown promising results but those containing carbapal 940 as penetration enhancer shown to be ideal[37].

Md Haneefa KP et al., 2014 formulated and evaluated emulgel with ethanolic extract of the leaves of the medicinal plant Pothos scandans to enhance its burn-wound healing potential and reported that among the tested formulations formulation F1 that contains 1% carbapal 940 shown better results[38].

Shrikhande et al., 2013 formulated and evaluated emulgel formulations with Tea tree oil, Lemon grass oil, Ginger and Capsicum oleo resin and reported that those formulations with cow ghee as excipient are ideal products with enhanced Pharmacokinetic and Pharmacodynamic profiles[39].

Tejinder Kaur Marwaha 2013 designed and evaluated emulgel formulation containing extract of Guggul and essential oil from Psoralia corylifolia for the treatment of psoriasis and concluded that formulation M3 as optimized and ideal formulation among the tested formulations[40].

Tejinder Kaur Marwaha 2013 formulated and evaluated emulgel with Babchi oil and reported that the formulation P8 as optimized and good[41].

Evten Algin Yapar et al., 2013 formulated and evaluated emulgel based formulations with Green tea extract and Rose oil and concluded that the formulations with 20 % Green tea extract and 5% Rose oil are ideal[42].

F Hussaini et al., 2012 formulated and evaluated emulgel of Chestnut extract and concluded that it’s a perfect mode for topical drug delivery of the selected medicinal plant extract for the treatment of Varicose veins[43].

4. CONCLUSION
From the above studies it can be concluded that the emulgel based dosage forms are suitable and advantageous for the formulation of both hydrophobic and hydrophilic drugs and also cosmeceutical and nutraceutical products to enhance their drug delivery and Pharmacokinetic and Pharmacodynamic profiles. The formulated emulgels shown better results both In-vitro and In-vivo evaluation parameters like colour, viscosity, spreadability, drug release and various Biological activities tested. Therefore, it is recommendable dosage forms for enhancing the topical drug delivery of natural drugs for various topical skin diseases like Leprosy and Psoriasis. However it is also recommended to continue the studies by isolation, characterization and formulation of the active constituents responsible for the Biological activity of the formulated extracts into emulgel formulations so that it is more as effective as the synthetic reference compounds like Dapsone for Leprosy and also safe, effective, efficient and economical than the existing marketed products for the similar complications.

REFERENCES:


