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Emulgels as Novel Approach in Topical Drug Delivery

Nirmal Singh

V.M.S. College of Pharmacy, Amritsar road, Batala

Abstract: With the advancement in new era, there are advances in drug formulations and innovative routes of drug delivery. The horizons of understanding the concepts of drug transport and targeting across the tissues has expanded. Number of medicinal substances is applied to the skin or mucous layer that either upgrades or reestablishes a crucial capacity of skin or pharmacologically adjusts an activity in the underlined tissues. Numerous broadly utilized skin specialists like balms, creams, lotions have numerous impediments, Unease to the patient on application, low spreading coefficient and issue of physical stability. Nowadays, gels has been gained its virtue in cosmetics as well as in pharmaceuticals. Therefore, To overcome the drawbacks, an emulsion based methodology is being explored for the effectively incorporation of hydrophobic drugs through the novel approach. This paper focuses on the emulgel as an innovative technique in the delivery of hydrophobic drugs

Keywords: Emulgels, Topical drug delivery, Skin, Targeted delivery

Introduction

Many current drug delivery systems are precisely tailored to maximise the delivery of a particular form of drug or try to resolve only a few of the challenging issues associated with therapeutic delivery targeting. These efforts have resulted in increased patient adherence and pharmacological response to the therapeutic regimen. Effective and target specific drug delivery is one of the most challenging tasks.

The topical delivery has emerged as a promising route for delivery of drug, in comparison to enteral (orally, in digestive tract) and parenteral administration (injected into the ciculatory system). This route also allows the drugs with poor bioavailability and decrease in dosing frequency like once in a day results in improved compliance. The resistance encounterd along the transepidermal pathway arises at the stratum cornueum which is the uppermost layer of skin, comprises of corneocytes implanted in lipid matrix. The features that potentially affect the drug

penetration across the skin are the diffusion of the vehicle or drug through the surface of the skin ensuing partioning into the uppermost layer

The topical route offers following advantages:

- Avoids first pass metabolism,
- Easy to apply,
- Relatively large area of application is available,
- Risks of parenteral delivery are not involved,
- Medication can be terminated when required,
- Drug can be delivered to specific site,
- Improve patient compliance,
- Avoid plasma drug level fluctuation.

Recent years have witnessed a lot of work on development of topical vehicle systems that could enhance the local availability of the active ingredients across the skin. This includes the optimization of vehicle to incorporate both hydrophilic and lipophilic drug along with their high penetration. Thus to achieve this aim the use of chemical enhancers and other strong solvents is very common [1]. This is one of the most unwanted aspects in chronic use as they tend to cause irritation. Therefore, the demand of time is to develop a topical vehicle system that is devoid of use of any penetration enhancer and other irritant solvents with equal excellence of drug permeation through skin. Thus to rise above the challenges of conventional drug delivery system different carrier systems are studied.

Advantages of Novel Drug Delivery System

- To increase drug penetration and deposition
- To increase the drug bioavailability
- To minimizes the drug degradation and loss

- Sustained or continuous effect of medication thereby decreasing frequency of application
- Reduction in skin irritation potential and other side effects
- Increasing the region-specificity at target site.

Emulgels are semisolid dosage form applied topically consisting of low quantity of oil phase in a gel. Emulgels have characteristics similar to the lipoprotein structure of the skin and, compared to creams or ointments can be applied more readily on large surfaces. They are also referred to as creamed gel, gelled emulsion, or quassium emulsion.

Advantages of Using Emulgels as a Drug Delivery System [2]

1. Hydrophobic drugs inclusion into the gels: The formulation based on emulgelhelps to incorporate water insoluble drugs into the oily phase and then release oily phase into the aqueous phase, leads to the o / w emulsion formation which can be further blended into a gel base.
2. Improved physical stability:
3. Good loading capacity
4. Modified and controlled release drug delivery system
5. More practicability: As preparation involves simple steps and no specialized instrumentation is required. Therefore this method is more feasible and economical.

Preparation of Emulgels

1) Gel Formers used in the formulation of Emulgels:

Nowadays choice of gel formers has been critical with respect to drug solubility and subsequent release of the poorly soluble drug. Various studies have been conducted in which the effect of gel formers on permeation and deposition of drug is studied.Diclofenac diethylammonium (DCFD) gel for the treatment of rheumatoid arthritis symptoms as DCFD is more lipophilic in nature so can permeate through the skin at an elicit rate [3].Similarly, transdermal gel formulation of Ibuprofen using Carbopol 934. Skin permeation studies conducted using Franz Diffusion Cell showed relative bioavailability of gel compared to marketed formulation was 228.8% [4].

One of the study reported gel against HIV-I infection taking chloroquine as an active ingredient and hyroxyethylcellulose (HPC) as gel former. The rationale of this study was to development, optimizationand characterization of chloroquine formulation with preservation of its anti-HIV-1 activity. This formulation showed remarkable activity against HIV-1 [5].

a) Carbopols

Carbopols (cross linked polyacrylic acid polymers) are most commonly used gelling agents for topical drug delivery due to their viscosity, transparency, physical stability, spreadibility and good release profile of drug. Topical gel delivery of curcumin for its anti-inflammatory effects from two different gels prepared with different gel forming agent. Two gel formers used were Carbopol 934P (CRB) and hydroxypropylcellulose (HPC) [6].

Carbomers are the one of the best agents to formulate the topical aqueous dosage forms. Number of topical products are available commercially made up of these gel formers as they offers

Carbomers are very well suited to aqueous formulations of the topical dosage forms. Many commercial topical products available today have been formulated with these polymers, as they endow withvarious benefits to topical dosage forms [7]:

- Protective in use& Reliable: As per various reports, carbomers are safe, effective and reliable to use in topical formulations such as gels, creams, and ointments.
- Non-irritant: Low irritancy properties and no sensitization is observed with repetitive usage of the formulation..
- Compatible to active pharmaceutical ingredient: Carbomersoffer an outstanding vehicle for drug delivery. They cannot reach the skin or impact the action of the drug owing to their extremely high molecular weight.
- Excellent thickening agent: Carbopols have good suspending and emulsifying properties for topical dosage formulations.

Table: Various grades of carbopols available commercially

Polymer Name	Appearance	Viscosity (0.5%) mPa.s	Properties
Carbopol 934	White powder	30,500-39,400	Best in lotions and creams.
Carbopol 934P	White powder	29,400 - 39,400	Used to prepare gels and emulsions. This is highly purified product
Carbopol 940	White fluffy powder	40,000 - 70,000	Silightly acidic, high efficacy in concentrated formulations. very good clarity in water or hydro alcoholic gel systems.
Carbopol 941	White powder	4,000 - 11,000	Suitable for low viscosity formulations such as emulsions and suspensions
Carbopol 980	White powder	40,000-60000	Best suitable for clear, transparent aqueous abd hydro-alcoholic gels

Poloxamers

Poloxamers are non-ionic copolymers comprised of hydrophobic chain of polyoxypropylene surrounded by two hydrophilic chains of polyoxyethylene. The most commonly used poloxamers are poloxamer 407 and 188. Poloxamer188 is frequently employed in solid lipid nanoparticles (SNP) and micellar nanoprticles (MNP) for topical drug delivery. Similarly,developed and characterized aceclofenac gel using poloxamer 407 was reported in one of the study. It is principally a thickener and gelling agent, can also act as emulsifier in low viscosity formulations such as creams and emulsions. In this reported study, acelofenac gels were formulated with varying concentration of poloxamer 407 and it was found that spreadability and consistency of

Poloxamer 407 gel containing aceclofenac were 12.4g.cm/sec and 8mm as compared to 13.2g.cm/sec and 11mm respectively of marketed gel, indicating good spreadability and consistency of the prepared gel. The transparency of prepared batch was good as compared to the marketed gel. Thus, poloxamer 407 has all the well desirable characteristics required for a perfect gelling agent [8].

In 2011 Shalviri et al.[9], tried to enhance the topical delivery of poorly soluble drugs through low surfactant microemulsion gels. The gelling agents evaluated were Carbopol 934, Colloidal silica, Hydroxy propyl methyl cellulose K100M, Lubrajel NP and Xanthum gum. The release profile data showed higher release rate upto 8 to 10 folds for Xanthum gum and Colloidal silica as compared to conventional carbopol formulations. Thus, it showed that choice of gelling agent has significant role on the release rate of the drug.

2) **Emulgel Formation**: Dispersion of carbomer gel with slightly heat is added to the prepared emulsion gradually with vigorous stirring. The emulgel is stirred for 45-60 minutes at 2000rpm at room temperature. Then the pH of the formulation wasmaintained to 6.8 using suitable buffer or triethanolamine.

The following table presents the emulgel formulations studied:

Table: Emulgel based Formulations Studied

Drug	Description	Reference
Chlorphenesin	Emulgel prepared with HPMC showed higher stability,better release profile and antifungal activity.	[10]
Meloxicam	Drug diffusion coefficients were studied for HEC gel, Carbopol gel and Emulgel.	[11]
Itraconazole	Optimisedemulgel showed 46.6%inhibition as compared to 32.3% inhibition of marketed formulation.	[12]
Diclofenac	New diclofenac formulation was 30 to 40 times more effective in facilitating skin penetration than voltaren	[13]

	marketed emulgel.	
Miconazole Nitrate	Emulgel fungus inhibition was 39.7% as compared to 28.3 % inhibition by marketed formulation.	[14]
Diclofenac diethylamine	In vitro drug release of emulgel was comparable to that of marketed formulation.	[15]
Clotrimazole	Emulgel prepared with two polymers HPMC and carbopol 934 showed excellent stability and high extent of release.	[16]
Mefenamic Acid	Emulgel formulations showed compareable results when compared to diclofenac sodium salt marketed gel.	[17]
Piroxicam	Skin penetration was uoto 89% with emulgel and anti inflammatory activity was better than the marketed formulation.	[18]
Piroxicam with enetration enhancers	Emulgel based formulation showed 9.92 fold higher flux than marketed gel. Enhancement ratio with Myrj 52 was 3.11 and with Transcutol and cineol was <1.	[19]
Metronidazole	Permeability enhancement factor was 3.65 as compared to marketed for topical rosacea infections.	[20]
Sulphadiazine	Enhanced permeability	[21]
Insulin	Application of insulin emulgel iontophoretically can be used as an alternative (acceptable and painless) to injectable insulin.	[22]
Calcipotriol	Drug release was significantly increased with emulgel formulation than compared to commercial cream	[23]

Conclusions:

To overcome the limitations of the conventional topical dosage forms, a new emulsion based drug delivery system is explored so as to incorporate hydrophobic drugs successfully. Emulgels for dermatological applications provide certain constructive properties such as being

thixotropic, no greasiness, ease in spreadability, soothing and emollient action, leaves no stain, easy removal with water, improved physical stability and have a prolonged shelf life. Therefore, Emulgels are introduced as the novel system for topical delivery with the aim of improving local bioavailability, easy applicability and have better patient acceptability.

References:

1) Walters K.A. (1989). Penetration enhancers and their use in transdermal therapeutic systems, in: Transdermal Drug Delivery, Developmental Issues and Research Initiatives. J. Hadgraft, R.H. Guy Ed, Marcel Dekker, *New York.*,pp: 197- 246.
2) Panwar N. Upadhyay, Bairagi M., S., Gujar G. N. Darwhekar, Jain D.K. (2011). Emulgel: A review.*Asian Journal of Pharmacy and Life Science,* 1(3): 333-343.
3) Manosroi A., Jantrawut P., Manosroi J. (2008). Anti-inflammatory activity of gel containing novel elastic noisomes entrapped with diclofenac diethylammonium.*International Journal of Pharmaceutics.*,360: 156-163.
4) Rhee Yun-Seok, Si-Young Chang, Chun-Woong Park, Sang-Cheol Chi, Eun-Seok Park V. (2008) Optimization of ibuprofen gel formulations using experimental design technique for enhanced transdermal penetration. *International Journal of Pharmaceutics*, 364: 14-20.
5) Brouwers J., Vermeire K., Schols D., Augustijns P. (2008). Development and in vitro evaluation of chloroquine gels as microbicides against HIV-1 infection. *European Journal of Virology.*,378: 306-310.
6) Patel N.A., Patel N.J., Patel R.P. (2009). Formulation and evaluation of curcumin gel for topical application. *Pharm. Dev. Technol.*14(1): 80-89.
7) Hosmani, Avinash&Thorat, Y.S &Kasture, P.V. (2006). Carbopol and its Pharmaceutical Significance: A Review. Pharmaceutical Reviews. 4.
8) Nagariya K., Jadon P.S., NarukaP.S., Chouhan C.S. (2010). Formulation Development and characterization of Aceclofenac gel using Poloxamer 407. *J. Chem. Pharm. Res.*,2(4): 357-363

9) Shalviri A., Sharma A.C., Patel D., Sayani A. (2011). Low-surfactant microemulsions for enhanced topical delivery of poorly soluble drugs. *J. Pharm. Pharm. Sci.,* 14(3):315-324.

10) Mohamed M. I. (2004). Optimization of chlorphenesinemulgel formulation. *AAPS Pharm. Tech. Sci.,* 6(3): 81-87.

11) Hascicek C, AyselBediz-olcer, NursiGonu L. (2009). Preparation and Evaluation of Different Gel Formulations for Transdermal Delivery of Meloxicam.*Turk J. Pharm. Sci*., 6(3): 177-186.

12) Deveda P., Jain A., Naveen Vyas, Hemant Khambete, Sanjay Jain. (2010). Gellified Emulsion For Sustain Delivery Of Itraconazole For Topical Fungal Diseases. *International Journal of Pharmacy and Pharmaceutical Sciences*,2(1):104-112.

13) Brunner Martin, David Davies, Wolfgang Martin, Chiara Leuratti, Edith Lackner and Markus Müller. (2011).A new topical formulation enhances relative diclofenac bioavailability in healthy male subjects.*British Journal of Clinical Pharmacology*. 71(6): 852-859

14) Jain Ankur, PiyushaDeveda, Vyas Naveen, Chauhan Jitendra, Khambete Hemant, Jain Sanjay. (2011*).* Development of antifungal emulsion based gel for topical fungal infection(s.*)IJPRD*., 2(12): 1-8.

15) Bhanu P. Vijaya, Shanmugam V. and Lakshmi P. K. (2011). *International Journal Of Comprehensive Pharmacy*, 9(10): 1-4.

16) Shahin Mostafa, Seham Abdel Hady, Mohammed Hammad and Nahed Mortada. (2011). Novel Jojoba Oil-Based Emulsion Gel Formulations for Clotrimazole Delivery.*AAPS Pharm. Sci. Tech*, 12(1): 239-247

17) Khullar Rachit, Kumar D, Seth N, Saini S. (2012). Formulation and evaluation of mefenamic acid emulgel for topical delivery, Saudi Pharmaceutical Journal, 20: 63-67.

18) KhuntDignesh M., Mishra Ashish D., Dinesh R. Shah. (2012). Formulation Design & Development of Piroxicam. *International Journal of Pharm. Tech. Research*, 4(3): 1332-1344.

19) Shokri J., Sh. Azarmi, Z. Fasihi, S. Hallaj-Nezhadi, A. Nokhodchi and Y. Javadzadeh. (2012). Effects of various penetration enhancers on percutaneous absorption of piroxicam from emulgels. *Res Pharm Sci.*,7(4): 225-234

20) Rao Monica, Girish Sukre, Sheetal Aghav, and Manmeet Kumar. (2013). Optimization of MetronidazoleEmulgel.*Journal of Pharmaceutics Volume 2013*, Article ID 501082,9pageshttp://dx.doi.org/10.1155/2013/50108.

21) GhodekarSonal V., Shilpa P. Chaudhari, Mukesh. P. Ratnaparakhi. (2012). Development And Characterization Of Silver Sulfadiazine EmulgelFor Topical Drug Delivery. *International Journal of Pharmacy and Pharmaceutical Sciences*, 4(4): 305-316.

22) Akram M., Naqvi S.B., Khan A. (2013). Design and development of insulin emulgel formulation for transdermal drug delivery and its evaluation. Pak *J. Pharm Sci*., 26(2): 323-332

23) BadilliUlya, GulinAmasya, Tangul Sen and NiluferTarimci. (2013). Topical emulgel formulation containing inclusion complex of calcipotriol with cyclodextrin. *J. Incl. Phenom. Macrocycl. Chem*; DOI 10.1007/s10847-013- 0293-2.