ejpmr, 2020,7(4), 222-226

SJIF Impact Factor 6.222

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Review Article

ISSN 2394-3211

EJPMR

A REVIEW ARTICLE ON ROLE OF LIPIDS IN DRUG DELIVERY SYSTEM

Shafin P.*, Dr. Sirajudheen M. K.[1], Dr. Shijikumar P. S.[2], Sherin A.[3]

[1]Department of Pharmaceutics, Jamia Salafiya Pharmacy Collage, Pulikkal, India-673637.
[2]Department of Pharmaceutical Analysis, Jamia Salafiya, Pharmacy Collage, Pulikkal, India-673637.
[3]Department of Pharmaceutical Chemistry, Jamia Salafiya Pharmacy Collage, Pulikkal, India- 673637.

***Corresponding Author: Shafin P.**

Department of Pharmaceutics, Jamia Salafiya Pharmacy Collage, Pulikkal, India-673637.

Article Received on 05/02/2020 **Article Revised on 26/02/2020** **Article Accepted on 16/03/2020**

ABSTRACT

Lipids drug delivery system is used in nowadays due to their properties to improve the stability and bioavailability of poorly water soluble drugs. In these drug development world many of newly discovered oral drugs are less water soluble in nature. Lipid based drugs can be formulated for different routes. oral, parenteral etc.. it will also provide cost effective and sufficient stability and efficacy.

KEYWORDS: Lipids, Lipid formulation, Solid lipid nanoparticle, hydrogels.

INTRODUCTION

Most recently discovered oral medicines ar poorly soluble and may lean with alternative medicines. Lipids are shown to considerably improve the bioavailability of bound compounds at low concentrations. The poor solubility of medication in water of oleophilic compounds has become a haul in drug discovery in addition because the early and late stages of pharmaceutical development method. However, lipid-based delivery technologies haven't been wide used industrial oral merchandise. Lipids will have an effect on the transportation and fate of medication within the GI tract through many mechanisms, as well as improved solubility and dissolution mechanics, improved permeation through the internal organ mucous membrane and triggered precipitation of the drug. Depletion within the lipoid emulsion (for example through digestion) the impact of lipids on drug absorption isn't quantitatively foreseeable, partially because of the big variety of advanced dynamic processes that may occur influenced by lipids. Quantitative mechanistic analysis of vital processes for the lipoid system, operate associate degreed overall impact on drug intake will facilitate perceive drug-lipid interactions within the GI tract and also the use of those interactions to get an best distribution of lipid-based medicine. during which lipoid will use as a carrier fir delivery of poorly water soluble medicine. during this review, we have a tendency to discuss the consequences and role of lipoids and lipid digestion on drug delivery.[1]

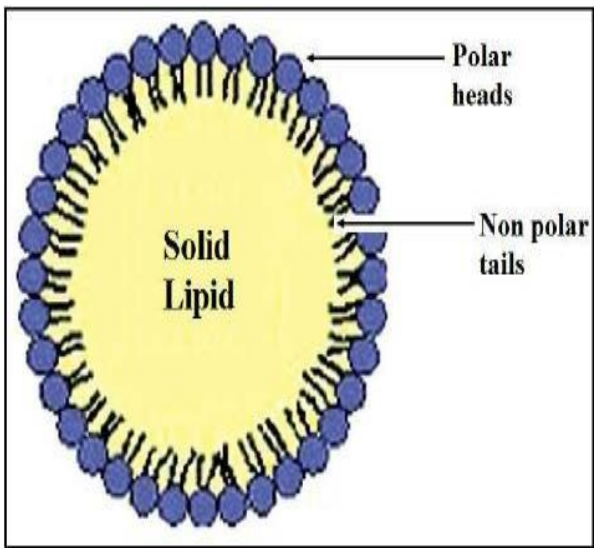


Fig. 1: Solid lipid nanoparticle.

Solid Lipid Base Nano Particles

Lipid-based drugs may be used for targeted drug administration. The solid lipid nanoparticles (SLNs) were made from biocompatible and biodegradable solid phase lipids. It can be used to administer unifilariasis drugs. for example: doxicillin, diethylcarbamazine.[2] The administration of lipid-based drugs can be formulated for different routes of administration, mainly for topical, oral, pulmonary and parenteral administration.[3] The beta element is a safe natural essential oil with a broad spectrum of activity against tumors. However, its clinical application was affected by low water solubility and limited bioavailability. The installation of SLN is a potential strategy to circumvent the blood-brain barrier, the main restrictive component of neurotherapeutic

bioactivity. SLNs-b has the same efficacy as commercially available elements in vitro and an increased accumulation of brain drugs in vivo. Survival data were promising and the acute toxicity experiment proved its safety. All of these data suggest that SLN-b is a safe and effective drug delivery system, especially for brain tumor therapy, and justifies further development.[4]

Issue to Be thought of for the Formulation

Main factors moving the choice of excipients for lipid-based formulations area unit as follows:

(i) Solubility,
(ii) Dispersion,
(iii) Digestion,
(iv) Absorption.

Different factors area unit as follows

1. Restrictive issues-irritancy, toxicity, knowledge, and knowledge,
2. Solvent capability,
3. Miscibility,
4. Morphology at temperature (i.e., melting point),
5. Self-dispersibility and role in promoting self-dispersion of the formulation,
6. Edibleness and fate of digestible product,
7. Capsule compatibility,
8. Purity, chemical stability,
9. value of products.[5-7]

Lipids

Lipids area unit a with chemicals completely different cluster of compounds with high solubility in nonionic solvents and low tide solubility. they're chemical in nature and play a significant role within the basic structural parts of biological membranes, vitamins, hormones, living thing messengers, protein cofactors. vital a part of our diet. This clearly shows that lipids area unit without doubt biocompatible, perishable and non-toxic to the body. Thus, once used showing wisdom, lipids will be wonderful vehicles for the event of safe, effective, cheap and ascendable nanomedicines, nutraceuticals and cosmetics.[8-9]

Lipid formulations

Depending on the physical state of the lipid at room temperature, lipid-based formulation can be liquidated in liquid lipid-based formulations, solid lipid-based formulations and colloidal vehicles developed using lipids.

Liquid lipid-based formulation

The formulations developed with Liquid Lipid exist as simple emulsions or self-emulsifying drug delivery systems (SEDS). Depending on their size, they are called self-emulsifying drug delivery systems (SMEDDs) or self-nanoemulsifying drug delivery systems (SNEDDs). SEDDS are isotropic mixtures of oils, surfactants, co-safety agents and medicinal substances. The ideal proportion of drug, oil, surfactant and co-surfactant needed to facilitate the formation of self-emulsification. Generation created by building a pseudo-phase diagram. Generation generates thin rope on the thin side. Water (O / W) emulations when diluted with aqueous phases with light agitation. These formulations are best for oral intake and are usually given with water. The presence of water and digestive awareness in the gastrointestinal tract provide conditions conducive to self-emulsification of SEDDS.[10-11] The tablets were made with mixtures of microcrystals. cellulose, maltodextrin and modified povidone. Also a solid micro-state The emulsion was prepared by coating a pre-microemulsion with an Enteric Coating Substance. Various efforts have been made to convert liquid to solid using lyophilization, spray drying and solvent evaporation.[12]

Solid lipid based formulation

Formulations using solid or waxy lipids were added to multi-partially developed system (powder, granules or pellets), which contains the active ingredient either as a fine dispersion or solid solution, which can then be bottled in capsules or sachets. The formula to this category includes fixed lipid nanoparticles and nanostructured lipid carriers.[13]

Solid lipid dispersions and surface adsorption techniques, the excipients with excellent flow position, compressibility, high specific surface area and high surface capacity (eg, Neusilin, Florite and Sylysia) can be potential use in the development of lipid-based formulation to overcome the poor physiological properties of lipids. In addition to simple and cost-effective production, the dosage forms are in the presence of Gi fluids, the medications with the maximum surface, which in turn has the rate of Gi fluids. In this technique, the solid lipid is heated at its melting temperature. And is the drug is exhausted or solubilized in the molten liquid lipid is followed by the suitable adsorbent followed by the addition of suitable adsorbent. This mixture is then properly added to obtain a uniform mixture.[14]

Lipid as colloidal drug carries

Colloidal drug carriers supported lipids like liposomes, solid lipid nanoparticle ,structured lipid carriers, lipid-based micelles, lipid-polymer hybrids, lipid nanospheres, cubosomes, ethosomes and phytosomes were wont to improve the therapeutic efficacy of drugs and plant extracts.

Liposomes are compact vesicles made up of one or more phosphorus lipid bilayers that include an aqueous phase. They can briefly be classified as small unilamellar vesicles, large multilamellar vesicles and large unilamellar vesicles depending on the size and number of lipid bilayers present. You are excellent Active substance carriers and are able to carry hydrophilic active substances in their inner aqueous Phase or hydrophobic drugs in their hydrophobic lipid bilayers. B. are liposomes They consist of bio-membranes and are biodegradable, non-toxic and widely used. Liposomes

can also evade phagocytosis against macrophages by transferring them Stealth character and thus the half-life of drugs. You can also Increase the solubility and absorption of poorly water-soluble active ingredients.[15]

Role of lipids in oral drug delivery

The therapeutic efficaciousness of a drug poorly soluble in water will be improved by increasing its gi solubilization with concomitant modification of pharmacokinetic profiles. Lipid-based drug delivery systems play a very important role in delivering hydrophobic medication with low bioavailability, exploitation numerous lipids as carriers.[16]

A water-insoluble drug will be developed as a lipid-based formulation once the drug itself is AN oil-like substance (e.g., ethyl group icosapentate, fat-soluble vitamin nicotinate , teprenone, NSAID farnesil and dronabinol), or once typical formulation approaches like granulation or soluble liquids in capsule don't enhance the oral bioavailability.[17] A spread of lipid-based systems composed of straightforward oil solutions to complicated mixtures of oils, co-solvents, surfactants and co-surfactant will be obtained supported the sort of excipients and formulation variables. Indeed, these systems will be reborn to solid intermediates (powders, granules and pellets) by numerous techniques and might be crammed in arduous gelatin capsule or will be compressed into tablets once mixing with appropriate tableting excipients.[18]

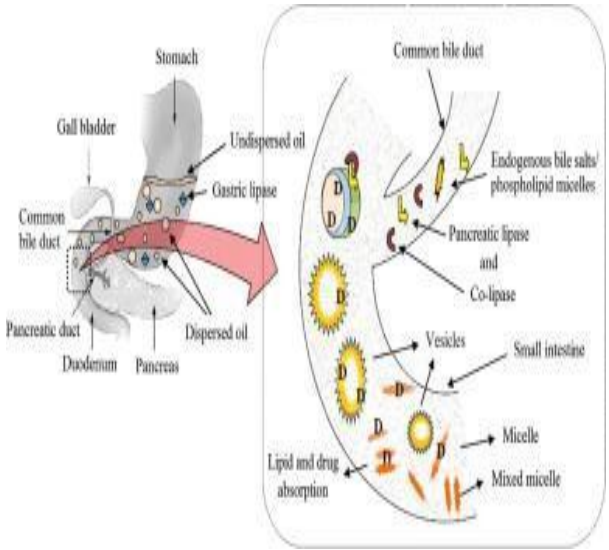


Fig. 2: Oral lipid-based drug delivery systems – an overview.

Role of lipids in transcutaneous and topical drug delivery

Super molecule formulations, though gaining increasing importance within the canal and oral administration of medicines, also are vital within the transcutaneous and topical administration of medicines. Examples and mechanisms by that lipids increase drug transport transdermally (through the skin) and locally (in the skin) are going to be mentioned. supermolecule typeulations will form structures like micelles, reverse micelles, emulsions, micro emulsions and liposomes that may assist delivery to and thru the skin. A case study of a topical immunosuppressive drug investigated for the treatment of dermatitis and skin problem are going to be given. A formulation of chemical compound ointment supported lipids provided superior uptake of the skin in vitro and in a very model of effectiveness in vivo wine.[19]

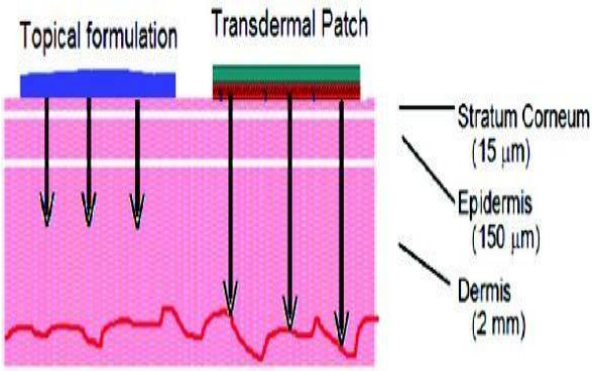


Fig. 3: Lipids in Transdermal Drug Delivery.

Skin permeation through the corneum is ruled by the porousness constant, Kp, of Fick's laws of diffusion as shown within the equations below. The porousness constant is comprised of the drug's effective diffusion constant within the corneum (D), the skin vehicle partition constant (Ps/v), and also the effective diffusion path length (h) through the skin barrier. Flux (J) is that the Kp increased by the drug concentration (c) within the donor vehicle.[20]

Solid lipid nanoparticles

A solid lipoid nanoparticle is often spherical with a mean diameter between ten and a thousand nanometers. Solid lipoid nanoparticles have a solid lipoid core matrix which will solubilize oleophilic molecules. The lipoid core is stable by surfactants (emulsifiers). The surfactant used depends on the routes of administration and is a lot of restricted for channel administrations. The term lipoid is employed here in a very broader sense and includes triglycerides (for example tristearin), diglycerides (for example glycerin bahenate), mono glycerides (for example glycerin monostearate), fatty acids (for example lipid acid), steroids (for example cholesterol) and waxes (for example cetyl palmitate) , All surfactant categories (in terms of charge and molecular weight) were accustomed stabilize the lipoid dispersion. it's been found that the surfactant mixture will forestall particle agglomeration a lot of with efficiency.[21]

Advantages[22]

- Ability to manage and target drug unharness.
- Ability to enhance the soundness of medicine.
- Ability to encapsulate a high active ingredient content (compared to alternative carrier systems, eg chemical compound nanoparticles).

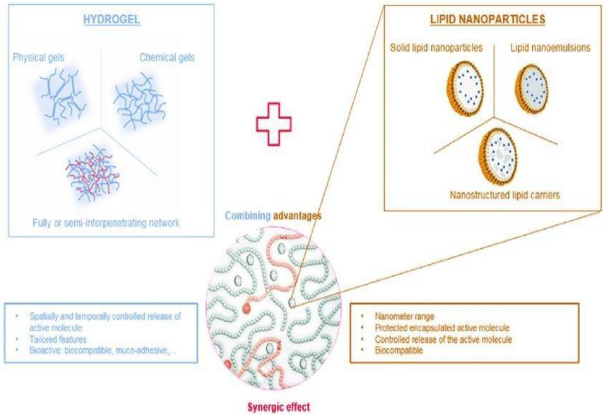
- The flexibility to hold each oleophilic and deliquescent medication.
- Most lipids used square measure perishable and have wonderful biocompatibility. they're non-toxic, non- allergenic and non-irritating.
- They're typically developed victimization water-based technologies and may so avoid organic solvents.
- they're straightforward to scale and sterilize.
- They're cheaper than compound / surfactant-based carriers.

Lipoid nanoparticles and their hydrogels for drug delivery

Within the past twenty years, interest in lipid-based formulations for dermal and transcutaneous drug delivery has inflated steady, conjointly as alternative potential drug delivery routes.[23] The latest developments are targeted on rising the low bioavailability of oleophilic medicine and dominant their unharness. Solid lipide nanoparticles (SLN) and lipid nanoemulsions (LNE) were initial developed within the early Nineteen Nineties. SLN and LNE square measure mixture nanoparticles with a oleophilic core that square measure, severally, in solid or liquid state at temperature. SLN and LNE ingredients square measure principally non-toxic and extremely biocompatible; so, they need been approved by the Food and Drug Administration (FDA) and therefore the European Medicines Agency (EMA). The oleophilic nucleus should shield the active molecule at bay inside environmental (UV, pH) or physiological (immune system, enzyme) degradations, providing sensible solubility to the oleophilic drug and preventing mixture formation. However, SLN and LNE could have some limitations concerning the soundness of the drug package. whereas necessary drug run is discovered for liquid-core erythema nodosum, the SLN crystalline core will induce part demystification and drug expulsion. a brand new generation of lipide nanoparticles (LNP) was so introduced within the 2000s: nanostructured lipid carriers (NLC). Its main structure consists of a combination of liquid and solid lipids, probably capable of retentive higher payloads of active molecules, whereas higher dominant their unharness because of the lipid mix.[24]

Combination of hydrogels

Oleophilic medicine is with efficiency loaded into lipide nanoparticles that the lipid core provides associate adequate matrix, with the LNP being encapsulated inside the gel scaffold. The double encapsulation provides a further level of management over the drug's spacial and temporal unharness, whereas making the most of the biological properties of the gel. during this review, we offer a comprehensive summary of the mixture of lipid nanoparticles and varied forms of hydrogels drug delivery systems, with a stress on polysaccharide-based hydrogels combination hydrogels and lipid nanoparticle.



Liposomes as sac Drug Delivery System

Liposomes square measure mixture and coaxial vesicles in 2 layers, wherever the liquid compartment is totally closed by a membrane in 2 layers, composed principally of natural or artificial lipids. Essential elements of the vesicle drug delivery system embrace phospholipids (primarily phosphatidylcholine) and steroid alcohol, wherever steroid alcohol acts as a flow buffer. though steroid alcohol doesn't participate within the formation of bilayer, it is more to phosphatidylcholine up to one: one or maybe to the 2: 1 molar magnitude relation of steroid alcohol to phosphatidylcholine. Liposomes became important as potential drug delivery systems for targeted drug delivery.[25]

Blessings of Liposomes as sac Drug Delivery System[26]

1. Liposomes square measure appropriate to deliver deliquescent and oleophilic medicine.
2. Improved stability, protects the encapsulated drug from setting.
3. Reduced toxicity.
4. Reduced exposure of sensitive tissues to cyanogenetic medicine and their metabolites.
5. Liposomes square measure appropriate to deliver little relative molecular mass medicine yet as high relative molecular mass medicine.
6. Target specific delivery is achieved.
7. Improved pharmacokinetic properties as reduced elimination and accumulated circulation life time.

Disadvantages of Liposomes as sac Drug Delivery System

1. Liposomes square measure leaky in nature resulting in premature drug unharness.
2. Poor encapsulation potency for deliquescent drug.
3. Liposomes square measure costly.
4. Liposomes possess short half-life

CONCLUSION

The systems for administering lipid-based medicine have shown nice potential in overcoming issues of low bioavailability of poorly soluble medicine. because the mechanisms accountable for up the bioavailability of medicines area unit quite totally different from alternative administration systems, these systems need

the applying of specific characterization ways, which may simulate what happens with the formulation throughout transit through the bum. though the introduction of in vitro dynamic lipolysis models has created nice progress in establishing in vitro-in vivo correlation, the event of sturdy and easy-to-predict ways for the in vivo fate of those systems remains a significant challenge for formulation scientists. . the most issues that have restricted broader applications of lipid-based drug delivery systems within the past are related to low stability and troublesome handling with these formulations, because of their liquid nature. These issues were with success solved with the applying of various activity techniques for liquid formulations. the applying of those industrially viable techniques, like spray drying, freeze drying, granulation and spray coating on inert pellets, has expedited the massive scale production of those merchandise, that ought to cause a rise within their variety in the market.

REFERENCES

1. Rebecca L. Carriera. Lipid-associated Oral Delivery: Mechanisms and Analysis of Oral Absorption Enhancement.j control release, 2016; 240: 544-560.
2. Ryan F. Donnelly.Solid lipid nanoparticle-based dissolving microneedles: A promising intradermal lymph targeting drug delivery, 2019; 10: 34.
3. Hina Shrestha, Rajni Bala, and Sandeep Arora review article.Lipid-Based Drug Delivery Systems. R. H. Muller, M. Radtke, and S. A. Wissing, "Solid lipid nanoparticles (SLN) and nanostructured lipid carriers (NLC) in cosmetic and dermatological preparations,"Advanced drug Delivery Reviews, 2002; 54(1): 131-155.
4. Xiaomin Zhang. Solid lipid nanoparticles as a drug delivery system to across the blood-brain barrier.Biochemical and biophysical reserch communications, 2019; 519: 385-390.
5. P. P. Constantinides. "Lipid microemulsions for improving drug dissolution and oral absorption: physical and biopharmaceutical aspects." Pharmaceutical Research, 1995; 12(11): 1561-1572.
6. R. G. Strickley. "Solubilizing excipients in oral and injectableformulations." Pharmaceutical Research. 2004; 21(2): 201-230.
7. J. B. Cannon and M. A. Long. "Emulsions, microemulsions, and lipid-based drug delivery systems for drug solubilization and delivery part II." in Oral Applications, 2008; 16: 227-254.
8. Kalepu, S., Manthina, M., Padavala. Oral lipid-based drug delivery systems—an overview. Acta Pharm. Sin. B., 2013; 3(6): 361–372.
9. Wang G. Advances in lipid-based drug delivery: enhancing efficiency for hydrophobic drugs. Expert Opin. Drug Deliv, 2015; 12(9): 1475–1499.
10. Abdelwahed, W. Freeze-drying of nanoparticles: formulation, process and storage considerations. Adv. Drug Deliv. Rev., 2006; 58(15): 1688–1713.
11. Pharmaceutical Press and American Pharmacists Association , Pharmaceutical Excipients, 2013.
12. Dixit A.R., Rajput S.J., Patel, S.G. Preparation and bioavailability assessment of SMEDDS containing valsartan. AAPS PharmSciTech, 2010; 11(1): 314–321.
13. Chen, C.C., et a 2010. Effects of lipophilic emulsifiers on the oral administration of lovastatin from nanostructured lipid carriers: physicochemical characterization and pharmacokinetics. Eur. J. Pharm. Biopharm, 2010; 74(3): 474–482.
14. Freitas, C., M€uller, R.H., Spray-drying of solid lipid nanoparticles (SLN(TM)). Eur. J.Pharm. Biopharm, 1998; 46(2): 145–151.
15. Cai, S. Lymphatic drug delivery using engineered liposomes and solid lipid nanoparticles. Adv. Drug Deliv. Rev., 2011; 63 (10–11): 901–908.
16. Sandeep Kalepu. Oral lipid-based drug delivery systems – an overview Department of Pharmaceutical Technology. Shri Vishnu College of Pharmacy, Bhimavaram 534202, Andhra Pradesh, India Received 2 August 2013; revised 10 September 2013; accepted 5 October, 2013.
17. L. Gibson.Lipid-based excipients for oral drug delivery D.J. Hauss (Ed.), Oral lipid-based formulations: enhancing the bioavailability of poorly water soluble drugs, Informa Healthcare, New York, 2007; 4: 33-61.
18. V. Jannin, J. Musakhanian, D. Marchaud .Approaches for the development of solid and semi-solid lipid-based formulations Adv Drug Deliv Rev., 2008; 60: 734-746.
19. Barry BW. Mode of action of action of penetration enhancers in human skin. J. Control. Release, 1987; 6: 85-97.
20. Williams AC, Barry BW. Penetration enhancers. Adv Drug Deliv Rev., 2004; 56: 603-18.
21. Rawat MK, Jain A and Singh S .Studies on binary lipid matrix based solid lipid nanoparticles of repaglinide: in vitro and in vivo evaluation. Journal of Pharmaceutical Sciences, 2011; 100(6): 2366-2378.
22. Mukherjee. "Solid lipid nanoparticles: a modern formulation approach in drug delivery system." Indian journal of pharmaceutical sciences, 2009; 71: 349-358.
23. Puglia, C.; Blasi, P., Rizza, L.; Schoubben, A.; Bonina, F.; Rossi, C.; Ricci, M. Lipid nanoparticles for prolongedtopical delivery: An in vitro and in vivo investigation. Int. J. Pharm. 2008; 357: 295–304. [CrossRef] [PubMed].
24. Maeda, H. Polymer therapeutics and the EPR effect. J. Drug Target, 2017; 25: 781–785. [CrossRef] [PubMed].
25. K. Sashi, K. Satinder, and P. Bharat. "A complete review on: liposomes," International Research Journal of Pharmacy. 2012; 3(7): 10-16.View at: Google Scholar.
26. S. M. Jadhav, P. Morey, M. M. Karpe, and V. Kadam. "Novel vesicular system: an overview," Journal of Applied Pharmaceutical Science. 2012; 2(1): 193–202.View at: Google Scholar.