S Meenu et al /J. Pharm. Sci. & Res. Vol. 12(10), 2020, 1252-1255

ISSN:0975-1459
Journal of Pharmaceutical Sciences and Research
www.jpsr.pharmainfo.in

An Updated Review on Pharmacosomes: Novel Drug Delivery System

S Meenu *, S D Shaiju
Department of Pharmaceutics, Ezhuthachan College of PharmaceuticalSciences, Marayamuttom, Neyyattinkara, Trivandrum – 695124, Kerala,India.

Abstract

There are several vesicular drug delivery systems have been developed as controlled and targeted drug delivery system. Many constraints of various drug delivery systems, such as problems of drug incorporation, leakage from the carrier, insufficient shelf life , can be avoided by the pharmacosome approach. Pharmacosomes are one of the novel vesicular drug delivery system. They are colloidal dispersion of drug covalently bound to lipids. They provide an efficient method for the delivery of drug to the target site. The physicochemical properties depend on drug as well as the lipid. Pharmacosomes may be hexagonal aggregates, ultrafine vesicular and micellar form. Both synthetic and natural drugs which are facing difficulties like low solubility and low permeability can be effectively formulated.

Keywords: Pharmacosomes, vesicular drug delivery system, micellar, hexagonal aggregate, ultrafine vesicular.

INTRODUCTION

Pharmacosomes are novel vesicular drug delivery system. Vesicular systems are concentric lipid bilayer assemblies and these are formed when certain amphiphilic building blocks are confronted with water. Pharmacosomes are colloidal dispersion of drug covalently bound to lipids. They provide an efficient method for the delivery of drug to the target site, leading to reduction of drug toxicity with no adverse effects, also reduce the cost of therapy by improved bioavailability of medication especially in case of poorly soluble drugs. Pharmacosomes are suitable for incorporating both hydrophilic and lipophilic drugs due to their amphiphilic property to improve their solubility, bioavailability and minimize gastrointestinal toxicity of various drugs. The system is composed by linking a drug (pharmakon) to a carrier (soma), so they termed as “Pharmacosomes”. The physicochemical properties of pharmacosome depend on drug as well as the lipid. Pharmacosomes may be hexagonal aggregates, ultrafine vesicular and micellar form. A drug possessing free hydroxyl group or an active hydrogen atom (-NH2, -OH, -COOH) can be esterified with or without a spacer chain to the hydroxyl group of a lipid molecule, thereby producing an amphiphilic prodrug. Such a prodrug conjoins hydrophilic and lipophilic properties and thus manifests amphiphilic characteristics. Upon dilution with water, pharmacosomes are generated from these amphiphilic prodrugs. Both synthetic and natural drugs which are facing difficulties like low solubility and low permeability can be effectively formulated. Pharmacosomes have been prepared for various NSAIDs, proteins, cardiovascular and antineoplastic drugs. Developing the Pharmacosomes of the drugs has been improve the absorption and minimize the gasrointesinal toxicity. Pharmacosomes are amphiphilic complexes of drug with lipids. The amiphilic character help to reduce interfacial tension leads to increase in contact area and increase bioavailability of drugs[4].

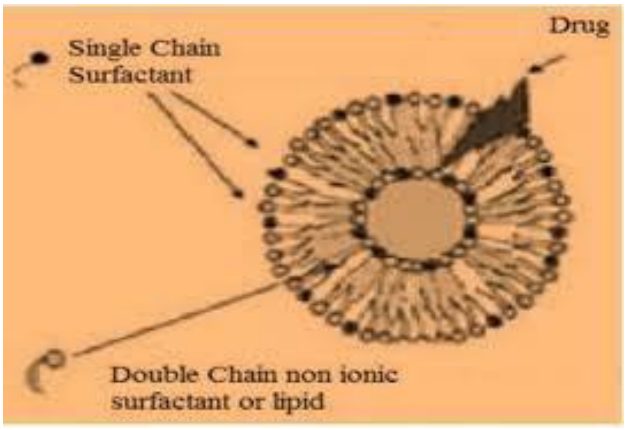

Fig : 1 Pharmacosomes

SALIENT FEATURES OF PHARMACOSOMES

- Pharmacosomes can incorporate both hydrophilic and lipophilic drugs.
- The physical and chemical bonding characteristics of the complex that controls overall stability of the formulation.
- They have the capability to penetrate through the cell membrane, cell wall,tissues.
- Appropriate drug incorporation into lipid.
- Drug leakage can be prevented due to the covalent linkage between the drug and phospholipid.
- Administered through several routes like topical, oral, rectal, extravascular or intravascular route.
- Having predetermined entrapment efficiency.
- Membrane fluidity depends on the phase transition temperature of the drug - lipid complex.
- At the time of administration, their degradation velocity to active drug molecule depends on the extend of size and functional group present in the drug molecule, fatty acid chain length in lipid.

ADVANTAGES OF PHARMACOSOMES

- No leaching will occur as drug is bounded to the lipid by covalent bonding.
- Deliver drug at the specific site.
- The drug is released from the lipid polymer by hydrolysis.
- The metabolism of drug depend on the functional group, size of the drug, length of chain in lipid and spacer.
- They are suitable for both lipophilic and hydrophilic drugs.
- The dugs and carrier are covalently linked together so entrapement efficiency is high.
- Improve bioavailability in case of poorly soluble drugs.
- Reduce the adverse effect and toxicity.
- No problem of drug incorporation.
- Reduce the cost of therapy[1].

DISADVANTAGES OF PHARMACOSOMES

- The storage of pharmacosomes undergoes fusion, aggregation and also chemical hydrolysis.
- Synthesis of compound depend upon its amphiphilic nature.
- It requires surface and bulk interaction of lipid with drugs.
- It requires covalent bonding to protect the leakage of drugs[1].

MATERIALS FOR PHARMACOSOMES

1) Drugs

Drugs contain active hydrogen atom (-COOH, OH, NH2) can be esterified with the lipid to form amphiphilic complex with or without spacer chain. The formation of such complex facilitates membrane, tissue, cellwall transfer in the organism and enhances the therapeutic efficiency of the drugs.

2) Solvents

They solvents should high high pure and volatile in nature. A solvent with intermediate polarity is selected for the preparation.

3) Lipid

Phospholipids are the major component of biological membranes. There are two types of phospholipids generally phosphoglycerides and spingolipids. The most common is phosphotidylcholine. It is amphiphilic molecule in which a glycerol bridges links a pair of hydrophobic acylhydrocarbon chains with hydrophilic polar head group. Drug solubility can be increased by the use of lipids by their wetting and dispersion properties. Amphiphilicity is one of the major reasons in increasing bioavailability of the drug molecule[6][8].

PREPARATION OF PHARMACOSOME

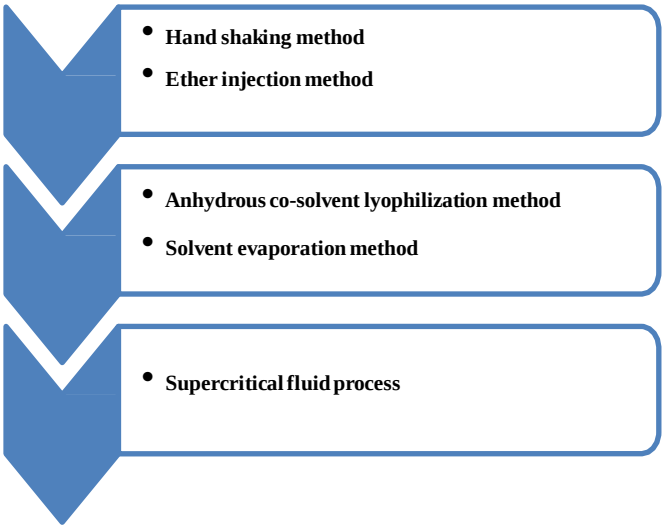

Fig : 2 Method of preparation of pharmacosomes

1) Hand shaking method

- Both the drug and lipid were taken in a round bottom flask and add organic solvent to it.
- The organic solvent was then removed by rotating the mixture in rotary vaccum evaporator at 100 rpm for 45 min.
- Results in the formation of a thin film which was then hydrated with suitable solvent which results in the formation of vesicular suspension [3].

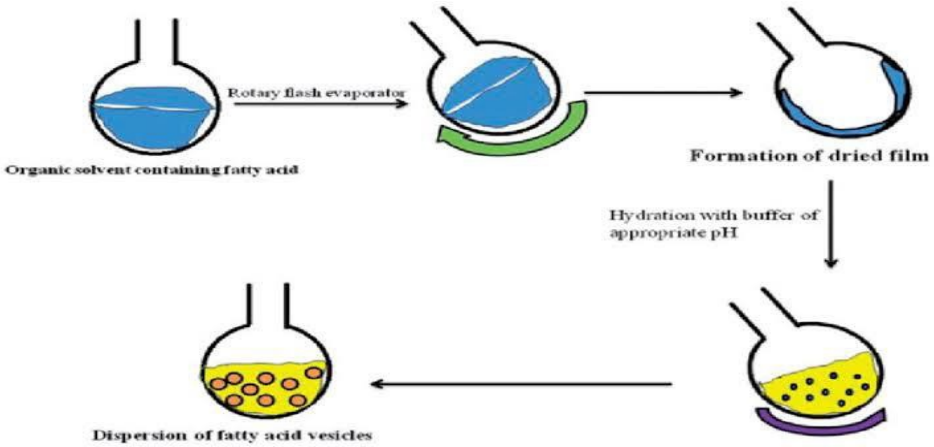

Fig: 3 Hand shaking method

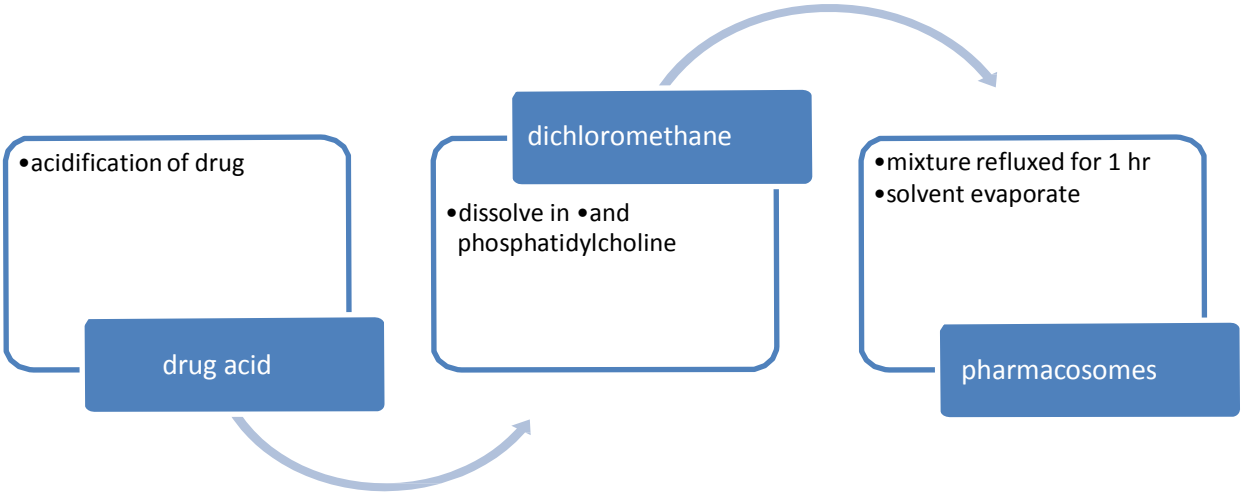

Fig: 4 Solvent evaporation method

2) Ether injection method

- The drug and lipid is dissolved in ether.
- The mixture was injected slowly dropwise in the preheated distilled water at 55-60℃, vesicles of pharmacosomes are formed [2].

3) Anhydrous co-solvent lyophilization method

- Drug and phospholipids are dissolved in solution of dimethyl sulfoxide containing glacial acetic acid.
- Then the above mixture is agitated to get clear liquid and the freeze dried overnight.
- The complex obtained is flushed with nitrogen and stored at 4 ℃ [1].

4) Solvent evaporation method

- The drug is first acidified so that the active hydrogen might be available for complexation.
- The drug acid is then extracted with chloroform and recrystalized.
- The accurately weighed PC and drug acid are placed in a 100ml round bottom flask and dissolved in sufficient amount of dichloromethane.
- The mixture is refluxed for 1 hr. then the solvent is evaporated under vaccum at 40℃ in a rotary vaccum evaporator.
- The dried residues are then collected and placed in vaccum desicator for complete drying [7] [9].

5) Supercritical fluid process

- Drug and lipid are premixed in a supercritical fluid of carbondioxide then high super saturation is obtained by passing through the nozzile mixture chamber.
- The turbulent flow of solvent and carbon dioxide results in fast mixing and leading to the formation of pharmacosomes [1].

CHARACTERIZATION OF PHARMACOSOMES

1. Surface morphology

The surface morphology can be predicted using SEM OR TEM. The size and shape of pharmacosomes undergo variations by rotation speed, vaccum applied, purity grade of lipid and method of preparation.

2. Size

The size of the vesicle is in nanorange. The size is determined by using zeta sizer XS the basic principle of the instrument is scattering of lighit.

3. Drug entrapment

To know about the amount of drug present in the drug-lipid complex. The pharmacosomes were transferred into a suitable volume of solvent. Leave the content for 24 hrs without disturbing and estimate the drug present by using UV spectroscopy or HPLC.

4. Solubility

Solubility is determined by placing the knoum amount of phospholipid complex in a bottle containing aqueous buffer solution and organic phase 1- octanol with continous shaking at a temperature of 37℃ for 24 hrs. then both the layers will be separated and sample were analyzed using HPLC or UV spectrometer.

5. Drug- lipid compatability

Differential scanning electron microscopy is used to determine drug – lipid compatability and their interactions. The thermal response is studied using separate samples and heating them ina pan which is closed. The nitrogen gas is passed and the temperature is maintained in a definite range.

6. Dissolution studies

Dissolution studies invitro are done by using various models available using different buffers, then the results obtained are estimated on the basis of activity of the drug substance.

7. *In vitro* drug release rate

Reverse dialysis bag technique is used. In this method pharmacosomes are introduced into the dialysis bag containing the continous phase and are suspended in a

vessel containing the donor phase and stirred at predetermined time intervals. The dialysis bag is removed and the content are analyzed for the drug release [5] [1] [7] [10].

Table I: Outcomes Of Various Drugs After Incorporation In Pharmacosomes

DRUGS	OUTCOMES
Etodolac	Increased solubility, entrapment efficiency and sustained release.
Aceclofenac	Enhancement of solubility, dissolution profile and improved bioavailability.
Diclofenac	Improved solubility and drug loading.
Ketoprofen	Improved solubility, dissolution profile
Naproxen	Solubility enhanced and achieved controlled drug release.

APPLICATIONS

- Increase absorption and permeation of the drug.
- The mechanism of action of drugs and non bilayer phases can be studied.
- Better stability and shelf life compared to other vesicular drug delivery systems.
- To study the ability of transportation of biological components like proteins and aminoacids.
- Phytoconstituents such as flavanoids, glycosides, xanthones etc, shows increase in pharmacokinetic and pharmacodynamic actions.
- The approach has successfully improved the therapeutic performance of various drugs. That is, pindolomate, taxol, acyclovir etc.
- The phase transition temperature of pharmacosomes in the vesicular and micellar state should have significant influence on their interaction with membranes.
- Pharmacosomes have greater degree of selectivity for action on specific target cells.
- Pharmacosomes caninteract with biomembranes enabling a better transfer of active ingredient. This interaction leads to change in phase transition temperature of biomembranes there by improving the membrane fluidity and enhance the permeations.
- Development of novel ophthalmic DDS.
- Improved bioavailability and reduced gastrointestinal toxicity in aspirin was predicted by preparing aspirin phospholipid complex[1][4].

CONCLUSION

In pharmacosomes drug is bound to the lipid by covalent, vanderwaal and hydrogen bonding. The drug shows excellent entrapment efficiency and there is minimal loss of drug due to leakage. Similar to other vesicular drug delivery system pharmacosomes play an important role in the selective targeting and the controlled delivery of various drugs. Pharmacosomes reduce toxicity and can improve therapeutic activity of drug.

REFERENCES

1) Supraja B, Mullangi S. An updated review on pharmacosomes, a vesicular drug delivery system. Journal of Drug Delivery and Therapeutics. 2019;9(1):393- 402.
2) Kusuma K, Priyanka D. Formulation and evaluation of pharmacosomal gel loaded with NSAID. World Journal Of Pharmaceutical And Medical Research. 2018;4(7):81-8.
3) Letha S, Shammika P, Viswananad V. Formulation and evaluation of etodolac pharmacosomes : A novel approach towards rheumatoid arthritis. International Journal of Pharmacy and Technology. 2017;9(2):29665-80.
4) Sonam T, Richa T. Pharmacosomes: an overview. International Journal Of Pharmaceutical and Biological Science Archive. 2017;5(02):1-7.
5) Sharma P H, Powar P V. Pharmacosomes: a novel drug delivery system. The Pharma Innovation Journal. 2014;3(10):94-100.
6) Sulthana S K, Sindhuri K T. An updated overview on pharmacosomes. Internatinal Journal Of Universal Pharmacy And Bio Sciences. 2014;3(3):710- 31.
7) Kamalesh M, Dr Diraj B. Formulation and evaluation of pharmacosomes of ketoprofen. Indo American Journal of Pharmaceutical Research. 2014;4(3):1363-8.
8) Kumar P, Arnab D. Pharmacosomes: a potential vesicular drug delivery system. Internatinal Research Journal Of Pharmacy. 2012;3(3):102-4.
9) Semalty A, Semalty M. Development and evaluation of pharmacosomes of aceclofenac. Indian J. Pharm. Sci. 2010;72(5):576-81.
10) Semalty A, Semalty M. Development and physicochemical evaluation of pharmacosomes of diclofenac. Acta Pharma. 2009;59:335- 44.