Lipophilic drugs can be solubilized to increase the bioavailability by using several methods as microemulsion, nanosuspension, liposome, solid lipid nanoparticles (SLN), self-emulsifying drug delivery system (SEDDS), complexation with cyclodextrin, etc. SEDDS has received particular attention as a means of enhancing the oral bioavailability of poorly absorbed drugs. SEDDS are liquid to semisolid in nature, but it has drawbacks as formulation development, quality control, stability, etc. These liquid SEDDS can be converted into solid dosage form without affecting drug release property. After administering the drug gets released and self-emulsify in the GI tract. Generally solid SEDDS are formed with mono, di or triglycerides of fatty acids, non-ionic surfactants and solidifying agents with diluents such as microcrystalline cellulose, lactose, etc.

Key words: Self emulsification, biopharmaceutical classification, excipients, dosage form

INTRODUCTION

The oral route is one of the preferred routes for chronic drug therapy. Approximately 35-40% of new drug candidates have poor water solubility. The oral delivery of such drugs is frequently associated with low bioavailability, high inter and intra subject variability and lack of dose proportionality. Efforts are going on to enhance the oral bioavailability of lipophilic drugs in order to increase their clinical efficacy. To overcome these problems, new strategies were reported to increase solubility and bioavailability including complexation with cyclodextrins, solid dispersion (suspension), co-precipitation, micronisation, salt formation, emulsion, use of micelles, and cogrinding. 14

Emulsions are used as vehicles for the administration of drugs, especially due to its potential of enhancing the oral bioavailability of poorly absorbed drugs. Microemulsions have got advantage like excellent thermodynamic stability, high drug solubilization capacity, improvement in oral bioavailability and protection against enzymatic hydrolysis. The only problem with microemulsion is poor palatability due to the lipid content leading to poor patient compliance, more over due to their water content, microemulsions cannot be encapsulated into soft gelatin or hard gelatin capsule. There is a need for converting it into an alternative formulation like anhydrous self-emulsifying drug delivery system (SEDDS) etc., because of its low loading dose.

SEDDS are solid dosage form with a unique property, that is they are able to self-emulsify rapidly into fine O/W emulsion in the gastrointestinal fluids, under gentle agitation provided by the gastrointestinal tract. This fine O/W emulsion results in small droplets of oil dispersed in the gastrointestinal fluids that provide a large interfacial area enhancing the activity and minimizing the irritation due to contact of drug in the gut wall. 15 16 Self Emulsifying System (SES) can be formulated with little energy input and the shelf life is longer than conventional emulsions. Therefore, an SES can be an efficient vehicle for class II to IV molecules of the Biopharmaceutical Classification System (BCS) drugs. 11

Biopharmaceutical drug classification system

Biopharmaceutical drug classification is a fundamental guideline classifying drugs based on the solubility and permeability, as shown in Table 1. 12

<table>
<thead>
<tr>
<th>Class</th>
<th>Permeability</th>
<th>Solubility</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>II</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>III</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>IV</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

Class I includes drugs that are water soluble and gastrointestinal tract permeable. This class does not suffer from absorption or permeation problems that may affect oral drug bioavailability. While classes II, III and IV contain drugs having problems in solubility and/or permeability that may reflect on their bioavailability in the blood after the drug is taken orally. Classes II, III and IV form approximately 80% of the drugs available in the market.

Purpose

1. Highly important consideration in the formulation of solid SES is effective incorporation of the drug, in terms of both the solubilization within the oil surfactant mix in order to allow a suitable solid dosage to form and once formed the effect that the drug may have on the emulsification properties.

Table 2: Summarizes examples of drugs related to II, III and IV classes

<table>
<thead>
<tr>
<th>Class</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artemether</td>
<td>Acyclovir</td>
<td>Lamotrigine</td>
<td>Leflunomide</td>
</tr>
<tr>
<td>Carbamazepine</td>
<td>Acyclovir</td>
<td>Lamotrigine</td>
<td>Leflunomide</td>
</tr>
<tr>
<td>Dapsone</td>
<td>Allopurinol</td>
<td>Aminoglycoside</td>
<td>Levamisole</td>
</tr>
<tr>
<td>Erlotinib</td>
<td>Aminoglycoside</td>
<td>Aminoglycoside</td>
<td>Levamisole</td>
</tr>
<tr>
<td>Folic Acid</td>
<td>Aminoglycoside</td>
<td>Aminoglycoside</td>
<td>Levamisole</td>
</tr>
<tr>
<td>Gliclazide</td>
<td>Aminoglycoside</td>
<td>Aminoglycoside</td>
<td>Levamisole</td>
</tr>
<tr>
<td>Griseofulvin</td>
<td>Aminoglycoside</td>
<td>Aminoglycoside</td>
<td>Levamisole</td>
</tr>
<tr>
<td>Hydralazine</td>
<td>Aminoglycoside</td>
<td>Aminoglycoside</td>
<td>Levamisole</td>
</tr>
<tr>
<td>Haloperidol</td>
<td>Aminoglycoside</td>
<td>Aminoglycoside</td>
<td>Levamisole</td>
</tr>
<tr>
<td>Haloperidol</td>
<td>Aminoglycoside</td>
<td>Aminoglycoside</td>
<td>Levamisole</td>
</tr>
<tr>
<td>Phenyoxyphthanic Acid</td>
<td>Carbocyclics</td>
<td>Carbocyclics</td>
<td>Levamisole</td>
</tr>
<tr>
<td>Ergometrine</td>
<td>Carbocyclics</td>
<td>Carbocyclics</td>
<td>Levamisole</td>
</tr>
<tr>
<td>Ethambutol</td>
<td>Carbocyclics</td>
<td>Carbocyclics</td>
<td>Levamisole</td>
</tr>
<tr>
<td>Hydrochloride</td>
<td>Carbocyclics</td>
<td>Carbocyclics</td>
<td>Levamisole</td>
</tr>
<tr>
<td>Hydralazine</td>
<td>Carbocyclics</td>
<td>Carbocyclics</td>
<td>Levamisole</td>
</tr>
<tr>
<td>Hydrochlorothiazide</td>
<td>Carbocyclics</td>
<td>Carbocyclics</td>
<td>Levamisole</td>
</tr>
<tr>
<td>Lamivudine</td>
<td>Carbocyclics</td>
<td>Carbocyclics</td>
<td>Levamisole</td>
</tr>
<tr>
<td>Levamisole</td>
<td>Carbocyclics</td>
<td>Carbocyclics</td>
<td>Levamisole</td>
</tr>
<tr>
<td>Metformin</td>
<td>Carbocyclics</td>
<td>Carbocyclics</td>
<td>Levamisole</td>
</tr>
<tr>
<td>Hydrochloride</td>
<td>Carbocyclics</td>
<td>Carbocyclics</td>
<td>Levamisole</td>
</tr>
</tbody>
</table>

2. The advantage of solid SES is in its dose reduction, if an improvement in oral bioavailability is established.

3. SES are usually formulated in a liquid form, which has some disadvantages, especially during the manufacturing processes, leading to high production costs, tedious process control, and low stability. Furthermore, incompatibility problems as explained earlier with the capsule shell are common. 15 16

ADVANTAGES OF SMEDDS

Improvement in oral bioavailability

Dissolution rate dependant absorption is a major factor that limits the bioavailability of numerous poorly water soluble drugs. The ability of SMEDDS to present the drug to GIT in solubilised and micro-emplsified form (globule size between 1-100 nm) and subsequent increase in specific surface area enable more efficient drug transport through the intestinal aqueous boundary layer and through the absorptive brush border membrane leading to improved bioavailability. E.g. In case of halofantrine approximately 6-8 fold increase in bioavailability of drug was reported in comparison to tablet formulation.

 Ease of manufacture and scale-up

Ease of manufacture and scale-up is one of the most important advantages that make SMEDDS unique when compared to other drug delivery systems like solid dispersions, liposomes, nanoparticles, etc., dealing with improvement of bio-availability. SMEDDS require very simple and economical manufacturing facilities like simple mixers with agitator and volumetric liquid filling equipment for large-scale manufacturing. This explains the interest of industry in the SMEDDS.

Reduction in inter-subject and intra-subject variability and food effects

There are several drugs which show large inter-subject and intra-subject varia-
tion in absorption leading to decreased performance of drug and patient non-compliance. Food is a major factor affecting the therapeutic performance of the drug in the body. SMEDDS are a boon for such drugs. Several research papers specifying that, the performance of SMEDDS is independent of food and, SMEDDS offer reproducibility of plasma profile are available.\(^{[47]}\)

**Ability to deliver peptides that are prone to enzymatic hydrolysis in GIT**

One unique property that makes SMEDDS superior as compared to the other drug delivery systems is their ability to deliver macromolecules like peptides, hormones, enzyme substrates and inhibitors and their ability to offer protection from enzymatic hydrolysis. The intestinal hydrolysis of prodrug by cholinesterase can be protected if Polysorbate 20 is emulsifier in micro emulsion formulation.\(^{[49]}\) These systems are formed spontaneously without aid of energy or heating thus suitable for thermo labile drugs such as peptides.\(^{[49]}\)

**No influence of lipid digestion process**

Unlike the other lipid-based drug delivery systems, the performance of SMEDDS is not influenced by the lipolysis, emulsification by the bile salts, action of pancreatic lipases and mixedmicelle formation. SMEDDS are not necessarily digested before the drug is absorbed as they present the drug in micro-emulsified form which can easily penetrate the mucin and water unstirred layer.

**Increased drug loading capacity**

SMEDDS also provide the advantage of increased drug loading capacity when compared with conventional lipid solution as the solubility of poorly water soluble drugs with intermediate partition coefficient (2<log P<4) are typically low in natural lipids and much greater in amphiphilic surfactants, co-surfactants and co-solvents.

**DISADVANTAGES OF SMEDDS**

- One of the obstacles for the development of SMEDDS and other lipid-based formulations is the lack of good predictive in vitro models for assessment of the formulations.
- Traditional dissolution methods do not work, because these formulations potentially are dependent on digestion prior to release of the drug.
- This in vitro model needs further development and validation before its strength can be evaluated.
- Further development will be based on in vitro - in vivo correlations and therefore different prototype lipid based formulations needs to be developed and tested in vivo in a suitable animal model.
- The drawbacks of this system include chemical instabilities of drugs and high surfactant concentrations in formulations (approximately 30-60%) which irritate GIT.
- Moreover, volatile co-solvents in the conventional self-microemulsifying formulations are known to migrate into the shells of soft or hard gelatin capsules, resulting in the precipitation of the lipophilic drugs.
- The precipitation tendency of the drug on dilution may be higher due to the dilution effect of the hydrophilic solvent.
- Formulations containing several components become more challenging to validate.

**Mechanism of self emulsification**

Self-emulsifying process are related to the free energy, \(\Delta G\) given by

\[
\Delta G = S N p r^2 s (1)
\]

Here, \(N\) is the number of droplets with radius \(r\) and \(s\) the interfacial energy.\(^{15}\) It is apparent from the equation that the spontaneous formation of interface between the oil and water phase is energetically not favorable. The system commonly classified as SEDDS have not yet been shown to emulsify spontaneously in the thermodynamic sense.

Mustafa and Groves developed a method of quantitatively assessing the ease of emulsification by monitoring the turbidity of the oil-surfactant system in a water stream, using phosphated nonylphenoloxylate (PNE) and phosphated fatty alcohol ethoxylate (PFE) in \(\alpha\)-hexane and suggested that the emulsification process may be associated with the ease with which water penetrates the oil-water interface, with formation of liquid crystalline phase resulting in swelling at the interface, thereby resulting in greater ease of emulsification.\(^{[26]}\) Consequently, the authors were able to relate the phase behavior to the spontaneity of emulsification, with liquid crystals formation, tending to form emulsion more readily, as indicated by the lower equilibration times.\(^{[17]}\) Pouton has argued that the emulsification properties of the surfactant may be related to phase inversion behaviour of the system.\(^{[27]}\) For example, if one increases the temperature of the oil in the water system stabilized by using non-ionic surfactants, the cloud point of the surfactant will be reached followed by phase inversion.\(^{[18]}\) The surfactant is highly mobile at the phase inversion temperature; hence the O/W interfacial energy is minimized, leading to a reduction in energy required to bring about emulsification. Pouton has suggested that the specificity of surfactant combination required to allow spontaneous emulsification is associated with a minimization of phase inversion temperature, there by increasing the ease of emulsification.\(^{[18]}\)

**Role of excipient used in solid self emulsification system**

Self-emulsifying solid dosage form mainly contains oil, surfactant, cosurfactant, filler etc. A wide range of oils has been studied either as model system or as potential vehicles for the dosage forms, with many of the oils under study being medium chain fatty acid ester or a medium/long chain saturated, partially unsaturated or unsaturated hydrocarbon, in liquid, semi-solid or solid form at room temperature. In SEDDS we can use different types of oil for examples mono, di, triglycerides of fatty acids, fatty alcohols, vegetable oils, refined animal oils etc.\(^{19}\) Nature of oil is very important in the formation of SEDDS. Chemicals structure of the oil components and interactions of these components with the various enzymes, surfactants and proteins associated with digestion and absorption process, for example, fatty acid chain length is important factor for chylomicron formation. Short and medium chain acids are predominantly absorbed by portal blood system while longer chain fatty acid may be reesterified in the cell lining the small intestine and absorbed via the lymphatics.\(^{20,21}\)

The absorption enhancement is greater when using unsaturated fatty acids. Figure 1 showed digestion of lipid and subsequent absorption via the portal blood and intestinal lymphatics.\(^{22}\)

M. Cheema et al reported that a greater degree of unsaturation led to a more rapid onset of lipoprotein synthesis as a result of faster absorption or greater affinity of fatty acid binding to protein because unsaturated fatty acids have lower melting points as compared to saturated with increasing fluidity.\(^{23}\)

Liquid crystal formation from oil depends on oil polarity, which would influence the emulsification process. Very polar or non-polar oils tend to form poor emulsions. Miglyol 812 and 840 both have intermediate polarity which shows favourable emulsification properties with Tween85. Solubility of the drug in the oil-surfactant mixture is very important whereas solubility of drug in vegetable oil is not a problem. The simplest and most desirable formulation may well be a simple oil solution which is self emulsified in the gut during digestion.\(^{24}\)

For toxicity reason, these days research focuses on the use of non-ionic surfactant with relatively high hydrophilic lipophilic balance (HLB) value. Surfactants posses properties to inhibit the digestion of oils, so selection of surfactant is very important. Pouton and Wakerley et al have screened a range of surfactants, finding that in general molecules with unsaturated acyl chains were most efficient emulsifiers.\(^{25,26}\)
Dissolution tests showed that nearly 100% of progesterone dissolved within 30 min and within 5 min from capsules containing the progesterone dissolved in self emulsifying system. From the aqueous suspension, 50% of the dose was released within 60 min. They also observed that pellets administered orally to dogs were tested versus the same dose of progesterone dissolved in liquid SES in capsules or a suspension of micronized progesterone. In that SES pellets and SES solution had higher plasma levels of progesterone at each time point as compared to the aqueous suspension of progesterone.  

E. Franceschinis et al developed a method of producing self-emulsifying pellets by wet granulation. Here they first developed a binder solution containing an oil (mono and diglycerides), polysorbate 80 and model drug nimesulide in different proportion. This oil/surfactant mixture was stirred then added to water to form self-emulsifying system. Second step was to prepare granules from microcrystalline cellulose and lactose in a granulator. These binder solutions were sprayed on to the granules and pellets were formed by increasing the speed of the granulator. Pellets were able to generate significantly smaller droplets with respect to corresponding emulsions.

M. Serratoni et al presented controlled drug release from self-emulsifying pellets. The prepared self emulsifying system were formed by mixing oil/surfactant within solubilised drug in appropriate concentrations, because higher quantity of drug incorporated into SES, could be precipitated when diluted with water. This SES was added into damp mass of microcrystalline cellulose and lactose monohydrate, water was then added to the prepared wet mass for extrusion-spheronization to form pellets. These pellets were coated by hydrophilic polymers namely ethyl cellulose then coated by aqueous solution of hydroxypropylmethy cellulose in a fluid bed coater. The ability of this formulation to enhance dissolution of the model drug, where dissolution results for the uncoated pellets containing methyl or propyl parabens with and without the addition of self emulsifying system were compared.  

Ahmed abdalla and Karsten Mader investigated preparation and characterization of self-emulsifying pellets formulation. They formulated three self emulsifying systems separately by melting Cithrol GMS (mono and diglycerides) and solutol HS 15, to this was added drug, dye and spin probe. Then added water to the mixture and blend until creamy mass was formed, this dry MCC into it to form suitable mass for extrusion. The dye was added for assessment of self emulsification and spin probe was added for the release kinetics and microenvironment of pellets, during release process, which were assessed using electron spin resonance spectroscopy. The dissolution profile showed complete release of drug as diazepam from the non self emulsifying GMS/MCC pellets. It had a 3-fold duration of action. Nearly 90% of the drug was released after an hour while only 55% was released from the GMS/MCC pellets. Pellets composed of MCC/GMS were only capable of releasing diazepam until the saturation solubility reached.

T. Iosio et al prepared bi-layered self emulsifying pellets, SEP was formed by co-extrusion spheronization with two cohesive layers, in that, type 1 pellets had formulation A (a matrix made of lactose and MCC loaded with a SES dispersed in the inner part) and formulation B (a inert matrix containing in lactose, MCC, and water) in the outer and type 2 having formulation B in the inner core and formulation A externally. SEP were formulated in two steps, first prepared oil-surfactant mixture then added to water to form self-emulsifying system and this mixture was then loaded into MCC and lactose to form suitable extrusion-spheronization mass for pellets. Pellets of type I plus 2% of croscarmellose sodium released 90% of vinpocetine as a model drug within 30 min, pellets of type II were release in 20 min and from the physical mixture only 25% of drug was released after 60 min.  

Self emulsifying beads:

Self emulsifying system can be formulated as a solid dosage form by using less excipient. Patil and Paradkar discovered that deposition of SES into microporous polystyrene beads was done by solvent evaporation. Porous polystyrene beads with complex internal void structures were typically produced by copolymerizing styrene and divinyl benzene. It is inert and stable over a wide range of pH, temperature and humidity. Geometrical features, such as bead size and pore architecture of PPB, were found to govern the loading efficiency and in vitro drug release from SES-loaded PPB.

Self emulsifying microsphere:

You et al. formulated solid SE sustained-release microspheres using the quasi-emulsion solvent diffusion method for the spherical crystallization technique. Zedoary turmeric oil release behavior could be controlled by the ratio of hydroxypropyl methylcellulose acetate succinate to Aerosil 200 in the formulation. The plasma concentration time profiles were achieved after oral administration of such microspheres into rabbits, with a bioavailability of 135.6% with respect to the conventional liquid SEDDS.

Technique of solid SEDDS development

Solid SEDDS were developed mainly by adsorption of solid carriers, spray drying, melt extrusion, dry emulsion, solid dispersion etc. These solid SEDDS can be converted into pellets, tablets and capsules.

i) Solid carriers

These solid carriers have property to absorb liquid/semisolid formulation as self emulsifying system (SES). It is a simple procedure, where SES is incorporated into a free flowing powder material which has adsorption quality. The mixture is uniformly adsorbed by mixing in a blender. This solid mixture is filled into capsule or added to more excipient before compression into tablets. The above mixture solidified to powder forms using three kinds of adsorbents: microporous calcium silicate (Florite TM RE); magnesium aluminum silicate (Neusilin TM US2) and silicon dioxide (Sylvesta TM 320).  

ii) Spray Drying

In this technique first the prepared formulation containing oil, surfactant, drug, solid carrier etc, is sprayed into a drying chamber through a nozzle. The volatile particles first evaporate leaving behind small solid particles. These particles are then filled into capsules or compressed into tablets.

iii) Melt extrusion

This formulation technique depends on the property of the plastic mass material which can be easily extruded and spheronised with pressure. Here there is no need for addition of liquid form of excipient but a constant temperature and pressure need to be maintained.

iv) Dry Emulsion

It is mainly O/W emulsion, which is then converted into solid form by spray drying/solid carrier/ freeze drying.

Dosage forms from self emulsifying system:

- Dry emulsions
- Self-emulsifying capsules
- Self-emulsifying sustained/controlled-release tablets
- Self-emulsifying sustained/controlled-release pellets
- Self-emulsifying solid dispersions
- Self-emulsifying beads
- Self-emulsifying sustained-release microspheres
- Self-emulsifying nanoparticles
- Self-emulsifying suppositories
- Self-emulsifying implant

Self emulsifying capsule:

It is a capsules containing liquid or semisolid form of self emulsifying system. In the GIT, the capsules get dispersed to SES uniformly in the fluid to micron size, enhancing bioavailability. Second type of self emulsifying capsule is solid SES filled into capsule.

Self emulsifying tablets:

S. Naz zal et al developed self-nanoemulsified tablet dosage form of Ubiquinone. The main objectives of this study were to study effect of formulation ingredients on the release rate of Ubiquinone and to evaluate an optimized self-nanoemulsified tablets formulation. The first prepared self nanoemulsion system containing Ubiquinone was prepared as nanoemulsion, this nanoemulsion was adsorbed by granular materials and then compressed to form tablets. The optimized formulation of coenzyme Q10 self-nanoemulsified tablet dissolution profile showed that 80-90% drug release took place in 45 minute.  

A. A. Attama et al formulated the solid self-emulsifying systems in the delivery of diclofenac. This solid self emulsifying system was developed using goat fat and tween 65. The fatty material and surfactant were heated together to melt and added to weighted quantity of drug and dissolved in the melt, this molten mass was then poured into plastic mould and cooled. This tablets will melt and added to weighted quantity of drug and dissolved in the melt, this molten mass was then poured into plastic mould and cooled. This tablets will liquify at body temperature without agitation and at gastrointestinal conditions, agitation as peristaltic movement will lower the liquification time, resulting in faster emulsification with increased plasma concentration. Different formulation ratio shows varying dissolution profile at constant speed/agitation. These tablets showed good release profiles with acceptable tablet properties.

Self emulsifying pellets:

C. Tule et al presented comparative bioavailability study in dogs of a self – emulsifying formulation of progesterone presented as in pellets and the liquid form was compared with an aqueous suspension of progesterone. The in vitro dissolution tests showed that nearly 100% of progesterone dissolved within 30
Self-emulsifying nanoparticle:

Nanoparticle technology can be applied to the formulation of self-emulsifying nanoparticle. One of the solvent was injection, in this method the prepared molten lipid mass contained lipids, surfactant and drug. This lipid molten mass was injected drop wise into a non solvent system. This is filtered and dried to get nanoparticles. By this method 100 nm size particle with 70-75% drug loading efficiency was obtained. Second technique is sonication emulsion diffusion-evaporation; by this method co-load 5-fluorouracil and antsense EGF receptor (epidermal growth factor receptor) plasmds into biodegradable PLGA/O-CMC nanoparticles. The mixture of PLGA (poly-lactic-co-glycolide) and O-CMC (O-carboxyethyl-chitosan) had a SE effect, with no additional surfactant required.44

Trickler et al. developed a novel nanoparticle drug delivery system consisting of chitosan and glyceryl monooleate (GMO) for the delivery of paclitaxel (PTX). These chitosan/ GMO nanoparticles, with bioadhesive properties increased cellular association and was prepared by multiple emulsion (o/w/o) solvent evaporation methods.45

Examples of marketed SEDDS formulations

<table>
<thead>
<tr>
<th>Drug Name</th>
<th>Compound</th>
<th>Dosage form</th>
<th>Company</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neoral® Cyclosporine A/I</td>
<td>Soft gelatin capsule</td>
<td>Novartis</td>
<td>Immune suppressant</td>
<td></td>
</tr>
<tr>
<td>Retinovir®</td>
<td>Soft gelatin capsule</td>
<td>Abbott</td>
<td>HIV antiviral</td>
<td></td>
</tr>
<tr>
<td>Fortovase®</td>
<td>Soft gelatin capsule</td>
<td>Hoffmann-La Roche inc.</td>
<td>HIV antiviral</td>
<td></td>
</tr>
<tr>
<td>Agenerase®</td>
<td>Soft gelatin capsule</td>
<td>GlaxoSmithKline</td>
<td>Antithrombotic</td>
<td></td>
</tr>
</tbody>
</table>
| Liprex®            | Soft gelatin capsule | Genus | Anti-platelet 
| Sandimmune® Cyclosporine A/I | Soft gelatin capsule | Novartis | Immuno suppressant 
| Targetrol®          | Soft gelatin capsule | Lipoid | Lipo-phospholipids |
| Rocaltrol®          | Soft gelatin capsule | Roche | Calcium Regulator |
| Gengraf®            | Calcitriol         | Abbott     | Calcium Regulator |

CONCLUSION

Self-emulsifying drug delivery system in solid dosage form has improved solubility/dissolution, absorption and bioavailability for poorly water soluble drug. This is the method suit for lipopholic drugs where resulting emulsification gives faster dissolution rates and absorption. Solid SEDDS is superior to SEDDS in reducing production cost, simplifying industrial manufacture, and improving stability as well as patient compliance. Solid SEDDS has the flexibility to develop into different solid dosage form for oral and parenteral administrations.

REFERENCES


Source of support: Nil, Conflict of interest: None Declared