A Review on Study of Self Emulsifying Drug Delivery System Used for Enhancement Solubility And Oral Bioavailability

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***Abstract*—The simplest and most practical way to administer deugs is orally. oral drug delivery systems are the most economical and dominate the global drug delivery industry. The main issue with oral medications poor aqueous solubility is the primary cause of formulations' low and inconsistent bioavailability. This could result in elevated therapeutic failure, lack of dose proportionality, and variability between and within subjects. According to estimates, 40% of active. water insoluble substances are poorly soluble in water. To increase the bioavailability of medications with one of the biggest problems with drug formulations is these characteristics. Different technological approaches are documented in the literature, such as solid dispersions, the formation of cyclodextrin complexes or micronation and various drug delivery system technologies. Incorporating these strategies, self-emulsifying drug delivery systems (SEDDS) have drawn increased interest for improving oral bioavailability while lowering dosage. Isotropic mixtures of oil, solvents, surfactants, and co-solvents/surfactants are known as SEDDS. The primary feature of these systems is their capacity to create micro-emulsions or fine oil -in-water (o/w) emulsions with mild stirring after dilution through the use of water. SEDDS may be an option for lipophilic medications, whose absorption is limited by their rate of dissolution promising method to increase oral absorption's rate and scope. This review article explains how self-emulsifying drug delivery systems can increase the solubility and bioavailability of poorly soluble drug.**

***Index Terms*—Self-emulsifying drug delivery system, Excipients, Types of SEDDS, Method of preparation, Application**

I. INTRODUCTION

The simplest and most practical method is oral administration that is non-invasive. System for oral drug delivery is the most economical and tops the global pharmaceutical market for delivery. The oral route presents challenges. for medication molecules with subpar aqueous solubility. When a medication is taken orally the initial process of solubilization followed by absorption. Roughly 40% of novel chemical drug components possess low solubility in water, which is a significant threat to the current drug delivery system. The pace limiting factor for these medications absorption is how they dissolve in the digestive system. The medications with low solubility in water and high Drugs with permeability are categorized as class II by system for classifying biopharmaceuticals (BCS). Various methods such as solid micronation, complexation with cyclodextrins and dispersion are utilized to develop formulations, but in certain in certain instances, these methods have proven effective. (Stegemanna S,,et;al 2007)[1]. However, they have numerous other drawbacks. Drug delivery systems that self-emulsify (SEDDSs) have become well-known for their capacity to raise solubility and bioavailability of medications with low solubility. SEDDSs are isotropic oil and surfactant mixtures. It can be utilized, and occasionally it contains co-solvents. For formulation design in order to enhance the oral absorption of substances that are very lipophilic. When added to an aqueous solution, SEDDSs emulsify spontaneously to create fine oil-in-

water emulsions. phase when gently stirred. SEDDS may be given orally in gelatin capsules, either soft or hard. and create thin, comparatively stable emulsions of oil in water after dilution in water. This piece provides a summary of SEDDSs and how they are used (P.P. Bhatt,et;al 2004) [2]. Formulations that self-emulsify spread easily in the GI tract (GIT), as well as the GI motility of the the intestine and stomach supply the required self-emulsification agitation. These systems have the benefit of the medication in dissolved form and the A large interfacial area is provided by small droplet size for the absorption of drugs. (Shah NH,et;al 1994) [3]. The droplet size of SEDDSs' emulsions is usually between 100 and 300 nm, whereas self-micro-emulsifying drug delivery systems Transparent micro- emulsions with droplets smaller than 50 nm are formed by SMEDDSs. In contrast to emulsions, which are sensitive and metastable dispersed forms, SEDDSs are easily manufactured and physically stable formulations. Therefore, these systems may improve the rate and extent of absorption and produce more repeatable blood-time profiles for lipophilic drug compounds that show dissolution rate-limited absorption. R.N..(Gursoy,et;al 2004)[4].The development of liquid crystals (LC) and gel phases is the next step in the self-emulsification process. Drug release from Since it is likely to impact the angle of curvature of the droplet formed and the resistance provided for drug partitioning into aqueous media, SEDDS is heavily reliant on the liquid crystalthat forms at the interface. (Serajuddin A.T.M 1999)[5].

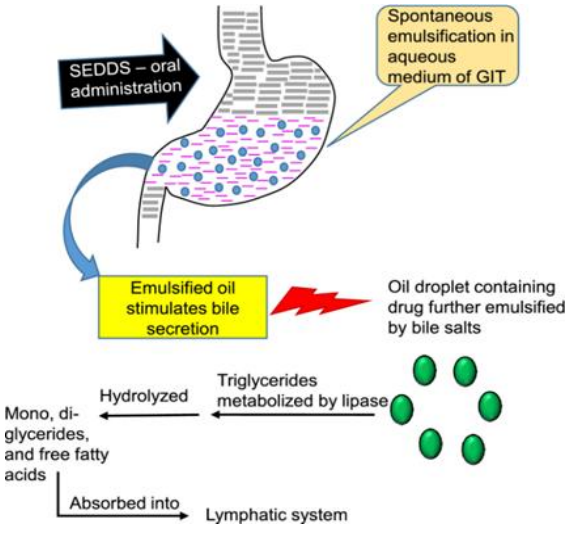

FIG1 Process of self-emulsification.

Advantages of SEDDS:

1.Enhanced oral bioavailability enabling reduction in dose

2.Selective targeting of drug(s) toward specific absorption window in GIT.

3.Protection of drug(s) from the hostile environment in gut.

4. Control of delivery profile.

5.Reduced variability including food effects

6.Protective of sensitive drug substances.

7.High drug payloads.

8. Liquid or solid dosage forms. [6,7]

Disadvantages of SEDDS:

1.Lack of good predicative in vitro models for assessment of the formulations.

2.High surfactant concentration used in this formulation which irritates GIT

3.Volatile co-solvent migrates into the shells of soft or hard gelatin capsule.

4.The precipitation tendency of drug on dilution may be higher due to dilution effect of hydrophilic solvent.

5.Formulations containing several components become more challenging to validate. [7,8,9]

II. EXCIPIENTS

A) OILS: Depending on the molecular makeup of the triglyceride, the oil is one of the most crucial excipients in the SEDDS formulation because it can increase the fraction of lipophilic drug transported via the intestinal lymphatic system, which increases absorption from the GI tract. It can also help self-emulsify or solubilize the necessary dose of the lipophilic drug. LCT and MCT oils, or long and medium chain triglycerides, have been employed to create self- emulsifying formulations with varying saturation levels. (HaussDJ and kimura M and karim A,et;al 1988)[1O,11,12].

B) SURFACTANTS: When designing self-emulsifying systems, a variety of compounds with surfactant properties can be used, but the selection is restricted because so few surfactants are taken orally.All right. Non-ionic surfactants with a comparatively high hydrophilic-lipophilic balance (HLB) are the most commonly advised. One important consideration when selecting a surfactant is safety (Serajuddin.ATM,et;al 1988)[13].

C)CO-SOLVENTS: Relatively high surfactant concentrations (typically greater than 30% w/w) are necessary for the creation of an ideal SEDDS; therefore, the surfactant concentration can be decreased by co-surfactant incorporation. Together with the surfactant, the cosurfactant's function is to reduce the interfacial tension to a negligible, even temporary, negative value. When this value is reached, the interface will enlarge to create finely distributed droplets, which will then adsorb more surfactant and surfactant cosurfactant until their bulk condition is sufficiently depleted to restore positive interfacial tension. However, many non-ionic surfactants do not require the use of a co-surfactant in self-emulsifying system (Pillay.V,1999, et; al1999) [14].

III. TYPES OF SEDDS

Self-emulsifying drug delivery system Self micro-emulsifying drug delivery system:

Better drug release properties are associated with both SMEDDS and SEDDS. SEDDS formulations are straightforward binary systems that include a lipophilic phase, a surfactant, and a drug that can self-emulsify in gastrointestinal fluids. The dispersion appears turbid due to the droplet size being between 200 and 300 nm, which offers a greater surface area for absorption. Additionally, the oil concentration ranges from 40 to 80%.

Self-micro emulsifying drug delivery system: Cosurfactant is necessary for the creation of microemulsions in SMEDDS formulation, which have droplets smaller than 50 nm and a dispersion that ranges from optical clarity to translucent appearance. Less than 20% of the mixture contains oil. Because the particle size is smaller than that of a solid dosage form, it can easily pass through the gastrointestinal tract and be absorbed because it has a larger surface area for absorption and dispersion. Thus, the drug's bioavailability is enhanced. (Khedekar K,et;al,2013)[15].

IV. METHOD OF PREPARATION

A) Solidification techniques for transforming liquid/semisolid: The most straightforward and widely used technology for encapsulating liquid or semisolid SE formulations for oral administration is capsule filling. The procedure for semisolid formulations consists of four steps: A) The semisolid excipient is heated to at least 20 degrees Celsius over its melting point. B) Including the active ingredients (with stirring).C) The molt-filled capsules cooling to room temperature for liquid formulations, it involves a two-step process. D) Filling the capsules with the formulation After that, the capsule's body and cap are sealed using either bandaging or micro spraying (.BoTang,et;al 2008) [16].

B) Spray drying: This method basically uses the formulation creation that involves combining lipids, surfactants, medication, solid carriers, and solubilizing the mixture prior to spraying drying. The liquid formulation that has been dissolved is then atomized to create a droplet spray. The droplets enter a drying process. chamber, where the water contained in an emulsion or other volatile phase is evaporatively prepared into tablet shape, and the drying characteristics of the product and powder specifications are taken into consideration when choosing the design of the drying chamber.

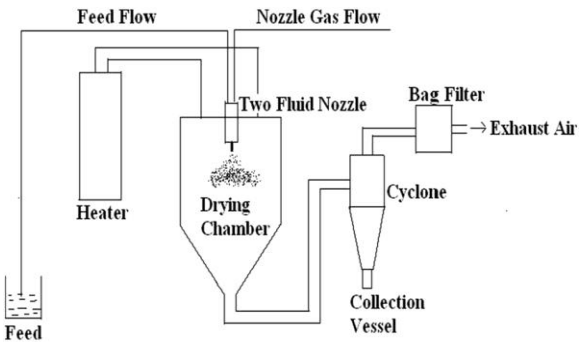

Fig2 spray drying

C)Adsorption to solid carriers: Liquid SE formulations can be converted into free-flowing powders by adsorption to solid carriers. The adsorption process is straightforward and only requires adding the liquid to carriers and blending.

D)Melt granulation: This method involves adding a binder that melts or softens at comparatively low temperatures to produce powder agglomeration.

Application:

Improvement in solubility and Bioavailability: When a medication is made with SEDDS, it raises the solubility since it avoids the dissolution phase in instance of a Class-O drug (high solubility/low permeability). One preferred medication is

ketoprofen, a non-steroidal anti-inflammatory drug (NSAID) that is somewhat hydrophobic. for formulations with sustained release; however, during long-term treatment, it has caused gastric irritation. Ketoprofen also exhibits incomplete release from sustained release formulations as a result of its poor solubility. Complete drug release from sustained release formulations that contain nanocrystalline ketoprofen has been reported. The creation of matrix pellets of nano-crystalline ketoprofen, sustained release ketoprofen microparticles, floating oral ketoprofen systems, and transdermal systems are some of the formulation techniques that have been successful in achieving sustained release, reducing gastric irritation, and increasing the bioavailability of ketoprofen. Processing, stability, and financial issues may arise during the preparation and stabilization of drugs with nanocrystalline or enhanced solubility forms. (Vergote GJ,et;al 2001) [17]. Protection against Biodegradation Self-emulsifying drug delivery systems may be particularly helpful for medications whose low solubility and GI tract degradation also contribute to poor absorption. low bioavailability in the mouth. Numerous medications undergo physiological system degradation, which can be caused by enzymatic, hydrolytic, or acidic stomach PH. These medications can be effectively shielded from these degradation processes when they are delivered in the form of SEDDS because the liquid crystalline phase of SEDDS may serve as a barrier between deteriorating surroundings and the medication.(Yamada T,et;al 2001)[18].Controlling the release of drug: Various formulation techniques have been tried to attain sustained release, Creating matrix pellets of nanocrystalline ketoprofen, sustained release ketoprofen microparticles, floating oral ketoprofen systems, and transdermal ketoprofen systems are some ways to improve the bioavailability and lessen the gastric irritation of ketoprofen. Creation and maintenance of enhanced solubility or nano-crystalline forms of drug may present issues with stability, processing, and cost. When ketoprofen is included in the SEDDS formulation, this issue can be resolved. This combination improved bioavailability because it reduces stomach irritation and increases the drug's solubility. Additionally, the release of ketoprofen was maintained by the addition of a gelling agent to SEDDS. FUTURE TRFEND: With regard to the creation of formulations into granules and powders, which can subsequently be compressed into tablets or processed further into traditional "powder-fill" capsules. Techniques for converting liquid/semisolid SEDDS and SMEDDS are currently being employed for poorly soluble medications in the future. Formulations into tablets or processed further into traditional powder-fill capsules.

V. CONCLUSION

Self-Emulsifying Drug Delivery Systems (SEDDS) shows that they have a great deal of promise for improving the oral bioavailability and solubility of medications that are not very water soluble. When the gastrointestinal tract is slightly disturbed, SEDDS create fine oil-in-water emulsions that enhance drug absorption, dissolution, and overall therapeutic effectiveness. By combining the right oils, surfactants, and co-surfactants, lipophilic medications can be rapidly dispersed without being constrained by dissolution rate restrictions. Additionally, SEDDS can lessen absorption variability brought on by physiological factors and food effects. When compared to traditional formulations, SEDDS enhance pharmacokinetic parameters and increase bioavailability, according to numerous in vitro and in vivo investigations. Their use in industrial applications is further supported by their scalability and ease of formulation. SEDDS provide a viable, effective, and adaptable approach to enhance the oral administration of medications classified as Class II and IV by the Biopharmaceutics Classification System (BCS), opening the door to better therapeutic results.

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