Self emulsifying drug delivery systems (SEDDS) are equivalent mixtures of drugs, lipids, surfactants and cosolvents. SEDDS typically produce emulsions ranging from nanometers to several microns. This delivery system is useful for lipophilic drugs that exhibit dissolution rate limited absorption. This delivery system helps in improving the rate and extent of absorption and improves the blood time profiles. This formulation is helpful for all the categories of BCS classification.

1. **Ashok R. Patel et al., 2007** This work was aimed at formulating a SMEDDS (selfmicroemulsifying drug delivery system) of fenofibrate and evaluating its in vitro and in vivo potential. The solubility of fenofibrate was determined in various vehicles. Pseudo ternary phase diagrams were used to evaluate the microemulsification existence area, and the release rate of fenofibrate was investigated using an in vitro dissolution test. SMEDDS formulations were tested for microemulsifying properties, and the resultant microemulsions were evaluated for clarity, precipitation, and particle size distribution. Formulation development and screening was done based on results obtained from phase diagrams and characteristics of resultant Microemulsions.

2. **Vandana B. Patravale et al., 2008** The objective of the present investigation was to formulate self-microemulsifying drug delivery systems (SMEDDS) using a novel, indigenous natural lipophile (N-LCT) as an oily phase. SMEDDS based on N-LCT and commercially available modified oil (Capryol 90) were formulated and their application in improving the delivery of a lipophilic anti-malarial drug, β-Artemether (BAM) was also evaluated. BAM-loaded SMEDDS were characterized with respect to mean globule size and in vitro drug release profile in comparison to the marketed formulation (Larither®).

3. **Vivek Borhade et al., 2008** The objective of present investigation was to formulate self-microemulsifying drug delivery systems (SMEDDS) of tacrolimus (FK 506), a poorly water soluble immunosuppressant that exhibits low and erratic bioavailability. Solubility of FK 506 in various oils, surfactants cosurfactants and buffers was determined. Phase diagrams were constructed at different ratios of surfactant/cosurfactant (Km) to determine microemulsion existence region. The effect of oil content, pH of aqueous phase, dilution, and incorporation of drug on mean globule size of resulting microemulsions was studied.
4. Ajeet K. Singh et al., 2009 The purpose of this study is Limited aqueous solubility of exemestane leads to high variability in absorption after oral administration. To improve the solubility and bioavailability of exemestane, the self microemulsifying drug delivery system (SMEDDS) was developed. SMEDDS comprises of isotropic mixture of natural or synthetic oil, surfactant, and cosurfactant, which, upon dilution with aqueous media, spontaneously form fine o/w microemulsion with less than 100 nm in droplet size. Solubility of exemestane were determined in various vehicles. Ternary phase diagrams were plotted to identify the efficient self-emulsification region.

5. Hitesh C. Bari et al., 2011 The objective of the present study was to design and optimized chlordiazepoxide solid self microemulsifying drug delivery system prepared via spray drying for oral administration. Four formulations were selected from pseudo ternary phase diagram (ethyl oleate labrasol+cremophor RH40-water) of highest microemulsion region and exposed to spray drying. Reconstitution properties (dilution studies, globule size and zeta potential) and solid state characterization (PXRD, DSC and SEM) of formulations were investigated.

6. Ahmed Abdalla et al., 2008 In this study author has been studied the development of a new pellet based self-emulsifying (SE) drug delivery system for the oral delivery of poorly soluble drugs. He studied the influence of physiological dilution media and enzymatic digestion on the solubilization capacity of the formulation using the model drug Progesterone. The liquid SE lipid was mixed with microcrystalline cellulose and converted into pellets by extrusion/spheronization.

7. A. Zvonar et al., 2009 The purpose of the study is to improve the solubility of Furosemide by micro encapsulating self emulsifying drug delivery systems. An InfoTech IE-50R encapsulator equipped ES with a concentric nozzle was used to transform self micro emulsifying system to solid microcapsules. The obtained micro capsules was optimized with respect to drug loading capacity and encapsulation efficiency and evaluated for its impact on furosemide permeability through rats male intestine and Caco-2 cell monolayer’s. This technique improved the permeability of Furosemide when compared with micro spheres without SMES.

8. Karsten Mader et al., 2006 Author has been investigated the feasibility of producing solid self emulsifying pellets using the extrusion/spheronization technique. These pellets are made
from a mixture of C18 partial glycerides, Solutol_HS15 and microcrystalline cellulose. Pellets with good physical properties are produced. The release kinetics and the microenvironment of the pellets were assessed using electron spin resonance (ESR). This, formulation was capable of accelerating the release of the drug diazepam. The pellets are capable of transferring lipophilic compounds into the aqueous phase and have a high potential to increase the bioavailability of lipophilic drug.

9. Nian ping feng et al., 2012 In this study author has developed self-micro emulsifying drug delivery system (SMEDDS) to enhance the oral bioavailability of the poorly water-soluble drug, Oridonin. The SMEDDS were characterized by morphological observation, droplet size and Zeta potential determination, cloud point measurement and in vitro release study. The formulation consists of 30% mixture of Maisine 35-1and Labrafac CC (1:1), 46.7% Cremopher EL, and 23.3% Transcutol P. on invitro dissolution these showed a complete release of oridonin from SMEDDS in an approximately 12 h. Relative bioavailability is more when compared with that of the suspension. Thus oral bioavailability of oridonin is increased.

10. Colin W P et al., 2006 has been developed the formulation for poorly soluble drugs. These drugs are dissolution limited and are typically BCS class II or class IV compounds. According to him reduction in particle size improves the bioavailability of the drug. This depends on interaction with gastro intestinal contents. Factors like bioavailability and meta stable nature of drug are considered to improve the solubility of drugs. The use of a lipid formulation classification system combined with appropriate in vitro tests will help to establish an invitro and in vivo correlation.

11. Jiabi Zhu et al., 2011 has been developed Water-in-oil-in-water (w/o/w) double emulsions which are potential for enhancing oral bioavailability of drugs with high solubility and low permeability, but they are instable in industrial application. He had developed self-double-emulsifying drug delivery systems (SDEDDDS) by formulating mixtures of hydrophilic surfactants and water in-oil (w/o) emulsions which can spontaneously emulsify to water-in-oil in-water (w/o/w) double emulsions in the mixed aqueous gastrointestinal environment. This improved the oral absorption of pidotimod, a peptide-like drug with high solubility and low permeability.
12. **Anthony AA et al., 2005** was developed self micro emulsifying drug delivery systems using a biodegradable homolipid caprohircus and evaluated the SMEDDS using invitro method. Where drugs are encapsulated in a lipid base with or without a pharmaceutically acceptable surfactant, Capra hircus and Tween 65, lipophilic piroxicam, hydrophilic drug chlorpheniramine maleate and hydrolipophilic drug metronidazole. The drug release studies were conducted in simulated gastric fluid (SGF), simulated intestinal fluid (SIF), and distilled water, representing different pH values. Particle size was determined by light microscopy. The drug release was affected by the particle size of the SMEDDS. From the above studies it was known that piroxicam release from the SMEDDS was highest in SIF compared to the other drugs. This method was considered as an alternative to conventional dosage forms.

13. **Nagarsenkar M.S. et al., 2006** has developed self nano emulsifying drug delivery systems with the objective to overcome problems associated with the delivery of cefpodoxime proxetil (CFP), a poorly bioavailable high dose antibiotic having pH dependant solubility. The influence of CFP and the pH of dilution medium on the phase behavior of selected system were assessed. The globule size of optimized CFP SNEDDS in various dissolution media was determined to check the effect of pH on its behavior. The optimized CFP SNEDDS needed surfactant which is not less than 40% and having globule size of 170nm. The optimized SNEDDS released CFP completely within 20 min irrespective of the pH of dissolution medium.

14. **M.A Khan et al., 2002** was studied optimization of self nano emulsified tablet dosage form using ubiqinone and studied the effect of formulation ingredients containing copolyvidone (X1), maltodextrin (X2) and microcrystalline cellulose (X3) as the ingredients. The cumulative percent of Ubiquinone was emulsified in 45 min with constraints on weight, flowability index, tensile strength, and friability and disintegration time. Based on this different Ubiquinone release rates and profiles were obtained. The optimization model predicted an 85.4% release from the above ingredients. A new formulation was prepared based on this release. The observed responses were in close relation with the predicted values of optimized formulation.

15. **Bong kyu yoo et al., 2011** was prepared solid self-nano emulsifying drug delivery system containing phosphatidyl choline (PC), an endogenous phospholipid with excellent in vivo
solubilization capacity, as oil phase for the delivery of bioactive carotenoid lutein, by spray drying the SNEDDS (liquid system) containing PC using colloidal silica (Aerosil_ 200 VV Pharma) as the inert solid carrier, and to evaluate the enhanced bioavailability (BA) of lutein from S-SNEDDS. The relative BA of S-SNEDDS compared with other formulations. Thus, S-SNEDDS containing PC as oil phase could be a useful lipid drug delivery system for enhancing the BA of lutein in vivo.

16. Akhter et al., 2012 has been investigated of Nanoemulsion System for Transdermal Delivery of Domperidone: Ex-vivo and in vivo Studies. The study was to investigate the nanoemulsion system for enhanced percutaneous penetration of domperidone. Pseudoternary phase diagrams were constructed in order to optimize the surfactant, cosurfactant and surfactant: cosurfactant weight ratios (Smix). Nine nanoemulsion formulations were selected, characterized and their ex-vivo permeation studies using rat skin were performed.

17. Baboota S. et al., 2008 has been designed, developed and evaluated of novel nanoemulsion formulations for transdermal potential of celecoxib. The invitro skin permeation profile of optimized formulations was compared with CXB gel and nanoemulsion gel. Significant increase in the steady state flux (Jss), permeability coefficient (Kp) and enhancement ratio (Er) was observed in nanoemulsion formulations (p < 0.05). The highest value of these permeability parameters was obtained in formulations T2, which consisted of 2% (m/m) of CXB, 10% (m/m) of oil phase (Sefsol 218 and Triactin), 50% (m/m) of surfactant mixture (Tween-80 and Transcutol-P) and 40% (m/m) water. The anti-inflammatory effects of formulation T2 showed a significant increase (p<0.05) in inhibition after 24 h compared to CXB gel and nanoemulsion gel on carrageenan-induced paw edema in rats. These results suggested that nanoemulsions are potential vehicles for improved transdermal delivery of CXB.

18. Shakeel F. et al., 2010 was developed skin permeation mechanism of aceclofenac using novel nanoemulsion formulation. An optimized oil-in-water nanoemulsion of aceclofenac was prepared by the spontaneous emulsification method. The optimized nanoemulsion contained 2% w/w aceclofenac, 10% w/w Triacetin, 35.33% w/w Tween 80, 17.66% w/w Transcutol P and 32% w/w distilled water. FTIR spectra of skin treated with the nanoemulsion formulation indicated breaking of the hydrogen bond network at the head of
ceramides. DSC thermo grams indicated that intracellular transport could be possible mechanism of permeation enhancement and that permeation occurred due to the extraction of SC lipids by the nanoemulsion.

19. **Shakeel F. et al., 2008** The aim of study is Characterization and Invitro Evaluation of Celecoxib Nanoemulsion for Transdermal Drug Delivery. The potential of naonemulsions for transdermal delivery of celecoxib. The prepared nanoemulsions were subjected to different dispersion stability tests and characterized for morphology, viscosity, droplet size and refractive index. The invitro skin permeation profile of optimized formulation was compared with celecoxib gel and nanoemulsion gel. Significant increase in permeability parameters was observed in nanoemulsion formulations (p<0.05). These results suggest that nanoemulsions are potential vehicles for improved transdermal delivery of celecoxib.

20. **Shakeel F. et al., 2010** has been worked to enhance The anti-inflammatory effects of celecoxib from a transdermally applied nanoemulsion. The anti-inflammatory effects of an optimized nanoemulsion formulation were compared with those of conventional CXB gel and nanoemulsion gel on carrageenan-induced paw edema in rats. These tests were compared using Dunnet test of one-way analysis of variance (ANOVA). The % inhibition value after 24 h application was significant for optimized formulation C2 (85.4%) compared with CXB gel and nanoemulsion gel (p<0.05). These results suggest that nanoemulsions can be successfully used to enhance the anti-inflammatory effects of CXB.

21. **Yadav VB et al. 2009** developed a compaction technique to enhance the solubility, dissolution rate and other physicochemical properties of poorly water-soluble drug indomethacin (IM) with different polymers. The IM was compacted with the different polymers like hydroxy propyl methylcellulose (HPMC), Kollicoat IR, Chitosan, Polyvinyl Pyrrolidone without using any binder and solvent. Polymer and drug were dry-blended, compressed into slugs on a tablet press, and then milled into a granular powder. Dissolution testing of the milled compacted granules were performed in 750 ml dissolution medium at 37°C (n = 6) and at a stirring speed of 100 rpm using six-station USP type-I dissolution apparatus. The compaction processes enhanced drug dissolution rate relative to drug alone and physical mixtures of IM and polymers. The compaction method produced granules with
comparable solubility, dissolution and flowability enhancement compared to raw IM.

22. **Jane E. Hilton et al. 1986** prepared Solid dispersion systems containing indomethacin and polyvinylpyrrolidone (PVP) 17 or 90 were prepared in drug: PVP ratios of 70:30, 80:20 and 90:10 by co-precipitation and spray drying. Dissolution rates of indomethacin from the powdered systems were compared with that of the pure drug in water, in an aqueous polyethylene glycol (PEG) 300 solution and in 40 mM sodium cholate solution. Dissolution into PEG solution showed the drug dissolution rate from the systems depended upon the availability of drug to complex with PEG. In 40 mM sodium cholate solution, the dissolution rates of indomethacin from the systems were markedly enhanced due to favourable pH conditions, and were similar to one another, except for the indomethacin: PVP 17 co-precipitate which exhibited the fastest dissolution rate. The PVP 90 systems exhibited slightly slower dissolution rates in sodium cholate solution than the PVP 17 systems probably as a result of an increase in viscosity of the diffusion layer.

23. **Pradeep Patil, et al. 2004** The purpose of this study was to formulate a gelled self-emulsifying drug delivery system (SEDDS) containing ketoprofen as an intermediate in the development of sustained release solid dosage form. Captex 200 (an oil), Tween 80 (a surfactant), and Capmul MCM (a cosurfactant) were used to formulate SEDDS. Silicon dioxide was used as a gelling agent, which may aid in solidification and retardation of drug release. Effect of concentrations of cosurfactant and gelling agent on emulsification process and in vitro drug diffusion was studied using factorial design. Multiple regression analysis data and response surfaces obtained showed that liquid crystal phase viscosity increased significantly with increasing amount of silicon dioxide, which in turn caused an increase in average droplet size of resultant emulsion and slower drug diffusion. Drug release from the formulation increased with increasing amount of cosurfactant.

24. **Amit Kale, Vandana Patravale et al 2008** The main objective of study is to improve solubility, dissolution rate and bioavailability of a poorly water-soluble calcium channel blocker, nimodipine (NM). Solubility of NM in various oils, surfactants and cosurfactants was determined. The NM loaded SEDDS selected for the in vitro and in vivo studies exhibited globule size less than 180 nm. In vitro dissolution studies indicated that NM loaded SEDDS could release complete amount of NM irrespective of the pH of the
dissolution media. Pharmacokinetics of NM suspension. Relative bioavailability of NM in SEDDS was significantly higher than all the other formulations. NM loaded SEDDS were subjected to various conditions of storage as per ICH guidelines for 3 months. NM SEDDS successfully withstood the stability testing.

25. Jessy shaji, Digamber jadhav et al., 2010 Discussed about SEDDS, which 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 acid, non ionic surfactants and solidifying agents with diluents such as microcrystalline cellulose, lactose etc. As a result 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 suited for lipophilic 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.

26. Surjyanarayan Mandal, et al., 2010 The objective of this study was to design and develop microemulsion drug delivery system of Atorvastatin and to investigate its intestinal transport behavior using the single-pass intestinal perfusion method in rat. Microemulsion drug delivery system of Atorvastatin was prepared by water titration method and optimized formulation was characterized. According to these results, the Atorvastatin microemulsion drug delivery system had a small particle size (28.6±0.3 nm) and a native charge. Atorvastatin microemulsion drug delivery system and its dilutions were stable. The estimated absorption of Atorvastatin in human for the microemulsion drug delivery system was higher than that for PDS and MFA (p<0.01).