# Design And Development Of Self-Micro Emulsifying Drug Delivery System For Combination Of Felbinac With Isolated Compound

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**KEYWORDS**
Self-microemulsifying drug delivery systems, Felbinac, Composition, anti-inflammatory gel, Oral Bioavailability.

**ABSTRACT**
The present investigation was aimed to develop self-micro emulsifying drug delivery system (SMEDDS) of the felbinac and beta sitosterol as isolated compound. SMEDDS is one of the promising approach for the delivery of both the hydrophobic as well as hydrophilic drug. In the present research work Felbinac and beta sterol help in the reduction of inflammation and pain. . Ternary phase diagrams (Sigma plot) were constructed in order to obtain the most efficient self-emulsification region, and the formulation of both the drug loaded SMEDDS was optimized by a pseudo ternary phase diagram. The S:Cos ratio 2:1 was show the larger than the other ratio 1:1 and 3:1 Tween 20 taken as surfactant, propylene glycol taken as cosurfactant and as oil virgin coconut oil were used for SMEDDS formulation by titration method. With the help of Box-behnken design (Statease software) the ratio formulation was optimized and this was developed into gel. SMEDDS was evaluated and compared with gel SMEDDS.

## 1. INTRODUCTION

Modern drug discovery techniques have led to a steady increase in the number of poorly soluble drug candidate compounds; currently, more than half of newly identified pharmacologically active chemical entities are lipophilic and have poor water solubility. Numerous techniques, including microemulsion, β-cyclodextrin complex, pH adjustments, and salt formation, are employed to improve a drug's bioavailability. SMEDDS, or self-micro emulsifying drug delivery, is one method for boosting oral bioavailability.[1] SMEDDS is a specific class of emulsion that has garnered attention due to its potential to increase the oral bioavailability of drugs that are poorly absorbed. When combined with water, these systems essentially consist of combinations of oil and surfactant that produce an emulsion with little to no energy input. The concept of employing such systems for pharmacological reasons was first put up by the Groves group. Therefore, increasing the pharmaceutical product's bioavailability is a component of the SMEDDS formulation.[2,3]

NSAIDs are produced in a variety of dosage forms, such as oral, slow-release, and sustained-release formulations, as well as gels, patches, and suppositories for topical application. Since the objective is to reduce NSAID toxicity while preserving therapeutic delivery to a specific location, efforts to alter drug composition and delivery methods are still underway. Nanoparticles, liposomes, and microspheres are being studied in order to enable dosage reduction and precision targeting. Intra-articular delivery is under consideration; however, because joints have very efficient lymphatic drainage systems, the efficacy of this focused approach is not yet proved.[4,5]

## 2. MATERIAL AND METHODS:

### 2.1 Chemical Felbinac was Purchased from Chempure Pvt Ltd, Banglore, INDIA.

### 2.2 Preformulation Studies

#### 2.2.1 Organoleptic Properties

Organoleptic test or commonly called as sensory test. It is use for measuring the acceptability of the product consisting of texture, colour, shape, aroma, taste of the product. Organoleptic properties were observed by visual observation. The organoleptic studies of Felbinac such as appearance, colour, odor, state etc. were observed.

**2.2.2 Solubility study**
The drug (1 mg) was precisely weighed and put into a 10 ml test tube. It was then dissolved in various combinations of methanol, ethanol, DMSO, water, chloroform, acetone, and n-hexane.

**2.2.3 Melting Point**
The sample's melting point was determined by noting the temperature at which the sample begins to melt, noted the reading in triplicate.

**2.2.4 pH**
Using a digital pH meter, pH was measured. A digital pH meter was used to measure the pH after a medication (Felbinac and Beta-sitosterol) of 1-2 mg was dissolved in 10 ml of distilled water.

**2.2.5 Partition coefficients**
The partition coefficient was determined by the shake flask method using two immiscible solvents, the most common hydrophilic solvent was water and octanol as oil phase were taken for the study. A partition coefficient was calculated by the ratio of the concentration of a substance in one medium or phase (C1) to the concentration in a second phase (C2) when the two concentrations are at equilibrium; that**.**
Partition coefficient = (C1/C2) equilibrium. [6]

**2.3 UV estimation For Felbinac and Beta sitosterol**
According to Indian Pharmacopoeia standard stock solution for API were prepared for that 10 mg of Felbinac and Beta-sitosterol was dissolve in 100 ml of methanol (100µg/ml). Out of this stock 0.5-3 ml was pipetted and diluted up to 10 ml by solvent methanol (5-30 µg/mL) and (10-60µg/mL) and examined between 200-800 nm using UV-Vis Spectrophotometer.

**2.4 Fourier transmission Infra-Red Spectroscopy**
FT-IR spectrum of Drug and excipient combination was recorded over the range of 4000 to 400 cm−1 by KBr pellet method using a FT-IR spectrophotometer.

**2.5 DSC (Differential scanning calorimetry)**
In the present research the drug felbinac and beta-sitosterol were analysed with the help of DSC. For this the samples were placed in a small sample in a closed crucible Inserted the crucible into a temperature-controlled DSC cell. Analyze the heat flow to identify phase transitions and reactions.[7,8]

**2.6 Formulation of Self Micro-emulsion Drug delivery System**
The selection of the oil, surfactant and cosurfactant were done with the help of solubility study in order to determine the solubilisation capacity of the drug. To determine solubility of drug shake flask method was used. An excess amount of was added to each cap vial containing 2 ml of the vehicles. After sealing, the mixture was vortexes at maximum speed for 10 min in order to facilitate proper mixing of drug with the vehicles. Mixtures were then shaken in shaker maintained at room temperature until equilibrium (48 h). After 24 h the vial observed for the residue of drug, and again the excess amount of drug was added into the vial showing no residue and kept for shaking for an additional 24 h. Then mixtures were then centrifuged at 3000 rpm for 10 min. The supernatants were collected into glass vials, and analysis was carried out with UV visible spectroscopy to find the concentration of drug.[9]

**2.7 Optimisation by Pseudo ternary Phase diagram**
Pseudoternary phase diagrams were constructed to investigate the effect of surfactant to cosurfactant ratio on the area of SMEDDS existence region. Pseudoternary phase diagrams of oil, water, and surfactant/cosurfactants (S/Cos) mixtures were constructed at fixed surfactant/ cosurfactant weight ratios. Phase diagrams was obtained by mixing of the ingredients, which shall be pre-weighed into glass vials and titrated with water and stirred well at room temperature.

**2.8 Optimization of formulation via DOE**
For the optimisation of the SMEDDS trial formulation were prepared and as independent variable oil (A or X1), surfactant (B or X2)and co-surfactant (C or X3) were taken and for dependent variable Y1 or R1 viscosity and R2 or Y2 drug content were selected.

**2.8.1 Determination of viscosity**
SMEDDS (10 ml) was taken and its viscosity was measured by using Brookfield viscometer (Brookfield engineering Laboratories) using spindle 62 at 25±0.5 ◦C at 50 rpm**.**

**2.8.2 Determination of drug content**
The drug content of the SMEDDS formulation was determined by diluting the solution in methanol and the volume was made up to 10 ml with methanol (1mg/ml).From the above stock solution, 0.2 ml (200µg/ml) was withdrawn and diluted up to 10ml with methanol (20 µg /ml). From the above solution 0.2ml (20 µg/ml) diluted up to10 ml with methanol (2µg/ml) and stirred for 30 min. Samples were prepared in triplicate and absorbance were measured at 225 nm (isosbestic point), this was the intersection point of the felbinac and beta-sitosterol using UV-visible Spectrophotometer (Shimadzu UV-1700) using methanol as a reference solution**.**

**Drug Content =Concentration of drug X dilution factor**
**% drug content = Actual drug concentration /Total drug amt taken X 100**
**2.9 Characterisation of the SMEDDS of optimised formulation**
**2.9.1 Visual inspection**
Visual inspection was made after each addition of water to the oil and surfactant or surfactant and co-surfactant mixture. The samples were identified as SMEDDS, by visual observation.

**2.9.2 SEM**
The surface morphology of the SMEDDS gel formulation was determined by using scanning electron microscope by gold sputter technique.

**2.9.3 Determination of particle Size (PS) and Zeta Potential (ζ)**
Mean Particle size of trial formulation was determined by using dynamic light scattering method.The Zeta Potential of SMEDDS were measured using the laser Doppler method. Each batch was analyzed in triplicate. For PS and ζ, analysis was carried out for 100s and 60s respectively at room temperature by keeping angle of detection at 90 degree.

**2.9.4 Determination of drug content**
The drug content of the SMEDDS optimized formulation B2:1 was determined by diluting the solution in methanol and the volume was made up to 10 ml with methanol (1mg/ml).From the above stock solution, 0.2 ml (200µg/ml) was withdrawn and diluted up to 10ml with methanol (20 µg /ml). From the above solution 0.2ml (20 µg/ml) diluted up to10 ml with methanol (2µg/ml) Samples were prepared in triplicate and absorbance were measured at 225 nm, this was the intersection point of the felbinac and beta-sitosterol using UV-visible Spectrophotometer.[10]

**Drug Content =Concentration of drug X dilution factor**
**% drug content = Actual drug concentration /Total drug amt taken X 100**
**2.10 Characterisation of SMEDDS gel**
**2.10.1 Physical Property**
SMEDDS gel was evaluated for their visual appearance, consistency, grittiness and phase separation with naked eyes.

**2.10.2 pH**
1% aqueous solution of the prepared gel was made by dissolving 1gm of formulation in 100 ml distilled water and; kept it a side for 2 hr. After stabilization pH of the formulation was measured using digital pH meter in triplicate manner at room temperature**.**

**2.10.3 Viscosity**
To determine viscosity 20 gm of SMEDDS gel was filled in a 25 ml beaker and the beaker was subjected to Brookfield viscometer assembled with spindle. For the viscosity of the formulation spindle no. 62 was used and the RPM was 30 and reading was noted in the triplicate.

**2.10.4 Spreadability**
About 2 gm of formulation was placed in between 2 glass slides (sandwich) and 500 gm weight was placed on the upper slides for 5 minutes to expel air and to provide a uniform film of the SMEDDS gel between the slides. By putting a weight of 1kg, the time (in seconds) required by the top slide to cover a distance of 7.5 cm with the help of string attached to the hook is noted**.**

**2.10.5 Swelling Index**
To determine the swelling index of prepared topical gel, 1 gm of gel was taken on porous aluminium foil and then placed separately in a 50 ml beaker containing 10 ml 0.1 N NaoH. Then samples were removed from beakers after 3 hours and put it on dry place for some time after it reweighed. Swelling index was calculated as follows.
**Swelling Index (SW) % = [(Wt -Wo) / Wo] x 100.**
Where, (SW) % = Equilibrium percent swelling, Wt = Weight of swollen gel after time t, Wo = Original weight of gel at zero time.[11]

**2.10.6 Cumulative drug release**
The *in vitro* drug release studies were performed by using Franz diffusion cell with cellophane paper. The water jacketed recipient compartment had total capacity of 25 ml and it had 2 arms, one for sampling and another for thermometer. The donor compartment had internal diameter of 1.15 cm. The donor compartment was placed in such a way that it just touches the diffusion medium in receptor compartment. The receptor compartment contained phosphate buffer saline (PBS) that was maintained at 37°C ± 1°C. Samples were periodically withdrawn from the receptor compartment, replacing with the same amount of fresh PBS solution, and assayed by using a spectrophotometer at 225 nm.[12]

**2.11 Drug release kinetic study**
To analyse the mechanism of drug release from the topical SMEDDS gel, the release data should be fitted to following equations: -

**2.11.1 Zero – order equation:**
The zero-order kinetics is a method which releases the substances constantly from the dosage form which are independent to the concentration. A dissolution of the drug from various dosage form which does not segregate, causes slow drug release occurs. it can be described by the equation.
**Q = k 0t**
Where Q is the amount of drug released at time t, and k0 is the zero – order release rate.

**2.11.2 First – order equation:**
The first order kinetic is a process which releases the drug from the system where the rate of release is dependent on concentration. The first order equation is expressed by an equation,
**In (100 – Q) = In 100 – k1t**
Where Q is the percent of drug release at time t, and k1 is the first – order release rate constant.

**2.11.3 Higuchi's equation:**
Higuchi formulated a several methods to study the release of hydrophilic and hydrophobic drugs are combined in semisolid or solid matrixes. This Higuchi model is expressed by the equation as
**Q = k2√t**
Where Q is the percent of drug release at time t, and K2 is the diffusion rate constant

**2.11.4 Hixson Crowell model:**
Hixson and Crowell cube root law explains the release of drugs from the system where there is change in diameter of the particles and surface area of the particles. The Hixson Crowell model states that the drug

particles and dissolution rate are assumed as the rate of drug release is limited and not by the diffusion. Hence, this model results in proportion between the cube root of its volume and surface area of particle.

**2.11.5Korsmeyer Peppas model:**
This model was first proposed by Korsmeyer Peppas in 1983, obtained an easy relationship which processes are illustrated the release of drug from a polymeric form**.** This model formulated a simple model and semi-empiric model.

**2.12 Stability studies**
The optimized formulation was placed in the stability test chamber and subjected to stability studies at accelerated testing ($25^0C\pm2^0C$ and 60±5% RH) and ($40^0C\pm2^0C$ and 70±5% RH) for 3 months. The formulation was checked for parameter at the interval of 0,30, 60, 90 days (3 month) months.[13,14]

**3. RESULTS AND DISCUSSION**
**3.1 Organoleptic Properties**
Felbinac was discovered to have a off white colour to it when tested. Felbinac was odourless and has a solid-state powder form, according to research conducted on it. Felbinac exhibited the same appearance, colour, odour and state as the I.P. requirements for these characteristics.

**3.2 Solubility study:**
The solubility of Felbinac was determined in various non-volatile or volatile liquid vehicles such as water, methanol, ethanol, DMSO, acetone and chloroform.

**3.3 Determination of melting point:**
The capillary method was used to determine the melting point of a substance. The melting point of the **Felbinac** was found to be $164^0C$, which was well within the limits of the drug specification range.

**3.4 Determination of pH:**
The digital pH meter used to determination the pH of the Felbinac. This was found to be 7.4±0.049. These were well within the limits of the drug specification range.

**3.5 Determination of Partition coefficient:**
The Partition coefficient of the Felbinac was 1.68±0.035 through this it was observed that the compound was hydrophilic in nature.

**3.6 Lambda max of Felbinac**

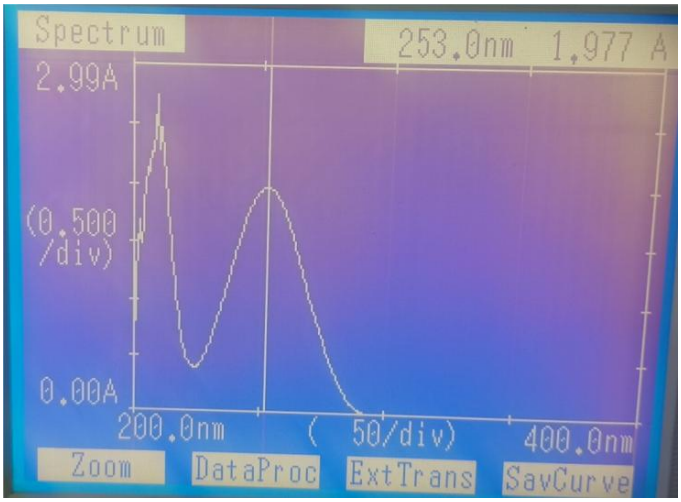


**Figure 1. UV spectroscopy of Felbinac**

### 3.7Standard curve of Felbinac

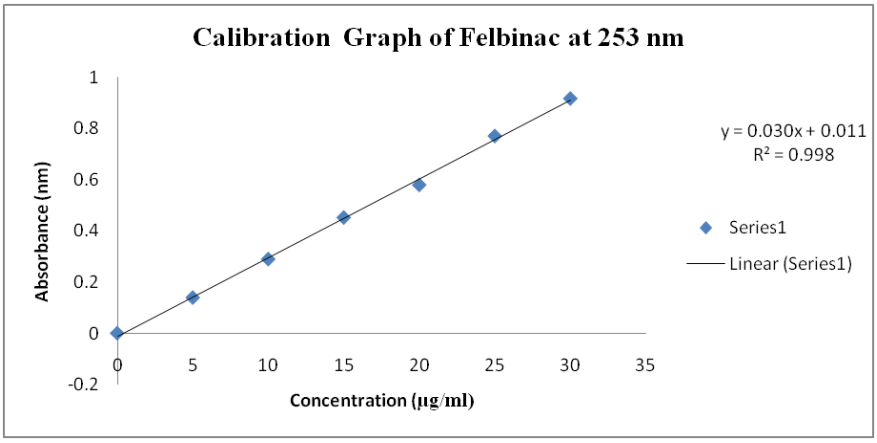


**Figure 2. Calibration curve of Felbinac at 253nm**

### 3.8Organoleptic Properties

An evaluation of the API's organoleptic qualities, including Appearance, color, odour, and state, was conducted. Beta sitosterol was discovered to have a white color to it when tested. Beta sitosterol was odourless and has a solid-state powder form, according to research conducted on it. Beta sitosterol exhibited the same appearance, color, odour and state as the I.P. requirements for these characteristics

### 3.9Solubility study

In numbers of solvents the solubility of the Beta sitosterol was checked. It was performed as per the IP solubility parameters which helped in the correct identification of the solubility.

### 3.10 Melting Point

The melting point of the Beta sitosterol shows the initial temperature 134°C at which the melting properly started and at 136°C compound melted.

### 3.11 Partition coefficients

The partition coefficient of the **Beta sitosterol** was 8.19 (K). This result reveals that it was lipophilic in nature.

### 3.12 UV estimation for Beta sitosterol

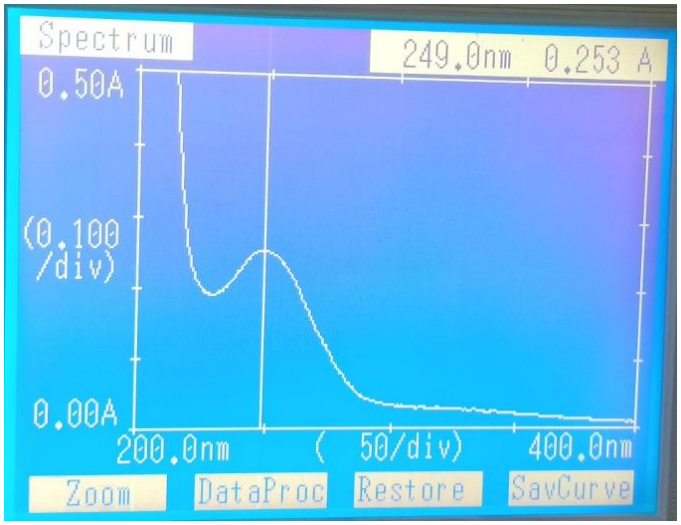


**Figure 3. UV spectroscopy graph of the Beta-sitosterol**

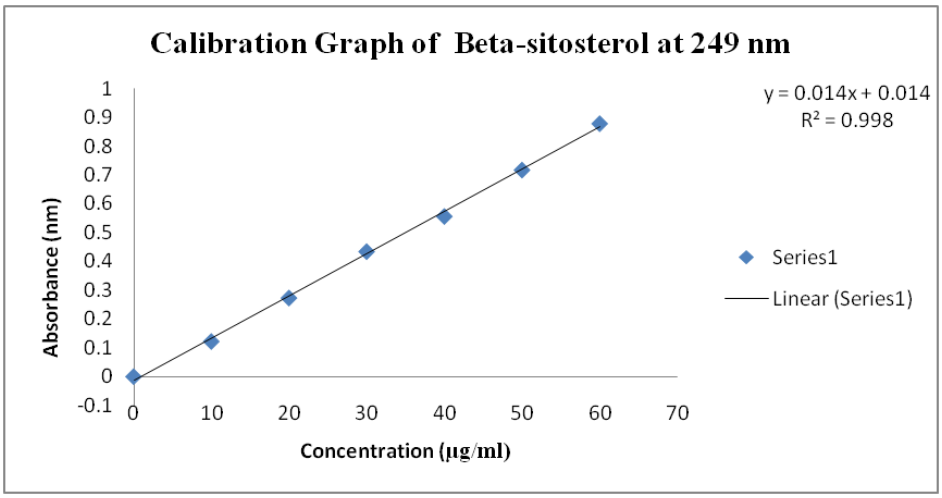


**Figure 4. Calibration study of Beta-sitosterol at 249 nm**

### 3.13 Determination of isosbestic point and selection of suitable Wavelength

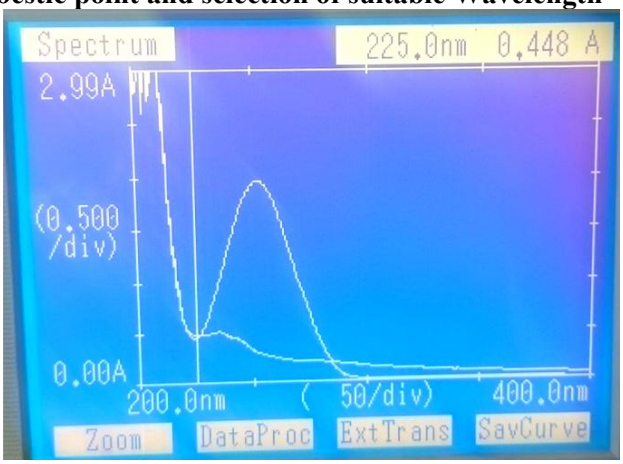


**Figure 5. Overlay spectra of Felbinac and beta-sitosterol with Iso absorptive point**

### 3.14 Compatibility study by FTIR:

FTIR graph of Felbinac + beta sitosterol

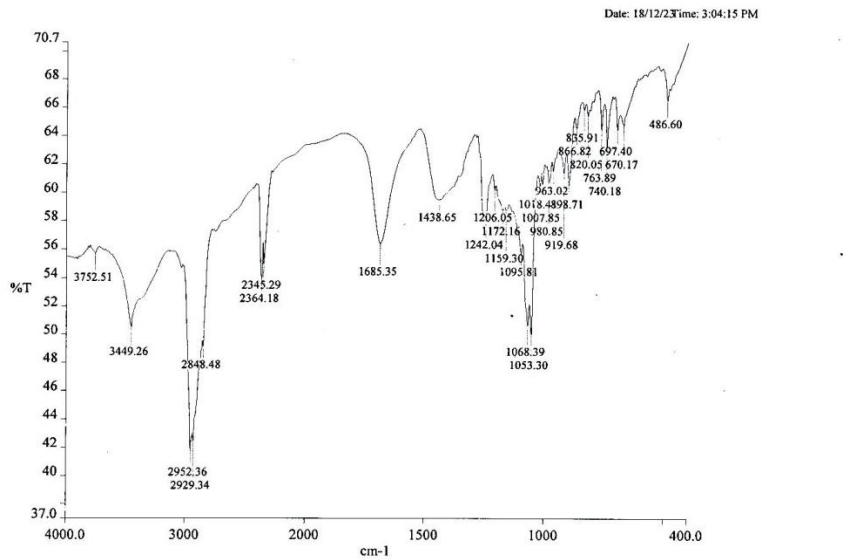


**Figure 6. FTIR graph of Felbinac + beta sitosterol**

### 3.15 DSC (Differential scanning calorimetry)

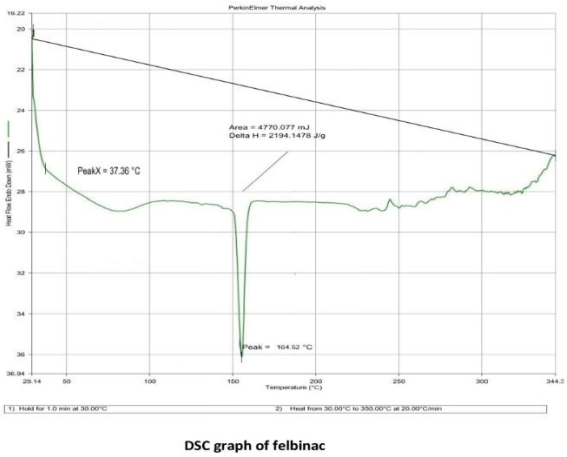


**Figure 7. DSC graph of felbinac**

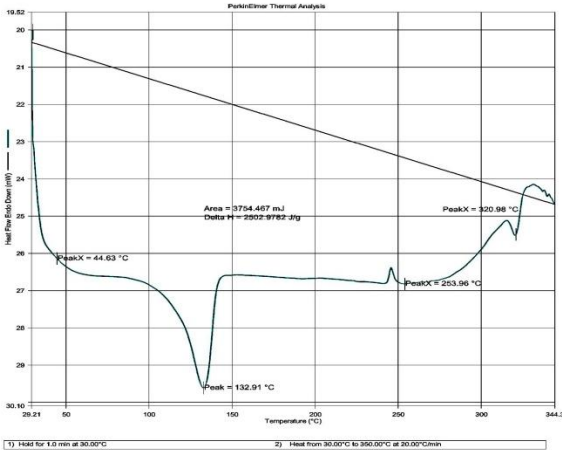


**Figure 8. DSC graph Beta-sitosterol**

### 3.16 Optimisation by Pseudo ternary Phase diagram:

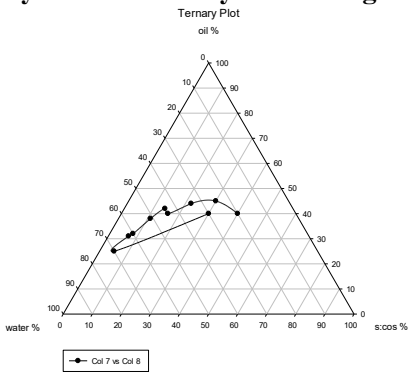


**Figure 9. Ternary plot S: COS 1:1 ratio**

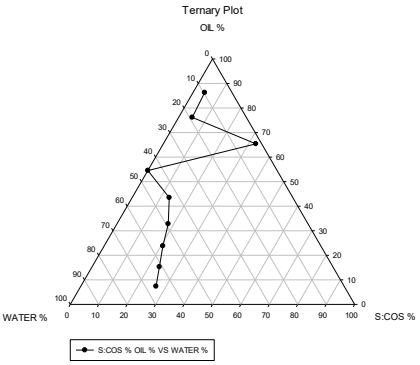


**Figure 10. Ternary plot S: COS 2:1 ratio**

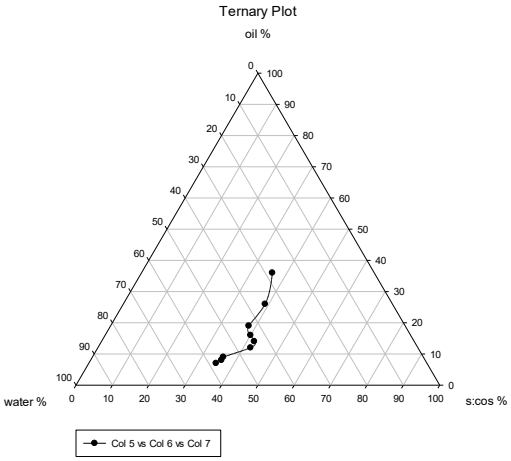


**Figure 11. ternary plot S: COS ratio 3:1**

### 3.17 Scanning Electron Microscopy: SEM

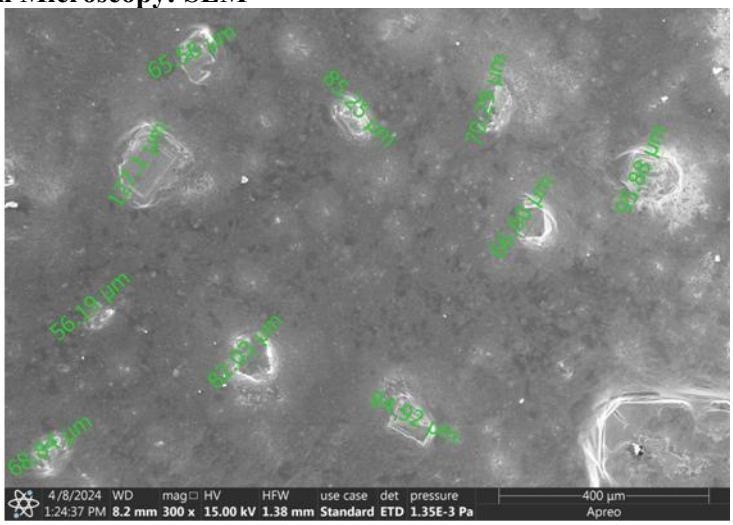


**Figure 12. SEM image of the Optimised formulation of SMEDDS B2:1**

### 3.18 Determination of particle Size (PS) and Zeta Potential (ζ)

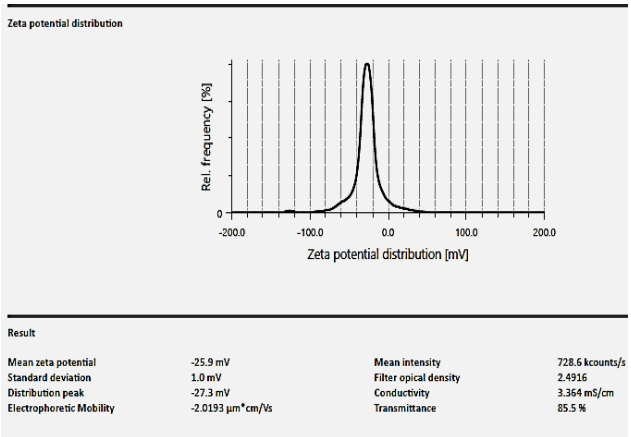


**Figure 13. Zeta potential for the optimised formulation B2:1**

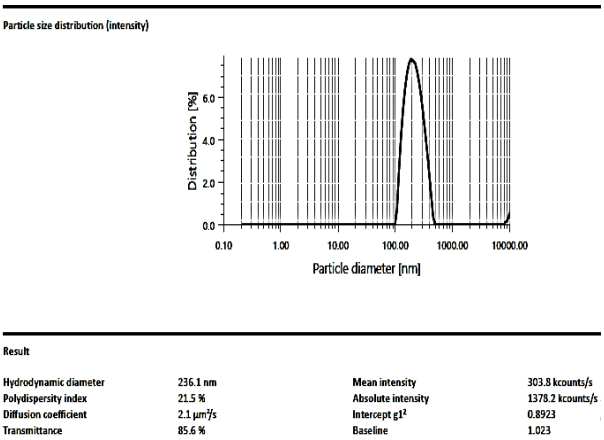


**Figure 14. Particle size for the optimised formulationB2:1**

### 3.19 Determination of drug content

| Formulation code | Drug Content % |
|---|---|
| B2:1 | 89±0.024 |

**Table 1. % drug content of the SMEDDS B2:1**

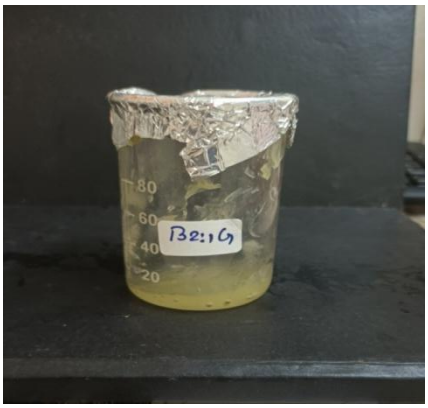


**Figure 15. Optimised SMEDDS gel formulation B2:1G**

### 3.20 Characterisation of SMEDDS gel

#### 3.20.1 Physical Property

| Formulation code | Parameters | Inference |
|---|---|---|
| **B2:1 G** | Visual appearance | **Translucent** |
| | Consistency | **Uniform mixture** |
| | Grittiness | **Non gritty** |
| | Color | **White** |
| | Phase separation | **Non phase separation (oil and water equally distributed)** |
| | Greasy | **Non greasy (non-sticky)** |
| | Texture | **Smooth in touch** |

**Table 2. Physical Property of the optimized formulation**

#### 3.20.2 pH

| Formulation code | Parameters | Inference |
|---|---|---|
| **B2:1 G** | pH | **7.0±0.024** |

**Table 3. Represent the pH of the SMEDDS gel loaded with drug**

The pH of the optimised formulations from was found to be in the range of 6 to 7 ideally, the gel should possess pH in the range of 6-7, so as to minimize discomfort or irritation due to acidic pH and microbial growth due to basic pH. B2:1 G optimized SMEDDS gel shows basic pH.

#### 3.20.3 Viscosity

| Formulation code | Parameters | Result |
|---|---|---|
| **B2:1 G** | Viscosity **(Viscosity (cps) at Room Temperature ± SD.)** | 3689 ±0.054 |
| | | |

**Table 4. Represent the Viscosity of the SMEDDS gel loaded with drug**

#### 3.20.4 Spreadability and swelling index

| Formulation code | Parameters | Result |
|---|---|---|
| **B2:1 G** | Spreadability**(gm.cm/ sec)** | 26±0.04 |
| | **Swelling index (%)** | 77.8% |

**Table 5. Represent the Spreadability and swelling index of the SMEDDS gel loaded with drug**

### 3.20.5 Cumulative drug release

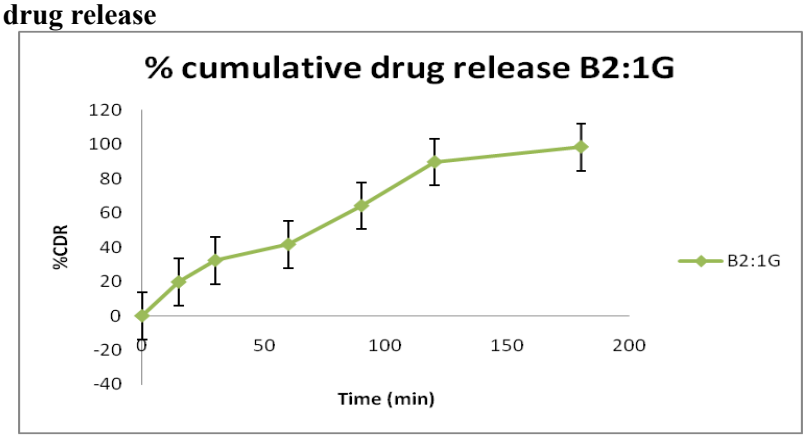


**Figure 16. % cumulative drug release of optimized formulation B2:1 G SMEDDS gel**

### 3.20.5.1 Kinetic release model for the optimized formulation B2:1 G

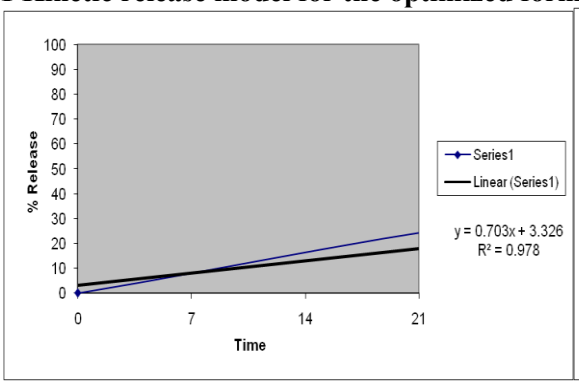


**Figure 17. Zero order release**

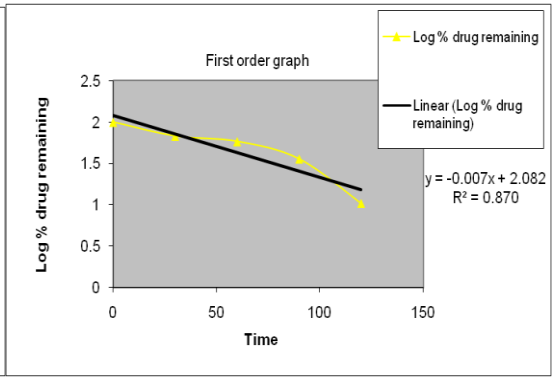


**Figure 18. First order release**

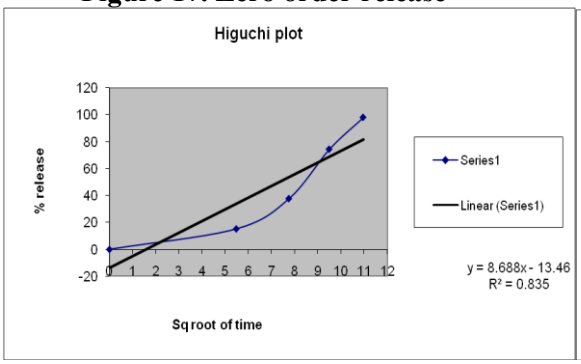


**Figure 19. Higuchi plot**

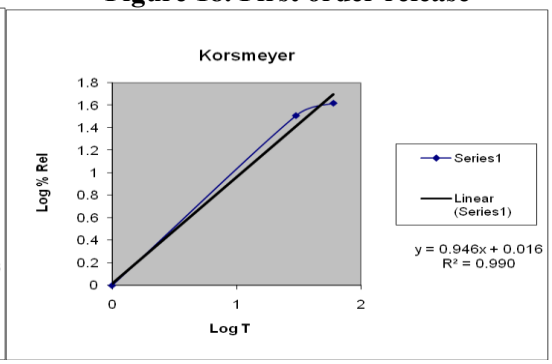


**Figure 20. Korsmeyer plot**

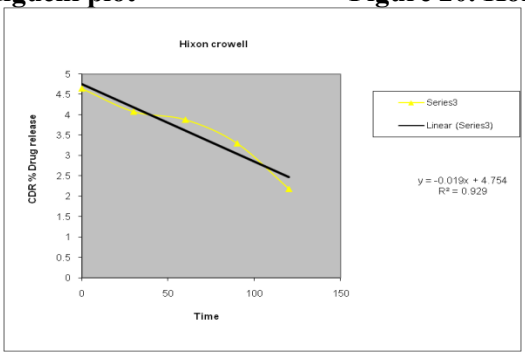


**Figure 21. Hixoncrowell plot**

**3.21 Stability Study**

| S.No | Time (Days) | $25^0C±2\ ^0C$ and 60 ± 5% RH | | | |
|---|---|---|---|---|---|
| | | **pH** | **Viscosity** | **Homogeneity** | **Texture** |
| **1.** | **0** | **7.0±0.024** | 3689 **±0.054** | Uniform mixture | Non gritty and smooth |
| **2.** | **30** | **7.0±0.024** | 3681±0.068 | Uniform mixture | Non gritty and smooth |
| **3.** | **60** | **7.0±0.024** | 3682±0.047 | Uniform mixture | Non gritty and smooth |
| **4.** | **90** | **7.0±0.024** | 3685±0.061 | Uniform mixture | Non gritty and smooth |

**Table 6. Stability Study of optimized gel B2:1 G formulation at 25 $^0C±2\ ^0C$ and 60 ± 5% RH**

| S. No | Time (Days) | 40 $^0C$ ± 2 $^0C$ and 70 ± 5% RH | | | |
|---|---|---|---|---|---|
| | | **pH** | **Viscosity** | **Homogeneity** | **Texture** |
| **1.** | **0** | **7.0±0.024** | 3689 **±0.05** | Uniform mixture | Non gritty and smooth |
| **2.** | **30** | **7.0±0.024** | 3661**±0.02** | Uniform mixture | Non gritty and smooth |
| **3.** | **60** | **7.0±0.024** | 3654**±0.01** | Uniform mixture | Non gritty and smooth |
| **4.** | 90 | **7.0±0.024** | 3649**±0.04** | Uniform mixture | Non gritty and smooth |

**Table 7. Stability Study of optimized gel B2:1 G formulation at 40 $^0C$ ± 2 $^0C$ and 70 ±5 % RH**

## 4. SUMMARY AND CONCLUSION

The organoleptic properties of the API, such as its appearance, color, odour, and condition, were assessed. When tested, it was found that felbinac had an off-white color.

The organoleptic properties of the API, such as its appearance, color, odour, and condition, were assessed. When beta sitosterol was analyzed, it was found to be white in color. Research on beta sitosterol revealed that it had a solid-state powder form and was odourless. The solubility of beta sitosterol was examined in a variety of solvents.

Beta sitosterol's UV spectra were recorded in methanol throughout a 200–800 nm scanning range, and the compounds' λmax was calculated. The active constituent's wavelength was determined to be 249 nm, and the blank was methanol. The equation for regression was y = 0.014x + 0.014. R2 = 0.998 was determined to be the regression coefficient. A six-point calibration curve was produced for the sample in the concentration range of 10–60 µg/ml.

The two medications' overlain spectra revealed that beta-sitosterol had a λ max at 249 nm and felbinac had one at 253 nm.

The percentage of Felbinac and beta sitosterol respectively indicating no interference between both the drugs.

Characteristic peaks for O-H and C-H stretching were observed in the FTIR spectra of the standard sample of beta sitosterol at 1376.11 and 2364.18 cm-1, respectively, and in the FTIR spectra of the standard sample of Felbinac at 3030.18 and 2367.64 cm-1.

From the DSC graph of felbinac it was reveal that the first heating, untreated felbinac (100: 0) gave only one sharp endothermic melting peak at 164 °C. Untreated beta sitosterol (0: 100) gave a broad melting peak at 100°C with shouldering at the leading edge during the first run with an enthalpy of 104 J/g. The cooling curve produced an endothermic peak at 132.91°C. During the second heating, a complex endothermic process was observed representing exothermic peak 253.96°C (Tms).

Phase diagrams were generated to figure out the concentration range of components for the SMEDDSs, with the highlighted regions indicating the clear O/W ME zone. The 2:1 ratio of surfactant and cosurfactant was chosen above the other three ratios of 1:1, 2:1, and 3:1 because it resulted in a more transparent formulation and a thermodynamically stable SMEDDS formulation.

Based on the results of pseudo-ternary phase diagrams, $S_{mix}$ i.e tween 20: propylene glycol ratio was fixed to 2:1. The oil phase (virgin coconut oil) to $S_{mix}$ ratio was used as one of the independent variables and stirring time as another independent variable and their effect on independent variables were studied.

The responses of dependent variables Y1 (viscosity), and Y2 (drug content) were founded in range from 1245 to 2871cps, and 78.56 % to 98.12 % respectively. The in vitro drug release was found to be inversely related viscosity.

The optimized SMEDDS formulation B2:1 was observed visually and it was found transparent and clear solution, if it was translucent and turbid then it was not considered as the SMEDDS.
The result of optimized formulation zeta potential (-25.9) and particle size (236.1) shows that the formulation was stable and good for the drug delivery at the site of action.
The result of the entrapment efficiency shows that it entrapped the 89 % drug and quite good for the therapeutic value.
The SMEDDS gel prepared after passive loading of the SMEDDS during the formation of the gel and later it was converted into SMEDDS gel.
The pH of the optimised formulations from was found to be in the range of 6 to 7 ideally, the gel should possess pH in the range of 6-7, so as to minimize discomfort or irritation due to acidic pH and microbial growth due to basic pH. B2:1 G optimized SMEDDS gel shows basic pH.
After the measurement of the viscosity it was found that the B2:1 G was shows 3689 ±0.054 cps viscous at 30 rpm with spindle no. 62. The spread- ability of the optimized formulation B2:1 G was 26 gm.cm /sec .it was spread as per the requirement.
The percentage cumulative release after three hours was near to 90% that means it was good for the delayed release.
After the study and plot of release kinetic it was revealed that it follows the Korsmeyer model of kinetic release with the regression $R^2$=0.990 and its suitable for the topical application of the formulation.
The short-term stability study was performed at as per the ICH guidelines this shows there was only slightly change in the viscosity but it was the considerable change and not effect on the stability of the SMEDDS gel.

**CONCLUSION**

At the end of the research, it was reveals that felbinac and beta sitosterol was simultaneously responsible for the reduction of the inflammation. Due to its SMEDDS based gel formulation, the formulation retains on the affected area for the longer time and it was helpful.

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