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RESEARCH ARTICLE
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FORMULATION AND EVALUATION OF SELF-NANOEMULSIFYING DUAL DRUG DELIVERY SYSTEM OF CELECOXIB AND CURCUMIN.

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Abstract
The goal of this research is to create new lipid-based SNEDDS (self-nanoemulsifying drug delivery systems) Celecoxib & Curcumin. A Sonication method was used to determine the solubility in equilibrium of celecoxib and curcumin in various oils and other components Surfactants (Tween-20, Tween-80, Span-20, Span-80) and cosurfactants (Polyethylene glycol-400, Isopropyl alcohol, Glycerol) and water. Solubility, partition coefficient and compatibility tests were evaluated. The formulation was evaluated for optical clarity, phase separation study, Analysis of globular size, self-emulsification time, and zeta potential electrophoretic mobility & transmission electron microscopy (TEM). Form invitro dissolution study % cumulative release of celecoxib and curcumin is more when comparing SGF to SIF (simulated gastric fluid to simulated intestinal fluid).

INTRODUCTION

Inflammation

Infections, damaged cells, poisonous chemicals, or radiation are all examples of stimuli that can cause inflammation. Inflammation is the immune system's reaction to these harmful stimuli. It accomplishes two important goals at once: it eliminates potentially damaging stimuli and it kickstarts the healing process. As a consequence of this, inflammation is an essential defense mechanism for maintaining good health. Acute inflammatory reactions are characterized by activity and interactions at molecular as well as cellular levels, which frequently serve to lessen the possibility of further injury or infection. As a result of this mitigation process, the intensity of the acute inflammation is lessened, and the tissue's homeostasis is restored. On the other hand, acute inflammation that is not properly managed can develop into chronic inflammation, which in turn can cause various disorders that are characterized by chronic inflammation.

Inflammation manifests itself as redness, swelling, heat, discomfort, and tissue dysfunction. These symptoms are caused by local immunological, vascular, and inflammatory cell responses to infection or damage. Tissue inflammation can also result in cell death in the afflicted tissue. Changes in arterial permeability and leukocyte recruitment are significant microcirculatory processes that occur during the inflammatory phase.

Inflammatory Response Mechanisms

The inflammatory response may be described as the coordinated activation of signalling pathways that determine the quantities of inflammatory mediators in both local tissue cells and inflammatory cells taken from the circulation. This is a possible approach to think about the inflammatory response. Inflammation is the primary driver behind a wide variety of chronic diseases, for example those affecting the cardiovascular and gastrointestinal systems, as well as diabetes, arthritis, and cancer. Although initial stimulus and where it occurs in body both have an effect on how the inflammatory response is processed, all of these steps share a core mechanism (Figure 2) that can be stated as follows:

1) Damaged stimuli are recognized by cell surface pattern receptors.
2) The inflammatory mechanisms are activated.
3) Inflammatory markers are generated.
4) Cells that contribute to inflammation are brought in.

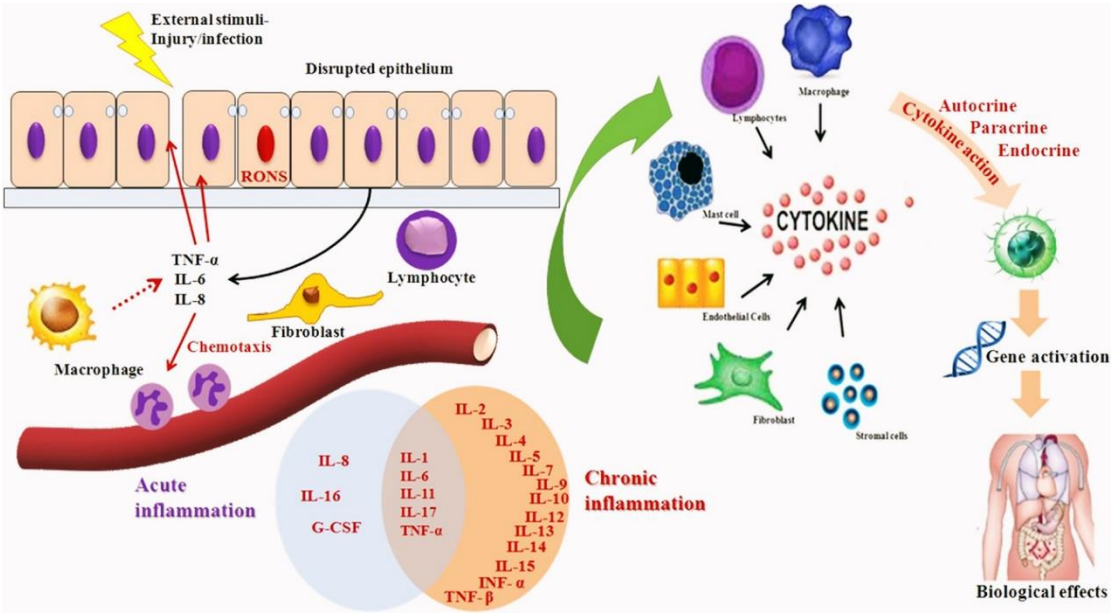

Figure 1: Inflammatory Response Mechanisms

Types of inflammation

Acute inflammation

Inflammation is first physiological response to tissue damage, and it acts as the body's initial line of defence in the event of an infection or injury. Acute inflammation and chronic inflammation are two forms of inflammation that differ in how rapidly they respond to a damaging stimulus. Acute inflammation is characterised by exudative lesions with inflammatory cell infiltration, which is mostly composed of granulocytes and lasts for a few days after damage. Chronic inflammation can last for months or even years if acute inflammation does not resolve, with macrophages and lymphocytes accounting for the bulk of inflammatory cell infiltration. Our focus here is on acute inflammation.

Chronic Inflammation

Term “chronic inflammation” can also refer to a slow, inflammation which may last for months or even years. Degree Because the consequences of chronic inflammation are heavily influenced by the source of the damage as well as the capability of body to repair and reverse damage. Chronic inflammation is a biological process, not a disease in and of itself. Chronic inflammation progresses quietly. It is the primary factor in the development of the vast majority of persistent diseases, and it poses a significant risk to the health and longevity of people. There is a correlation amongst chronic inflammation with a number of different disorders.

A. Cardiovascular

B. Cancer
C. Diabetes
D. Chronic kidney disease
E. Rheumatoid arthritis

SEDDS/SNEDDS as self-emulsifying/nano-emulsifying drug delivery systems.
SEDDS refer to combinations of oil, surfactant, and co-solvent or co-surfactant that have the ability to emulsify or nano emulsify under influence of mild agitation resulting from digestive motility of GIT. Distinction among emulsions and nano emulsions is the fact that emulsions although they have excellent kinetic stability, they are thermodynamically unstable and will eventually phase split, whereas nano emulsions are thermodynamically stable. SNEDDS and SNEDDS can be distinguished by droplet size. SEDDS with droplet sizes smaller more than 100 nm referred to as "SNEDDS. SEDDS are possible used to dissolve hydrophobic medicines and administer them in various dosage types. When SNEDDS are dispersed in water or other biological fluids within the body, they form droplets similar to those found in nano emulsion systems. After being disseminated, these systems behave in vivo like oil-in-water (O/W) nano emulsions. Hydrophobic medication remains in solution throughout its passage through the body, and the rate-limiting phase in such drug absorption, dissolution, can be bypassed. SEDDS promote drug solubilisation and release at the absorption site, leading in more equal absorption of hydrophobic medicines and greater bioavailability. There are three varieties of nano emulsions available, depending on their composition.

Nano emulsion
Nano-emulsions are developed to improve dispersion of Active substances that are medicinal. These are the systems of isotropic, thermodynamically stable surfactant as well as co-surfactant .Nano emulsion is a viable option to upsurge drug delivery system penetration and target poorly soluble medications by boosting drug absorption through the skin, improving drug retention in the targeted area, and lowering adverse effects.
Furthermore, nano-emulsions improves medication penetration via skin, which A piques researchers' curiosity. The barrier properties of stratum conium, a 10 to 20 um thick tissue layer with an expertly constructed, organized lipid/protein matrix, are the principal impediment to transdermal medicine administration.

Advantages and disadvantage of nano emulsion
The advantages and disadvantages of nano emulsion Figure 2 illustrates this.

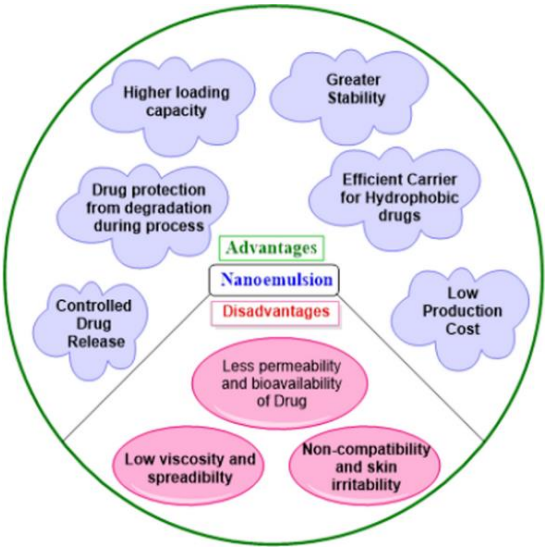

Figure 2: The benefits and drawbacks of nano emulsion

Method of preparation of nano-emulsion

Method of high energy

High energy techniques rely on mechanical equipment (microfluidizers, homogenizers, or ultrasonic devices) to generate large quantities of energy that condense into microscopic oil droplets. When the energy input rises, the droplet size shrinks. Because so much energy is required to form nano emulsions, this might be viewed as a disadvantage, especially as only around 0.1% of the energy generated is really utilized for emulsification.

Microfludization

Microfludization is a highly efficient high-energy technique that produces small droplets with consistent particle size distributions. The Microfludization process commences with the amalgamation of oil, water, and surfactant or cosurfactants in a high shear mixer. The o/w emulsion is driven through an interaction chamber in a homogenizer by a pneumatic chamber. It is divided into pieces at high speeds by two limited tubes. The configuration of the channels causes them to clash, causing turbulence, shear, and cavitation, which results in the creation of small droplets.

Ultra sonication

Numerous scholarly publications discuss the development of Nano emulsion, which endeavours to utilize ultrasonic sound frequency to reduce droplet dimensions. An alternative method involves inhaling a consistent amplitude at pressures within the system that exceed the surrounding atmospheric pressure. Elevating the external pressure in an ultrasonic field leads to an augmentation of the cavitation threshold, thereby causing a reduction in the number of bubbles. Elevating external pressure, conversely, enhances collapse pressure of cavitation bubbles. According to reference 46, it has been observed that during cavitation, the collapse of bubbles is more rapid and forceful in comparison to when the pressure is maintained at atmospheric levels.

Phase inversion method

The present methodology utilizes the chemical energy derived from phase transitions induced by the emulsification pathway to achieve optimal dispersion. When there is a change in the composition of an emulsion but the temperature remains the same, or when there is a change in temperature while the composition of the emulsion remains the same, this is known as a phase transition. Shinoda and colleagues first investigated the phase inversion temperature and came to the conclusion that an increase in temperature causes chemical changes in polyoxymethylene surfactants due to the breakage of polymer chains. This was the finding that led to the conclusion.

Homogenization at extreme pressure

The process of high-pressure homogenization is a technique that involves high energy to produce nano emulsions of oil-in-water (O/W). This method is commonly utilized for the uninterrupted generation of finely dispersed emulsions, as stated by Dumay et al. (2013). The application of pressure is employed to facilitate the passage of a liquid through a homogenization valve that is engineered to produce suspended particles of uniform size. Contemporary homogenizers are capable of exerting pressures within the range of 20 to 100 MPa, which can result in reduction of particle size as well as enhancement of stability of nano emulsions.

Low Energy Methods

Low-energy techniques have been developed by leveraging the properties of the system and the intricate interfacial hydrodynamic dynamics. The categorization of low energy techniques is based on their thermal or isothermal nature. Emulsions are produced through thermal procedures due to the temperature-dependent alterations in surfactant properties, while isothermal techniques generate emulsions through constant-temperature changes.

Material and methods

Al the chemicals, equipment's and consumables, which are used in the formulation preparation of SNEDDS as well as characterization are listed in the table

Materials

Celecoxib and curcumin 10 mg drug were kindly obtained as a gift sample from yarrow Chem product Company. Span 20 (Loba-chemical), Span 60 (S.D FINE-Chemical), tween 20 (Loba -chemical), tween 60 (S.D fine -chemical), cholesterol (S.D Fin – Chemical) , Distilled (S.D fine chemical), U.V spectrophotometer(shimadzu Corp, Japan), Digital electronic balance (Shinko Denshi crop Japan), magnetic stirrer(B.D scientific industries Delhi), sonicator (Rolex). All other chemicals were of analytical grade.

Methodology

Construction of phase diagrams

There is a pseudo-ternary phase diagram was produced by using the equilibrium solubility data of celecoxib and curcumin in a variety of oils, surfactants, and cosurfactants. In order to generate acceptable SNEDDS formulations of celecoxib and curcumin, peppermint oil, Tween-20, and PEG-400 were optimized as oil phase, surfactant, and cosurfactant, respectively. For the purpose of this investigation, the aqueous phase was represented by distilled water. The aqueous phase titration method that was presented in a research publication was used to generate a pseudo-ternary phase diagram for peppermint oil, Tween-20, PEG-400, and water. This diagram was used to illustrate how these four components interact with one another. For every phase diagram, a transparent and consistent mixture was produced by using magnetic stirring in conjunction with a certain ratio of surfactant to cosurfactant (1:1, 1:2, and 2:1). After that, the combinations were subjected to titration with water and oil, and they were visually inspected for phase clarity and flowability. Each oily combination was subjected to a water phase treatment that consisted of a single drop at a time until the turbidity or phase separation occurred. leads to the localization of the nano emulsion region in the phase diagrams. To determine the self-emulsification region at room temperature (25 degrees Celsius), varying amounts of lipophilic excipient (Peppermint Oil), water, and Smix (Tween-20 and PEG-400) were used. The physical appearance of blank SNEDDS was noted on each phase diagram, with one axis indicating the aqueous phase (water), the second representing the oil phase (peppermint oil), and the third reflecting a specific mass ratio of the surfactant (Tween-20) to the cosurfactant (PEG-400). Some are pseudo-ternary phase diagrams that are built in the SNEDDS formulation.

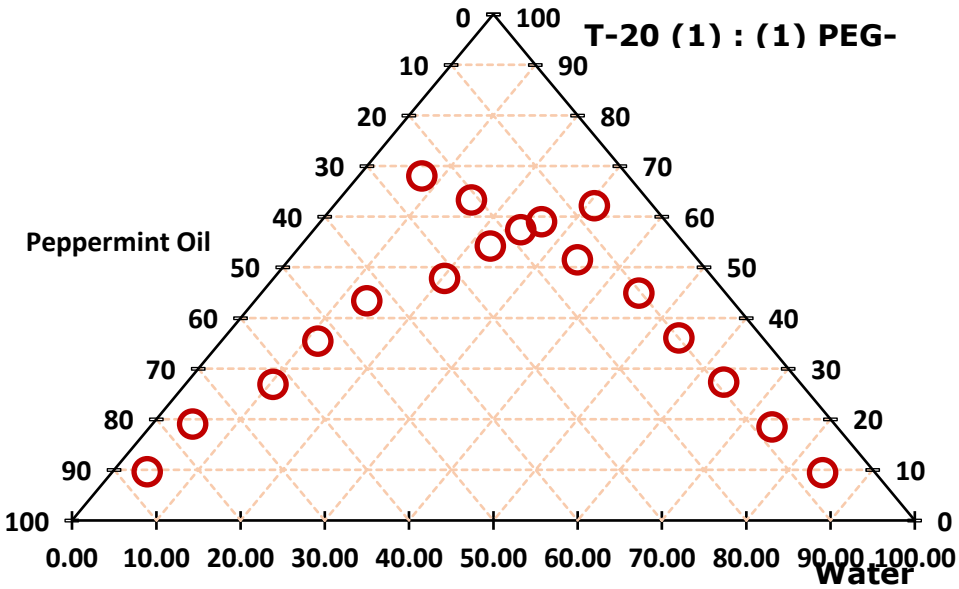

Figure 3: Tween-20/PEG-400 (1:1) pseudo-ternary phase diagram of peppermint oil

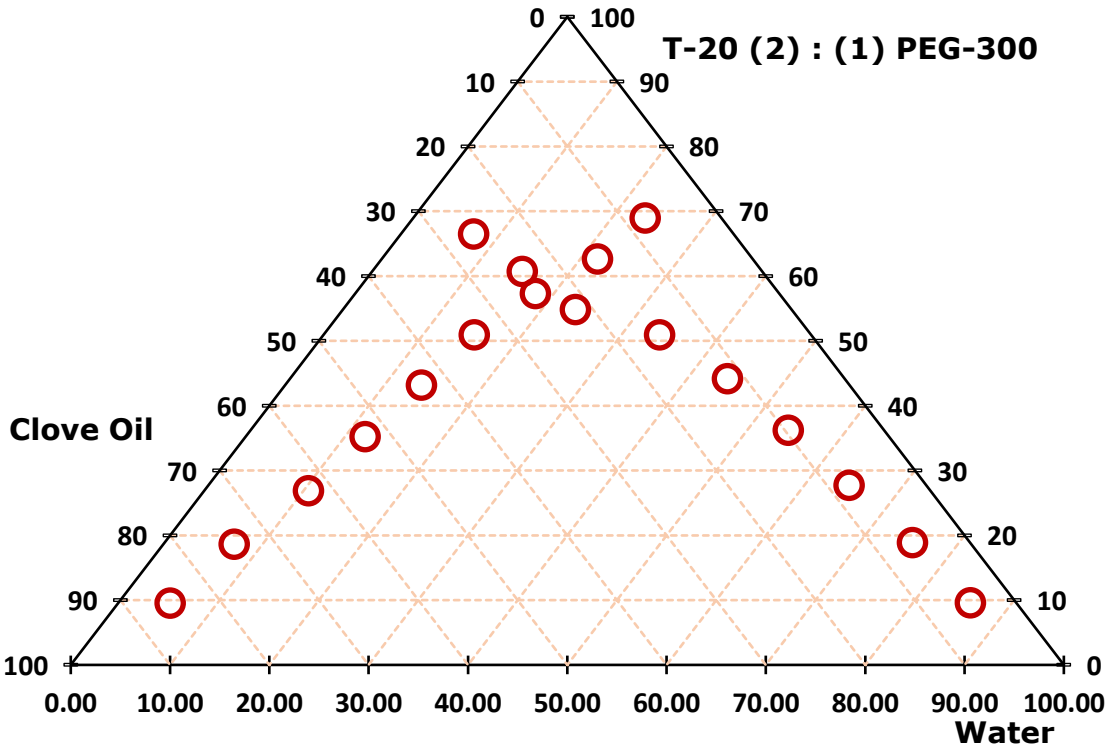

Figure 4: Clove oil Tween-20/PEG-400(2:1) pseudo-ternary phase diagram

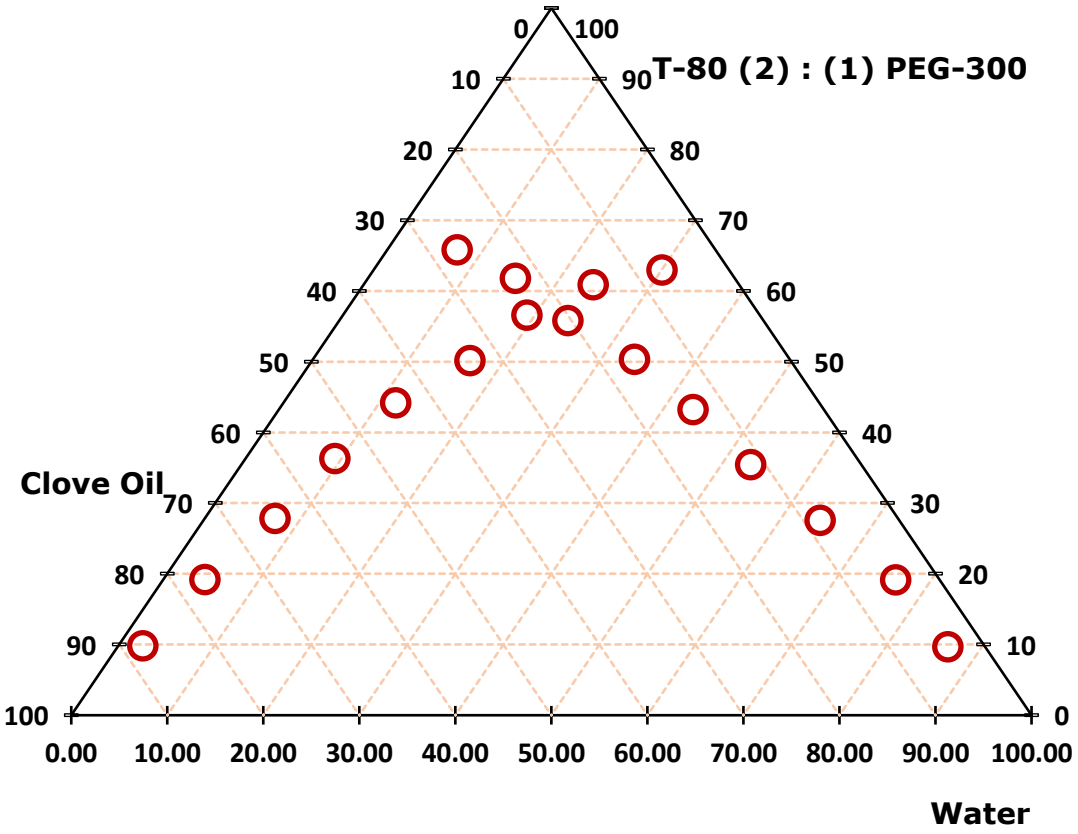

Figure 5: Pseudo-ternary phase diagram of clove oil, Tween-80/PEG-400(2:1)

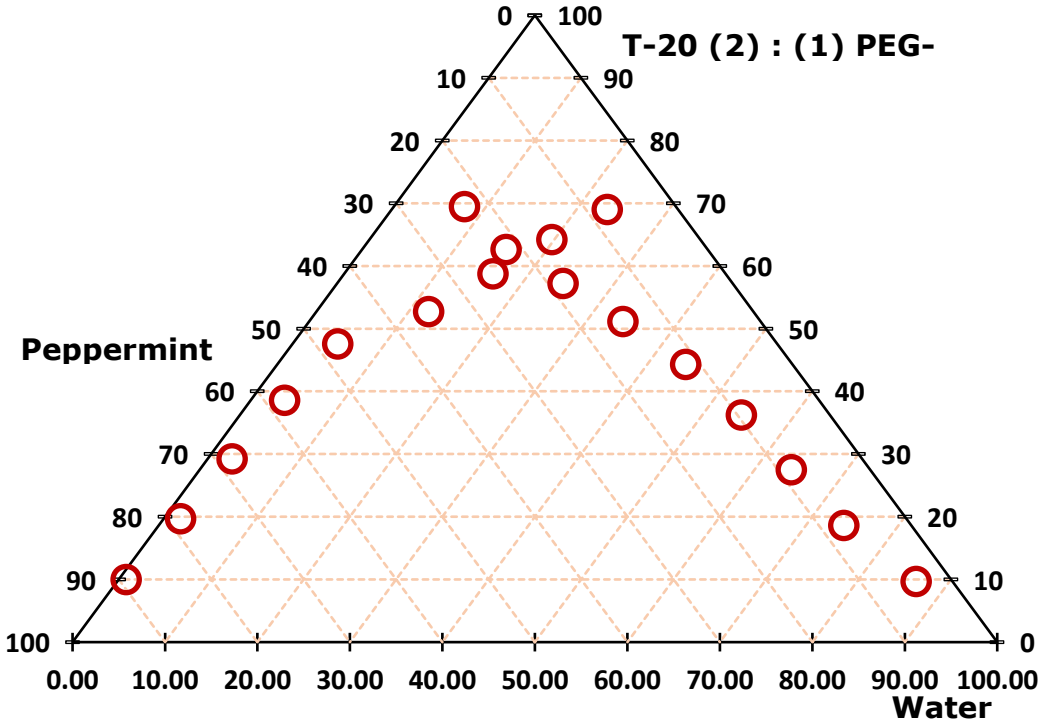

Figure 6: Pseudo-ternary phase diagram of peppermint oil, Tween-20/PEG-400(2:1)

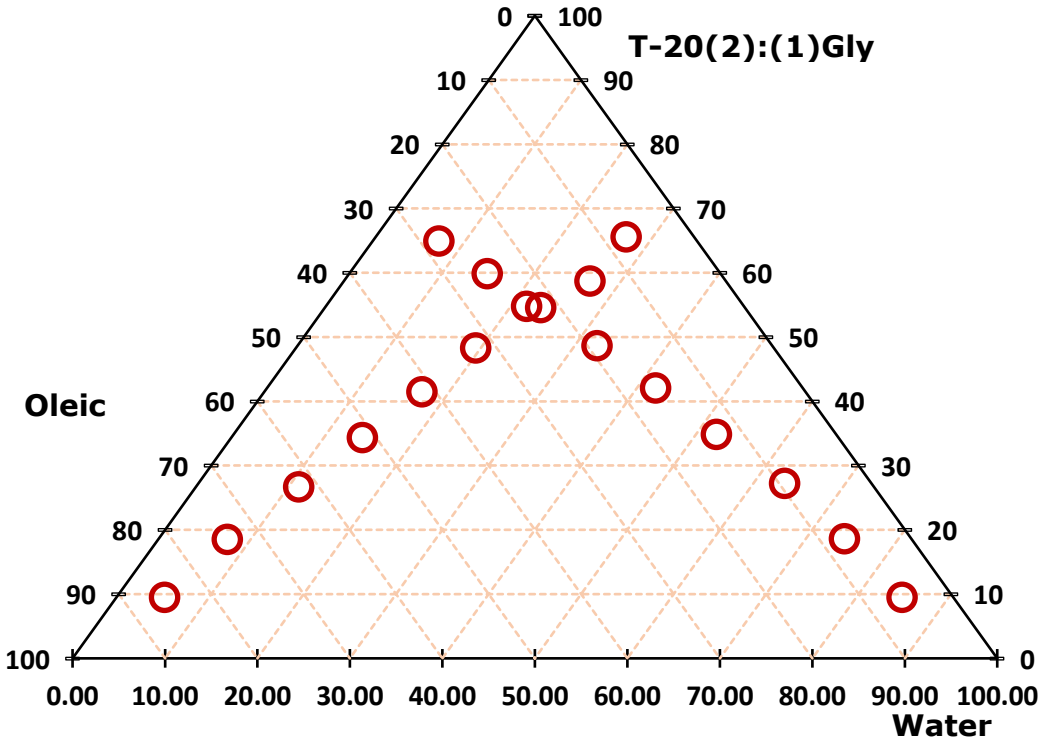

Figure 7: Pseudo-ternary phase diagram of oleic acid, Tween-20/Glycerol (2:1)

Preparation method for Self-Nanoemulsifying Drug Delivery System

After finding the self-emulsifying area using a pseudo ternary diagram, the oil, surfactant, and co-solvent ratios were chosen, and all three components of the combination were changed to meet the criteria. Before combining it with a surfactant and a co-solvent, the drug was first dispersed in a particular oil and then let to sit. After the components were mixed together with a vortex mixer, they were heated in a water bath to 400.5 degrees Celsius for one hour. In the scientific literature, there are a limited number of papers that make use of an experimental design in order to improve a self-nano

emulsifying medication delivery system (also known as a self-nanoemulsifying drug delivery system). In this study, we improved the composition of SNEDDS formulations by employing a basic lattice mixture design (Figure 22). This was done in preparation for an in vitro evaluation. Eight batches were made and tested and Design Expert Software (version 11) was used to analyse data from independent sources.

Characterization of SNEDDS

Self-emulsification time and optical clarity measurement

After diluting 0.5 mL of SNEDDS with 100 mL of deionized water, the liquid was stirred at room temperature using a magnetic stirrer at a speed of 200 revolutions per minute. This allowed the self-emulsification durations to be calculated. The amount of time necessary to create nano-emulsions that are homogeneous is referred to as the emulsification times. In order to calculate the transmittance percentage at 638.2 nm, the purity of the nano-emulsion was examined visually as well as spectrophotometrically (using a Shimadzu, UV-1800 PC, Japan) at max=256 nm. The blank for the experiment was made up of deionized water. When the transmittance percentage is close to 100 percent, the manufactured SNEDDS are regarded as being transparent and fall within the range of nanometres.

Determination of drug content in the SNEDDS of Celecoxib and curcumin

Methanol was used to disperse liquid SNEDDS containing celecoxib and curcumin, each of which was equivalent to 5.1 mg. The amount of methanol used was appropriate. After the samples had been properly mixed to interfusion the medication in methanol, they were centrifuged for 15 minutes at 3000 rpm using a micro-centrifuge manufactured by Remi motors in Mumbai, India. This was done in order to separate the undissolved excipients. After appropriate dilution, It was the supernatant subjected to spectrophotometric examination at 256 and 400 nm using a UV-visible spectrophotometer to determine the concentrations of celecoxib and curcumin, respectively. The content of Celecoxib was calculated from the standard curve of the drug in methanol using the Beer-Lambert's equation ($y = 0.0308 \times \text{concentration} + 0.0297$).

Phase Separation study

As all nano emulsion prone to phase separation this study is designed at the moderate stage of formulation formation to access whether the formed SNEDDS emerge any indication of phase separation or not 1 mL of SNEDDS was added to a test tube holding 5 mL of distilled water at 25°C. The mixture was held for 2 hours after 1 minute of vortex mixing to detect any phase separation.

Globular size analysis

The SNEDDS was prepared to the Malvern Zeta sizer Nano ZS (Malvern instrument ltd, Uk) will be used to calculate the size of droplets prepared samples. All the measurement were carried out at 25^0C and result expressed in mean +-SD (n=6).

Zeta potential determination

The zeta potential will be calculated using the Malvern Instrument Ltd (UK) Zeta sizer Nonseries ZS. Using a Zeta sizer, the produced sample will be diluted with ionized water up to 1000 times. Light scattering will be investigated at 250 degrees Celsius and a 900-degree angle.

TEM (Transmission Electron Microscopy)

The particle morphology of SNEDDS nano-emulsion was investigated using FEI Tecnai TM G2 spirit transmission electron microscope. Sample was taken 1ml from each and was diluted using ethanol and sonication for 2-3 minutes before measurement. A drop of material was placed on a carbon copper grid and stained with 1%w/v water solution before being blotted off and immediately seen under TEM.

SEM (Scanning Electron Microscopy)
Scanning electron microscopy (SEM JSM-6360 (JEOL Inc. Japan) was used to study morphology and structure. A little drop of sample was oven dried and air dried before being sprinkled on SEM stubs (pins) using double-sided adhesive tape from the samples. The aluminium was then coated for 6 minutes at 20mA using a sputter -coater (ion -sputter JFC100). The sample will be photographed using a scanning electron microscope with a secondary detector while it is subjected to a 15 kV accelerating voltage.

In Vitro Release Study
For SGF (Simulation gastric fluid)
All SNEDDS formulations were tested for in vitro release. Each SNEDDS sample (equivalent to 3mg) was diffused via a dialysis bag, and the dialyses were discharged into a beaker of 100ml SGF at 37°C (room temperature). At time intervals of 0, 10, 20, 30, 40, and 50 minutes, 3ml of dissolution medium was collected and was replaced by new dissolution media. The absorbance of the samples were then determined spectrophotometrically at 220nm for nano emulsion.

For SIF (Simulation of intestinal fluid)
All SNEDDS formulations were tested for in vitro release. Each SNEDDS sample (equivalent to 3mg) was diffused via a dialysis bag, and the dialyses were discharged into a beaker of 100ml SIF at 37°C (room temperature). At time intervals of 0, 10, 20, 30, 40, and 50 minutes, 3ml of dissolution medium was collected and replaced with new dissolution media. The absorbance of the samples was then determined spectrophotometrically at 220nm for nano emulsion.

RESULT AND DISSCUSSION
Screening of SNEDDS formulation compositions
It is absolutely necessary to develop drug delivery systems that self-nano emulsify medications that have a low water solubility. The amount of drug that can be loaded into a formulation is a highly important design factor that is determined by how soluble the medication is present in the formulation's various components. It is important that the formulation's volume be lowered as much as possible so that the therapeutic dosage of the medicine can be delivered in encapsulated form. In order to produce a highly concentrated form of nano emulsions, the components that are chosen for the formulation process need to have the ability to solubilize the medicine at a high level.
In this study, non - ionic surfactants are used because they are less impacted by pH and ionic strength fluctuations. The solubility of Celecoxib in various excipients have been reported. Among some tested oils, peppermint showed the best solubility for Celecoxib and Curcumin. Hence, peppermint oil was selected as the oil phase in SNEDDS preparation of Celecoxib and Curcumin.

Pseudo-Ternary Phase Diagram
Pseudo-ternary phase diagrams were created to identify areas of self-nano emulsification and to calculate the requisite quantities of oil, surfactant, and cosurfactant for the creation of SNEDDS. When SNEDDS from a fine oil-water emulsion are gently agitated into aqueous medium, this formulation is thermodynamically spontaneous since the quantity of free energy required to create an emulsion is so small. In the visual test, the apparent spontaneous production of emulsions is what the examiner is looking for. The SNEDDS series was created, and their self-emulsifying properties were examined visually after they had been prepared. The pseudo-ternary phase diagram was utilized throughout the screening process for surfactants. Because Tween 20 was utilized as a surfactant, the clear gel that was generated here in Tween-80 may be seen here. The pseudo-ternary phase diagrams of O/W microemulsions were composed of a mixture of Tween-20: PEG-400 (2:1, w/w), peppermint oil, and distilled water with a varied ratio, as shown in Figure 23. The ratios were different since the mixture was an O/W microemulsion.

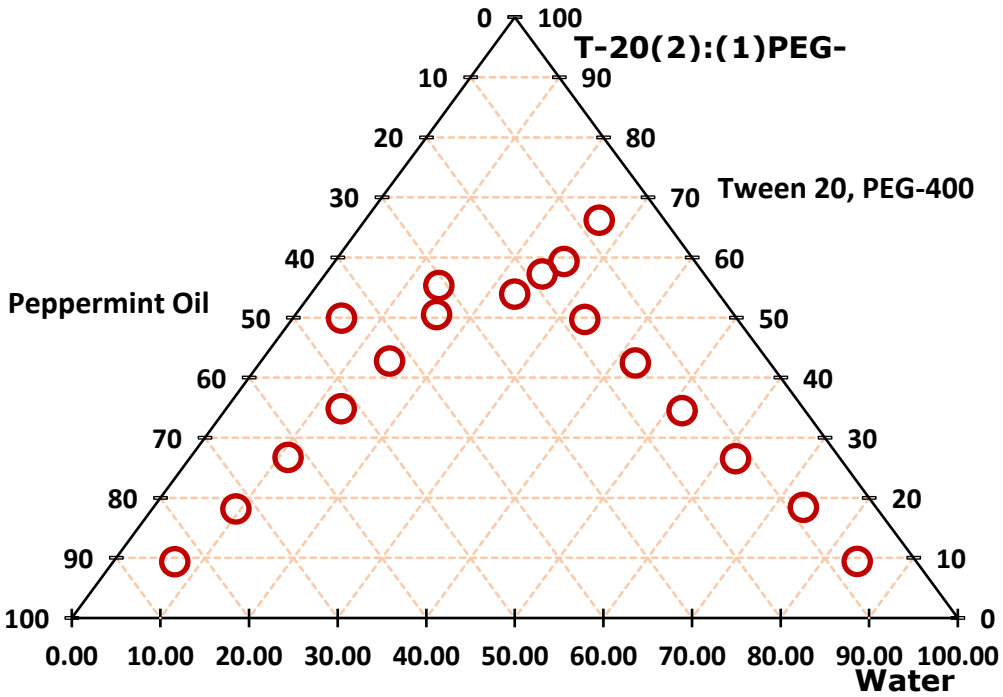

Figure 8: Pseudo-ternary phase diagram of peppermint oil, Tween-20/PEG-400(2:1)

Characterization of SNEEDS formulation containing Celecoxib and Curcumin

Measurement of self-emulsification time and optical clarity

The formation of a spontaneous emulsion takes place when the gel phases that have formed on the surface of the droplet as a result of mild agitation are quickly reached by water in a short amount of time. By raising the concentrations of both the co-surfactant and the surfactant, the time required for the self-emulsification process was reduced and improved, respectively. These findings might be attributed to the surfactant enhancing SNEDDS's free surface energy and viscosity (Parmar et al., 2011). All formulations achieved transmittance rates more than 80%, demonstrating emulsion purity and the creation of nano-emulsions with minuscule globule sizes. The self-emulsification property can be evaluated based on how long it takes for the emulsion to become clear once it has formed. When subjected to light agitation, SMEDDS should be able to disperse instantly, rapidly, and fully without any drug precipitation. It was discovered that the emulsification process took a total of 44 seconds.

After being diluted 10 or 100 times, the optical clarity of SNEDDS was 98.41% and 97.56%, respectively, both of which were much closer to the perfect score of 100%. It shows that a transparent nano-emulsion was generated by diluting with distilled water from the SNEDDS up to a hundred times its original concentration.

Determination of drug Content

Drug content of liquid SNEDDS was found to 97.76, respectively, inferring that the carrier oil (peppermint) is a good solubility in retaining the drug content in the formulation.

Phase Separation Studies

The study of phase separation suggests that a mixture of Celecoxib, Curcumin peppermint oil, Tween 20 and PEG-400 exhibited negligible phase separation during the 2-hr study period.

Globular size analysis

The droplet size of the prepared samples was determined, and the prepared SNEDDS formulation that had been loaded with the medicine celecoxib and curcumin was analysed for globular size using a Malvern Zeta sizer Nano ZS (Malvern instrument ltd, UK). At a temperature of 250 degrees Celsius,

each measurement was taken, and the results were expressed as a mean minus a standard deviation (n=6). The liquid SNEDDS formulation had a very small droplet size on average, maybe around 100 nanometres. Figure 24 has been used to illustrate this point. After being diluted with water, the SMEDDS appeared clear and translucent, and the preparation maintained its consistency for more than a week.

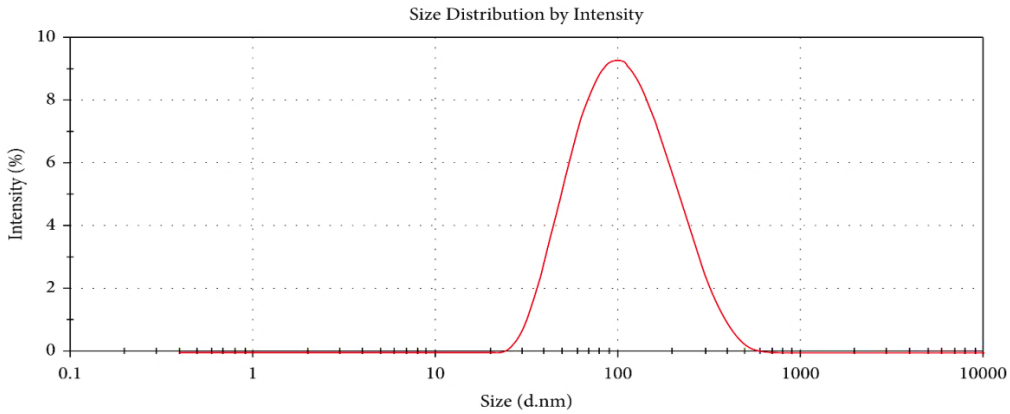

Figure 9: Zeta sizer determination of prepared SNEDDS formulation

Determination of zeta potential

The zeta potential will be calculated using the Malvern Instrument Ltd (UK) Zeta sizer Nonseries ZS. Using a Zeta sizer, the produced sample will be diluted with ionized water up to 1000 times. Light scattering was investigated at 250°C and 90° angle. The zeta potential of the system was found to be neutral (25.6 mV), indicating no –ve (negative) charge droplets of the nano emulsion. The zeta deviation was found to be 4.79 mV. Electrophoretic mobility or conductivity was found to be 0.0183 mS/cm which also indicated no –ve (negative) charge in nano emulsion droplets. Figure 16shows the results of zeta - potential and electrophoretic mobility.

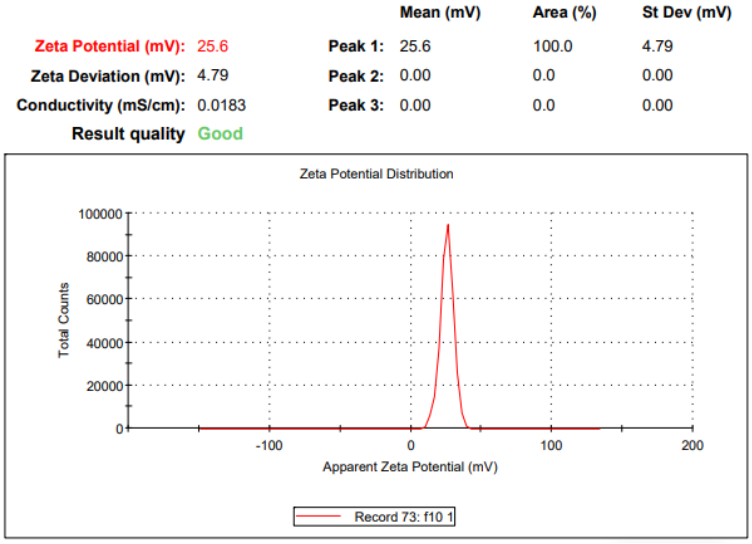

Figure 10: Zeta potential determination for nano emulsion

Transmission electron microscopy of prepared SMEEDS formulation

The transmission electron microscope (TEM) was used to look at the surface morphology of the formulations (Figure 26). It was discovered that the liquid SMEDDS that had been created had the shape of spheres and were dispersed evenly across the film. The evidence presented in Figure 26 demonstrates that the formulations of SMEDDS have a smooth shape and are relatively homogeneous (100 nm).

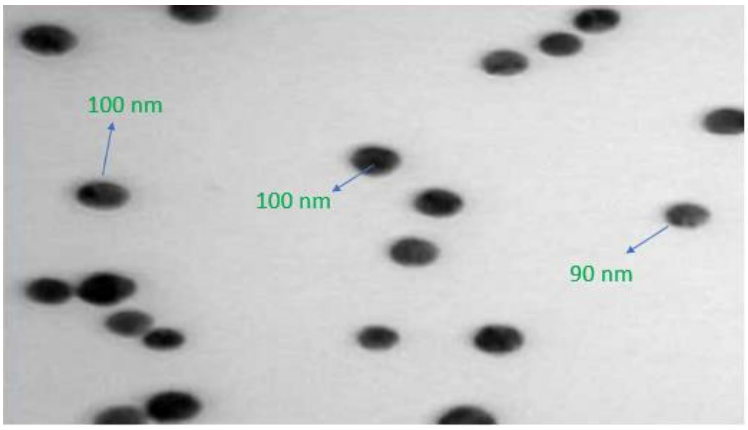

Figure 11: Transmission electron microscopy (TEM)

Scanning electron microscopy of prepared SNEEDS formulation

Morphology and structure were examined by scanning electron microscopy (SEM JSM-6360 (JEOL Inc. Japan). A little drop of sample was air dried by oven drying and sprinkled on SEM stubs (pins) using double-sided sticky tape from the samples. It was then coated with aluminum for 6 minutes at 20mA using a sputter -coater (ion -sputter JFC100). A scanning electron microscope with a secondary detector was used to investigate the sample, which was exposed to an accelerating voltage of 18 kV.. The resulting digital images were captured. The size of the b/w particles was determined to be around 2 millimetres (Figure 27).

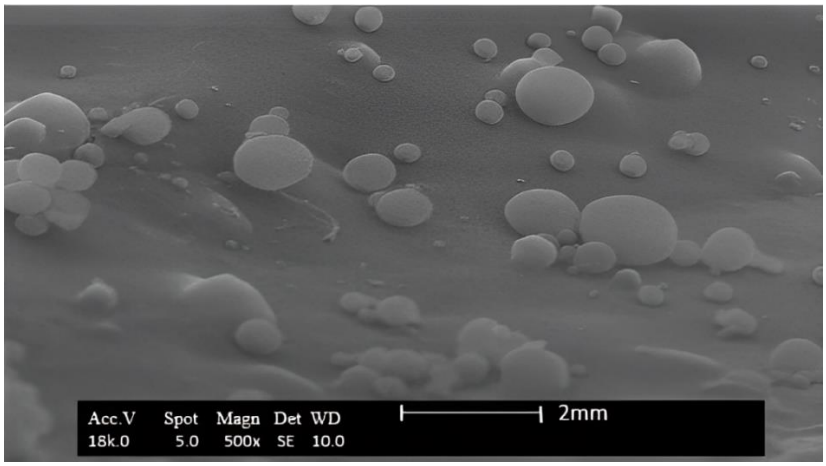

Figure 12: SEM is an abbreviation for scanning electron microscopy

In-Vitro drug release profile

For SGF

In vitro dissolution of nano emulsion from SNEDDS containing nano emulsion, SNEDDS containing nano emulsion and pure nano-emulsion was done in SGF (simulated gastric fluid) buffer and this result was presented in **figure 13.** The percentage cumulative released of celecoxib in SGF medium was found to be 45, 62, 79, 80 and 85% after 10, 20, 30, 40 and 50 min respectively. The percentage cumulative released curcumin in in SGF medium was found to be 20, 26, 38, 44 and 48% after 10, 20, 30, 40 and 50 min respectively.

8.4.2 For SIF

In vitro dissolution of nano emulsion from SNEDDS containing nano emulsion, SNEDDS containing nano emulsion and pure nano-emulsion was carried out in SIF (simulated intestinal fluid) buffer and this result was shown in **figure 13.** The percentage cumulative released of celecoxib in SGF medium was found to be 43, 60, 65, 70 and 75% after 10, 20, 30, 40 and 50 min respectively. The percentage

cumulative released curcumin in in SGF medium was found to be 15, 21, 32, 38 and 42% after 10, 20, 30, 40 and 50 min respectively.

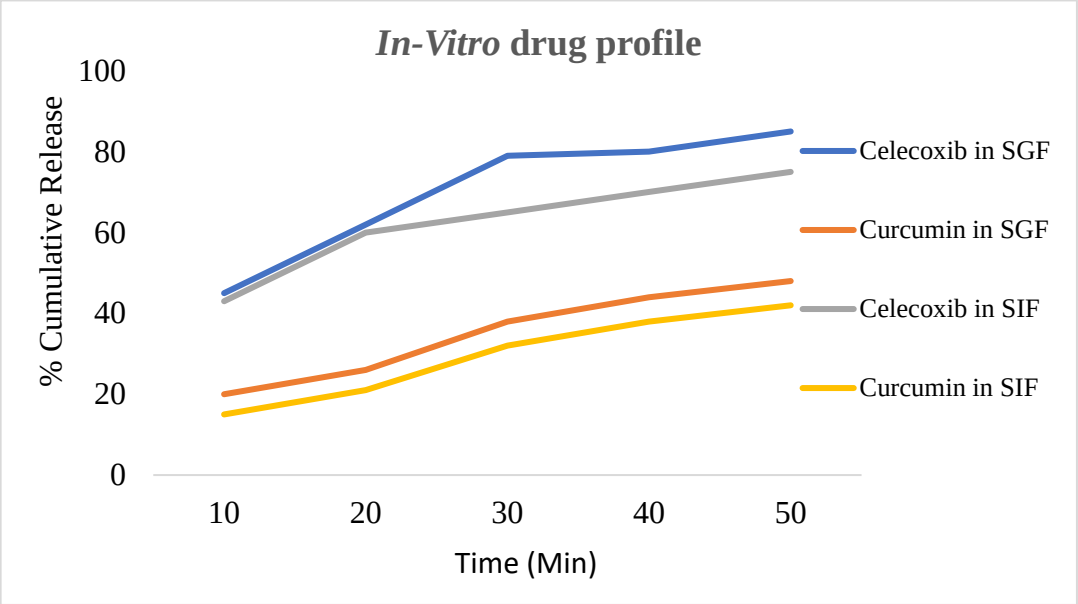

Figure 13: Drug release in vitro as a function of time. The release media were SGF, simulated gastric fluid (SGF), and simulated intestinal fluid (SIF) at 37ºC.

Conclusion

According to the findings, a self-Nano emulsion drug delivery system for a drug formulation that is only marginally water-soluble was successfully created and improved.

The main objective of this work was to develop SNEDDS for increasing the bioavailability of curcumin and celecoxib that have a low water solubility.

In the SNEDDS formulation that was selected, peppermint oil was used for the oil phase. Additionally, tween 20 was employed as a surfactant, and PEG-400 was used as a co-surfactant. All three components mixed together in the following proportions: 1:1, 2:1, 1:2. From in vitro release study it can be concluded that % Cumulative release of Celecoxib and Curcumin is more in simulated gastric fluid (SGF) as compared to simulated intestinal fluid (SIF).

Celecoxib and curcumin SNEDDS were effectively created and evaluated for their in vitro performance in the current investigation. Due to the increased surface area, the nanosized of these formulations facilitates improved drug solubility and absorption. These systems' lipidic makeup makes it possible to transport medications to the lymphatic system. The technique used in the inquiry for screening SNEDDS excipients contributed to our understanding of how well different surfactants emulsify different oily phases. Additionally, it facilitated the quick screening of a sizable pool of co-surfactants suitable for oral administration. The medication absorption may also be aided by the smaller particle size and quicker emulsification time.

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