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Development And Evaluation Of Polyherbal Self Nanoemulsifying Drug Delivery System (SNEDDS)

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ABSTRACT
An SNEDDS is a drug delivery system that uses a mixture of oils, surfactants, and co-surfactants to form a fine oil-in-water nano-emulsion when exposed to aqueous media, such as gastrointestinal fluids. This system is thermodynamically stable and can enhance the solubility and bioavailability of poorly soluble drugs, thereby improving their therapeutic efficacy. The current study's aim was to formulate an polyherbs containing SNEDDS with a careful selection of its components, oils, surfactants, and co-surfactants.Surfactants are essential for emulsion stability, reducing interfacial tension between oil and water phases. This study employed hydrophilic non-ionic surfactants, including sesame oil, span 80 and Propylene glycol. The choice of these surfactants is supported by their high hydrophilic–lipophilic balance (HLB) values, which indicate their ability to stabilize O/W emulsions effectively. Lipid-based self-nanoemulsifying drug delivery systems (SNEDDS) have resurged the eminence of nanoemulsions by modest adjustments and offer many valuable opportunities in drug delivery..

Keyword: *: Self-nanoemulsifying drug delivery system (SNEDDS), solubility enhancement, oral bioavailability, Curcuma longa (rhizome), Tinospora cordifolia (leaves), Gymnemasylvestre(levaes).*

1. INTRODUCTION

According to a recent report by the World Health Organization, the incidence of diabetes was the highest in India with 32 million people [1]. In developed countries, the prevalence of diabetes Type 1 in both adults and children is usually up to 90%. As in other countries, diabetes also distresses the US population, and its complications are the leading cause of death in the US population [2]. increases glucose uptake in muscle and fat cells. Within these cells glucose enters glycolysis and provides energy. Insulin also supports lipid and protein synthesis and is responsible for promoting cell growth and proliferation. In fat cells glucose can be stored as lipids for long periods of time. In extreme starvation glucagon can mobilize these lipid stores for energy. The interplay of all the processes regulated by the hormones insulin and glucagon [3].Insulin-Dependent Diabetes Mellitus or Type 1 is recognized and characterized by insulin production capability of islets' Langerhans and usually occurs in children and adolescents. Type 1 diabetes accounts for 5-10% of diabetes. Although the cause of Type 1 diabetes is unclear, it may be guessed that autoimmune attack, infectious agents, etc [4]. The symptoms appear to be unpredictable together with; thirst (polydipsia), excessive urine (polyuria), constant hunger, weight loss, changes in vision and fatigue may occur suddenly. Insulin injections are given to people with type 1 diabetes mellitus. Insulin regulates blood glucose levels to prevents major complications which affect blood vessels, nerve pathways, eyes and kidney. Whereas noninsulin-Dependent Diabetes Mellitus or Type 2 in which body produces insulin in inadequate amounts and inappropriately uses secreted insulin, due to receptor levels defects. It is the most common type of diabetes, accounting for 90-95% of diabetes..

Type 2 diabetes is nearing epidemic proportions, due to an increased number of older adults, and a greater prevalence of obesity and sedentary lifestyles. Symptoms may be similar to type 1 diabetes, but sometimes inconspicuous [5]. Thus, the disease may be diagnosed several years after onset. Diabetes mellitus can be treated with dietary modifications, insulin, and oral hypoglycemic drugs. Improvement in dietary habits is effective for 60% of diabetic patients. The total daily requirement of calories should be decided which de- pends on the financial resources, occupation, weight, sex, and age. Oral drugs containing hypoglycemic agents are beneficial in the treating

Type 2 diabetes mellitus (NIDDM) patients who do not respond to simple dietary restrictions. Biguanides and sulphonylureas are frequently used in diabetes mellitus treatment. Diabetes, particularly type 2, can be easy to ignore, especially in the early stages when you're feeling fine. However, when not managed, diabetes affects many major organs, including your heart, blood vessels, nerves, eyes and kidneys. Long-term complications of diabetes develop gradually, but they can eventually be disabling or even life-threatening, hence the importance of following a good diabetes care plan [6].The oral administration route remains the best choice for drug delivery owing to its safety, patient compliance, and capacity for self-administration. In addition to being the most convenient route of administration, oral delivery has been limited owing to the numerous barriers present at the gastro-intestinal (GI) tract. The solubilization of the drug within the GI tract is a mandatory for the drug absorption, as insufficient drug dissolution may lead to incomplete absorption, low bio-availability, and high variability following oral administration [7]. The oral delivery of drugs may also be associated with precipitation, food and drug interactions, susceptibility to degradation, and first-pass metabolism, leading to low oral bio-availability. Among the wide number of lipid-based drug-delivery systems, self-nano-emulsifying drug-delivery systems (SNEDDSs) are one of the most investigated in oral drug delivery.SNEDDSs have been described as a blend of oils, surfactants, and cosurfactants or cosolvents. Following aqueous dispersion and mild agitation (such in GI tract), SNEDDSs spontaneously form fine oil-in-water nano-emulsions with droplet size of 200 nm or below. The spontaneous emulsification takes place when the entropy change favoring dispersion exceeds the energy required to increase the surface area of the dispersion. SNEDDSs have shown immense potential in overcoming limitations related to the oral administration of several compounds. Such limitations include low solubility in the GI tract, inconsistent dissolution, enzymatic degradation, and erratic intestinal absorption. Surfactants and lipid components used in SNEDDSs can cooperate to enhance the GI absorption drugs [8]. Furthermore, these components can be modified easily according to the need to make SNEDDSs feasible for both hydrophilic and hydrophobic drugs. Recent studies have shown that SNEDDSs could be effective oral drug carriers of peptides and proteins by preventing their GI degradation and improving their intestinal membrane permeability. Curcuma longa, commonly known as Turmeric, is a rhizomatous herbaceous perennial plant belonging to the Zingiberaceae family. It originated in India and is widely cultivated in China, Sri Lanka, West and East Africa and other tropical countries. Traditional Medicine (TCM) for the treatment, prevention and management of various illnesses such as cancer, coughs, diabetes, Arthritis, diarrhoea, inflammation, psoriasis, hepatobiliary diseases, skin disorders, gastric ulcers and peptic ulcers. It promotes blood circulation, removes stagnation, alleviates depression, and serves as a natural flavouring agent that strongly affects food's colour, taste and nature.Tinosporacordifoli a (Thunb.) Miers has long been a part of Ayurvedic medicine in India. This perennial, h erbaceous vine belongs to the family Menispermaceae with many common names viz., Giloy, Guduchi, Gurcha, Amrita or heart-leaved moonseed. Giloy is a large climbing shrub with elongated twining branches spreading extensively. A special feature is the presence of wiry aerial roots arising from the branches. *Gymnemasylvestre* is a plant included in Apocynaceae family and is located in many regions of Asia, Africa and Australia. This plant is widely used as a traditional therapy for different purposes. Gymnemasylvestre was considered as one of the major botanicals to treat diabetes in the Ayurvedic system of medicine and also is included in Indian Pharmacopoeia as an anti-diabetic plant. Gymnemasylvestre is reported to be effective against arthritis, diuretic, anemia, osteoporosis, hypercholesterolemia, cardiopathy, asthma, constipation, microbial infections, indigestion, and as an anti-inflammatory agent. Although this plant has been proven valuable through its numerous useful properties, not many studies especially clinical studies on this plant are available.The study aims to achieve several goals. First, it focuses on formulating a SNEDDS that can effectively encapsulate the active compounds of the polyherbal formulation used for diabetes treatment. This involves selecting suitable lipids, surfactants, and co-surfactants to create a stable and efficient self-emulsifying system [9-10]. The formulation must be optimized to ensure the optimal solubilization and dispersion of the polyherbal components within the SNEDDS. Additionally, the study aims to enhance the solubility and bioavailability of the active compounds in the polyherbal formulation. By improving solubility, the SNEDDS can increase the absorption and bioavailability of these compounds, leading to improved therapeutic efficacy. Stability assessment is also an important objective, as the physical and chemical stability of the SNEDDS loaded with the polyherbal formulation needs to be evaluated. Stability studies will assess factors such as droplet size, zeta potential, drug content, and physical appearance to ensure the long-term stability and shelf life of the formulation. Furthermore, the study plans to conduct in vitro and in vivo evaluations to assess parameters such as drug release profile, dissolution rate, permeability, pharmacokinetics, and pharmacodynamics of the SNEDDS formulation. Finally, the antidiabetic activity of the SNEDDS-loaded polyherbal formulation will be assessed in appropriate animal models or cell culture studies. This assessment will involve measuring blood glucose levels, insulin sensitivity, and markers of diabetes control to determine the efficacy of the formulation in treating diabetes.

Material And Methods

Plant material was extracted by soxhlet extractor (Perfit India Ltd.). Extracts were concentrated by vacuum rotary evaporator (Buchi R-114, Switzerland). A CAMAG twin trough development chamber was used for developing TLC plates.

Procurement and Authentication of Plant material:A systematic approach is necessary in pharmacognostic study, which helps in confirmation and determination of identity, purity and quality of a crude drug. The selected plant material Curcuma longa, Tinospora cordifolia, Gymnemasylvestrewere collected from Indore and authenticated by botanist.The selected plant

materialswere separated and cleaned to remove unwanted materials. The dried plant materials were coarsely powdered in a blender and were used for further analysis.

Macroscopical study: Macroscopical characters were examined with the naked eyes to determine the color, shape, odor, margin, texture, base symmetry, etc. of the plant parts**.**

Microscopical study (Transverse section) The Transverse sections were shown by the photomicrographs of the thin-hand sections of the leaves and stems were made using a digital scanning electron microscope**.**

Powder microscopy: The shade dried plant materials were powdered and the powders passed through sieve no. 60# separately and individually then subjected to powder analysis. Each one of the powders was taken to which few drops of chloral hydrate was added and heated for one to two minutes. The chloral hydrate was used to clear the tissues and for clarification. For microscopical studies, the air-dried powdered drug was treated with NaOH, mounted on glycerine after staining with safranin, and powder characteristic was observed using the compound microscope and camera lucida [11]**.**

Physicochemical Evaluation: Physicochemical (Proximate) analysis helps to set up certain standard for dried crude drugs in order to avoid batch-to-batch variation and also to judge their quality. Their studies also give an idea regarding the nature of phytoconstituents present. Physicochemical studies of the air-dried powdered drug have been conducted to its high medicinal properties. The following physic-chemical analysis such as ash value, foreign matter, loss on drying (LOD), foaming index, swelling index, extractive value and pH were performed by Indian Pharmacopoeia and the WHO-recommended parameters from plant powder**.**

Thin Layer Chromatography analysis: Thin-layer chromatography (TLC) is very common technique for separation, identification, and determining the purity of chemical compounds. The principle of separation in TLC is based on the adsorbent. TLC fingerprinting studies were performed. The studies were performed on size 5 x 20 cm and thickness 250 µm precoated silica gel 60 F254 plates. The prepared ethanol extracts (2 mg/ml in their respective solvents), and the standard quercetin and kaempferol solution (1mg/ml in methanol), respectively were applied to the TLC plates by using a capillary tube and the plates were allowed to air dry for 15-20 minutes after that the plates were kept inside Hot-air oven at 100-105°C for one hour, for activation of plates. The activated plates were immersed in a development chamber and TLC studies were carried out for different mobile phases with different ratios, covered with a proper lid, and then it was allowed to develop. After drying, then the TLC plates were kept inside the UV cabinet at short wavelength, 254 nm, and long-wavelength, 366 nm, for the visualization of the separated bands. Then, the Rf value of each different spot that was observed was calculated. Various mobile phases with varying ratios were tried for theCurcuma longa, Tinospora cordifolia and Gymnemasylvestreextract [12].

Preparation of SNEDDS (Self-Nanoemulsifying Drug Delivery Systems) tablets: The ratio of sesame oil: span 80:propylene glycol was made with comparison from 1:1:1 to 1:9:1. The determination of the percentage of each component is 1:1:1 (lower limit) until 1:9:1 (upper limit) with a total weight of SNEDDS was 5.0 grams. The formulation SNEDDS containing all herb extract 1.0 gram (1:1:1) with Curcuma longa, Tinospora cordifolia, Gymnemasylvestre. Weigh all ingredients, then vortexed for 1 minute, sonication for 15 minutes and incubation at a temperature of 45 °C.

Table 1: Various composition of SNEDDS containing (1:1:1) with Curcuma longa, Tinospora cordifolia, Gymnemasylvestre

F. Code	Proportion of sesame oil: span 80: propylene glycol (ratio)	Sesame oil	Span 80	Propylene glycol
PS1	01:01:01	1.67	1.67	1.67
PS2	01:02:01	1.25	2.5	1.25
PS3	01:03:01	1	3	1
PS4	01:04:01	0.83	3.33	0.83
PS5	01:05:01	0.71	3.57	0.71
PS6	01:06:01	0.62	3.75	0.62
PS7	01:07:01	0.56	3.89	0.56
PS8	01:08:01	0.5	4	0.5
PS9	01:09:01	0.25	4.5	0.25

Evaluation of Physical Properties of SNEDDS:

Optimization of best SNDDS on basis of Transmittance value (%): Clarity test using the transmittance value (%) parameter. The amount of 100.0 µL SNEDDS was added with 5.0 mL distilled water in a measuring flask and homogenized with vortex for 60 seconds, then measured using a UV-VIS spectrophotometry at max wavelength of 650 nm, distilled water was used as blank.

The results of the SNEDDS optimized for clarity (Transmittance) test compare with the water clarity. The optimum component of SNEDDS from the solubility transmittance clarity test results were Sesame oil: Span 80: propylene glycol in a ratio of 1:9:1, 1:8:1 and 1:7:1 shows a system that has a high percent transmittance value than other ones. Thus, the formulation code PS9, PS8, PS7 were evaluated for further studies [13].

Loading Dose: The loading dose of the herbals water extract that was able to be accommodated in the SNEDDS formula was carried out on the weight series 100, 150, and 200 mg. Plant extract for into the system then vortex for 1 minute, then mix with sonicator for 15 minutes, incubated in a water bath at 45 ºC for 15 minutes. The solubility of herbals water extract was observed by performed visually, then centrifugated at 6000 rpm for 10 minutes, observing the occurrence of precipitation or separation [14].

Emulsion time: The emulsion time was observed by taking an amount of 1.0 mL SNEDDS of each formula into 250.0 mL of distilled water is conditioned at 37 ºC above the magnetic stirrer at a speed of 100 rpm. Observations were made on the time required by SNEDDS to form the emulsion o/w [oil/water] marked by the complete mixing of the SNEDDS into the media. Observation physical stability of SNEDDS was carried out using the freeze-thawing method which refers to the study [8]. SNEDDS was taken each formula of 1.5 mL into Eppendorf, then stored at 4 and 30 ºC for 24 hours at each temperature during six cycles of storage, then centrifuged at 6000 rpm for 10 minutes. SNEDDS otherwise stable if there was no precipitation after centrifugation [15].

Particle Size Analysis of SNEDDS: Amount of 100 µL optimum SNEDDS formula was diluted to 5.0 mL of distilled water and mixed, then 3.0 mL was taken and put into the cuvette to be analyzed using the zetasizer instrument, particle size data obtained as an output on the computer are mean particle size distribution [16].

Results And Discussion

Procurement and Authentication of Plant material: A systematic approach is necessary in pharmacognostic study, which helps in confirmation and determination of identity, purity and quality of a crude drug. The plant specimen was authenticated,

Curcuma longa (rhizome): Curcuma longa is also known as haldi in India. The Curcuma longa plant is erect and can grow to a height of 0.5–1.0 m. It has an underground rhizome and an aerial shoot with leaves and flowers. The plant is sterile but can produce new sprouts from the branches of its rhizomes. The main rhizome, also known as round turmeric, is ovate or pear-shaped, while the secondary rhizome, also known as long turmeric, is cylindrical. The main rhizome can be up to 4 cm long and 3 cm thick, while the secondary rhizome is 0.5–1.5 cm thick. The main rhizome has leaf scars around the upper part and scars from secondary rhizomes and roots around the lower part. The secondary rhizome is indistinctly ringed. The fractured surface of the rhizome is orange-yellow and waxy. The rhizome is hard and tough, and sinks in water. The rind of the rhizome is thicker than ginger, making up almost a quarter of the thickness of the rhizome.

Tinospora cordifolia; Giloy(fruit):

Leaves of *T. cordifolia* are simple, alternate, glabrous exstipulate have long petiole approx. 12–15 cm. round, heart shaped, ovate lamina, 7–9 nerved. Stem of this plant is slightly succulent lengthy, filiform and climbing in nature. Aerial roots arise from the branches, which are characterized by tetra to penta-arch primary structure, removal of the exterior skin, the greenish color mucilaginous substance is observed. Bark is whitish creamy to greyish in color. Flowers are unisexual, yellow colored. Male flowers are in the form of bunch and female flowers acquire solitary inflorescence. Sepals are 6 (in 2 pair of 3 each). Petals are smaller than sepals and it is also 6, free and membranous. Flowering and fruiting occur during March to June, they are orange-reddish in color, fleshy, aggregate of 1–3 and ovoid on thick stalk

***Gymnemasylvestre*(levaes):** Gymnemasylvestre is a woody climber plant that is sometimes cultivated for medicinal purposes. It has small, yellow flowers that bloom throughout the year. Gymnemasylvestre leaves are elongated-oval in shape, with soft hairs on the upper surface. They are usually opposite on the plant, and are 3-5 cm long and 1.5 – 3cm wide. The leaves have a rounded or heart-shaped base, and are pubescent on both sides.

Microscopical study

Curcuma longa (rhizome): The transverse section of the rhizome is characterized by the presence of mostly thin-walled rounded parenchyma cells, scattered vascular bundles, definite endodermis, few layers of cork developed under the epidermis, and scattered oleoresin cells with brownish contents. The epidermis is consisted of thick-walled cells, cubical in shape, of various dimensions. The cork cambium is developed from the sub-epidermal layers and even after the development

of the cork, the epidermis is retained. Cork is generally composed of four to six layers of thin-walled brick-shaped parenchymatous cells. The parenchyma of the pith and cortex contains grains altered to a paste, in which sometimes long lens shaped unaltered starch grains of 4–15 µm diameter are found. Oil cells have suberised walls and contain either orange-yellow globules of a volatile oil or amorphous resinous masses. Cortical vascular bundles are scattered and are of a collateral type. The vascular bundles in the pith region are mostly scattered and they form discontinuous ring just under the endodermis. The vessels have mainly spiral thickenings and only a few have reticulate and annular structure.

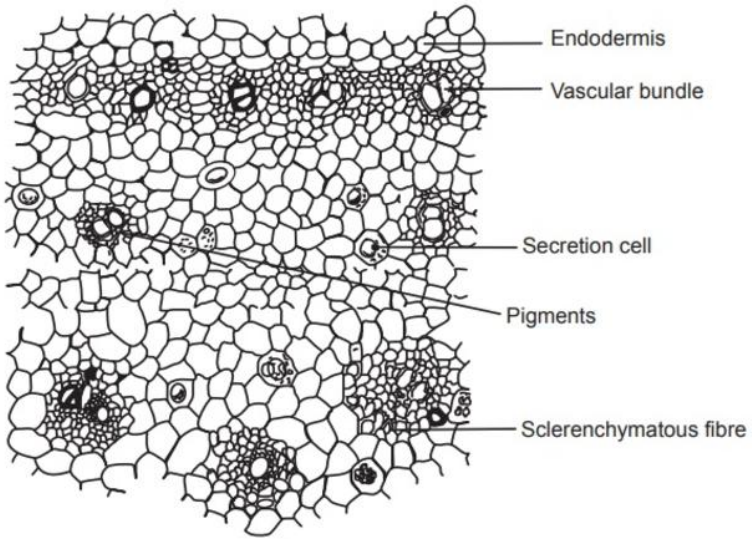


Figure 1: Microscopic study of Curcuma longa (rhizome)

***Tinospora cordifolia* (leaves):**

When viewed under a microscope, the leaves of the Tinospora cordifolia plant have the following characteristics. Anomocytic stomata are present, measuring 36–54 µm in length and 18–36 µm in width. Unicellular trichomes are present, measuring 115–145 µm in length and 32–42 µm in width. Reticulate venation with multicostate veins that are prominent on the dorsal side. The petiole is slender and long, ranging from 3–9 cm. The base of the petiole is pulvinate and slightly twisted. The transverse section of the petiole is circular in outline**.**

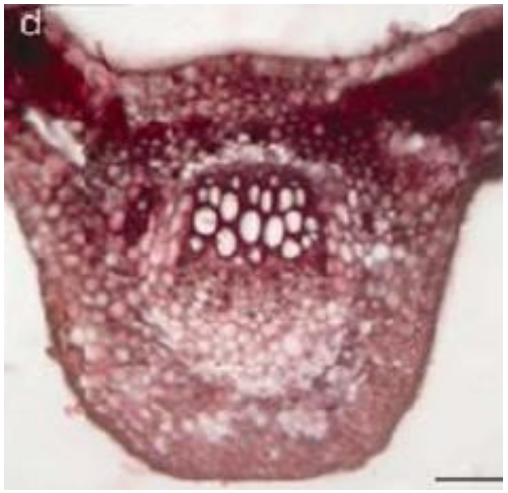
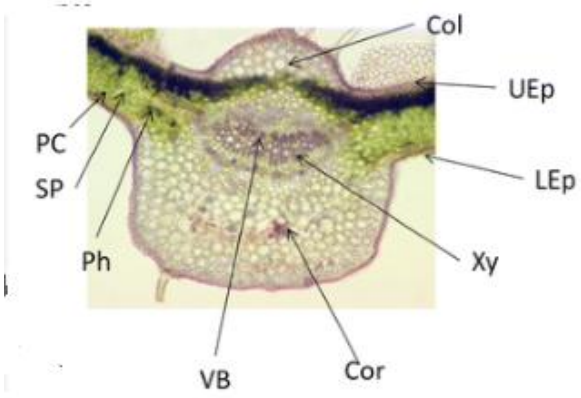


Figure 2: Microscopy of *Tinospora cordifolia* (leaves)

***Gymnemasylvestre*(leaves):** The T.S. of the leaves of Gymnemasylvestre having upper and lower epidermis covered with cuticle with uni or tri cellular covering trichomes which are slightly curved at the bulbous base. Below the epidermis is single layer of palisade cells followed by 2-3 layered spongy parenchyma. Midrib region shows 2-7 layers of collenchymatous cells. Stomata are of paracytic type, mostly on lower the surface. There is a fan shaped vascular bundle in the centre. Each vascular bundle is collateral, closed and surrounded by parenchymatous sheath. Rosette crystal of calcium oxalate present in the spongy parenchyma



Tr: Trichome; Epi: Epidermis; Co: Cork; Cor: Cortex; Col: Collenchyma; PC: Palisade Cells; SP: Spongy Parenchyma; Uep- Upper epidermis; End: Endodermis; Pe: Pericycle; Xy: Xylem; Ph: Phloem; VB: Vascular Bundle; MR: Medullary rays; Ves: Vessels; Pi: Pith

Figure 3: microscopy of *Gymnemasylvestre*(leaves)

Physico-chemical Investigations: The study of various physicochemical parameters of *Curcuma longa* (rhizome), *Tinospora cordifolia* (leaves), *Gymnemasylvestre*(levaes)was performed and the results were listed in Tables 6.4-6.6.

Curcuma longa (rhizome) were purchased from local market. *Tinospora cordifolia* (leaves) and *Gymnemasylvestre*(leaves) were collected from local area.

Table 1: Physicochemical parameters of *Curcuma longa* (rhizome)

S. No.	Physicochemical parameter values	(% w/w)	(% w/w)	(% w/w)
1	Total ash	8.92±0.23	4.74±0.18	8.82±0.67
2	Acid insoluble ash	2.65± 0.06	1.48± 0.11	1.21± 0.45
3	Water soluble ash	1.57±0.23	1.08±0.16	0.98±0.24
4	Sulphated ash	4.12±0.12	8.09±0.12	9.09±0.12
5	Foreign organic matter determination	1.04	1.21	1.98
7	Loss on drying	7.23±0.12	9.23±0.12	13.18±0.10

Table 2: Extractive values of various plants

Extract	Extractive Values (% w/w)	Color of extract
Curcuma longa (rhizome)	15.28	Brick red
Tinospora cordifolia (leaves)	13.24	Dark Green
Gymnemasylvestre(leaves)	14.79	Dark Green

Preliminary Phytochemical Screening: The qualitative phytochemical screening of the tubers for the presence of alkaloids, carbohydrate ,reducing sugars, glycosides like anthraquinones, flavanoids, saponins, tannins, phenolic compounds, fixed oils, fats, proteins, amino acids and sterols in extracts of the this plant were carried out.Qualitativephytochemicalscreeningofvariousextractsofthisplantwasconductedandtheresult revealed the presence of alkaloids, flavonoids, carbohydrates, cardiac glycosides, saponinglycosides,phenoliccompounds,tannins,terpenoidsandtriterpenes. Preliminary phytochemical analysis of *Curcuma*

longa (rhizome), *Tinospora cordifolia* (leaves), *Gymnemasylvestre*(leaves) extract investigated for the presence of various secondary metabolites using different solvents.

Table 3: Qualitative phytochemical screening of *Curcuma longa* (rhizome), *Tinospora cordifolia* (leaves), *Gymnemasylvestre*(levaes) extract

S. No.	Chemical class	*Curcuma longa* (rhizome) extract	*Tinospora cordifolia* (leaves) extract	*Gymnemasylvestre*(leaves)extract
1	Alkaloids	+	+	+
2	Napthoquinone	+	-	-
2	Steroids	+	+	-
3	Carbohydrate	+	+	+
4	Terpenoids	+	+	+
5	Tannin	+	+	-
6	Glycoside	-	+	-
7	Proteins	-	+	+
8	Flavonoids	+	+	+
9	Saponins	-	-	+
10	Fixedoilsand fats	+	-	-
11	Gum & mucilage	+	-	+

Thin Layer Chromatography (TLC) analysis of plant extracts: Various mobile phases with varying ratios were tried for the *Curcuma longa* (rhizome), *Tinospora cordifolia* (leaves), *Gymnemasylvestre*(leaves) extract. TLC profile of extract were shown in Figure 6.7.

Curcuma longa (rhizome): Mobile phase: ethyl acetate: glacial acetic acid : water (10 : 1.1 : 2.5)

Figure 4.: TLC of Curcuma longa (rhizome) extract

Tinospora cordifolia (leaves) extract Mobile phase: toluene: ethyl acetate : formic acid (7 : 6 : 0.5)

Figure 5: TLC of Tinospora cordifolia (leaves) extract

Gymnemasylvestre (leaves) extract; Mobile phase: ethyl acerate-methanol-water (7:1:2)

Observation: Under long U.V. (366nm)

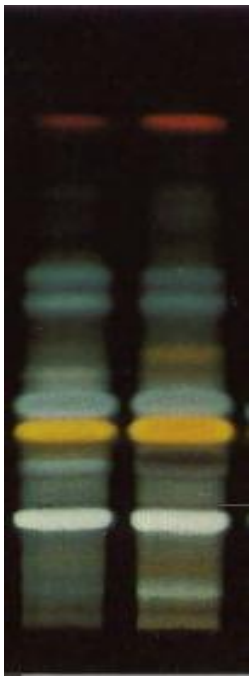


Figure 6.:TLCprofileofGymnemasylvestre (levaes) extract

Evaluation of Physical Properties of SNEDDS:

Table 4: Optimization of best SENDDS formulation

F. Code	Transmittance	Remark
PS1	46.97%	Cloudy
PS2	61.59%	Cloudy
PS3	55.40%	Cloudy
PS4	78.48%	Clear
PS5	84.53%	Cloudy
PS6	87.53%	Clear
PS7	98.80%	Clear
PS8	99.06%	Clear
PS9	99.62%	Clear

The aim of the orientation of the SNEDDS formula was to determine which formula could produce an emulsion mixture that had the same level of clarity (Transmittance) compare with the water clarity. The optimum component of SNEDDS from the solubility orientation results are Sesame oil: Span 80: Propylene glycol in a ratio of 1: 9: 1 shows a system that has a high percent transmittance value.

Table 5: Results of a loading dose of SNEDDS each 5.0 grams system into optimum formula based on transmittance value

F. Code	Amount	N1	N2	N3	Remark
PS7	300 mg	79.02%	79.16%	78.92%	Cloudy
PS7	200 mg	83.18%	83.11%	83.08%	Semi-clear
PS7	100 mg	87.08%	87.14%	87.42%	Semi-clear
PS8	300 mg	78.11%	78.06%	78.42%	Cloudy
PS8	200 mg	84.18%	84.11%	83.91%	Cloudy
PS8	100 mg	82.81%	82.13%	83.03%	Cloudy
PS9	300 mg	76.14%	76.46%	77.82%	Cloudy
PS9	200 mg	81.38%	82.14%	82.78%	Cloudy
PS9	100 mg	88.88%	89.04%	89.13%	Semi-clear

The test results in Table 6.2 showed that the ratio of formula 1:9:1, 1:8:1 and 1:7:1 with extract capacity of 200 mg gives clear results with the transmittance values in replication 1,2 and 3 not closely related to the difference in numbers. Cleare emulsion system, so that transmittance value was higher and closer to the water transmittance value and the higher transmittance value indicates that the droplets formed by the oil in the water was getting smaller and could be predicted to have a droplet size of 50 nm-300 nm. The particle size analysis results obtained from the droplet solution at a loading dose of 200 mg/5 gram system were 149.2 nm for PS9. Successful nano-emulsion had a clear visual appearance with transmittance values above 90%. The average transmittance value is 89.01%. The emulsification time describes the length of time needed

for the SNEDDS formula from the beginning of the dropping to emulsification and forms a homogeneous mixture in the medium with mild agitation. According there were emulsification types of nano-emulsions, including less than 30 seconds (A), less than 1 minute (B), less than 2 minutes (C) and between 4- 5 minutes (D). The centrifugation test aims to see the separation of the oil phase by damaging the absorbed emulator or surfactant layer around each grain. Freeze and thaw test to determine the physical stability of the SNEDDS formula at different temperature treatments in a relatively short period of time. The formula that was not deposition or stable had a phase separation value (F) = 1. The test results show that optimum formula SNEDDS herbals water extract had good stability with an average value of F was 0.95 and the emulsification time was 34.16 seconds [type B].

Summary And Conclusion

The overall results of this study indicated that an improved formulation of polyherbsSNEDDS was successfully developed.

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