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DESIGN DEVELOPMENT OF PHOSPHOLIPID COMPLEX OF SMILAX CHINA EXTRACT FOR EFFECTIVE TREATMENT OF DIABETES

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ABSTRACT

Phytoconstituents have been utilized as medicines for thousands of years, yet their application is limited owing to major hurdles like deficit lipid solubility, large molecular size and degradation in the gastric environment of gut. Recently, phospholipid-complex technique has unveiled in addressing these stumbling blocks either by enhancing the solubilizing capacity or its potentiating ability to pass through the biological membranes and it also protects the active herbal components from degradation.

A majority of the plant constituents, specifically phenolic compounds, are hydrophilic and possesses major hurdles like poor lipid solubility, large molecular size, and degradation in the gut owing to their liable nature to acidic and enzymatic environment which limits their application in the therapeutic usage. To improve the bioavailability of these water soluble molecules in the body, phospholipids based drug delivery system has been found to be promising. Owing to their better biocompatibility and biodegradability, natural materials like polysaccharides, proteins and phospholipids have gained much attention.

Phospholipid complex-technique, can serve as a potent drug delivery system for increasing therapeutic index which encapsulates, plant actives. In fact, these complexed actives are safer than its original form and can even serve as a better targeting agents to deliver these encapsulated agents at specific sites there by proving promising candidates in various medical fields for improving health aspects. This technique can be applied for herbal dosage forms and are often known as phytosomes. Present investigation deals with formulate phospholipid complex of hydroalcoholic extract of Smilax china for effective anti-diabetic effect.

KEYWORDS-*Phytoconstituents, Phospholipids, Phospholipid-complex technique, Bioavailability, Phytosomes, Smilax china.*

INTRODUCTION

Diabetes is a disease that occurs when your blood glucose, also called blood sugar, is too high. Glucose is your body's main source of energy. Your body can make glucose, but glucose also comes from the food you eat. The most common types of diabetes are type-1, type-2, and gestational diabetes. If you have type-1 diabetes, your body makes little or no insulin. Your immune system attacks and destroys the cells in your pancreas that make insulin. Type-1 diabetes is usually diagnosed in children and young adults, although it can appear at any age. People with type-1 diabetes need to take insulin every day to stay alive. If you have type-2 diabetes, the cells in your body don't use insulin properly. The pancreas may be making insulin but is not making enough insulin to keep your blood glucose level in the normal range. Type-2 diabetes is the most common type of diabetes. You are more likely to develop type-2 diabetes if you have risk factors, such as overweight or obesity, and a family history of the disease. You can develop type 2 diabetes at any age, even during childhood.

At current situation, human survival is largely dependent on the ecological resources onthis planet. Plant-based drugs have been used globally for human healthcare. Innumerous zone of total population of world's remains relies upon (grown plants) herbal plants medicinal for their essential/primary health care needs especially where present day medicines are not available in their areas.
Phospholipid complex-technique, can serve as a potent drug delivery system for increasing therapeutic index which encapsulates, plant actives. In fact, these complexed actives are safer than its original form and can even serve as a better targeting agents to deliver these encapsulated agents at specific sites there by proving promising candidates in various medical fields for improving health aspects. This technique can be applied for herbal dosage form and are often known as phytosomes. Present investigation deals with formulate phospholipid complex of hydroalcoholic extract of Smilax china for effective anti-diabetic effect.

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MATERIAL AND INGREDIENTS

Root of *Smilax china* L. was collected from local market of Bhopal the month of February, 2021. After the plant was collected they have been processed for cleaningin order to prevent the deterioration of phytochemicals present in plant.

QUALITATIVE AND QUANTITATIVE PHYTOCHEMICAL ANALYSIS

Preliminary phytochemical screening is primarily an important aspect for establishing profile of given extract for its chemical compounds produced by plant. Phytochemical examinations were carried out extracts as per the standard methods such as Detection of alkaloids, carbohydrate, glycosides, saponins, phenols, flavanoids, protiens, diterpenes.

RESULTS AND DISCUSSION

Table1: Different Formulations of Phospholipids Complex

Formulation	Ratio of Phospholipids and Cholesterol	Extract Concentration (%)	Dichloromethane Concentration
F1	1:1	1	25
F2	1:2	1	25
F3	1:3	1	25
F4	2:1	1	25
F5	2:2	1	25
F6	2:3	2	25

Table 2: Interpretation of Diffusional Release Mechanisms

Release exponent(*n*)	Drug transport mechanism	Rate as a function of time
0.5	Fickian diffusion	$_t$-0.5
0.5<*n*<1.0	Anomalous transport	$_t$n-1
1.0	Case-IItransport	Zero-order release
Higherthan1.0	Super Case-IItransport	$_t$n-1

Table 3: Extractive values of extracts of *Smilax china*

S.No.	Solvents	%Yield (W/W)
1	Pet. ether	2.58%
2	Hydroalcoholic	5.76%

Table 4: Result of Phytochemical screening of *Smilax china*

S. No.	Constituents	Hydroalcoholic Extract
1.	**Alkaloids** Hager's Test:	+ve
2.	**Glycosides** Legal's Test:	-ve
3.	**Flavonoids** Leadacetate Test:	-ve
4.	**Diterpenes** Copperacetate Test:	+ve
5.	**Phenol** Ferric Chloride Test:	+ve
6.	**Proteins** Xantho proteic Test:	***+ve***
7.	**Carbohydrate** Fehling's Test:	***+ve***
8.	**Saponins** Froth Test:	***-ve***

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Figure 1: Phytochemical screening of *Smilax china* of extract Result of estimation of total phenol and alkaloid content

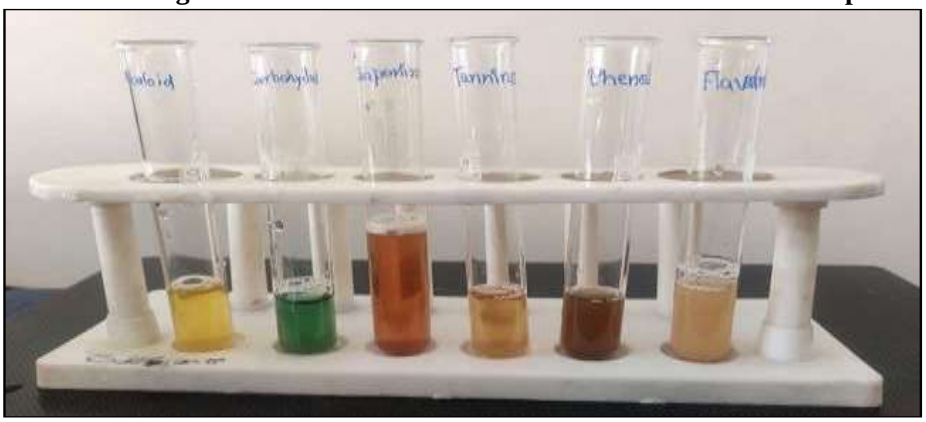

Table 5: Preparation of Calibration curve of Gallic Acid

S. No.	Concentration (µg/ml)	Mean Absorbance
1	10	0.226
2	20	0.412
3	30	0.614
4	40	0.803
5	50	0.966

Figure 2: Graph of Calibration curve of Gallic acid

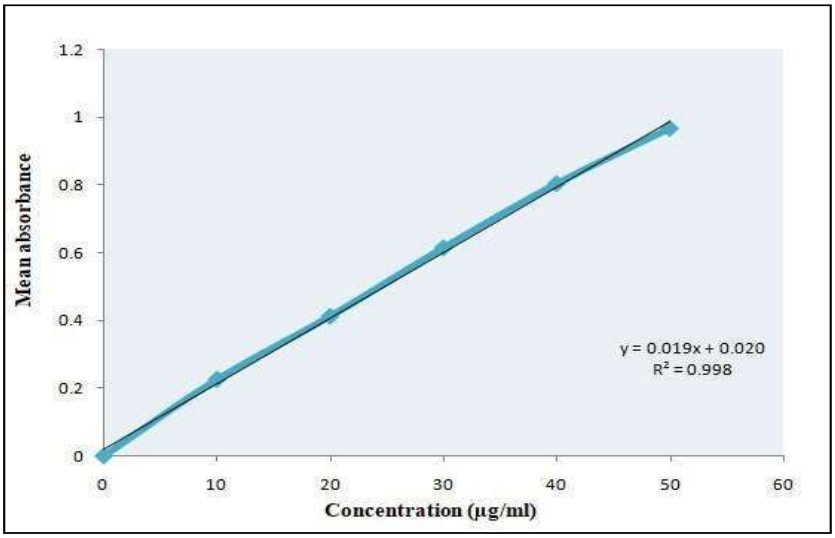

Table 6: Estimation of total phenolic and alkaloid content of *Smilax china*

S.No.	Extract	Totalphenolcontent (mg/100mg of dried extract)	Totalalkaloidcontent (mg/100mgofdried extract)
1.	Hydroalcoholic	0.756	0.632

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Figure 3: FT-IR spectra of hydroalcoholic extract

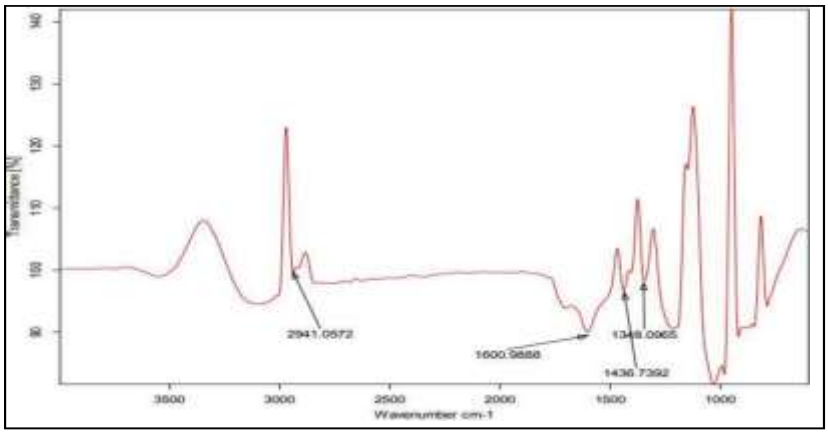

Table 7: Particle size and entrapment efficiency of drug loaded phospholipid complex

FormulationCode	Particlesize(nm)	EntrapmentEfficiency(%)
F1	355.25±0.32	45.65±0.25
F2	325.58±0.45	48.85±0.45
F3	345.65±0.25	53.32±0.22
F4	245.23±0.63	69.98±0.14
F5	305.65±0.54	57.74±0.32
F6	298.85±0.47	55.65±0.65

Average of three determinations (n=3)

Figure 4: Graph of Particle size and entrapment efficiency

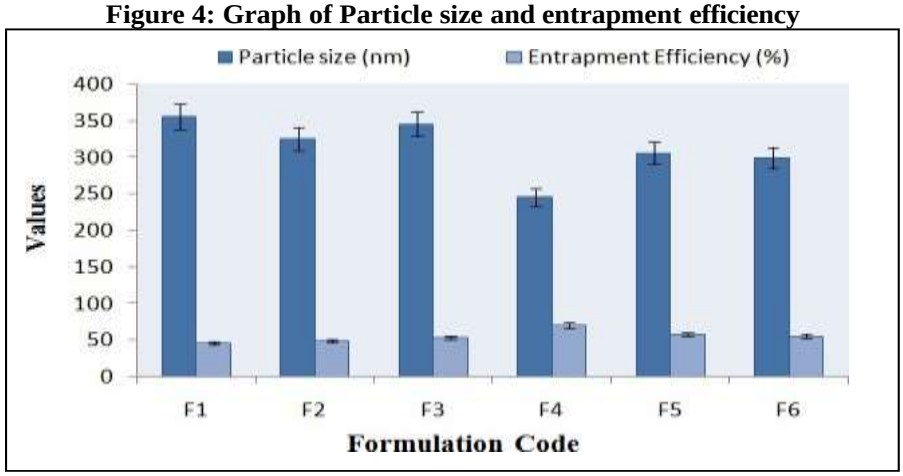

Table 8: *In-vitro* drug release data for optimized formulation F4

Time(h)	Square Root of Time(h)$^{1/2}$	Log Time	Cumulative*% Drug Release	Log Cumulative %Drug Release	Cumulative %Drug Remaining	Log Cumulative % Drug Remaining
0.5	0.707	-0.301	18.85	1.275	81.15	1.909
1	1	0	32.25	1.509	67.75	1.831
2	1.414	0.301	43.32	1.637	56.68	1.753
4	2	0.602	58.85	1.770	41.15	1.614
6	2.449	0.778	71.12	1.852	28.88	1.461
8	2.828	0.903	86.65	1.938	13.35	1.125
12	3.464	1.079	99.45	1.998	0.55	-0.260

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Table 9: % Inhibition of a carbose and Phospholipids complex F4

S.No.	Concentration (µg/ml)	%Inhibition	
		Acarbose	Phospholipids complex
1	100	51.19	27.54
2	200	70.10	33.65
3	300	74.20	39.14
4	400	85.18	42.88
5	500	88.75	57.69
IC50(µg/ml)		**35.33**	**444.63**

SUMMARY AND CONCLUSION

The powdered plant material (crude drug) contains active chemical constituents which are responsible for its biological activity. Extractive value determines the approximate measure of their chemical constituents in a given amount of plant material. % Yield of Pet. ether and Hydroalcoholic extract of *Smilax china* were found 2.58 and 5.76% respectively.

Alkaloids, diterpenes proteins, carbohydrate, phenol, and saponins are essential secondary metabolites which are present in hydroalcoholic extract of *Smilax china* plant. Except Flavonoids, glycosides, saponins.

Results of stability studies clearly indicates that optimized batches of phospholipids complex were stable over the chosen temperature and humidity conditions up to 3 months as were found no significant variation in physical appearance and % drug content. It can be concluded that the phospholipids complex containing *Smilax china* can provide a convenient and safe alternative to dosage form.

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