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ABSTRACT: Microsponges are microscopic spheres with pores, known for their inert nature. These spheres typically range in size from 10 to 25 micrometers and are synthesized using the Quasi-emulsion solvent diffusion method, a specialized technique for controlled release formulations. Their unique structure allows for the controlled release of active drug ingredients, making them particularly valuable in topical drug products. By delivering drugs directly to the skin in a controlled manner, microsponges help minimize systemic exposure and reduce local skin reactions to active drugs. Lovastatin belongs to the class of drugs called statins, which are used to lower blood cholesterol levels being BCS class II drug, having low solubility and high permeability considered as suitable candidate for formulating as Microsponges to overcome the problem like side effect, short half-life and low bioavailability. Lovastatin is a cholesterol bringing down specialist and it is quickly hydrolyzed to beta-hydroxyacid which is an inhibitor of 3-hydroxy-3-methylglutaryl-coenzyme A (HMG-CoA) reductase. It prevents the rate-limiting step in cholesterol biosynthesis, the conversion of HMG-CoA to mevalonate. Mutations in the mevalonate pathway gene are linked to porokeratosis. Remedial choices are not many and frequently restricted in viability. Porokeratosis might be alleviated by topical treatment that aims to replenish cholesterol, an essential end- product of the mevalonate pathway, and prevent theaccumulation of toxic mevalonate pathway metabolites, we hypothesized. Lovastatin Microsponges have potential applications in topical drug delivery systems. Topically applied Lovastatin Microsponges can increase the residence time of drugs in epidermis, while reducing the systemic absorption of the drug.

KEY WORDS: Microsponges, Quasi Emulsion Solvent Diffusion Method, Porous Particles, HMG-Coa, Porokeratosis, Mutations

INTRODUCTION

INTRODUCTION TO TOPICAL SUPERFICIAL ACTINIC POROKERATOSIS [1-2]

Porokeratosis is an enigmatic skin condition in terms of its etiopathogenesis, clinical presentation, histopathology and treatment options. Considered as a clonal keratinizing disorder of uncertain etiology, it clinically manifests as solitary or multiple atrophic patches surrounded by a hyperkeratotic ridge-like border which histopathologically corresponds to the cornoidlamella.Previously, it was assumed that cornoid lamellae emerge from sweat pores, but it was eventually understood that this concept was not correct. Ultraviolet light exposure, electron beam therapy,extensive radiation therapy, immunosuppression, transplant procedures, immunodeficiency syndromes, chronic renal failure, chronic liver disease, infections, hematological malignancies including lymphomas, HIV infection and hepatitisC virus infection have all been implicated in the pathogenesis. Local and systemic immunosuppression leading to reduction of immune surveillance and dysregulated proliferation of abnormal keratinocyte clones has been a well- accepted theory. Abnormal keratinocyte apoptosis was a proposed pathogenic factor in porokeratosis. This was best exemplified again in disseminated superficial actinic porokeratosis, which showed the presence of TUNEL (terminal deoxynucleotidyl transferase dUTP nick end labeling) - positive apoptotic cells seen under the conical lamellar structure. Segmental disseminated superficial actinic porokeratosis is believed to develop in a background of genetic alterations of keratinocytes in early embryogenesis leading to altered activity of regulatory proteins. Linear porokeratosis has been observed in monozygotic twins.

INTRODUCTION TO MICROSPONGES[3-4]

A microsponge's delivery system is a highly cross-linked, porous, polymeric microsphere, polymeric system consisting of porous microspheres that can entrap and release them into the skin over long period. This delivery system provides extended release with reduced irritation, better tolerance, improved thermal, physical and chemical stability. The Microsponges technology was developed by Won in 1987 and the original patents were assigned to advanced polymer system, Inc. This company developed a large number of variations of the technique and applied to the cosmetic as well as over the counter (OTC) and prescription pharmaceutical product. At present, this technology has been licensed to Cardinal Health, Inc, for use in topical products.

FORMULATION OF MICROSPONGES [5]

Drug loading in microsponges can take place in two ways, one-step process or by two-step process as discussed in liquid-liquid suspension polymerization and quasi emulsion solvent diffusion techniques which are based on physicochemical properties of drug tobe loaded.

1). Liquid-liquid suspension polymerization:

In this Liquid-liquid suspension polymerization method, the porous microspheres are prepared by suspension polymerization method in liquid-liquid systems. In their preparation, the monomers are first dissolved along with active ingredients in a suitable solvent solution of monomer and are then dispersed in the aqueous phase, which consist of additives (surfactant, suspending agents, etc.). The polymerization isthen initiated by adding catalyst or by increasing temperature or irradiation.

2). Quasi-emulsion solvent diffusion:

In this Quasi-emulsion solvent diffusion method that is two steps process where the microsponges can prepared by quasi-emulsion solvent diffusion method using the differentpolymer amounts. To prepare the inner phase, Eudragit RS 100 was dissolved in ethyl alcohol. Then, drug can be then added to solution and dissolved under ultrasonication at 35°c. The inner phase was poured into the PVA solution in water (outer phase). Following 60 min of stirring, the mixture is filtered to separate the microsponges. The microsponges are dried in an air-heated oven at 40°c for 12 hours and weighed to determine production yield (PY).

EVALUATION OF MICROSPONGE[6]

1).Particle size determination:

Laser light diffractometry or any other suitable methods are using to Particle size analysisof loaded and unloaded microsponges. The values can be expressed for all formulations, size range. Cumulative percentage drug release from microsponges of different particle size will be plotted against time to study effect of particle size on drug release. Particles larger than 30 μm can impart gritty feeling and hence particles of sizes between 10 and 25μm are preferred to use in final topical formulation.

2). Scanning electron microscope study:

For morphology and surface topography, prepared microsponges can be coated with gold palladium under an argon atmosphere at room temperature and then the surface morphology of the microsponges can be studied by scanning electron microscopy (SME).SEM of a fractured microsponge's particle can be taken its ultra structure.

3). Determination of loading efficiency and production yield:

The loading efficiency (%) of the microsponges can be calculated according to the following equation:

Loading efficiency = Actual Drug Content in Microsponge ×100/Theortical Drug Content.

4).Production yield:

The production yield of the micro particles can be determined by calculating accurately the initial weight of the raw materials and the last weight of the microsponge obtained. Production Yield (PY) = Practical Mass of Microsponges × 100 /Theortical Mass Theoretical mass (Polymer+drug).

5). Determination of true density:

The true density of Microsponges can be measured using an ultra-pycnometer under helium gas and is calculated from a mean of repeated determinations.

6). Compatibility studies:

Compatibility of drug with reaction adjuncts can be studied by thin layer chromatography (TLC) and Fourier Transform Infrared spectroscopy (FT-IR). Effect of polymerization on crystallinity of the drug can be studied by powder X-ray diffraction (XRD) and Differential Scanning Calorimetry (DSC).

7). Polymer/monomer composition:

Factors such as microsphere size, drug loading, and polymer composition govern the drug release from microspheres. Polymer composition of the MDS can affect partition coefficient of the entrapped drug between the vehicle and the microsponge system andhence have direct influence on the release rate of entrapped drug. Release of drug frommicrosponge systems of different polymer compositions can be studied by plotting cumulative % drug release against time.

INTRODUCTION TO GELS[7]

A gel is a solid or semisolid system of at least two constituents, consisting of a condensed mass enclosing and interpenetrated by a liquid. he word ‘‘gel’’ is derived from ‘‘gelatin,’’and both ‘‘gel’’ and ‘‘jelly’’ can be drawn back to the Latin gelu for ‘‘frost’’ and gel are, meaning ‘‘freeze’’ or ‘‘congeal.’’ This origin indicates the essential idea of a liquid settingto a solid-like material that does not flow, but is elastic and retains some liquid characteristics. Use of the term ‘‘gel’’ as a classification originated during the late 1800s as chemists attempted to classify semisolid substances according to their phenomenological characteristics rather than their molecular compositions. At that time, analytical methods needed to determine chemical structures were lacking.

DRUG PROFILE (LOVASTATIN)[8]

Lovastatin is an HMG-CoA reductase inhibitor. Lovastatin, also known as the brand name product Mevacor, is a lipid-lowering drug and fungal metabolitederived synthetically from a fermentation product of *Aspergillus terreus*. Originally named Mevinolin, lovastatin belongs to the statin class of medications, whichare used to lower the risk of cardiovascular disease and manage abnormal lipid levels by inhibiting the endogenous production of cholesterol in the liver.Lovastatin is a lactone which is readily hydrolyzed *in vivo* to the corresponding β-hydroxyacid and strong inhibitor of HMG-CoA reductase, a hepatic microsomal enzyme which catalyzes the conversion of HMG-CoA (3- hydroxy-3-methylglutaryl-coenzyme A) to mevalonate, anearly rate-limiting step in cholesterol biosynthesis. At therapeutic lovastatin doses, HMG-CoA reductase is not completely blocked, thereby allowing biologically necessary amounts of mevalonate to be available. Becausethe conversion of HMG-CoA to mevalonate is an early step in the biosynthetic pathway for cholesterol, therapy with lovastatin would not be expected to cause an accumulation of potentially toxic sterols. Lovastatin is a medication classified as a statin, which is a class of drugs used to lower cholesterol levels in the blood. Lovastatin is a cholesterol lowering agent and it is rapidly hydrolyzed to beta- hydroxy acid which is an inhibitor of 3-hydroxy-3-methylglutaryl-coenzyme A (HMG-CoA) reductase. It prevents the conversion of HMG-CoA to mevalonate whichis rate limiting step in the biosynthesis of cholesterol. Porokeratosis is associated with mevalonate pathway gene mutations. Therapeutic options are few and often limited in efficacy. We hypothesized that topical therapy that aims to replenish cholesterol, an essential mevalonate pathway end-product, and block the accumulation of mevalonate pathway toxic metabolites could alleviate porokeratosis. Common side effects of lovastatin may include headache, muscle pain, and gastrointestinal symptoms. Serious side effects, though rare, can include myopathy (muscle damage) and rhabdomyolysis (a severe form of muscle damage). Hence, Lovastatin is an antihyperlipidemic agent to treat high blood cholesterol and reduce the risk of cardiovascular disease. Recent studies suggest that statins may have potential as novel treatments for diverse conditions, ranging from sepsis and inflammatory diseases to chronic wounds and bone fracture. Lovastatin Microsponges are the best fit as they are porous, polymeric microspheres which are designed to deliver a pharmaceutical active ingredient efficiently at the minimum dose and also to enhance solubility and stability, reduce side effects, and modify drug release by using topical gel which provides highest patient compliance.

MATERIALS

Lovastatin was procured from market. Polymers like Eudragit RS100, Ethyl Cellulose, Eudragit RL 100 Etc. were purchased from market. Organic Solvents like Ethanol, Methanol, Acetone, Dichloromethane were used. Stabilizers like Polyvinyl Alcohol, Tween 80 were used. Outer Phase like Liquid Paraffin and water were used. Gelling Agent like Carbopol and HPMC were used. pH modifier like Triethanolamine was used. Viscosity Enhancer like Polyethylene glycol (PEG) was used. Preservatives like Methyl Paraben and Propyl paraben were used. All these materials were purchased from the market.

RESULT AND DISCUSSION

Calibration Curve of Lovastatin:

Accurately weighed 100 mg of Lovastatin and dissolved in 30 ml methanol then made volume up to

100 ml by phosphate buffer pH 7.4 to get a concentration of 1000 µg/ml. From the above solution, 1 ml of solution was withdrawn accurately with the help of pipette and transferred to 10 ml volumetric flask. volume was made up to the mark with phosphate buffer 7.4 to make stock solution (100µg/ml) made the dilution of above concentration 2,4,6,8,10 (µg/ml) and determine absorbance by Shimadzu UV-visible double beam spectrophotometer.

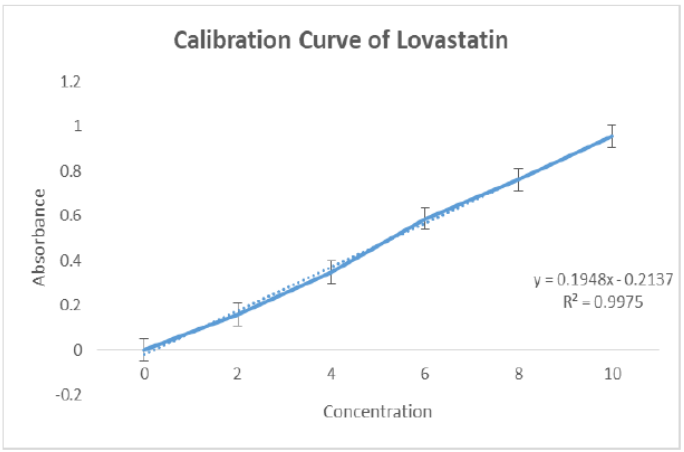

Figure 1: Calibration curve of Lovastatin

Identification of Drug- Lovastatin by FT-IR Spectroscopy:

The IR range of Lovastatin was recorded utilizing Fourier transform infra-red spectrophotometer. Sample preparation was finished by blending the drug in with potassium bromide (1:300), mix it in glass mortar. A transparent pellet of the combination was framed and set in the sample holder and looked over a recurrence range 400- 4000^{cm-1}. The spectrum obtained was compared with reported standard.

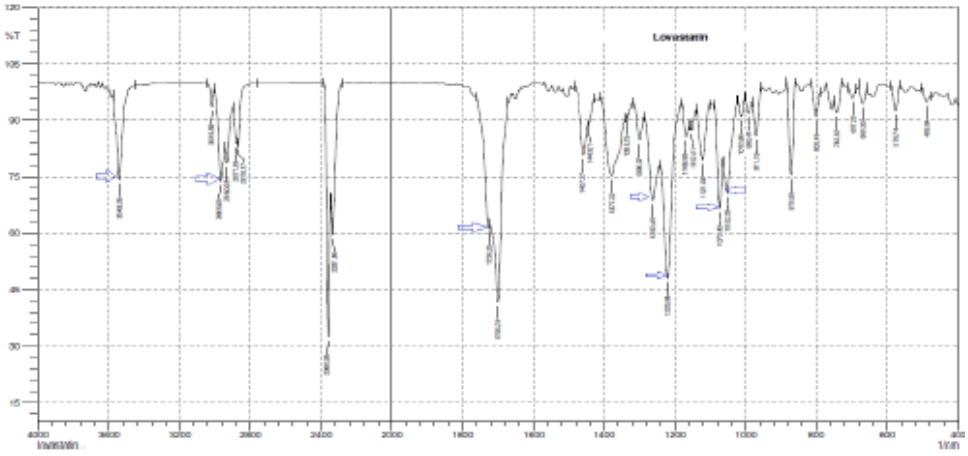

Figure 2: Identification of Drug- Lovastatin by FT-IR Spectroscopy

Method of Preparation Lovastatin loaded Microsponges

This is a two stage process where the Microsponges may be ready by Quasi- emulsion solvent diffusion method utilizing the various polymers. This is the two stage framework wherein the inner phase contained drug, suitable organic solvent (for dissolving drug), polymer(i.e Eudragit RS 100 or ethyl cellulose) and triethylcitrate (TEC) as plastisizer, which was added at a measure of 20% of the polymer to order with the plasticity dissolved under ultrasonication at 35oC. In another beaker PVA is dissolved in water. Add inner phase (organic solution) drop by drop in external phase (PVAsolution) under magnetic stirrer at 1000-2000 RPM under room temperature for 60 mins, the combination is filter and separate the microsponges. The microsponges are dried in an oven at 400oC for 12 hour and weight..

Formulation of Lovastatin loaded Microsponges by using QbD Approach

The critical quality attributes are categorized in high, medium and low risk parameters based on knowledge space to check influence of formulation and process parameters. Usually, high risk

parameters are considered important for Design of Experiments as they are having more effect than others and need to be in accepted multivariate ranges. The Critical parameters and critical quality attributes (CQAs) for selection of optimum formulation are shown in table.

Table 1: 3^2 factorial Design Batches

Independent variables			
Independent variables	Low (-1)	Medium (0)	High (+1)
Drug: polymer (X1)	1:1	1:2	1:3
Stirring speed (RPM) X2	500	1000	1500
Dependent variables			
Y1 - Yield (%)			
Y2-% Drug Content			
Y3-% Cumulative Drug release in Hours			

Table 2: Formulation and Characterization of Lovastatin Microsponges

Batch	Drug: polymer (X1)	Stirring Speed (RPM) (X2)	Yield (%)	Drug Content (%)	% CDR in Hours
LMS 1	1:1	500	94.3±1.23	93.1±1.32	88.96±1.43
LMS 2	1:1	1000	96.99±1.27	93.6±1.30	89.06±1.52
LMS 3	1:1	1500	92.5±1.30	93.4±1.28	87.98±1.37
LMS 4	1:2	500	93.7±1.37	92.8±1.24	83.11±1.32
LMS 5	1:2	1000	95.6±1.35	94.6±1.21	87.3±1.47
LMS 6	1:2	1500	92.4±1.18	91.3±1.35	85.94±1.28
LMS 7	1:3	500	94.4±1.12	92.54±1.31	86.1±1.25
LMS 8	1:3	1000	90.5±1.15	92.8±1.07	89.41±1.22
LMS 9	1:3	1500	93.55±1.21	93±1.10	89.75±1.24

Statistical Analysis

Design expert version 10 was used for statistical analysis and to produced first order polynomial equations. From preliminary results, 32 full factorial design was utilized in which two factors was evaluated, separately at three levels and possible nine combinations were formulated. Three level factorial studies were carried out using two different variables. In first factorial design, Drug: Polymer Ratio (X1) and Stirring Speed (X2) was taken as independent variables while %Yield (Y1), %Drug Content(Y2) and % Cumulative Drug Release(Y3) was selected as dependent variables for both factorial designs.

Effect on % Yield (Y1) surface response study:

Negative value of a indicates decrease in % Yield. Positive value of coefficient B indicates increase in

%Yield. It indicates linearity of surface response and contour plot as show in figure. Full modes were found significant for two independent variables and detailed ANOVA, Response surface counter plot and 3D plots are as follows:

%yield =+95.79-0.66 * A+1.29* B+0.26* AB-2.79 * A2 -0.24* B2

Table 3: ANOVA TABLE for Response surface Y1

ANOVA for Response Surface Quadratic model						
Analysis of variance table [Partial sum of squares - Type III]						
	Sum of		Mean	F	p-value	
Source	Squares	df	Square	Value	Prob > F	
Model	28.53	5	5.71	167.13	0.0007	significant
A-drug:polymer ratio	2.60	1	2.60	76.17	0.0032	
B-stirring speed	9.98	1	9.98	292.46	0.0004	
AB	0.28	1	0.28	8.07	0.0656	
A^2	15.55	1	15.55	455.47	0.0002	
B^2	0.12	1	0.12	3.47	0.1594	
Residual	0.10	3	0.034			
Cor Total	28.63	8				

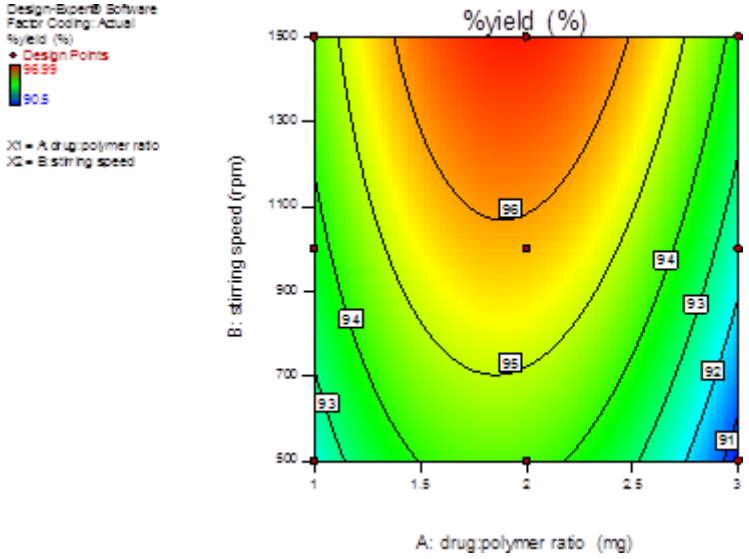

Figure 3: Response surface plot DRUG: POLYMER (mg) and Stirring Speed(RPM) on %Yield(Y1)

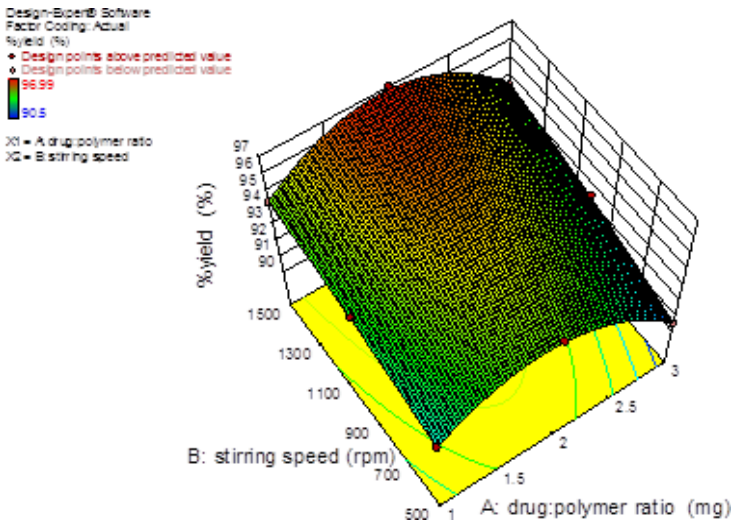

Figure 4: 3D surface plot DRUG: POLYMER (mg) and Stirring Speed (RPM)on %Yield(Y1)

Effect on % Drug Content (Y2) Surface response study:
Positive value for coefficient of B Stirring Speed in equation indicates increase in % Drug Content. Positive value of coefficient of A indicates in %Drug Content. It indicates linearity of surface response and counter plot.
%drug content= +94.35 + 0.43* A + 0.32* B - 0.26* AB - 1.13* A2 - 0.88* B2

Table 4: ANOVA TABLE for Response surface Y2

ANOVA for Response Surface Quadratic model						
Analysis of variance table [Partial sum of squares - Type III]						
	Sum of		Mean	F	p-value	
Source	Squares	df	Square	Value	Prob > F	
Model	6.07	5	1.21	17.87	0.0193	Significant
A-drug:polymer ratio	1.09	1	1.09	16.09	0.0278	
B-stirring speed	0.63	1	0.63	9.24	0.0559	
AB	0.27	1	0.27	3.98	0.1399	
A^2	2.54	1	2.54	37.40	0.0088	
B^2	1.54	1	1.54	22.64	0.0176	
Residual	0.20	3	0.068			
Cor Total	6.27	8				

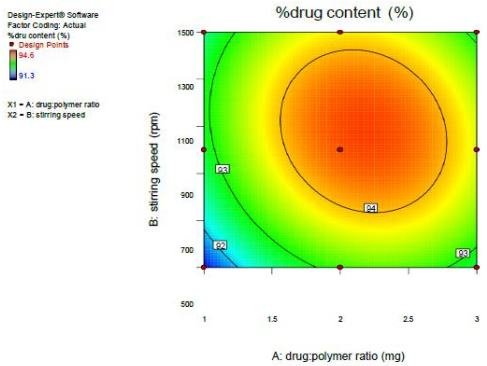

Figure 5: Response surface plot DRUG: POLYMER (mg) and Stirring Speed (RPM) on Drug content (Y2)

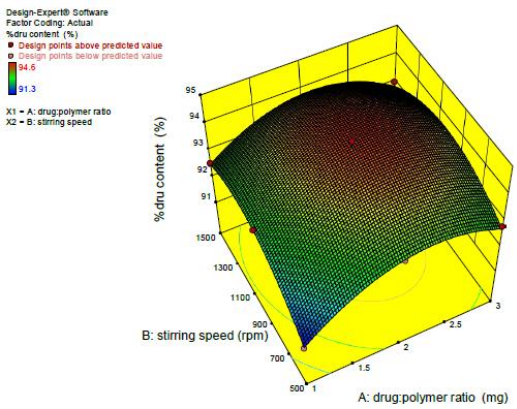

Figure 6: 3D surface plot DRUG: POLYMER (mg) and Stirring Speed (RPM) on Drug content (Y2)

Effect on % Cumulative Drug release (Y3) Surface response study:
Positive value for coefficient of B Stirring Speed in equation indicates increase in %CDR. Positive

value of coefficient of A indicates in %CDR. It indicates linearity ofsurface response and counter plot.

%cumulative drug release in hrs =+87.06+2.00* A+0.100* B+0.045* AB-1.39* A2 +2.07* B2

Table 5: ANOVA TABLE for Response surface Y3

ANOVA for Response Surface Quadratic model						
Analysis of variance table [Partial sum of squares - Type III]						
	Sum of		Mean	F	p-value	
Source	Squares	df	Square	Value	Prob > F	
Model	36.50	5	7.30	30.78	0.0088	significant
A-drug:polymer ratio	23.96	1	23.96	101.02	0.0021	
B-stirring speed	0.060	1	0.060	0.25	0.6496	
AB	8.100E-003	1	8.100E-003	0.034	0.8652	
A^2	3.87	1	3.87	16.33	0.0273	
B^2	8.60	1	8.60	36.25	0.0092	
Residual	0.71	3	0.24			
Cor Total	37.21	8				

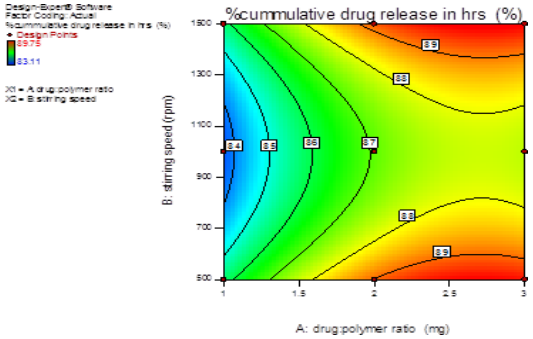

Figure 7: Response surface plot DRUG: POLYMER (mg) and Stirring Speed (RPM) on %CDR(Y3)

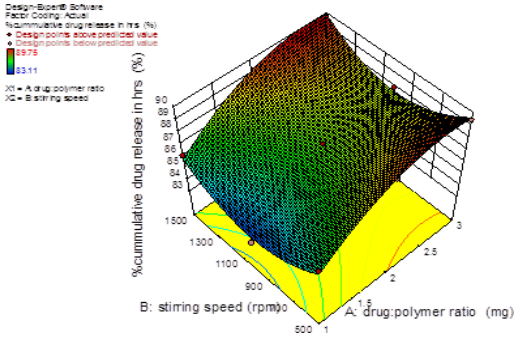

Figure 8: 3D surface plot DRUG: POLYMER (mg) and Stirring Speed (RPM) on %CDR (Y3)

Validation:

From polynomial equation generated for response, intensive grid and integrated examine was performed over experiment field using design Expert software 10. During independent variable characterization study, impact of parameter DRUG: POLYMER (mg)and Stirring Speed (RPM)were assessed. Criteria consideration of response % Yield (Y1), %Drug Content and %Cumulative Drug release (Y2) is between 1-8 hrs. and 84-90%respectively. Design space shown in figure 5.16 also called as overly plot which is shaded region with yellow color indicates that region of successful operating ranges.

Check point analysis of validation batches:

Batch 10 & 11 formulation was made for check point analysis and predictand experimental values compared.

Table 6: Validation of Batch: Predicted & Actual Response

Batch	Drug: Polymer ratio (X1)	Stirring Speed (X2)	% Yield (Y1)	% Drug content (Y2)	% Cumulative Drug release (Y3)
10 (Predicted)	2.83	1293	91.07	92.67	87.54
10 (Actual)	2.83	1293	93.96	92.56	87.43
11 (Predicted)	2.84	666	92.11	93.44	88.58
11 (Actual)	2.84	666	91.00	92.33	87.47

Table 7: % Cumulative drug release profile of Microsponges

Time (Hours)	Batch 10 (Mean± S.D.) (n=3)	Batch 11 (Mean± S.D.) (n=3)
0	0	0
1	29.54±1.38	33.84±1.45
2	38.61±1.97	41.16±1.67
3	46.77±1.77	48.92±1.83
4	59.13±0.86	55.09±1.34
5	68.35±1.43	67.61±1.62
6	74.12±1.73	74.33±1.18
7	84.26±1.14	83.97±0.90
8	87.54±1.49	87.47±0.97

Table 8: Formulation of final optimized batch

Ingredients	Batch 11
Drug: Polymer ratio [Lovastatin: Eudragit RS100]	2.84
Volume of Inner phase (ml) [methanol: DCM]	20
Volume of Outer phase(ml) [water]	30
Surfactant [PVA] Conc. (mg)	100
Stirring Speed (R.P.M)	666
Stirring Time (min)	75

Formulation of Lovastatin microsponge loaded topical gel

Gelling Agent was soaked in water for 2 h and then dispersed by agitation at approximately 600 rpm with the aid of magnetic stirrer to get a smooth dispersion. The dispersion was allowed to stand for 15 min to expel entrained air. To it the aqueous solution of triethanolamine (2% v/v) was added with slow agitation for adjusting pH to 6.5–7.5. At this stage permeation enhancers and microsponges containing drug were incorporated into the gel base. Prepared gels were packed in wide mouth glass jar covered with screw capped plastic lid after covering the mouth with aluminum foil and were kept

in dark and cool place until use.

Table 9: Formulation of Lovastatin microsponge loaded topical gel

Ingredients	Optimized Gel
Optimized Batch (mg)	100
HPMC (gm)	1.5
Polyethylene glycol (gm)	5
Methyl paraben (gm)	0.1
Propyl paraben (gm)	0.05
Triethanolamine (ml)	0.25
Water (ml)	100

Characterization of Lovastatin microsponge loaded topical gel

Physical Evaluation :

It will be evaluating Organoleptic property, Occlusiveness and wash ability of gel.

Measurement of pH of Gel:

The pH will be checked by a digital pH meter of formulated gel.

Viscosity study of Gel:

50 gm of arranged gel will be kept in 50 mL beaker and shaft Groove will dipped at specific RPM in Brookfield Viscometer. This was completed multiple times and recorded observationwill considered as mean of viscosity.

Spreadability of Gel:

An accurately weighed quantity of 1 g of gel will be pushed among two slides and left as suchfor about 5 minutes. Diameters of speed circles was measure in cm and were taken as comparative values for spreadability when no further spreading. The readings attained are mean of three determinations.

Homogeneity and Grittiness:

The consistency of prepared gel will be determined by pressing between the thumb and theindex finger. Minor quantity gel is wiped on skin of back of hand to check the homogeneity and grittiness.

Drug Content:

1 gm of each gel formulation will be determined in 20 mL of alcohol in volumetric flask with 30 min mixing. At long last, it was diluted and separated. Further dilution was made up to 10mL alcohol and again 1 mL was removed from above and diluted to 10 mL alcohol. The absorbance was estimated at 238 nm in UV.

Table 10: Characterization of Optimized LMSG

Parameter	Optimized LMSG
Dose	2 gm
Strength	20 gm
Clarity	Clear
Odour	Odourless
pH (mean ±S.D.) (n=3)	6.71±0.024
Spreadability (mean ±S.D.) (n=3)	10.67±0.85
Viscosity (mean ±S.D.) (n=3)	9157±0.76
% Drug content (mean ±S.D.) (n=3)	94.47±0.24

From these data we have found that Lovastatin microsponge topical gel prepared from Eudragit RS 100 having greater drug content and Spreadability mostly LMMSG containing APR-ER100

Microsponge. Table shows data for drug content, Spreadability, clarity, pH of various Lovastatin Topical Gel.

In-vitro Diffusion studies

In-vitro dissemination study will be performed utilizing Design glass cylinder (open at the twoends). Weighed 1 gm of gel was moved in 20 mL Phosphate buffer in 250 mL volumetric flaskwith mixing for 30 mins. The volume were made up to 100 mL and filter. 1 mL of above solution was diluted to 10 mL with Phosphate buffer and further 1 mL of the above solution were diluted to 10 mL with Phosphate buffer. The absorbance of the solution was estimated spectrophotometrically at 238 nm.

Table 11: ***In-Vitro Diffusion Studies***

Time	**%CDR (Mean± S.D.) (n=3)**
0	0
1	34.37±1.36
2	42.02±1.79
3	50.72±1.32
4	62.02±1.80
5	72.64±1.63
6	79.37±1.92
7	88.18±1.52
8	95.64±1.68

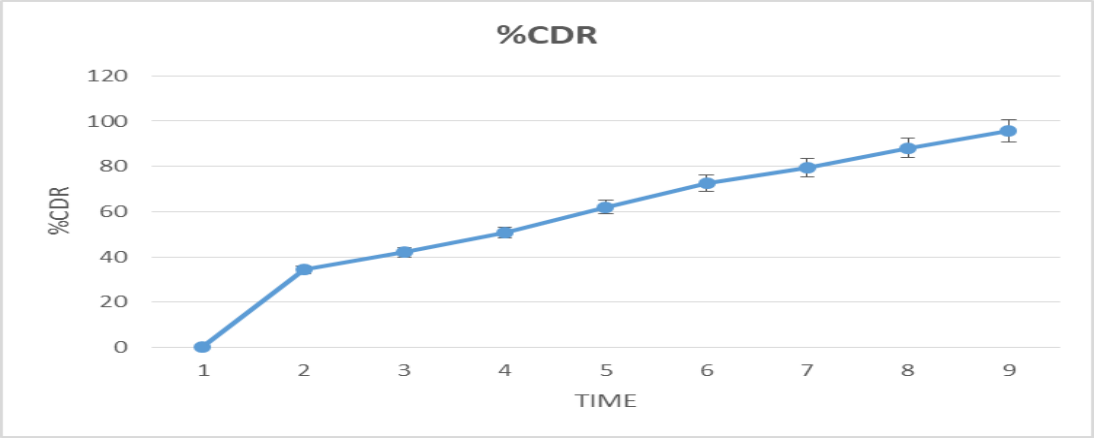

Figure 9: ***In-Vitro Diffusion Studies***

Stability Study

The drug or dosage form quality will be affected under impact of by varying temperature, humidity and light with time which was found out by stability testing. It was carried out at 25°C ± 2°C/ 60% RH ± 5% RH and 40°C ± 2°C/ 75% RH ± 5% RH for the selected formulation for three months. Samples were withdrawn on 0th, 10th, 20th and 30th day and were analysed for physical appearance and drug content.

Table 12: Stability Study

Parameter	Optimized Lovastatin Microsponges loaded Gel			
	Room temperature			
	0 day	10 days	20 days	30 days
Clarity	Clear	Clear	clear	Clear
Odour	Odourless	Odourless	odourless	odourless
pH	6.71±0.024	6.75±0.018	6.74±0.024	6.74±0.024
Spreadability	10.67±0.85	10.61±0.76	10.59±0.71	10.59±0.71
Viscosity	9157±0.76	9149±0.75	9154±0.72	9154±0.72
%Drug content	94.47±0.24	93.25±0.21	93.21±0.25	93.21±0.25

CONCLUSION

Microsponges serve as efficient carriers for Lovastatin, facilitating its targeted delivery to theskin. The porous structure of microsponges enhances drug loading capacity and promotes sustained release, ensuring prolonged drug action at the site of application. Lovastatin-loadedmicrosponges enhance the penetration of the drug through the stratum corneum, allowing for deeper penetration into the skin layers. This enhanced skin permeation improves drug distribution within the skin, potentially leading to improved therapeutic efficacy. The formulation of Lovastatin-loaded microsponges enables sustained release of the drug over anextended period. This sustained release profile ensures prolonged drug action, reducing the frequency of application and improving patient compliance.

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