Section A-Research Paper
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To Develop And Evaluate Niosomal Gel Formulation For Treatment Of Psoriasis Disease

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Abstract **—** Autoimmune condition psoriasis is characterized by silvery red, flaky lesions. As one ages, it occurs more frequently and frequently. It is an autoimmune disease with a genetic component, but the immunological dysfunction that results positions T-cells at the centre of immunogenetic mechanisms. Psoriasis affects approximately one-fourth of the global population. The clinical diagnosis of psoriasis is primarily based on the patient's unique medical history and physical exam findings. Therapies for psoriasis management are based on the severity of the condition. The most common treatment for psoriasis is topical therapy employing standard dosage forms with minimal adverse effects. Biological therapy was also proposed as an alternative to conventional treatment for certain types, while nano formulation has emerged as a revolutionary advance over the status quo. The use of nanocarriers in psoriasis treatment is a relatively recent innovation. Using nanocarrier-based drug delivery systems allows for targeted medication delivery with improved safety and efficacy. Treatments for psoriasis frequently employ nanocarriers like liposomes, nanostructured lipid nanoparticles, niosomes, and nano emulsions. Increased patient compliance, targeted medication administration, and enhanced safety and efficacy have all contributed to the rise in popularity of nanocarriers. Therefore, the objective of this thesis is to enhance psoriasis treatment by developing a niosomal gel. As a niosomal drug delivery system, the new niosomal gel is demonstrated to be an enhanced method of treating psoriasis with minimal adverse effects. Given that psoriasis is an autoimmune disorder, the use of nanocarriers in conjunction with immunosuppressive medication may be beneficial. Tacrolimus represents an innovative new approach to treating this condition. Improving treatment efficacy necessitates careful consideration of the formulation and dosage of medication fractions. The incorporation of nanotechnology into medication localization and topical targeted administrations bodes well for the creation of nanocarriers for dermatological applications. In conclusion, the optimal treatment for psoriasis will necessitate the development of trustworthy, innocuous nanocarrier technologies. Incorporating the current orally administered drug moiety into nanocarriers for topical distribution would enhance therapeutic payload while decreasing adverse effects, resulting in a more effective treatment for psoriasis.

Keywords — Niosomes, Gel formulation, Psoriasis, Drug delivery, Skin diseases, Nanotechnology

I. INTRODUCTION

Psoriasis is a skin ailment that is characterized by the presence of a chronic immune response. It affects somewhere in the range of 2% to 4% of the total population of the globe. The aberrant growth of skin cells, which leads to the formation of red, scaly plaques on the skin, is the characteristic that distinguishes this disorder from others like it. The most common forms of treatment for psoriasis today include topical lotions, phototherapy, and systemic medications. On the other hand, these treatments often come with a number of downsides, the most common of which are insufficient pharmaceutical penetration into the skin, restricted patient compliance, and dangerous side effects.

There seems to have a surge in fascination with cutting-edge medicine administration methods lately. within the field of dermatology. This is due to the fact that these systems provide potential answers that may help dermatologists overcome the limitations of the treatments that are now available. Niosomes are a kind of lipid-based vesicular system. Niosomes have recently come to the attention of researchers as a candidate for the role of carriers in the process of delivering drugs to the skin. Because of their enhanced skin penetration, controlled drug release, and increased drug stability, niosomal gel formulations are an attractive option for the treatment of psoriasis.

II. OVERVIEW OF PSORIASIS:

A. Definition and epidemiology of psoriasis

Psoriasis is a skin condition that is immune-mediated and persistent. It affects around 2% to 4% of the world's population. The abnormal proliferation of skin cells, which results in the creation of red, scaly plaques on the skin, is the defining feature of this condition. Psoriasis has a substantial negative influence on the quality of life of those who suffer from it since it may cause both physical and mental anguish, as well as a social shame. Psoriasis is thought to be caused by a confluence of genetic predisposition and environmental stimuli, despite the fact that its root cause is still a mystery and cannot be pinpointed with absolute certainty.

B. Pathogenesis and etiology of psoriasis

Psoriasis is thought to be an immunological-mediated illness, with immune dysregulation playing a fundamental role in its etiology Dendritic cells or T cells, particularly the CD4+ and CD8+ categories of T cells, are thought to play important roles in the initiation as well as development of psoriatic lesions. T cell activation causes the creation of pro-inflammatory cytokines that include tumor necrosis factor-alpha (TNF-alpha), interleukin-17 (IL-17), and interleukin-23 (IL-23), all of which increase inflammation and the aberrant proliferation of keratinocytes.

Psoriasis is a condition that may be caused by a combination of environmental and genetic causes. Psoriasis has been linked to a number of susceptibility genes, some of which are involved in immunological modulation, epidermal development, and the function of the skin barrier. These genes were discovered by genome-wide association studies (GWAS). Psoriatic flares may be exacerbated or triggered by Outside influences like injuries, illnesses, worry, as well as certain drugs in persons who are genetically predisposed to developing the condition.

C. Clinical manifestations and severity grading of psoriasis

Psoriasis manifests itself in a broad variety of clinical symptoms, each of which may range in terms of how severe they are and how far they spread. The most common kind of psoriasis is plaque psoriasis, which is characterized by well-defined, erythematous patches coated with silvery-white scales. Typically, these plaques appear on the elbows as well as knees, cranium, as

well as lower back; nevertheless, they are capable of manifesting themselves anywhere on the body.

Other forms of psoriasis There are many types of psoriasis, including guttate psoriasis, pustular psoriasis, inverse psoriasis, or erythrodermic psoriasis; every has its own collection of clinical signs. Psoriasis may be scored using a variety of different indices, such as the Psoriasis Area and Severity Index (PASI) and the Physician Global Assessment (PGA), to determine the severity of the condition. These scoring methods measure the severity of the illness by taking into consideration the amount to which the disease has spread throughout the body's surface area, as well as erythema, scaling, and plaque thickness.

III. CHALLENGES IN PSORIASIS TREATMENT:

When treating mild to severe psoriasis, conventional Topical treatments, including corticosteroids, vitamin D analogues, retinoids, as well as formulations containing coal tar, are often employed as the first line of defence. But these therapies have drawbacks that make them less effective and make it harder for patients to stick with them. The following is a list of some of the issues that are connected with standard topical treatments:

- ***Only a Slight Amount of Drugs Are Present:*** The stratum corneum, or outermost portion of the skin, acts as an obstacle, limiting the capacity of locally administered drugs to permeate lower layers of the skin, which is where pathological alterations take place. Because of this restricted medication penetration, topical therapies have a reduced capacity for therapeutic benefit.
- ***Poor Observance by the Patient:*** It is common for topical medicines to need administration on a regular basis and extended treatment times, both of which might contribute to poor patient compliance. Because of the inconvenient nature of these therapies and the amount of time commitment required, non-adherence may occur, which can negatively affect treatment results.
- ***Negative Effects on the Body:*** When used for an extended period of time, corticosteroids and other topical drugs may induce adverse effects such as skin shrinkage and telangiectasia, as well as systemic absorption, which can result in systemic side effects. These negative consequences prevent their usage for an extended period of time and call for the research and development of safer therapy alternatives.

IV. EVALUATION PARAMETERS FOR NIOSOMAL GEL FORMULATIONS:

A Niosomal gel compositions must go through thorough testing to assure their purity, stability, and effectiveness. Several parameters may be evaluated throughout the assessment process:

a) Characterization Physicochemical:

- *Size and distribution of sizes:* Particle size measurement methods such as dynamic light scattering (DLS) or laser diffraction may assess the average size and size distribution of niosomes.
- *Morphology:* To see the morphology and shape of niosomes, utilised electron microscopy (e.g., scanning electron microscopy or transmission electron microscopy).
- *Potential Zeta:* By measuring the surface charge of niosomes, zeta potential assessment offers information on their stability.

b) Drug Release and Encapsulation Efficiency Research:

- *Efficiency of Encapsulation:* The quantity of drug encapsulated inside niosomes may be measured by isolating the unencapsulated drug from the niosomal solution using ultracentrifugation or dialysis, followed by drug content measurement.
- *Drug Release Research:* To examine the release kinetics and profile of the medication from niosomal gel formulations, in vitro drug release studies may be performed using Franz diffusion cells or other appropriate equipment.

c) Studies on Skin Permeation and Penetration:

- In vitro skin permeation tests utilizing human or animal skin samples may measure the potential of niosomal gel formulations to permeate the skin and deliver the medicine to the target place.
- Tape stripping, confocal laser scanning microscopy, and histological examination may all offer information about the depth of drug penetration into the skin layers.

d) Assessment of Stability and Storage Conditions:

- Stability studies should be carried out to assess the physical, chemical, and biological stability of niosomal gel formulations over time under various storage settings (temperature, humidity, light exposure, etc.).
- To measure formulation stability, parameters such as particle size, drug content, and physical appearance may be assessed on a regular basis.

V. IN VITRO AND IN VIVO STUDIES:

The study of niosomal gel formulations for psoriasis therapy includes in vitro and in vivo research to examine their performance, effectiveness, as well as safety.

a) Niosomal Gel Formulation In Vitro Evaluation:

- Drug Release Research: To analyse the release kinetics and profile of the medication from niosomal gels, in vitro drug release experiments may be done utilizing suitable dissolving equipment.
- Skin Permeation Research: In vitro skin permeation studies may be performed on human or animal skin samples to assess the permeation profile and depth of medication penetration into the skin layers.
- Assays for Cytotoxicity and Cell Viability: Cell-based tests, such as the MTT and LDH release assays, may be used to assess the cytotoxicity and cell viability of niosomal gel formulations on relevant skin cell lines.

b) Psoriasis Animal Models and Their Importance:

- To evaluate the effectiveness and therapeutic potential of niosomal gel formulations, animal models including imiquimod-induced psoriasis-like models in mice or the psoriasis plaque test in pigs may be utilised.
- To give useful insights into the efficacy of the products, these models should match the pathogenic aspects of clinical psoriasis, such as epidermal hyperplasia, inflammatory cell infiltration, or changed cytokine levels.

c) In Vivo Studies on the Efficacy of Niosomal Gels in the Treatment of Psoriasis:

- Animal studies may be carried out to assess the therapeutic effectiveness of niosomal gel formulations in lowering psoriatic symptoms such as erythema, scaling, and epidermal hyperplasia.
- To evaluate the therapeutic effects of the formulations, parameters such as illness severity ratings, histological examination, and cytokine profiling may be employed.

VI. CLINICAL APPLICATION AND FUTURE PERSPECTIVES:

The translation of niosomal gel formulations for psoriasis therapy from preclinical to clinical settings involves overcoming a number of hurdles and taking into account regulatory considerations:

a) Clinical Trials and Regulatory Issues:

- Clinical studies should be done in psoriasis patients to assess the safety, effectiveness, and tolerability of niosomal gel formulations, in accordance with relevant ethical and regulatory requirements.
- Regulatory organizations, such as the FDA (Food and Drug Administration) or the EMA (European Medicines Agency), have certain standards for pharmaceutical product approval and commercialization, including niosomal gel formulations.

b) Limitations and difficulties:

- *Scalability:* To maintain constant quality and availability, niosomal gel formulations must

be scalable to suit the demands of large-scale manufacturing.

- *Cost-Effectiveness:* The cost of producing niosomal gel formulations should be minimized in order for them to be economically feasible and accessible to patients.

c) Prospective Future Directions and Advancements:

- Combination Therapies: Niosomal gel formulations may be studied in conjunction with other treatment methods, such as phototherapy or systemic medicines, to improve treatment success while minimizing adverse effects.
- *Targeted Delivery:* Future improvements in niosomal formulation design might include the use of targeting ligands or stimuli-responsive materials to provide site-specific drug delivery and improve therapeutic effectiveness.

VII. MATERIALS AND METHODS

Materials

Table 1: Listing of the utilized products as well as their producers

S.NO	Materials	Manufacturers
1	Tacrolimus	WE care, Mumbai
2	Span 20	Sigma Aldrich, India
3	Cholesterol	Merck, India
4	Propyl paraben	Sigma Aldrich, India
5	Carbopol 934	Sigma Aldrich, India
6	Sodium hydroxide	Sigma Aldrich, India
7	Potassium, dihydrogen phosphate	Sigma Aldrich, India
8	Acetone	Merck, India
9	Octanol	Merck, India
10	Methanol	Merck, India
12	Ethanol	Merck, India
13	DMSO	Merck, India

Table 2: Enlist the equipment's used during the project

S.NO	Name of Equipment	Manufactures
1	"UV-VIS Spectrophotometer"	Shimadzu, Japan
2	"FT-IR Spectrometer"	Perkin Elmer, UK
3	"Viscometer type DV-II+pro apparatus"	Brookfield
4	"Ultrasonic Bath Sonicator"	Hicon , New Delhi
5	"Digital pH Meter"	Hicon , New Delhi
6	"Digital Electronic Balance"	Ohaus Pvt.Ltd, New Delhi
7	"Melting Point Apparatus"	EI, New Delhi
8	"Magnetic Stirrer"	Hicon , New Delhi
9	"Centrifuge Machine"	Hicon , New Delhi
10	"Thermometer "	Hicks, Delhi

Methodology

Drug Identification Study

- ***Organoleptic Properties***

Assessing the drug for all organoleptic characteristics (color, odor, taste).

- ***Melting Point***

The melting point apparatus uses the capillary method to determine the melting point of a drug by filling and sealing a capillary with the drug. Putting the drug into the melting point apparatus and documenting its temperature enables this type of investigation.

- ***Research on Solubility***

Researchers examined the solubility of several drugs in water to determine which showed the most promise. Separately dissolving the medication in each solvent, the 10 mg dosages are then thoroughly mixed using a vortex. After collecting 1 cc of each, the concentration was measured with a UV spectrophotometer (pharma spec 1700, Shimadzu, Japan).

- ***UV Spectrophotometric Studies- λ–max-***

Dissolving the drug in a phosphate buffer with a pH of 7.4 produced an ordinary A stock solution

having an ending concentration of 100 mg/ml. The dilution aliquots of the initial samples with PB pH 7.4 resulted in concentrations ranging from between 10 and 50 g/ml. The maximum absorption occurred between 200 and 400 nanometers.

a) Generation of Calibration Curves -

At concentrations ranging from 10 ng/ml to 50 ng/ml, absorbance at the utmost wavelength permitted by the drug was determined. The calibration curve plots concentration against measured absorption.

- ***FTIR Spectra Analysis***

We performed infrared (IR) spectroscopy using an FTIR spectrophotometer (Perkin Elmer) and recorded the spectra to verify for the appearance and disappearance of peaks. The routine maintenance includes compressing the most recent version of the medication onto a disc. We examined and analysed the acquired spectra for the group of functional peaks.

- ***Partition Coefficient***

It is a combination of solute concentrations between two immiscible or slightly miscible liquids; in this case, octanol as well as phosphates buffer ph 7.4 was used as an immiscible liquid into which the drug substance was introduced and agitated for one hour, left for a few hours, and then separated for two hours in a separating funnel; the resulting fluids were then collected in two beaks.

Preparation Of Noisome Formulation

- ***The Design and Enhancement of Drug-Containing Niosomes***

By injecting ethanol (EI), we were able to create niosomes containing drugs. There were varied concentrations of non-ionic surfactant Span 20 and lipid cholesterol dissolved in ethanol. To obtain an organic phase, we sonicated 25 milligrams of the hydrophobic drug in ethanol. Add 20 ml of deionized water to a separate beaker to create the aqueous phase. Using a fine-bore syringe, the organic phase, which contained the medication, was added to the aqueous phase, which contained water, at a rate of 1 ml/min. After the solvent had dissipated, the mixture was homogenized at high speed for one hour at 50°C. The niosome characteristic of vesicular development is caused by evaporation of the solvent and the resulting temperature difference between phases.

Table 3: Formulation table of niosomes

Formulation	Cholesterol (mmol)	Surfactant	Drug	Ethanol	water
F1	0.2	0.2	25 mg	10 ml	20 ml
F2	0.3	0.3	25 mg	10 ml	20 ml
F3	0.4	0.4	25 mg	10 ml	20 ml
F4	0.5	0.5	25 mg	10 ml	20 ml
F5	0.6	0.6	25 mg	10 ml	20 ml
F6	0.7	0.7	25 mg	10ml	20 ml
F7	0.8	0.8	25 mg	10 ml	20 ml

- ***Production Of Gel Composition***

In order to produce the drug-loaded niosome gel, 0.75 weight percent Carbopol 934 was dissolved in 20 mL of deionized water over the course of one hour with constant agitation to prevent agglomeration. Before Carbopol 934 was added to the water, propyl paraben was added. To create a uniform combination, the Carbopol formation was set in a beaker, and the necessary quantity of drug-loaded niosomes or ordinary Tacrolimus was added to the Carbopol composition in a separate beaker. We used deionized water to fill the remaining containers. The final step was to evaluate and select the most effective gel.

- ***Safety Test for the Drug as well as Excipient***

The study aimed at figuring out the extent to which a particular substance would be suitable with a particular excipient. As this is a crucial initial stage of creating a pharmaceutical composition, experts measured as well as mixed equal quantities of a couple constituents before sending the mixture to an FTIR plate.

VIII. RESULT

A. Test for Drug Detection

- ***Organoleptic characteristics***

The organoleptic characteristics were evaluated directly; the color is pristine white and the odor is fragrant.

- ***Melting point***

The drug's melting point was determined to be among 126 as well as 128 degrees Celsius, which corresponds to the range of melting points stated in the documented that has been released and suggests its high purity.

- ***Studies of solubility***

The solubility of cyclosporin in various solvents is identified as well as evaluated; its solubility in water is extremely poor, while its solubility in organic solvents is predominant.

Table 4. Solubility profile

Solubility	Solvent
DMSO	20 mg/ml
Ethanol	30 mg/ml
Methanol	20 mg/ml

- ***UV Spectrophotometric Studies- λ–max***

For the UV Spectrophotometric Analysis, PB pH 7.4 was employed with a screening range of 200 to 400 nm, as well as the buffer's optimum was measured at 205 nm.

- Calibration Curve Preparing

Table 5: Preparation of Calibration Curve

S.No.	Concentration (µg/ml)	Absorbance
1.	10	0.131
2.	20	0.237
3.	30	0.357
4.	40	0.420
5.	50	0.558

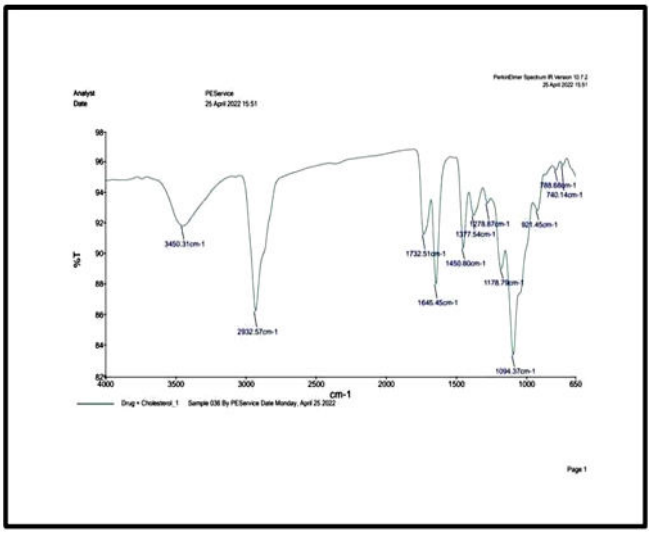


Fig 1. FTIR Of Drugs And Cholesterol

Table 6: FTIR interpretation

S.No.	Functional group	Theoretical group	Practical observed
1	O-H Stretching (Strong, broad)	3550-32OO cm	3450cm
2	C-H Stretching Medium	3000-2840cm	2919cm
3	C=O Stretching strong	1750-1735cm	1732cm
4	C=N Stretching medium	1690-1640cm	1645cm
5	C-H bending Medium	1450cm	1450cm

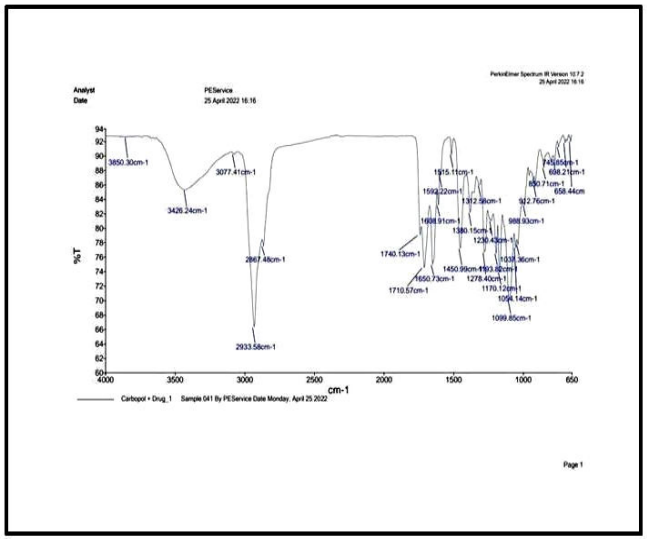


Fig 2. FTIR Of Drug And Carbapol

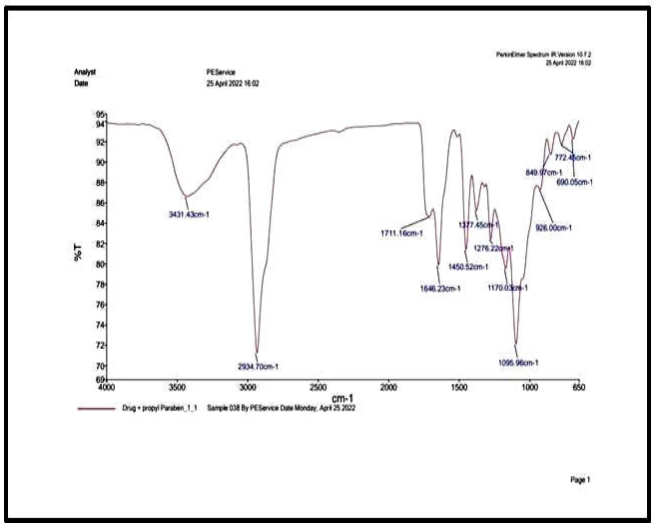


Fig 3. FTIR Of Drug And Propyl Paraben

Table 7: FTIR interpretation

S.NO	Functional group	Theoretical group	Practical observed
1	O-H stretching (Medium) sharp	3700-3584cm	3850cm-1
2	O-H stretching Strong, broad	3550-3200cm	3426cm-1
3	OH stretching (weak, broad)	3200-2700cm	3077cm-1
4	C-H stretching Medium	3000-2840cm	2867cm-1
5	C-H Stretching Medium	3000-2840cm	2933cm-1
6	C=O Stretching Strong	1750-1735cm	1740cm-1
7	C=N Stretching	1690-1640cm	1650cm-1

Table 8: FTIR interpretation

S.NO	Functional group	Theoretical group	Practical observed
1	O-H Stretching (medium, sharp)	3550-3200cm	3431cm-1
2	O-H Stretching (Weak, broad)	3200-2700cm	2934cm-1
3	C=O Stretching (strong)	1730-1715cm	1711cm-1
4	C=N Stretching (medium)	1690-1640cm	1646cm-1
5	O-H bending(medium)	1420-1330cm	1377cm-1

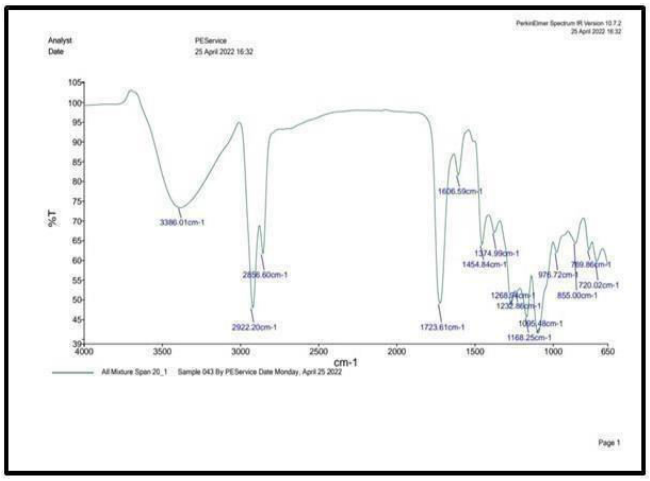


Fig 4. FTIR Of Drug And All Mixture

Table 9: FTIR

S.NO	Functional group	Theoretical group	Practical observed
1	OH Stretching (strong, broad)	3550-3200cm	3386**cm-1**
2	O-H Stretching (weak, broad)	3200-2700cm	2896cm-1
3	C-H Stretching (Medium)	3000-2840cm	2922cm-1
4	C=O Stretching (strong)	1740-1720cm	1723cm-1
5	C=C Stretching (Medium)	1650-1600cm	1606cm-1

B. Results From Niosome Characterization

- ***Molecule size, zeta potential, as well as niosome surface morphology observations***

The average particle size of the niosomes was 155 nm and their distribution was uniform. The PDI of the drug in niosomes is within the permitted range. Surface morphology analysis using transmission electron microscopy (TEM) revealed a spherical shape for the niosome vesicles, indicating a uniform distribution, and the calculated zeta potential for drug-loaded niosomes was -20.9ev. According to DLS measurements, the size of the vesicle particles was on the order of nanometers.

Table 10: Performance of Tacrolimus-loaded niosome entrapment

Formulation	% drug entrapment
F1	89.45
F2	68.24
F3	80.24
F4	91.26
F5	87.47
F6	82.22
F7	65.42

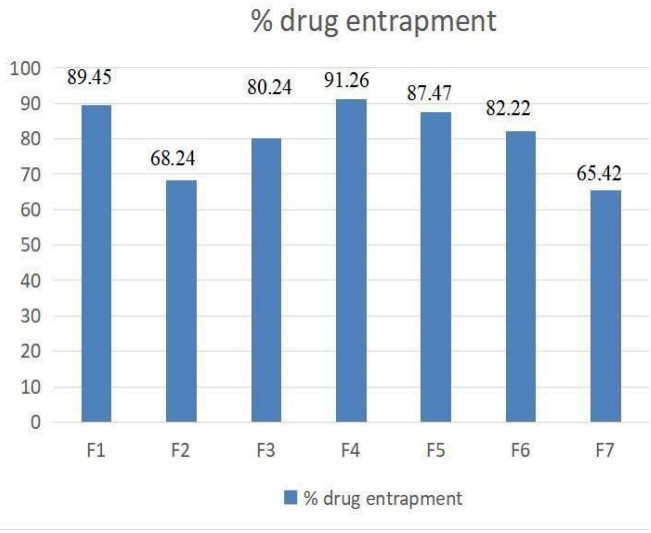


Fig 5. Entrapment Efficiency From F1 To F7

C. Evaluation results of drug loaded gel formulation

Table 11: Evaluation parameters of drug loaded niosomal gel

Formulation code	% Drugcontent	PH	Viscosity(CPS)	Homogeneity
F1	81.64	6.43	1565	Clear
F2	86.34	6.36	1540	Clear
F3	80.22	6.40	1530	Slight clear
F4	89.79	6.47	1700	Clear
F5	84.63	6.42	1680	Very Clear
F6	80.45	7.20	1564	Very clear

F7	79.22	6.38	1552	Slight clear

- ***In Vitro Research***

Table 12: Kinetic model parameters

MODEL DEPENDENT PARAMETERS								**MODEL INDEPENDENT PARAMETERS**			
Formulation	**Zero Order**	**First Order r^2**	**Higuchi r^2**	**Hixson r^2**	**Korsmeyer-Peppas**			**Similarity factor (f2)**	**Dissimilarity factor (f1)**	**Flux (J)**	**Permeation Coefficient(Kp)**
					r^2	**n**	**Diffusion**				
F1	0.996	0.723	0.828	0.722	0.963	2.288	Non-Fickian	99.26	0.59	3.185	0.031
F2	0.995	0.725	0.829	0.736	0.977	2.133	Non-Fickian	86.03	11.26	2.395	0.0266
F3	0.923	0.73	0.844	0.82	0.98	2.323	Non-Fickian	87.62	4.34	1.904	0.019

		0		2	6						
F4	0.923	0.733	0.843	0.793	0.989	2.242	Non-Fickian	92.26	3.57	2.152	0.022
F5	0.940	0.727	0.847	0.739	0.994	2.153	Non-Fickian	100	0.52	2.721	0.028
F6	0.951	0.735	0.835	0.736	0.993	2.211	Non-Fickian	88.55	3.09	1.747	0.018
F7	0.934	0.738	0.834	0.728	0.996	2.113	Non-Fickian	97.34	0.71	1.202	0.012

Fig 7. First Order Kinetic Model

Zero order kinetic model, First order kinetics model, Korsmeyer peppas kinetics model, Higuchi kinetics model

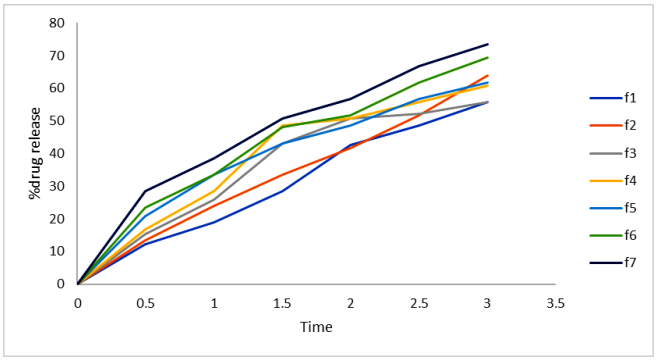
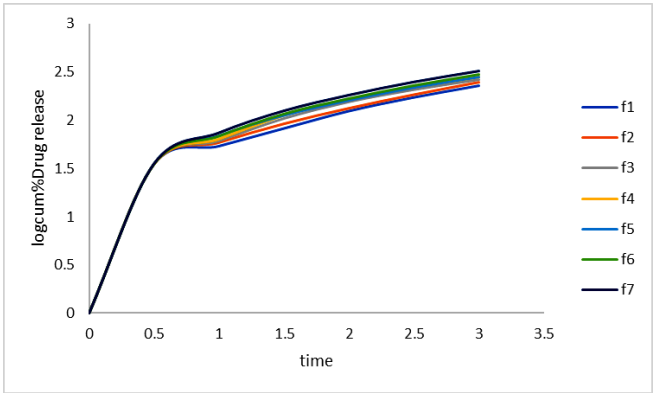


Fig 6. Zero Order Kinetic Model



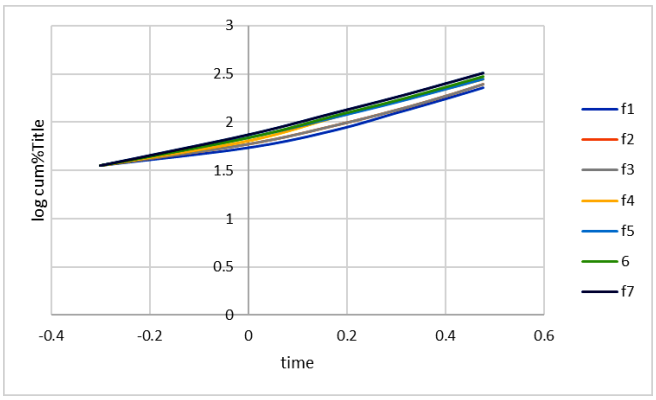


Fig 8. Korsmeyer Peppas Kinetics Model

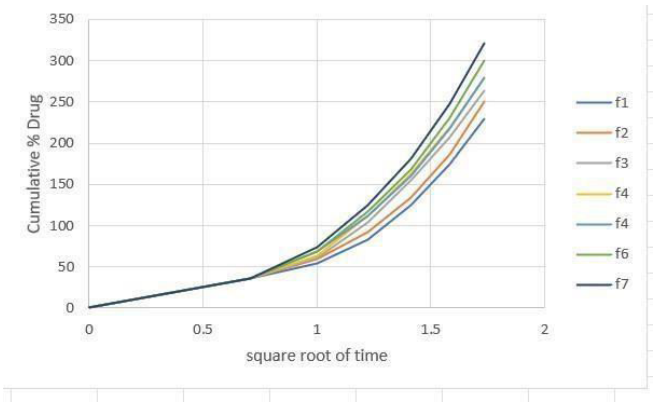


Fig 9. Higuchi kinetics model

D. Tests of Stability Results

In order to assess the stability of the drug-loaded niosomal gel over a 6-month period, an accelerated stability study was conducted. According to ICH guidelines, the gel was packaged in clean collapsible aluminum tubes, and its numerous replicates were stored in a humidity chamber maintained at 25 °C and 65% RH. The stability examination examines the product over a period of 0 to 6 months to determine if the pH, drug content, and percentage of release have changed, and the results indicate that the product is remarkably stable.

Table 13: Stability Research

Parameters	**Months**				
	0	**1**	**2**	**3**	**6**
Drug content (mg)	89.63	89.11	88.72	88.43	88.12
Ph	6.4	6.4	6.2	6.3	6.1
Drug Release (%)	16.20	27.22	46.18	48.26	59.12
Physical Appearance	Transparent consistent gel				

CONCLUSION

There are a variety of options for treating psoriasis. Since it is an autoimmune disease, psoriasis is difficult to cure because it causes the body's cells to proliferate at an excessively fast pace. This study used the immunosuppressant drug Tacrolimus to develop a niosomal gel system for the emerging strategy treatment option for psoriasis; the niosomal system includes non-ionic surfactant like span 20, which has a greater change the climate and long alkyl chain length, resulting in the high drug loaded concentration into its cores due to the hydrophobic nascent lipid bilayer. Niosome formulation follows the conclusion of all relevant research. Melting point and partition coefficient determination, as well as studies of organoleptic properties (color, odor, and taste), are all components of the pre-formulation process. FTIR spectroscopy is used to determine whether or not a drug polymer is chemically stable with other excipients. Pure drug samples may be identified by the existence of certain peaks that correlate with the peaks of other compounds containing the same functional groups. The injection of ether is the method of choice for creating niosomes. It uses over 20 different kinds of non-ionic surfactant, together with cholesterol. The F4 formulation outperforms the competition in terms of entrapment efficiency. The Use of Transmission Electron Microscopy in Experiments Particle and zeta potential study on a quantitative scale The average particle size of the niosomes was at about 155 nm, and their distribution was quite even. PDI-loaded drug-carrying niosomes. A polydispersity index value below 0.2 indicates that the formulations are homogeneous. Surface morphology studies revealed that the average zeta potential of drug-loaded niosomes was -20.9 ev. Analysis by transmission electron microscopy revealed that the niosome vesicles were round, pointing to a consistent distribution. The DLS results also found that the vesicle particles were in the nm size range. Together, propyl paraben (a preservative) and carbapol-934 (a gelling agent) turn niosomes into niosomal gel. When looking at the release kinetics, ph., viscosity, drug content, and spreading capabilities of the gel, F4 formulation came out on top.

Summary

The findings as a whole proved that the drug-loaded niosomes were an effective therapy for

psoriasis. Our long-term objective is to employ niosomes, a nanocarrier technology system, to topically administer the immunosuppressant medication therapy for the management of psoriasis, allowing for its application directly to the site of infection with minimal systemic adverse effects. Since psoriasis is an autoimmune disease, there is an increasing need for a niosomal-based gel solutions that incorporates immunosuppressant drug s for topical administration. There is a growing need to develop a nanocarrier system featuring an immunosuppressant for the majority operational attitudes of psoriasis (an autoimmune disorder), which has a number of potential advantages over the conventional or traditional systems developed for psoriasis.

REFERENCES

1. Lucka, T. C., D. Pathirana, A. Sammain, F. Bachmann, S. Rosumeck, R. Erdmann, J. Schmitt, H. Orawa, B. Rzany, and A. Nast. "Efficacy of systemic therapies for moderate to severe psoriasis: a systematic review and meta-analysis of long term treatment." Journal of the European Academy of Dermatology and Venereology 26, no. 11 (2012): 1331-1344
2. .Pinto, Maria Filipa, Catarina Costa Moura, Cláudia Nunes, Marcela A. Segundo, Sofia A. Costa Lima, and Salette Reis. "A new topical formulation for psoriasis: development of methotrexate loaded nanostructured lipid carriers." International journal of pharmaceutics 477, no. 1-2 (2014): 519-526.
3. Abdelkader, Hamdy, Sayed Ismail, Amal Kamal, and Raid G. Alany. "Design and evaluation of controlled-release niosomes and discomes for naltrexone hydrochloride ocular delivery." Journal of pharmaceutical sciences 100, no. 5(2011):1833-1846.https://doi.org/10.1002/Jps.22422
4. Alwan, Wisam, and Frank O. Nestle. "Pathogenesis and treatment of psoriasis: exploiting pathophysiological pathways for precision medicine." Clin Exp Rheumatol 33, no. 5 Suppl 93 (2015): S2-6.
5. Ammar, H. O., M. Ghorab, S. A. El-Nahhas, and I. M. Higazy. "Proniosomes as a carrier system for transdermal delivery of tenoxicam." International journal of pharmaceutics 405, no.12(2011):142-152
6. Andrews, Jeff, Gordon Guyatt, Andrew D. Oxman, Phil Alderson, Philipp Dahm, Yngve FalckYtter, Mona Nasser et al. "GRADE guidelines: 14. Going from evidence to recommendations: the significance and presentation of recommendations." Journal of clinical epidemiology 66, no. 7 (2013): 719-725
7. Armstrong, April W., Kenneth B. Gordon, M. Alan Menter, and Jashin J. Wu. "The evolving landscape of psoriasis treatment." Semin Cutan Med Surg 37, no. 2S (2018): S39
8. Attia, Ismail A., Sanaa A. El-Gizawy, Medhat A. Fouda, and Ahmed M. Donia. "Influence of a niosomal formulation on the oral bioavailability of acyclovir in rabbits." AAPS pharmscitech 8, no. 4 (2007): 206-212
9. Bailey, Elizabeth E., Elisabeth H. Ference, Ali Alikhan, Meghan T. Hession, and April W. Armstrong. "Combination treatments for psoriasis: a systematic review and metaanalysis." Archives of dermatology 148, no. 4 (2012): 511-522
10. Baillie, A. J., A. T. Florence, L. R. Hume, G. T. Muirhead, and A_ Rogerson. "The preparation and properties of niosomes—nonionic surfactant vesicles." Journal of pharmacy and pharmacology 37, no. 12 (1985): 863-868
11. Bansal, Saurabh, Geeta Aggarwal, Pankaj Chandel, and S. L. Harikumar. "Design and development of cefdinir niosomes for oral delivery." Journal of pharmacy & bio allied sciences 5, no. 4 (2013): 318.https://doi.org/10.4103/0975-7406.120080
12. Bartelds, Rianne, Mohammad Hadi Nematollahi, Tjeerd Pols, Marc CA Stuart, Abbas Pardakhty, Gholamreza Asadikaram, and Bert Poolman. "Niosomes, an alternative for liposomal delivery."PLoS One 13, no. 4 (2018): e0194179
13. Bhandari, Krishna Hari, Dong Xun Lee, Madhuri Newa, Sung II Yoon, Jung Sun Kim, Dae Duk Kim, Jung Kim et al. "Evaluation of skin permeation and accumulation profiles of a highly lipophilic fatty ester." Archives of Pharmacal Research 31, no. 2 (2008): 242-249
14. Bhutani, Tina, Jillian W. Wong, Bruce F. Bebo, and April W. Armstrong. "Access to health

care in patients with psoriasis and psoriatic arthritis: data from National Psoriasis Foundation survey panels." JAMA dermatology 149, no. 6 (2013): 717-721

15. Biju, S. S., Sushama Talegaonkar, P. R. Mishra, and R. K. Khar. "Vesicular systems: an overview." Indian journal of pharmaceutical sciences 68, no. 2 (2006).

16. Boehncke, Wolf-Henning, Nicolo Costantino Brembilla, and Michael John Nissen. "Guselkumab: the first selective IL-23 inhibitor for active psoriatic arthritis in adults. "Expert Review of Clinical Immunology 17, no. 1 (2021): 5-13

17. Bora, Aditya, Sambhaji Deshmukh, and Kapileswar Swain. "Recent advances in semisolid dosage form." International Journal of Pharmaceutical Sciences and Research 5, no. 9 (2014): 3596

18. Borghetti, Greice Stefani, and Miriam Teresinha Knorst. "Development and evaluation of physical stability from O/W lotions containing sunscreens." Revista Brasileira de Ciências Farmacêuticas 42 (2006): 531-537

19. Bouwstra, Joke A., P. Loan Honeywell-Nguyen, Gert S. Gooris, and Maria Ponec. "Structure of the skin barrier and its modulation by vesicular formulations." Progress in lipid research 42, no.(2003)1-36

20. Brewer J. M., Alexander J. A., Immunology, 75, 570—575 (1992)

21. D. Levine, Z. Even-Chen, I. Lipets, O.A. Pritulo, T.V. Svyatenko, Y. Andrashko,M. Lebwohl, A. Gottlieb, Pilot, multicenter, double-blind, randomized placebo-controlled bilateral comparative study of a combination of calcipotriene and nicotinamide for the treatment of psoriasis, J. Am. Acad. Dermatol. 63 (5) (2010)775–781

22. Dadwal, Ankita, Neeraj Mishra, and Raj K. Narang. "Novel topical nanocarriers for treatment of psoriasis: An overview." Current pharmaceutical design 24, no. 33 (2018): 3934-3950.

23. Dauden, E., A. J. Blasco, C. Bonanad, R. Botella, J. M. Carrascosa, Emilio González Parra E. Jodar et al. "Position statement for the management of comorbidities in psoriasis. "Journal of the European Academy of Dermatology and Venereology 32, no. 12 (2018): 2058-2073

24. Didem Ag Seleci, Muharrem Seleci, Johanna-Gabriela Walter, Frank Stahl, and P. Bhardwaj, et al. Journal of Drug Delivery Science and Technology 56 (2020) 101581

25. Diljyot, Kaur. "Niosomes: a new approach to targeted drug delivery." Int J Pharm Phytopharm Res 2, no. 1 (2012): 53-59

26. Doligalski, Christina Teeter, Esther C. Liu, Chelsea M. Sammons, Andrew Silverman, and Angela Tong Logan. "Sublingual administration of tacrolimus: current trends and available evidence." Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy 34, no. 11 (2014): 1209-1219

27. Eberle, Franziska C., Jürgen Brück, Julia Holstein, Kiyoshi Hirahara, and Kamran Ghoreschi. "Recent advances in understanding psoriasis." F1000Research 5 (2016).

28. El-Badry, Mahmoud, Gihan Fetih, Dina Fathalla, and Faiyaz Shakeel. "Transdermal delivery ofmeloxicam using niosomal hydrogels: in vitro and pharmacodynamic evaluation. Quot; Pharmaceutical Development and Technology 20, no. 7 (2015): 820- 826

29. Elman, Scott A., Michael Weinblatt, and Joseph F. Merola. "Targeted therapies for psoriatic arthritis: an update for the dermatologist." In Seminars in Cutaneous Medicine and Surgery, vol. 37, no. 3, pp. 173-181. 2018

30. Fontana, M. C., J. F. P. Rezer, K. Coradini, D. B. R. Leal, and R. C. R. Beck. "Improved efficacy in the treatment of contact dermatitis in rats by a dermatological nanomedicine containing clobetasol propionate." European Journal of Pharmaceutics and Biopharmaceutics 79, no. 2 (2011): 241-249

31. Förster, Matthias, Marie-Alexandrine Bolzinger, Hatem Fessi, and Stephanie Briançon. "Topical delivery of cosmetics and drugs. Molecular aspects of percutaneous absorption and delivery." European Journal of Dermatology 19, no. 4 (2009): 309-323