INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

Research Article

Stealth Liposomal Gel of Desonide: Formulation and Evaluation

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ARTICLE INFO

Published: 19 Sept 2025
Keywords:
Stealth liposomes, Desonide, Liposomal gel, Psoriasis, Controlled drug delivery.
DOI:
10.5281/zenodo.17160684

ABSTRACT

The present study focused on the design and evaluation of a stealth liposomal gel containing Desonide intended for topical application. Desonide, a corticosteroid, is commonly prescribed for treating inflammatory skin conditions such as psoriasis. Stealth liposomes were developed via the thin-film hydration technique using cholesterol, soya lecithin, and PEG, and were subsequently incorporated into a gel matrix formulated with Carbopol. The prepared liposomal gel was evaluated for its physicochemical characteristics including particle size, zeta potential, entrapment efficiency, and in vitro release behavior. Among the various formulations, the optimized batch (F3) exhibited a mean particle size of 238.9 nm, a zeta potential of –44.62 mV, and a drug entrapment efficiency of 76.42%. In vitro release studies confirmed a controlled drug release profile extending up to 4 hours. The developed formulation demonstrated improved stability, enhanced drug encapsulation, and sustained release, indicating its potential as a promising carrier for effective topical corticosteroid delivery

INTRODUCTION

Novel Drug Delivery Systems (NDDS) represent a significant advancement in pharmaceutical sciences, offering a more rational approach to drug administration by integrating modern insights into pharmacokinetics and pharmacodynamics [1]. These systems are designed to sustain drug concentrations within the body over an extended duration, thereby enhancing therapeutic effectiveness and minimizing adverse effects relative to conventional methods [2]. NDDS can improve drug stability, minimize degradation, and enhance bioavailability while reducing dosing frequency and improving patient compliance [3]. They encompass a range of delivery mechanisms, including sustained or controlled release systems that offer constant drug release (zero-order), localized delivery systems that target specific tissues, pre-programmed systems that release drugs based on molecular diffusion, and targeted systems that use carriers to deliver drugs

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Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

specifically to diseased sites [4]. Targeted drug delivery systems are particularly advantageous because they direct the therapeutic agent specifically to the desired site of action, thereby minimizing contact with healthy tissues [5]. These systems enhance therapeutic outcomes, lower drug dosages, and improve safety profiles. Ideal targeted delivery systems should be non-toxic, non-immunogenic, stable in various environments, and capable of predictable and controlled release [6]. Although these systems offer numerous advantages like prolonged drug action, reduced variability, and enhanced absorption, they also come with challenges such as complexity in manufacturing, high cost, and stability issues [7].

Liposomes, which are phospholipid-based vesicles, serve as excellent carriers in NDDS owing to their capacity to enclose both water-soluble and fat-soluble drugs [8]. Liposomes are available in multiple structural types, and their size and structure influence drug encapsulation efficiency and circulation half-life [9]. Liposome interaction with biological membranes can occur through mechanisms like endocytosis, fusion, and adsorption, depending on their size, surface charge, and composition [10]. Stealth liposomes are an advanced form of liposomes modified with polymers such as polyethylene glycol (PEG) is incorporated on the surface to reduce immune recognition and prolong circulation time to recognise the immune system, thus increasing their circulation time [11]. They deliver drugs through multiple mechanisms, including endocytosis by immune cells, fusion with cell membranes, and transfer of lipids between membranes [12]. Their mode of action includes sustained drug release, site-specific delivery, and avoidance of sensitive organs, which helps reduce toxicity [13]. These liposomes are stable, uniform, and suitable for delivering both water- and fat-soluble drugs [14]. The formulation of stealth liposomes involves components like phospholipids, sterols, and polymers, with PEG being the most common due to its safety and effectiveness [15]. Various preparation methods include hand-shaking, sonication, reverse-phase evaporation, and solvent injection techniques, each offering different advantages in terms of vesicle size, uniformity, and encapsulation efficiency [16]. Stealth liposomes are extensively utilized in modern therapeutic agents because of their high chemical and biological stability, efficient solubilization capabilities, improved intracellular delivery, reduced macrophage recognition, and capability to entrap both water-soluble and fat-soluble therapeutic agents [17]. In cancer therapy, they are used for targeted chemotherapy, as seen in DOXIL® (liposomal doxorubicin), which is approved for the therapeutic intervention of ovarian cancer and Kaposi's sarcoma [18]. They are also employed in vaccine formulations, such as Epaxal for hepatitis A, and in diagnostic imaging for MRI and CT scans [19]. Their ability to deliver drugs precisely makes them ideal for targeting tumors and inflamed tissues [20]. The future of stealth liposomes lies in active targeting, where ligands such as antibodies or vitamins are conjugated to enhance receptor-specific binding, offering significant potential for precision medicine and personalized therapy [21].

Psoriasis is a long-term inflammatory skin disorder characterized by an exaggerated immune response, which accelerates skin cell proliferation and results in the development of red, scaly lesions, typically appearing on the elbows, knees, and other parts of the body [22]. Although the exact cause is unknown [23]. Psoriasis symptoms can flare up periodically and may be triggered by factors such as stress, infections, or skin injuries [24]. this disorder involves both cutaneous and also increases the risk for other conditions, including

psoriatic arthritis, cardiovascular events, depression, and autoimmune diseases [25]. Psoriasis includes several types-plaque, inverse, and erythrodermic-each differing in clinical presentation and severity [26]. Represents a persistent skin inflammation identified by immune-mediated dysregulation, leading to abnormal keratinocyte proliferation and accelerated skin cell turnover [27]. Genetic mutations affecting skin barrier function and immune regulation are also associated with psoriasis susceptibility [28].

While there is no cure, management strategies focus on controlling symptoms and preventing flare-ups [29]. Topical treatments are typically used in the treatment of mild to moderate psoriasis, commonly involving corticosteroids, vitamin D3 analogues like calcipotriol, which modulate skin cell turnover and immune activity [30]. These treatments are often combined for greater efficacy and reduced side effects [31]. In more severe cases, phototherapy may be required, often under the guidance of a dermatologist. Combination therapies, especially those involving calcipotriol and betamethasone dipropionate, have demonstrated significant efficacy in alleviating symptoms and enhancing patients' overall quality of life [32].

Desonide is a synthetic, non-fluorinated topical corticosteroid used primarily for its anti-inflammatory effects in the treatment of dermatological conditions such as psoriasis. It has a molecular formula of $C_{24}H_{32}O_6$. Its mechanism of action involves inhibit the release of arachidonic acid by lipocortin induction, thereby suppressing inflammatory mediators like prostaglandins and leukotrienes [33]. Although effective, its topical use can cause local adverse effects such as skin irritation, redness, and itching [34]. Desonide is marketed under brand names like Desonate [35].

The formulation also includes several essential excipients, each serving a specific functional role. Cholesterol functions as an emulsifying and stabilizing agent in liposomal formulations [36]. It enhances the emollient properties of topical formulations of liposomes [37]. Polyethylene Glycol (PEG), commonly known as Carbowax [38]. It is employed in drug formulations to enhance solubility, stability, and reduce drug clearance [39], especially in PEGylated systems such as stealth liposomes [40].

Soya lecithin is a natural phospholipid used extensively in pharmaceutical and cosmetic formulations as a dispersant, emulsifier, stabilizer, and transdermal enhancer [41]. It is sensitive to oxidation, heat, and microbial degradation [42]. Lecithin is a major component of liposomes, contributing to bilayer formation [43], and is known to enhance drug penetration across biological membranes [44]. It has also been used in nutritional supplements and parenteral nutrition owing to its beneficial roles in liver health and fetal development [45]. Overall, these excipients jointly influence the stability, efficacy, and delivery efficiency of desonide in topical liposomal gel formulations.

MATERIALS AND METHODS:

Materials:

The materials used in the present study include Desonide, obtained from Intermed Laboratories, and Lecithin, sourced from Amitech Agro Product Pvt. Ltd. Cholesterol and Chloroform were procured from Chennai Chemicals, while Polyethylene Glycol (PEG) was supplied by Loba Chemie. These materials were selected based on their roles as active pharmaceutical ingredients and excipients essential for liposomal formulation and drug delivery.

Methods:

Preformulation studies:

Description:

The physical characteristics of the drug were evaluated through visual inspection like colour, odour and physical form of the compound.

Solubility studies:

Solubility tests were conducted in different solvents including distilled water, methanol, chloroform, acetone, and phosphate-buffered saline (pH 7.4) to evaluate the solubility behavior of Desonide.

Identification of a pure drug:

The identity of the pure drug (Desonide) was confirmed using Fourier Transform Infrared (FTIR) spectroscopy [46]. IR spectra were also recorded for individual excipients-cholesterol, polyethylene glycol (PEG), and lecithin—as well as for their combination with Desonide.

Standard curve for Desonide [47]:

a. Buffer Preparation (pH 7.4): A phosphate buffer was prepared by combining 50 ml of 0.2 M potassium dihydrogen phosphate with 39.1 ml of 0.2 M sodium hydroxide and adjusting the volume to 200 ml using distilled water.

b. Stock Solution: Desonide (100 mg) was dissolved in 50 ml of methanol, followed by dilution with phosphate buffer to achieve a 1 mg/ml concentration.

c. Working Standards: Dilutions ranging from 5 to 35 µg/ml were prepared by transferring appropriate aliquots into 10 ml volumetric flasks and adjusting with buffer. The absorbance was measured at 262 nm to construct a calibration curve.

d) Preparation of stealth liposome [48]:

Stealth liposomes were prepared by employing the Bangham technique. In this method, cholesterol and phospholipids were initially dissolved in chloroform and combined with a methanolic solution of a pre-measured quantity of Desonide. Polyethylene glycol (PEG) was subsequently incorporated into the mixture. The resulting solution underwent rotary evaporation at 100 rpm for 30 minutes, leading to the formation of a thin lipid layer along the interior surface of a round-bottom flask. This dry lipid film was then rehydrated using phosphate-buffered saline (PBS) for another 30 minutes, yielding the final stealth liposomal dispersion.

Table 1: Preparation of stealth liposome :

Formulation	Lecithin (mg)	Drug (mg)	Cholesterol (mg)	PEG (%)	Water (ml)	Chloroform (ml)
F1	10	10	10	10	Q.S	Q.S
F2	20	10	20	10	Q.S	Q.S
F3	30	10	30	10	Q.S	Q.S
F4	40	10	40	10	Q.S	Q.S
F5	50	10	50	10	Q.S	Q.S
F6	60	10	60	10	Q.S	Q.S
F7	70	10	70	10	Q.S	Q.S
F8	80	10	80	10	Q.S	Q.S

Characterization of stealth liposomes:

a) Optical microscopy [49]:

The liposomal suspension was examined under a compound microscope to visualize vesicle structure and morphology.

b) Morphological studies using SEM [50]:

Stealth liposomes were characterized using scanning electron microscopy (SEM). A sample of Desonide-loaded stealth liposomes was placed on a cover glass and mounted onto a specimen stub. To improve conductivity for electron microscopy, a 100 Å platinum alloy layer was applied to the dried sample using a sputter coater.. Following coating, Characterization was performed to determine the vesicle structure, dimensions, and external morphology.

c) Particle size and size distribution measurements [51]:

Particle size analysis was carried out using a dynamic light scattering instrument under standard laboratory conditions at 25°C. Before analysis, formulation F3 was diluted with distilled water and incubated for two days. The particle size distribution was expressed as the distribution index (PDI), which reflects particle size uniformity.

d) Zeta potential [51]:

Zeta potential and colloidal stability of the Desonide formulation were determined using Malvern Zetasizer

e) Determination of drug entrapment efficiency [52]:

The percentage of drug encapsulated within the stealth liposomes was assessed using centrifuging 1 mL of the formulation at 13,000 rpm for 90 minutes at 40°C using a Remi centrifuge. The supernatant liquid containing the free drug were carefully separated and analyzed after appropriate dilution with pH 7.4 phosphate buffer in spectrophotometry at 277 nm. Drug entrapment efficiency was expressed as a percentage, calculated using the ratio of encapsulated drug to the total drug content:
%EE = [(Total – Unbound) / Total] × 100

***In Vitro* release studies [53]:**

***In-vitro* of Desonide stealth liposomes:**

The *in vitro* release profile of Desonide from stealth liposomes was studied using a simple diffusion cell setup. The apparatus comprised a cylindrical glass vessel with an internal diameter of 2.5 cm, open at both ends, where one end was sealed with a Sigma dialysis membrane to function as the donor compartment. A formulation containing stealth liposomes corresponding to 5 mg of drug Desonide was placed within the dialysis bag and immersed in 200 mL of phosphate buffer (pH 7.4), which acted as the receptor medium. The system was maintained at 37 ± 2°C under continuous agitation using a magnetic stirrer. At predetermined time intervals, aliquots of the buffer were withdrawn and replaced with an equal volume of fresh buffer to maintain a consistent concentration gradient. The collected samples were analyzed using a UV-Visible spectrophotometer, with phosphate buffer used as the blank.

Preparation of Desonide gel:

The stealth liposomal gel was formulated by gradually dispersing carbomer into phosphate buffer (pH 7.1) under continuous stirring to ensure uniform dispersion. Methyl paraben was incorporated as a preservative. To adjust the pH

Triethanolamine was added. After the complete addition of all solid components, the formulation was allowed to swell under moderate stirring to obtain a homogenous and stable gel, as shown in (Table 2).

Table 2: Preparation of Desonide gel:

Formulation (ml)	Suspension (ml)	Carbopol (%)	Triethanolamine (ml)	Buffer (P.H 7.4)
F3	20	1	0.5	Q.S

Evaluation of Desonide Gel:

a) Organoleptic Characteristics:

The prepared stealth liposomal gel was to evaluate its physical and chemical characteristics, including appearance,smell,and consistency, phase separation, and sensory attributes such as greasiness and grittiness upon application.

b) Washability:

A small amount of gel was applied to the skin and rinsed with water to evaluate its washability. The ease of removal indicated the gel's suitability for topical application.

c) Viscosity:

A Brookfield-type viscometer was employed to assess the flow behavior (viscosity) of the Desonide gel formulation. The analysis was performed under standardized conditions to examine the formulation's rheological profile and ensure uniform consistency[54].

d) Spreadability;

To evaluate spreadability, One gram of the gel was carefully spread between two smooth glass surfaces for analysis. A standardized weight of 125 g was placed on the upper plate, and the diameter of the spread was recorded after 1 minute.

e) pH Measurement:

Desonide pH was recorded using a digital pH measuring device. The probe was directly immersed in the sample to ensure accurate pH determination, assessing the formulation's compatibility with skin.

f) Evaluation of Homogeneity:

The uniformity of the gel formulation was assessed using visually inspecting the formulation after it was allowed to settle in appropriate containers. The gel was observed for uniform distribution of contents, absence of lumps, and overall consistency in appearance.

g) Stability Studies [55]:

Stability of the stealth liposomal Desonide gel was assessed over a 3-month period by observing any changes in color, phase separation, or physical appearance under standard storage conditions. The formulation remained stable, with no significant changes observed.

h) *In-Vitro* Release Studies for Desonide Stealth Liposomal Gel [56]:

The drug release profile of the Desonide gel was studied using a modified Keshary–Chien diffusion cell. A pre-soaked cellophane membrane was secured to the open end of the donor compartment. One gram of gel was positioned within the donor phase of the diffusion setup, which was then dipped in 90 mL of phosphate buffer (pH 7.4) contained in a 100 mL beaker serving as the acceptor compartment. To ensure uniform

conditions, the membrane was submerged 1 cm below the buffer level, and the temperature was controlled at 32 ± 1 °C while stirring with a magnetic stirrer. Samples of 5 mL were collected at specified time points (30–270 minutes) and each withdrawn sample was replaced with an equal volume of fresh buffer to maintain sink conditions. The collected samples were analyzed using a UV-Visible spectrophotometer at 277 nm to quantify cumulative drug release, which was subsequently plotted over time to evaluate the release kinetics.

RESULT:

Preformulation Studies

Description: The unprocessed drug exhibited a crystalline texture, white to pale yellow in color, and lacked any distinct odor.

Solubility Studies: Desonide's solubility was assessed in various solvents, and results are Presented in Table 3.

Table 3: SOLUBILITY OF DESONIDE

Solvents	Solubility
Water	Insoluble
Methanol	soluble
Chloroform	soluble
Acetone	soluble
Phosphate buffer	Slightly soluble

Identification of pure drugs:

Drug and excipient identification was performed via FTIR analysis, and compatibility was verified through the overlay spectra, as illustrated in Figure 1.

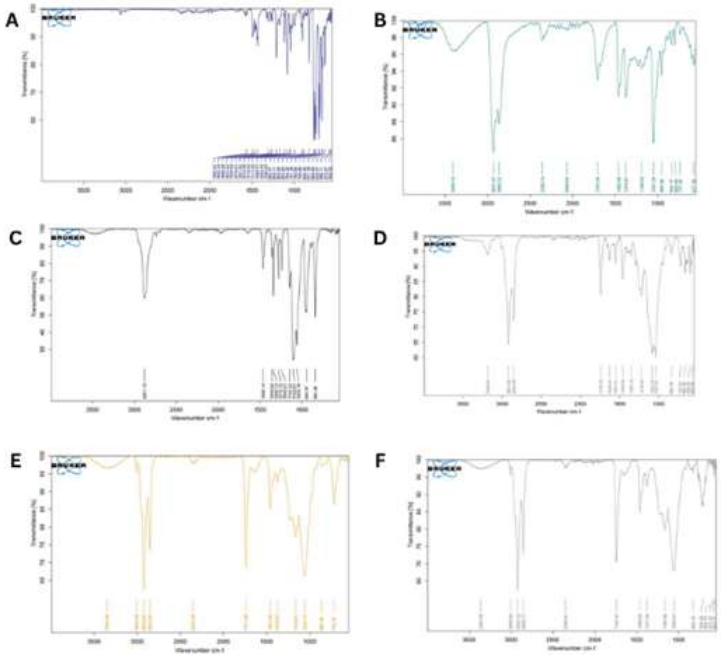

Figure 1. IR Spectroscopy of (A) Pure drug- Desonide (B) Cholesterol (C) PEG (D) Soya lecithin (E) Desonide + Cholesterol + Soya lecithin & (F) Desonide + Cholesterol + Soya lecithin + PEG.

Standard curve for Desonide:

A calibration curve was generated by plotting absorbance at 277 nm against concentrations ranging from 5–30 µg/ml, confirming linearity. Data are Exhibited in Table 4 and Figure 2.

Table 4. Standard curve for Desonide

Concentration (µg/ml)	Absorbance (nm)

5	0.218
10	0.335
15	0.448

20	0.571
25	0.687
30	0.769

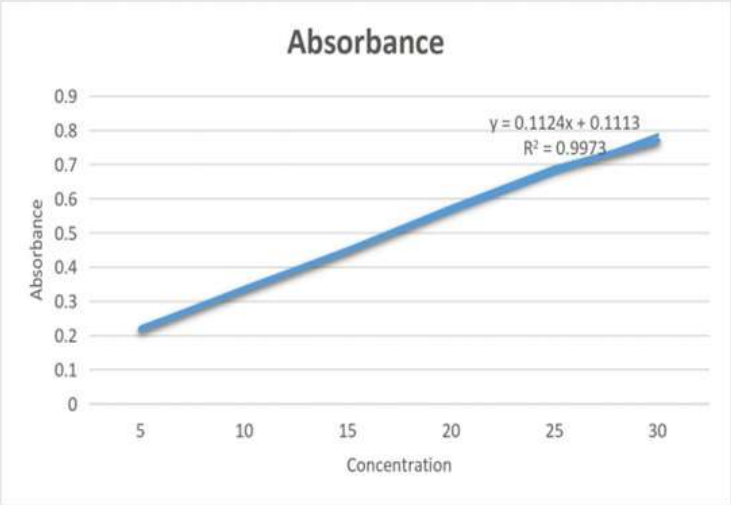

Figure 2. Standard curve graph for Desonide

Optical microscopy:

Optical microscopy revealed that the formulated stealth liposomes had spherical vesicle morphology. A representative image of formulation F3 is Visualized in Figure 3.

Figure 3. Optical microscopy of F3 formulation.

Scanning Electron Microscopy (SEM):

The stealth liposomes were analyzed using SEM to evaluate their structural features. The images confirmed small, spherical unilamellar vesicles, as illustrated in (Figure 4).

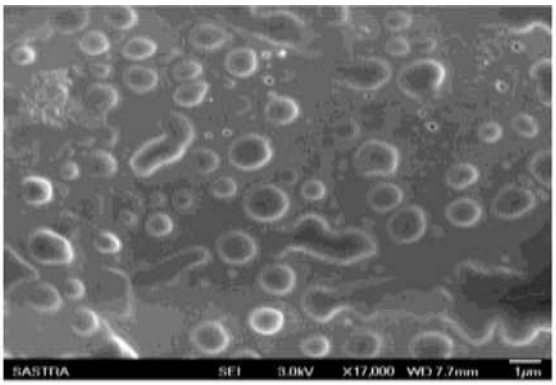

Figure 4. SEM image of stealth liposome (F3)

Particle size and size distribution:

Formulation F3 was characterized for particle size and polydispersity index (PDI) using dynamic light scattering. Results are illustrated in Table 5 and Figure 5.

Table 5. Particle Size Distribution of Formulation F3:

1.	Average particle size (nm)	238.9
2.	Poly dispersity index (PDI)	0.38

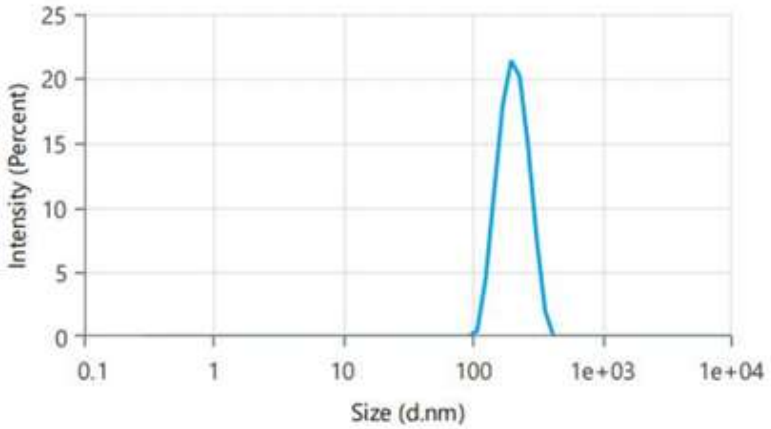

Figure 5. Particle Size Distribution Image of Formulation F3.

Zeta potential:

The zeta potential of formulation F3, assessed via Malvern Zetasizer, was –44.62 mV, suggesting stable vesicle dispersion. The graphical output is Displayed in (Figure 6).

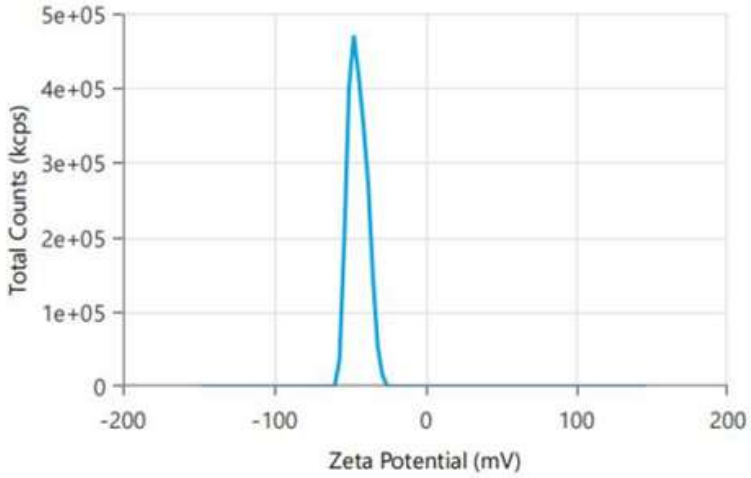

Figure 6. Zeta Potential Image of Formulation F3.

Drug Entrapment Efficiency:

Assessing the amount of drug encapsulated within stealth liposomes is critical prior to evaluating their performance in vitro or in vivo.Formulation F3 demonstrated an entrapment efficiency of 76.42%, confirming that the selected PEG and cholesterol levels effectively enhanced Desonide encapsulation. Entrapment data are presented in (Table 6).

Table 6. drug entrapment percentage (%) of the formulated stealth liposomes:

Formulation	Percentage drug entrapment (%)
F1	65.42
F2	68.16
F3	76.42
F4	71.92
F5	64.12
F6	58.76
F7	54.18
F8	60.66

***In-vitro* Release Studies:**

Desonide release from the stealth liposomal formulation was studied using phosphate buffer (pH 7.4) and a Sigma dialysis membrane.

Formulation F3 showed a cumulative release of 96.17% over 20 hours, reflecting a sustained release profile. This extended release is attributed to the gradual diffusion of the drug from the stealth liposomal matrix. The in vitro release data are summarized in (Table 7) and graphically Demonstrated in (Figure 7).

Table 7. *in-vitro* release study of stealth liposome

Time (Hrs)	Drug diffused (%)							
	F1	F2	F3	F4	F5	F6	F7	F8
1	20.63	19.36	23.54	22.24	19.54	21.12	23.01	20.78
2	21.09	20.12	26.20	23.86	20.32	21.29	25.15	21.50
3	23.46	21.36	31.71	30.01	21.56	21.96	31.54	24.01
4	36.52	24.13	33.17	32.29	26.88	23.52	33.31	33.24
5	43.56	25.72	34.54	32.92	31.98	21.64	34.01	41.55
6	46.72	26.81	39.73	41.91	34.21	36.21	39.24	45.58
7	49.13	28.07	41.02	46.54	45.32	41.35	40.50	48.78
8	50.62	40.28	51.02	48.73	46.01	43.44	41.65	49.90
9	51.13	42.36	59.92	51.17	48.44	46.01	44.31	53.51
10	53.52	44.72	64.01	54.71	52.88	50.98	48.65	57.01
11	56.18	53.14	66.23	56.23	54.11	54.44	54.55	63.35
12	58.86	54.78	70.64	59.32	63.32	56.92	59.65	67.54
13	62.73	56.06	71.94	61.24	66.92	60.54	63.12	71.12
14	63.70	64.13	73.59	64.69	67.90	64.88	67.98	74.92
15	66.32	68.83	76.89	66.88	69.21	70.89	72.78	79.89
16	71.24	72.62	81.36	80.58	71.69	72.04	76.66	83.97
17	74.54	76.68	84.52	81.98	74.02	76.64	80.95	86.65
18	76.44	78.64	90.35	86.52	79.32	81.64	84.66	89.78
19	81.71	84.92	92.73	89.64	84.57	84.24	88.54	91.12
20	86.62	88.35	96.17	91.35	86.77	89.02	92.88	93

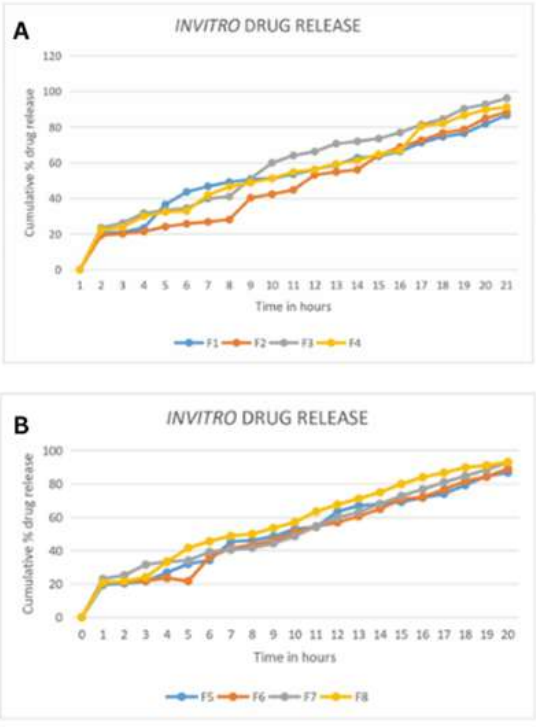

Figure 7. *Invitro* drug release of (A) formulation F1, F2, F3 and F4 and (B) formulation F5, F6, F7 and F8

Evaluation of physicochemical parameters:

Organoleptic Properties:

The Desonide gel exhibited a transparent and clear appearance. No phase separation was observed before or after the incorporation of the gel base, indicating good physical stability of the liposomes.

Washability:

The formulated Desonide gel was easily washable and did not leave any residue on the skin surface after application.

Viscosity:

Measured at 45,695 cps, the viscosity was within an acceptable range for semi-solid formulations.

pH Measurement:

A near-neutral pH of 6.8 was recorded, indicating skin compatibility.

Spreadability:

Calculated as 11.75 g·cm/sec, suggesting efficient application over the skin surface.

Homogeneity:

The gel was assessed for homogeneity through visual observation after it was allowed to settle down in a suitable container. The gel appeared uniform, indicating good homogeneity.

Stability Studies:

To determine its physical and chemical stability, the Desonide gel was observed over a three-month duration under refrigerated, ambient, and accelerated storage settings. No significant changes in color or appearance were observed, suggesting that the formulation was stable under storage conditions.

***In-vitro* release studies of desonide stealth liposomal gel**

The stealth liposomal gel also showed a sustained release profile, reaching 93.65% cumulative release after 20 hours. The gel matrix added an additional diffusion barrier, further modulating drug release. The release data of drug is given in the (table 8).

Table 8. *In-vitro* drug release studies of desonide stealth liposomal gel:

Time in hours (hrs)	Percentage of drug diffused (%)
1	21.5
2	24.34
3	29.44
4	31.15
5	34.89
6	36.75
7	44.98
8	49.34
9	53.25
10	59.66
11	62.75
12	66.75
13	73.78
14	79.47
15	82.42
16	84.65
17	86.79
18	88.33
19	90.12
20	93.65

***In vitro* drug release comparison: Stealth liposomes vs. liposomal gel:**

Comparative in-vitro drug release studies were conducted to evaluate the release profile of Desonide from both stealth liposomes and stealth liposomal gel formulations. The studies were carried out using the dialysis membrane diffusion method in phosphate buffer (pH 7.4) as the release medium, maintained at 37 ± 0.5 °C under

continuous stirring. Aliquots were withdrawn at predetermined time intervals and analyzed using a UV-Visible spectrophotometer at 277 nm to determine the concentration of drug released.

The results indicated that:

- The stealth liposomes exhibited a relatively faster and more direct release profile due to the absence of a gel matrix, reaching significant release levels within a shorter period.
- The stealth liposomal gel demonstrated a sustained and controlled drug release, attributed to the additional barrier and diffusion resistance offered by the gel base.

This comparison highlights the potential of stealth liposomal gel in prolonging the drug release and enhancing skin retention, which may lead to improved therapeutic efficacy in topical applications. The comparative drug release data is summarized in the following (Table 9) and (Figure 8).

Table 9. *In vitro* drug release comparison: Stealth liposomes vs. liposomal gel.

Time (hrs)	*In-vitro* release of stealth liposome (%)	*In-vitro* release of stealth liposome gel F3 (%)
1	23.54	21.52
2	26.19	24.34
3	31.71	29.44
4	33.17	31.15
5	34.54	34.89
6	39.73	36.75
7	41.02	44.98
8	51.02	49.34
9	59.92	53.25
10	64.01	59.66
11	66.23	62.75
12	70.64	66.75
13	71.94	73.78
14	73.56	79.47
15	76.89	82.42
16	81.35	84.65
17	84.52	86.79
18	90.35	88.33
19	92.73	90.12
20	96.17	93.65

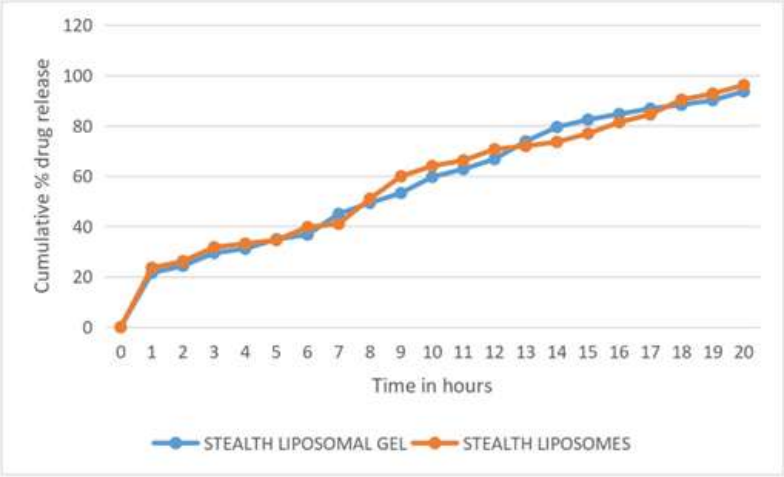

Figure 8: In vitro release comparison of stealth liposomes and liposomal gel.

Stability studies of Desonide gel:

The formulation was divided into three portions and stored under different conditions: refrigeration temperature (4 ± 1 °C), room temperature, and accelerated temperature (40 ± 2 °C with 70 ± 5% RH) for a period of 3 months. At the end of each month, samples were evaluated for percent drug release to assess the formulation's stability. The stability studies results are given in the (Table 10).

Table 10. Stability study data for Desonide gel

Formulation	Temperature	Amount of drug retained (%) after months			
		Beginning phase	Month 1	Month 2	Month 3
F3 GEL	Refrigeration 4°C ± 1°C	100	97.68	96.26	95.85
	Room Temperature	100	96.26	95.60	94.87
	40°C ± 2°C and RH 70% ± 5%	100	94.01	90.39	89.77

CONCLUSION:

The present research successfully developed a stealth liposomal gel formulation encapsulating Desonide for enhanced topical drug delivery. FTIR analysis confirmed the absence of chemical incompatibility between the drug and selected excipients. Among all batches, formulation F3 demonstrated the most favorable characteristics, including a high entrapment efficiency of 76.42%, nanosized vesicles with uniform distribution, and excellent colloidal stability. In vitro release studies of the optimized liposomes indicated a prolonged drug release profile, with over 96% release observed over 20 hours. Scanning Electron Microscopy confirmed the vesicular structure, supporting efficient formulation. When incorporated into a gel base, the formulation retained its physical integrity, exhibited appropriate spreadability, pH, viscosity, and homogeneity, and demonstrated stable drug release performance. Stability assessments over a 3-month period under varying storage conditions showed minimal degradation, confirming the formulation's robustness. Overall, the Desonide-loaded stealth liposomal gel developed in this study presents a promising platform for controlled topical delivery, potentially improving therapeutic outcomes and patient compliance in the treatment of inflammatory skin disorders such as psoriasis.

CONFLICT OF INTEREST: The authors declare that there are no conflicts of interest related to this study.

ACKNOWLEDGEMENTS:

The authors are grateful to Dr. A. Meena, Principal, and Dr. A. Shanthy, Vice Principal, K. K. College of Pharmacy, for their support and encouragement throughout this work.

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HOW TO CITE: Karthick K, Vani M, Arun T, Sudalaimani M, Stealth Liposomal Gel of Desonide: Formulation and Evaluation, Int. J. of Pharm. Sci., 2025, Vol 3, Issue 9, 2165-2181. https://doi.org/10.5281/zenodo.17160684