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Original Article

FORMULATION AND EVALUATION OF GALANTAMINE GEL IN TRANSDERMAL PATCH

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ABSTRACT

Background: *Galantamine is a potent acetylcholinesterase inhibitor used in the treatment of Alzheimer's disease. Conventional oral administration of galantamine can lead to inconsistent drug levels and side effects. To address these issues, this study explores the formulation and evaluation of a Galantamine gel for use in transdermal patches, aiming to provide a controlled, sustained release of the drug while improving patient compliance.*

Objective: *The objective of this study was to develop a Galantamine gel formulation suitable for incorporation into transdermal patches and to evaluate its release characteristics and skin compatibility.*

Methods: *Galantamine gel was formulated using a combination of polymers: Hydroxypropyl Methylcellulose (HPMC), Ethyl Cellulose, and Eudragit RSPO. The gel was incorporated into transdermal patches and evaluated for drug release using in vitro diffusion studies. Skin compatibility was tested to ensure the formulation is non-irritating and adheres well to the skin.*

Results: *The galantamine gel demonstrated effective controlled release of the drug through the transdermal patch, with consistent release rates that align with therapeutic requirements. Skin compatibility tests showed that the patches were non-irritating and adhered well to the skin without causing discomfort.*

Conclusion: *The developed galantamine gel for transdermal patches successfully provided sustained drug release and favorable skin compatibility. This formulation presents a viable alternative to oral administration, offering potential benefits in managing Alzheimer's disease with improved drug delivery and patient adherence.*

Keywords: *Galantamine, Transdermal Patch, Gel Formulation, Controlled Release, Skin Compatibility*

INTRODUCTION

The skin is the largest organ in the human body by mass, with an area of between 1.5 and 2.0 m² in adults. Drugs have been applied to the skin to treat superficial disorders, for the transdermal administration of therapeutics to manage systemic ailments and as cosmetics, dating back to the oldest existing medical records of man. For instance, the use of salves, ointments, potions and even patches, consisting of plant, animal or mineral extracts, was already popular in ancient Egypt and in Babylonian medicine (around 3000 BC)[1]. However, the routine use of transdermal delivery systems only became a common practice in the latter third of the 20th century when delivery technology was developed to enable precise and reproducible administration through the skin for systemic effects. Transdermal drug delivery is an alternative way of delivering drugs via the skin layer [2, 3].

Transdermal delivery that has evolved over thousands of years, focusing particularly on the evolution and current use of

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transdermal patches. A transdermal patch is a medicated patch that can deliver drugs directly into the bloodstream through the layers of the skin at a prescribed rate [4]. In fact, patches are the most convenient method of administration. They are non-invasive, and treatment can last for several days and can be stopped at any time. They come in different sizes and contain multiple ingredients [5]. When applied to the skin, the patch can deliver active ingredients into the systemic circulation via diffusion processes. Transdermal patches may contain high doses of active substances that remain on the skin for an extended period of time. One of the first transdermal patches developed in 1985 was the nitroglycerin patch [6]. The patch, developed by Gale and Berggren, uses a rate-controlling ethylene vinyl acetate membrane. Currently, several drugs are available as transdermal patches, including estradiol, clonidine, fentanyl, nicotine, scopolamine (hyoscine), and estradiol with nor-ethisterone acetate [7-9].

Influence of Human Biology on Performance of TDS

Percutaneous delivery of pharmaceutics is a technique that is used to deliver a drug into the systemic circulation across the skin. Various factors such as age, gender, ethnicity, skin hydration and metabolism affect the integrity and barrier properties of the skin, resulting in variations in the amount of drug absorbed. The main differences between male and female skin are pore size (sweat and sebaceous gland men have larger skin pores sizes) and pH (pH of male skin is significantly lower than that of female skin) [10]. However, studies have shown no significant difference between the permeation of nicotine across female and male skin under in vivo conditions to make any conclusions about gender-based variations.

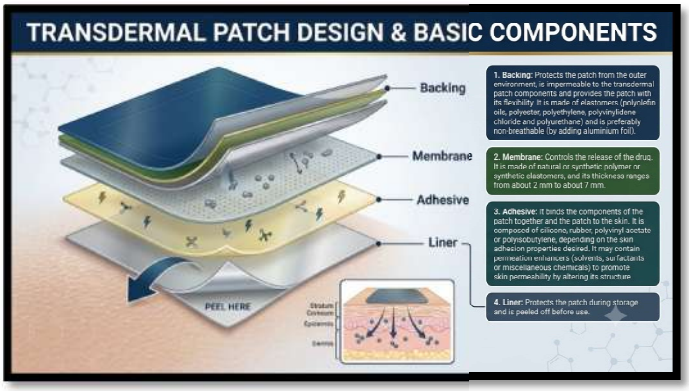


Figure 1: Parts of Transdermal Patch

Galantamine is used to treat mild to moderate dementia (memory loss and mental changes) that is a sign of Alzheimer's disease. Galantamine will not cure Alzheimer's disease, and it will not stop the disease from getting worse. However, galantamine can improve the thinking ability in some patients with Alzheimer's disease. At present, the most common form of delivery of drugs is the oral route. While this has the notable advantage of easy administration, it also has significant drawbacks - namely poor bioavailability due to hepatic metabolism (first pass) and the tendency to produce rapid blood level spikes (both high and low), leading to a need for high and/or frequent dosing, which can be both cost prohibitive and inconvenient [11].

To overcome these difficulties there is a need for the development of new drug delivery system; which will improve the therapeutic efficacy and safety of drugs by more precise (i.e. site specific), spatial and temporal placement within the body thereby reducing both the size and number of doses. Hence, in this project we hypothesized that Galantamine can be delivered buy Transdermal route overcoming challenges of oral route [12].

2. Materials

Galantamine was received as kind gift from Sun Pharmaceuticals, Maharashtra, India. HPMC, Ethyl Cellulose, Propylene Glycol & Dimethyl Sulfoxide (DMSO) purchased from purchased from Dow Chemical International Pvt.Ltd, Maharashtra, India.Eudragit RSPO purchased from Evonik Industries Pvt.Ltd,Maharashtra, India.

3 METHODOLOGY

3.1. Analytical method development

A. UV scan: A 100mg of Galantamine was accurately weighed and was first dissolved in 35ml methanol solution. The solution was then diluted using phosphate buffer (pH-7.4) to 100 ml. (stock solution-I). Take 10ml solution from stock solution 1 and volume make up to 100ml with phosphate buffer to get 100 µg/ml concentrations (stock solution-II). Take 10 ml solution from stock II and volume make up to 100 ml with buffer to get 10 µg/ml. 10 µg/ml solution was scanned from 200-400nm.

B. Construction of calibration curve: A 100mg of Galantamine was accurately weighed and was first dissolved in 35ml methanol solution. The solution was then diluted using phosphate buffer (pH-7.4) to 100 ml. (stock solution-I). Take 10ml solution from stock solution 1 and volume make up to 100ml with phosphate buffer to get 100 µg/ml concentrations (stock solution-II). It was further diluted with phosphate buffer pH-7.4 to get solutions in concentration range of 5, 10, 15, 20 and 25 µg/ml. The absorbances of these solutions were determined spectrophotometrically at 290 nm.

3.2. Preformulation study

A. Colour, Odour, Taste and Appearance:
The drug sample was evaluated for its Colour, Odour and Appearance.

B. Melting point determination:
Melting point of the drug sample was determined by capillary method by using melting point apparatus.

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C. Determination of solubility:

The solubility of Galantamine was determined by adding excess amount of drug in the solvent.

The Galantamine has very low aqueous solubility. Its solubility is not reported in any official book, so determination of solubility is important. The solubility was determined in distilled water and phosphate buffer pH 7.4. The procedure can be detailed as follows.

Saturated solution of Galantamine prepared using 10 ml. of distilled water/ phosphate buffer pH 7.4 in 25 ml volumetric flasks in triplicate. Precaution was taken so that the drug remains in medium in excess. Then by using mechanical shaker, the flasks were shaken for 48 hours. The sample withdrawn (1 ml after filtration) was diluted with appropriate medium and analyzed by using UV spectrophotometer at 290 nm for phosphate buffer and distilled water respectively.

3.3. Formulation of transdermal patches

Preparation of blank patches:

Polymers of single or in combination were accurately weighed and dissolved in respective solvent and then casted in a Petri-dish with mercury as the plain surface. The films were allowed to dry overnight at room temperature.

Formulation of Drug Incorporated Transdermal Patches:
The matrix-type transdermal patches containing Galantamine were prepared using different concentrations of HPMC, Ethyl Cellulose and Eudragit RSPO. The polymers in different concentrations were dissolved in the respective solvents. Then the drug was added slowly in the polymeric solution and stirred on the magnetic stirrer to obtain a uniform solution. PEG 400 was used as plasticizers. Then the solution was poured on the Petri dish having surface area of 78 cm^2 and dried at the room temperature. Then the patches were cut into 2×2 cm^2 patches. Drug incorporated for each 2x2 cm^2 patch was 240 mg. The formulation table is given in Table 1.

Table 1: Formulation of Galantamine Patches

INGREDIENTS	G1	G2	G3	G4	G5	G6	G7	G8	G9
Galantamine (mg)	5	5	5	5	5	5	5	5	5
HPMC (mg)	5	10	15	-	-	-	-	-	-
Ethyl Cellulose (mg)	-	-	-	5	10	15	-	-	-
Eudragit RSPO (mg)	-	-	-	-	-	-	5	10	15
PEG-400 (ml)	5	5	5	5	5	5	5	5	5
Chloroform (ml)	3	3	3	3	3	3	3	3	3
Dimethylsulphoxide (ml)	2	2	2	2	2	2	2	2	2
Dibutyl phthalate* (ml)	4	4	4	4	4	4	4	4	4

3.4. Evaluation Parameters of patches

3.4.1. Physical evaluations

a. Thickness: The thickness of films was measured by digital Vernier calipers with least count 0.001mm. The thickness uniformity was measured at five different sites and average of five readings was taken with standard deviation.

b. Folding endurance: The folding endurance was measured manually for the prepared films. A strip of film (4x3 cm) was cut evenly and repeatedly folded at the same place till it broke. The number of times the film could be folded at the same place without breaking gave the exact value of folding endurance.

c. Weight variation: The three disks of 2*1 cm^2 was cut and weighed on electronic balance for weight variation test. The test was done to check the uniformity of weight and thus check the batch-to-batch variation.

d. Drug content Determination: The prepared drug contained patches specified surface area (2 cm^2) were cut and dissolved in (5% of methanol contained) 100ml of pH 7.4 phosphate buffer, and vigorously shaked for 12hrs, and then sonicated for 15 minutes, centrifuged at 5000 rpm for 30 min. Filter the drug contained polymeric solution through 42 number Whatman filter paper, then 1ml of the filtrate was taken in a test tube and dilute it for five times with same solvent by using double beam UV-Visible spectrophotometer to determined drug content at λmax 290 nm. Respected Placebo patch was taken as a blank solution.

e. Flatness: A transdermal patch should possess a smooth surface and should not constrict with time. This can be demonstrated with flatness study. For flatness determination, one strip is cut from the centre and two from each side of patches. The length of each strip is measured and variation in length is measured by determining percent constriction. Zero percent constriction is equivalent to 100 percent flatness.

% constriction = ((l1 - l2) / l1) × 100
l1 = Initial length of each strip, l2 = Final length of each strip

3.4.2. In-vitro Drug Diffusion Study:

The in vitro study of drug permeation through the semi permeable membrane was performed using a Franz type glass diffusion cell. The modified cell having higher capacity (25 ml) is used to maintain sink condition. This membrane was mounted between the donor and receptor compartment of a diffusion cell. The transdermal patch was placed on the membrane and covered with aluminum foil. The receptor compartment of the diffusion cell was filled with isotonic phosphate buffer of pH 7.4. The hydrodynamics in the receptor compartment were maintained by stirring with a magnetic bead at constant rpm and the temperature was maintained at 37±0.5°C. The diffusion was carried out for 12 h and 1 ml sample was withdrawn at an interval of 1 h. The receptor phase was replenished with an equal volume of phosphate buffer at each sample withdrawal. The samples were analyzed for drug content spectrophotometrically at 290 nm.

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3.5. Drug release kinetics

Diffusion data of above two methods was fitted in Zero order, First order and Higuchi equations. The mechanism of drug release was determined by using Higuchi equation.

Zero-Order Kinetics:
Zero order as cumulative amount of Percentage drug released vs time:
C = K0 × t
Where K0 is the zero-order rate constant expressed in units of concentration/time and t is the time in hours. A graph of concentration vs time would yield a straight line with a slope equal to K0 and intercept the origin of the axes.

First order kinetics:
First order as log cumulative percentage of log(%) cumulative drug remaining vs time:
Log C = Log C0 - (k × t / 2.303)
Where C0 is the initial concentration of drug, k is the first order constant, and t is the time.

Higuchi Model:
Higuchi's model as cumulative percentage of drug released vs square root of time:
Q = K × t^(1/2)
Where K is the constant reflecting the design variables of the system and t is the time in hours. Hence, drug release rate is proportional to the reciprocal of the square root of time.

Korsmeyer-Peppas equations:
KorsmeyerPeppas equation used to determine the mechanism of drug release form the polymer matrix of the tablet. Log cumulative percentage of drug released VS Log time, and the exponent n was calculated through the slope of the straight line.
Mt / M∞ = K × t^n
Where Mt/M∞ is the fractional solute release, t is the release time, K is a kinetic constant characteristic of the drug/polymer system, and n is an exponent that characterizes the mechanism of release of tracers. For cylindrical matrix tablets, if the exponent n = 0.45, then the drug release mechanism is Fickian diffusion, and if 0.45 < n < 0.89 then it is non-Fickian or anomalous diffusion. An exponent value of 0.89 is indicative of Case-II Transport or typical zero-order release.

3.6. Compatibility study

FTIR study:
The infrared spectrum of the pure GALANTAMINE sample was recorded and the spectral analysis was done. The dry sample of drug was directly placed after mixing and triturating with dry potassium bromide.

4. RESULTS AND DISCUSSION

Initially the drug was tested by UV to know their significant absorption maximum which can be used for the diffusion study of the drug.

4.1. Analysis of drug

A. UV scan:
The lambda max of Galantamine was found to be 290 nm.

B. Construction of calibration curve:

Table 2: Standard graph of Galantamine

Concentration (µg/ml)	Absorbance (at 290 nm)
0	0
5	0.119
10	0.211
15	0.312
20	0.409
25	0.512

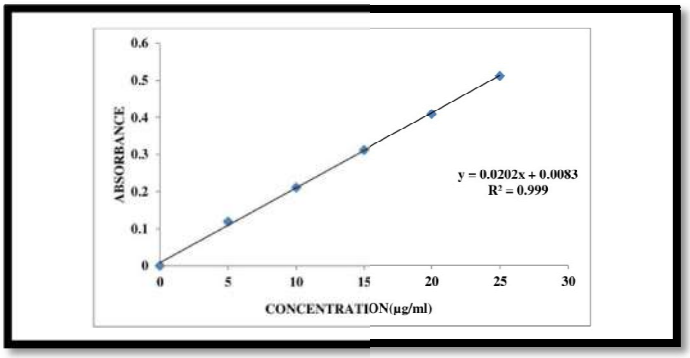


Fig 2: Standard calibration curve of Galantamine

4.2 Pre formulation study

Totally, Nine formulation trials were done with the aim to achieve the successful matrix type Galantamine transdermal patches. The blend trials prepared for the drug was evaluated for various physical parameters and content uniformity of drug by UV.

Table 3 galantamine evaluation study parameter

Parameter	Galantamine
Color	White
Odor	Odorless
Taste	Bitter
Appearance	A white powder

Table 3: Melting point determination

Drug	Reported melting point
Galantamine	207 to 210.0 °C

Table 4: Determination of solubility

Solvent	Drug solubility (mg/ml)
Distilled water	0.0403
pH 7.4 phosphate buffer	78.3

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Evaluation of Patch

The formulations G1 to G9 were varying in thickness when compared to other formulations which is due to the variation in the polymer concentration. Which shows the increase in polymer concentration increases the thickness of patch. For all other formulations it was found to be in between 1.76 to 1.99mm.All formulations from G1 to G9 shows weight variation in between 196.27 to 212.88 mg.Folding endurance from formulations G1 to G9 was found to be inbetween 72.39 to 89.38 which can withstand the foldings of the skin.All formulations showed % drug content from 97.37 to 99.85.

Table 5: Evaluation of patches

Formulation Code	Average weight (mg)	Thickness (mm)	Folding endurance	Flatness (%)	Appearance	% Drug Content
G1	210.54	1.85	85.22	98	Transparent	99.34
G2	205.38	1.93	89.38	96	Transparent	98.22
G3	200.47	1.89	76.46	99	Transparent	99.85
G4	198.59	1.82	82.58	97	Transparent	97.37
G5	196.27	1.99	72.39	100	Transparent	99.26
G6	201.62	1.76	86.76	99	Transparent	98.65
G7	208.77	1.83	79.51	98	Transparent	98.73
G8	202.26	1.95	84.49	99	Transparent	99.62
G9	212.88	1.89	82.12	97	Transparent	97.89

In vitro diffusion study:

All the formulation in vitro diffusion study was carried out by using Franz type diffusion cell under specific condition such as temp maintained at 32±0.5°C. The diffusion was carried out for 12 h and 5 ml sample was withdrawn at an interval of 1 h.

Table 6: In vitro drug permeation of Galantamine containing different concentrations of HPMC

Time (hr)	G1 (%)	G2 (%)	G3 (%)
0	0	0	0
1	25.44	28.98	26.25
2	34.87	32.42	34.23
3	42.52	37.23	48.45
4	55.04	44.57	58.37
5	61.06	52.91	64.64
6	68.76	61.15	69.22
7	71.62	69.65	77.73
8	78.76	75.21	84.78
9	83.24	84.87	88.62
10	87.12	88.97	91.32
11	91.63	93.13	95.58
12	96.42	96.65	99.75

Discussion on G1, G2, G3: The formulations G1 to G3 were prepared by different concentrations of HPMC (5, 10, 15mg). The drug release or drug permeation from the patch was dependent on the concentration of polymer in the matrix. At low polymer concentration the drug permeation is more; within 12 hours total amount of drug was permeated. The 15mg concentration of polymer showed maximum drug released at 12 hours (99.75%). Hence among these 3 formulations, G3 formulation showed total drug release at desired time period.

Table 7: In vitro drug permeation of Galantamine containing different concentrations of Ethyl Cellulose

Time (hr)	G4 (%)	G5 (%)	G6 (%)
0	0	0	0
1	25.35	25.62	25.23
2	39.09	37.53	39.05
3	46.69	43.02	42.51
4	56.41	48.51	55.52
5	61.58	57.46	61.87
6	68.36	64.65	68.75
7	72.67	68.59	73.97
8	78.54	72.78	79.72
9	82.65	82.53	85.46
10	89.87	86.76	88.78
11	92.84	91.54	92.63
12	98.54	94.53	96.87

Discussion on G4, G5, G6: The formulations G4 to G6 were prepared by different concentrations of Ethyl Cellulose (5, 10, 15mg). The drug release or drug permeation from the patch was dependent on the concentration of polymer in the matrix. The 5mg (G4) concentration of polymer showed maximum drug release 98.54% within 12 hours. The 10mg (G5) concentration of polymer showed maximum drug released at 12 hours 94.53%. The 15mg (G6) concentration of polymer showed drug release of 96.87% at 12 h.

Table 8: In vitro drug permeation of Galantamine containing different concentrations of Eudragit RSPO

Time (hr)	G7 (%)	G8 (%)	G9 (%)
0	0	0	0
1	27.02	28.51	25.34
2	34.45	32.12	37.53
3	44.22	41.32	45.98
4	49.64	46.06	53.39
5	57.43	54.81	64.13
6	62.11	61.47	68.51
7	68.75	73.51	75.76
8	71.87	81.39	78.21
9	78.54	84.62	82.51
10	81.56	89.03	88.54
11	88.65	93.65	92.05
12	95.56	96.73	97.65

Discussion on G7, G8, G9: The formulations G7 to G9 were prepared by different concentrations of Eudragit RSPO (5, 10, 15mg). The drug release or drug permeation from the patch was dependent on the concentration of polymer in the matrix. The 5mg (G7) concentration of polymer showed drug release 95.56% within 12 hours. The 10mg (G8) concentration of polymer showed drug release at 12 hours of 96.73%. The 15mg (G9) concentration of polymer showed drug release 97.65% at 12 h.
Among all 9 formulations, G3 formulation showed best drug permeation from the patch and passed all in vitro evaluation parameters.

4.4 Kinetic models for Galantamine

Various models were tested for explaining the kinetics of drug release. To analyze the mechanism of the drug release rate kinetics of the dosage form, the obtained data were fitted into zero-order, first order, Higuchi, and Korsmeyer-Peppas release model.

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Table 9: Kinetics data of G3 Galantamine patch

Cumulative (%) Release Q	Time (t)	Root (t)	Log (%) Release	Log (t)	Log (%) Remaining	Release Rate	1/Cum Release	Peppas log Q/100	Drug Remaining	Q0^(1/3)	Qt^(1/3)	Q0^(1/3) - Qt^(1/3)
0	0	0	-	-	2.000	-	-	-	100	4.642	4.642	0.000
26.25	1	1.000	1.419	0.000	1.868	26.250	0.0381	-0.581	73.75	4.642	4.194	0.448
34.23	2	1.414	1.534	0.301	1.818	17.115	0.0292	-0.466	65.77	4.642	4.037	0.605
48.45	3	1.732	1.685	0.477	1.712	16.150	0.0206	-0.315	51.55	4.642	3.722	0.920
58.37	4	2.000	1.766	0.602	1.619	14.593	0.0171	-0.234	41.63	4.642	3.466	1.176
64.64	5	2.236	1.811	0.699	1.549	12.928	0.0155	-0.189	35.36	4.642	3.282	1.359
69.22	6	2.449	1.840	0.778	1.488	11.537	0.0144	-0.160	30.78	4.642	3.134	1.508
77.73	7	2.646	1.891	0.845	1.348	11.104	0.0129	-0.109	22.27	4.642	2.813	1.828
84.78	8	2.828	1.928	0.903	1.182	10.598	0.0118	-0.072	15.22	4.642	2.478	2.163
88.62	9	3.000	1.948	0.954	1.056	9.847	0.0113	-0.052	11.38	4.642	2.249	2.392
91.32	10	3.162	1.961	1.000	0.939	9.132	0.0110	-0.039	8.68	4.642	2.055	2.586
95.58	11	3.317	1.980	1.041	0.645	8.689	0.0105	-0.020	4.42	4.642	1.641	3.000
99.75	12	3.464	1.999	1.079	-0.602	8.313	0.0100	-0.001	0.25	4.642	0.630	4.012

Summary of Kinetic Parameters for Optimized Formulation (G3):

- Zero-Order Kinetics: $y = 9.0507x + 14.501$, $R^2 = 0.9431$
- First-Order Kinetics: $y = -0.0993x + 2.011$, $R^2 = 0.9825$
- Higuchi Model: $y = 30.341x - 3.3465$, $R^2 = 0.9928$
- Korsmeyer-Peppas Model: $y = 0.5767x + 1.4017$, $R^2 = 0.9903$

From the above data, the optimized formulation G3 followed Zero order kinetics model rule with high correlation in diffusion parameters.

4.5. Compatibility studies - IR SPECTROSCOPY:

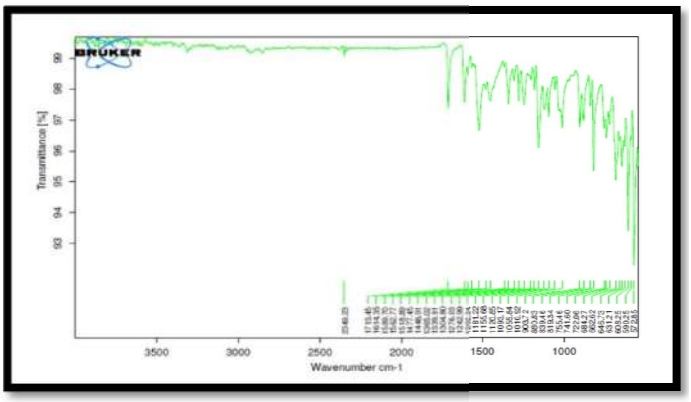


Figure 3: FTIR Spectrum of pure Galantamine drug

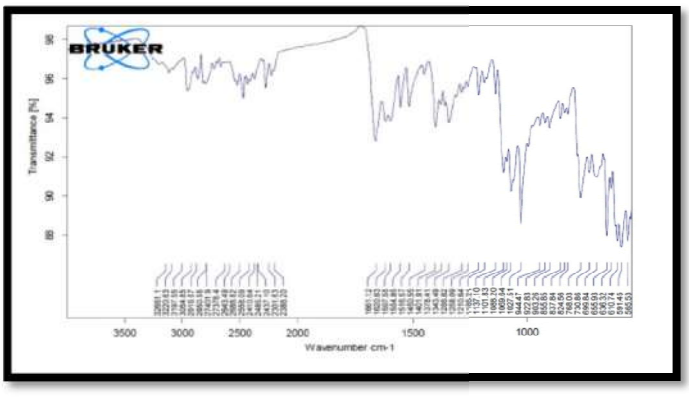


Figure 4: FTIR Spectrum of Optimized formulation

The compatibility studies of the drug with excipients indicate no characteristic visual changes and no additional peaks were observed during FT-IR studies, demonstrating stability and absence of chemical interaction between Galantamine and the polymers/excipients used.

CONCLUSION

The galantamine gel transdermal patch was successfully developed and evaluated using HPMC, Ethyl Cellulose, and Eudragit RSPO polymers. Formulation G3 containing HPMC exhibited excellent physical integrity, high drug content uniformity (99.85%), non-irritating skin compatibility, and a sustained, controlled release profile over 12 hours (99.75% release following Higuchi and Korsmeyer-Peppas kinetics). This transdermal system provides a viable and effective alternative to oral galantamine delivery, reducing side effects and improving patient compliance for Alzheimer's disease therapy.

DECLARATION OF AI USE

Authors have used AI Gemini Tool to for generating image for Understanding the novel drug delivery system only.

REFERENCES

[1] Chien Y.W., Liu J.C. Transdermal drug delivery systems. J. Biomater. Appl. 1986; 1:183-206.

[2] Lasagna L., Greenblatt D.J. More than skin deep: Transdermal drug-delivery systems. N. Engl. J. Med. 1986; 314:1638-1639.

[3] Kopper N.W., Gudeman J., Thompson D.J. Transdermal hormone therapy in postmenopausal women. Drug Des. Dev. Ther. 2009; 2:193-202.

[4] Al Hanbali O.A., et al. Transdermal patches: Design and current approaches to painless drug delivery. Acta Pharm. 2019; 69:197-215.

[5] Lina Du, et al. Ginger oil-loaded transdermal adhesive patch treats post-traumatic stress disorder. 2024.

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[6] Anubhav Anand, Dharamveer Panjwani. Optimization of simvastatin transdermal patch for hyperlipidemia treatment in rat model. 2024.

[7] Stabak Das, et al. Fabrication, evaluation, and enhanced penetration of vinyl and cellulose-engineered transdermal patch of nifedipine. 2024.

[8] Shahid Ullah Khan, et al. Nanotherapeutic approaches for transdermal drug delivery systems and their biomedical applications. Eur. Polym. J. 2024.

[9] Indira MuzibYallamalli, et al. Drug In Adhesive Transdermal System Of Furosemide. Int. J. Appl. Pharm. 2023.

[10] Sung-Joo Hwang, et al. Formulation, Preparation, Characterization, and Evaluation of Dicarboxylic Ionic Liquid Donepezil Transdermal Patches. Pharmaceutics 2022.

[11] Amira Sayed Hanaf, et al. Galantamine transdermal patch shows higher tolerability over oral galantamine in rheumatoid arthritis rat model. Drug Dev. Ind. Pharm. 2020.

[12] Woo Fong Yen, et al. Formulation and Evaluation of Galantamine Gel as Drug Reservoir in Transdermal Patch Delivery System. Sci. World J. 2015.

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