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Formulation And Evaluation Of Orodispersible Cinnarizine Tablet Using β-Cyclodextrin For Motion Sickness

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ABSTRACT

Introduction: The objective of the current research was to develop and assess orodispersible tablets containing Cinnarizine, aimed at enhancing patient adherence among individuals dealing with Motion Sickness, particularly those who suffer from dizziness, nausea, and vomiting during Traveling in various modes of transportation such as car, airplane, boat, or even experiencing amusement park rides can induce feelings of nausea.This specific patient group necessitates a drug delivery system that is both quick and easy to swallow.

Materials and Methods: The Cinnarizine-β-cyclodextrin inclusion complex was synthesized through Three different methods, namely the physical blend method, solvent evaporation method and kneading method, to determine the most suitable method for the formulation with the primary goal of increasing the drug's solubility and permeability. The efficiency of inclusion complexes at different Cinnarizine β-cyclodextrin ratios (1:0.5, 1:1, 1:1.5) was evaluated, revealing that the 1:1 ratio complex exhibited the highest effectiveness. Orodispersible tablets containing Cinnarizine (designated as F1 to F9) were manufactured using a straightforward and cost-efficient direct compression technique, employing varying concentrations of the super disintegrant sodium starch glycolate.

Results: The investigation encompassed pre-compression characteristics of the powder blends and post-compression parameters of the tablets, all of which met the desired criteria. Among all the formulations examined, Formulation F6 demonstrated the shortest disintegration time and the highest cumulative drug release at 93.66%, consequently being designated as the optimized formulation.

Conclusion: In conclusion, this study suggests that employing orodispersible tablets can significantly improve drug dissolution, absorption, therapeutic efficacy, and overall bioavailability in the treatment of Motion Sickness when compared to traditional treatment methods. This approach offers a cost-effective solution that enhances patient compliance and solubility of drug.

Key words : Motion Sickness, Orodispersible Tablet, Inclusion Complexation, Cinnarizine -β- cyclodextrin, sodium starch glycolate.

INTRODUCTION

Motion sickness, also known as travel sickness or kinetosis, is a common condition characterized by symptoms such as nausea, vomiting, dizziness, and discomfort. It typically occurs when there is a disconnect between the sensory signals that the brain receives from the inner ear, the eyes, and other parts of the body. For example, when you're in a vehicle like a car, plane, or boat, your inner

ear may detect motion, but your eyes might not see corresponding movement or may even perceive different motion. This sensory mismatch can lead to motion sickness as your brain struggles to reconcile the conflicting signals. Cinnarizine is a medication that plays an important role in the treatment and prevention of motion sickness.[1] Cinnarizine acts as an antihistamine, which means it can reduce the activity of histamine, a neurotransmitter involved in various bodily functions, including balance and nausea. By blocking histamine receptors in the brain, cinnarizine can alleviate some of the symptoms associated with motion sickness, such as nausea and vomiting.[2] Cinnarizine is also a calcium channel blocker, which relax and dilate blood vessels. This effect can help improve blood flow in the inner ear, reducing the sensory mismatch between the inner ear and the visual system.Cinnarizine is often used prophylactically, meaning it's taken before an anticipated motion sickness-inducing event. This is a common approach for individuals who know they are prone to motion sickness when traveling. By taking cinnarizine before the journey, it can help prevent the onset of symptoms or reduce their severity.[1,2]

Cinnarizine, classified as a BCS (Biopharmaceutics Classification System) Class Ⅱ drug, presents certain challenges when formulated as a conventional tablet, which can impact patient compliance. Being a Class 2 drug, cinnarizine has high permeability but low solubility. This means that it can be absorbed efficiently in the gastrointestinal tract but may dissolve slowly or inconsistently, leading to delayed or uneven drug absorption. In the form of conventional tablets, this erratic dissolution profile can result in unpredictable therapeutic effects, making it difficult for patients to gauge when the medication will take effect. This lack of predictability and potential variability in symptom relief may discourage some patients from adhering to their treatment regimen, as they may become unsure about the tablet's effectiveness.[2,3]

The present innovation pertains to the creation of orodispersible tablets containing Cinnarizine through the process of inclusion complexation utilizing β-Cyclodextrin. Cinnarizine, classified as an antihistamine calcium channel blocker is an orally administered tablet that exhibits significant potential in the treatment of Motion sickness. Given that Cinnarizine falls under BCS Class II due to its limited solubility,[3] various approaches have been explored to enhance its solubility. One effective method involves creating a complex with β-Cyclodextrin.[4,5,] This inclusion complexation with β-Cyclodextrin augments the drug's aqueous solubility. This enhancement will be harnessed in the development of orodispersible tablets, not only boosting the drug's bioavailability but also expediting its onset of action through rapid absorption from the gastrointestinal tract, as the drug will be readily available for absorption in solution form from the oral cavity itself.[5,6,4]

MATERIALS AND METHODS

The study received Cinnarizine from Torrent Chemicals Pvt. Ltd., Ahmedabad India. Additionally, β-cyclodextrin, Mannitol Pharmaco Mumbai, Sodium starch glycolate Ascot Pharma Ltd., Mumbai., and Magnesium stearate were sourced from Westarn Pharma, Mumbai India. The reference tablets, cinnarizine tablets, were procured. All remaining chemicals and reagents employed in the study were of analytical grade.

METHODS

PREPARATION OF CINNARIZINE -B-CYCLODEXTRIN COMPLEX BY DIFFERENT METHOD

Three methods, namely the physical blend method, solvent evaporation method and kneading method has been employed to formulate the cinnarizine-β-cyclodextrin inclusion complex. The aim is to determine the most suitable method for the formulation and focusing on which method provides the highest solubility of the drug.[26,5]

1. **Physical blend method:** The cinnarizine- β -cyclodextrin inclusion complex is formed using the physical blend method, which involves the direct mixing of cinnarizine and beta-cyclodextrin in predetermined ratios. This physical blending process ensures that the components are uniformly distributed. After mixing, additional steps such as sieving and compression are applied to further homogenize the mixture and increase its compactness.[5,7]
2. **Solvent evaporation method:** In the solvent evaporation method, cinnarizine-β-cyclodextrin are dissolved together in a solvent to form a uniform solution. This solution is then evaporated under reduced pressure or at an elevated temperature, causing the solvent to evaporate and leaving behind the cinnarizine-β-cyclodextrin inclusion complex. The complex is then collected, dried, and processed further as needed.[7]
3. **Kneading method:**k.neading method, cinnarizine-β-cyclodextrin are mixed together in a mortar and pestle with a small amount of solvent or Water. The mixture is kneaded until it forms a uniform paste-like consistency. Then, the mixture is dried to remove any remaining solvent or water, resulting in the formation of the inclusion complex.[26,7]

Saturation Solubility studies of cinnarizine-β-Cyclodextrin inclusion complexes prepare by different method

The solubility studies of cinnarizine-β-cyclodextrin inclusion complexes prepared by three different methods—physical blend, kneading, and solvent evaporation—were conducted to evaluate their solubility enhancement compared to the drug alone. The experimental procedure involved adding excess quantities of the complexes into glass vials containing 10 ml of 0.1 N HCl, followed by 24 hours of continuous shaking on a lab shaker for thorough mixing and equilibration. Filtration was then performed to remove any undissolved particles, and UV absorbance measurements were taken at 253 nm using a UV-visible spectrophotometer after appropriate dilutions. This systematic approach enabled the identification of the complex with superior solubility, aiding in the selection of an optimal complex for further in-vitro dissolution studies and formulation development.[26,7]

Saturation solubility studies of cinnarizine-β-Cyclodextrin inclusion complexes of different ratios

saturation solubility was conducted to assess the complex that had been prepared. This investigation served as the fundamental criterion for selecting and evaluating a preferred complex, aiming to enhance its solubility and consequently yield favorable outcomes in in-vitro dissolution experiments. The same procedure was applied to both the drug and its respective complex. The solubility assessments were carried out using glass vials, each containing 10 ml of 0.1 N HCL. Excessive amounts of the complexes were introduced into these vials. Subsequently, these vials were continuously agitated for 24 hours using a laboratory shaker. The resulting solutions were then filtered, appropriate dilutions were prepared, and UV absorbance measurements were taken at a wavelength of 253 nm.[10,19]

Table 1: Improving the Bioavailability of a BCS Class 4 Drug.

BCS Class	Solubility	Permeability	Rate-Limiting Step in Drug Absorption.	The Impact of Cyclodextrin Complexation.
1	High	High	Good Bioavailability	Can decrease absorption
2	Low	High	Aqueous diffusion	Can enhance absorption
3	High	Low	Passage Across Membranes.	Can decrease absorption

4	Low	Low	Diffusion Through Aqueous Solutions and Membrane Permeation.	Can enhance absorption

FTIR Analysis

The evaluation of drug-excipient compatibility was conducted via FT-IR spectroscopy, assessing the interaction between pure cinnarizine and various polymers including β-cyclodextrin, Magnesium Stearate, Sodium starch glycolate, and Mannitol. The instrumentation employed a dry air purge and scanned at a rate of 2 mm/sec with a resolution of 4 cm^{-1}, spanning the spectral range of 4000 to 400 cm^{-1}. Spectral scans were meticulously examined for characteristic drug peaks, alterations in peak positions, potential peak masking, or emergence of new peaks indicative of interactions. Such analysis serves as a pivotal tool in elucidating the compatibility between drugs and polymers, thereby informing crucial formulation decisions.[11,14]

Differential Scanning Calorimetry (DSC)

Differential Scanning Calorimetry (DSC) is used to identify cinnarizine. A sample is sealed in aluminum and heated gradually while monitoring heat flow. Key thermal events specific to cinnarizine, like melting points, are observed and compared to reference data for confirmation. DSC is crucial in academia for accurately characterizing cinnarizine's thermal properties.[16,11]

METHOD OF PREPARATION OF POWDER BLEND

Cinnarizine Complex with β-Cyclodextrin and Various Inactive Ingredients, Including Different Levels of sodium starch glycolate The formulation consists of a complex containing Cinnarizine and β-cyclodextrin, along with appropriate amounts of other inactive ingredients to achieve an equivalence to 25 mg of Cinnarizine. These formulations are labeled as F1 to F9. In the initial stage of preparation, the active and inactive ingredients were accurately weighed and sifted through a 60-mesh sieve. Subsequently, the remaining ingredients were added to this mixture and blended together for a duration of 20 minutes. Finally, the blend was passed through a mesh with a 40 size, and it was used for assessing its flow characteristics.[10,18,22]

Table 2: Various Ratios Employed in the Formulation of the Complex.

Sr.no	Carrier	Ratio of Drug (cinnarizine) to Carrier (β-Cyclodextrin) by Weight (w/w).		
1	β-Cyclodextrin	1 :0.5	1:1	1:1.5

EVALUATIONS OF POWDER BLEND FOR FLOW PROPERTIES

Bulk Density:

To determine the bulk density, a precisely weighed powder blend from each formula was gently shaken to disperse any agglomerates, and it was then placed into a measuring cylinder. The volume occupied by the powder was measured, providing the bulk volume. The bulk density of the powder blends was calculated using the following formula:[9,12]

$$\rho bulk = m/Vo$$

Tapped Density:

To establish the tapped density, an accurately weighed powder blend from each formula was lightly shaken to disrupt any agglomerates, and it was introduced into a measuring cylinder. The measuring

cylinder was tapped until no further change in volume was observed, yielding the tapped volume. The tapped densities (TD) of the powder blends were determined using the following formula:[12]

$$\rho t = m/V_t$$

Angle of Repose:

The angle of repose is a measure used to assess the flow properties of solids. It is a characteristic linked to the friction or resistance between particles. The angle of repose (θ) for the powder was determined by pouring the powder through a funnel. The tip of the funnel's orifice was fixed at a height of 1 cm above a horizontal surface, and the powder was allowed to flow solely due to gravity. The angle of repose, θ, was calculated using the following relationship.[16,17]

$$\theta = \tan -1(h/r)$$

The angle of repose (θ) is calculated using the formula: tan θ = h/r, where 'h' represents the height of the pile of powder (h=1) and 'r' is the radius of the base of the cone.

Hausner Ratio:

Hausner's ratio is determined using the equation: Hausner's Ratio = Tapped bulk density / Loose bulk density. A Hausner ratio less than 1.12 indicates good flow, while a ratio greater than 1.35 suggests poor flow.[9,16]

$$\text{Hausner's Ratio} = \rho t / \rho bulk$$

Compressibility Index:

The compressibility index is a straightforward measure that can be determined with small quantities of powder. In theory, materials that are less compressible tend to flow more easily. The compressibility index of the powder blends is determined using the following formula: [8]

$$CI = \rho t - \rho bulk / \rho t \times 100$$

Table 3: Formulation for Orodispersible Tablet of Cinnarizine.

Sr. No.	Ingredients (mg)	Formulations								
		F1	F2	F3	F4	F5	F6	F7	F8	F9
1	Cinnarizine	25	25	25	25	25	25	25	25	25
2	β-cyclodextrin	38	38	38	76	76	76	114	114	114
3	Sodium Starch Glycolate	8	12	16	8	12	16	8	12	16
4	Mannitol	125	121	117	87	83	79	49	45	41
5	Mag. stearate	4	4	4	4	4	4	4	4	4
6	Orange Flavour	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s
	Total (mg)	200	200	200	200	200	200	200	200	200

PREPARATION OF CINNARIZINE ORODISPERSIBLE TABLETS USING DIRECT COMPRESSION TECHNIQUE

Following the assessment of the powder blend, Orodispersible tablets were crafted through the direct compression method utilizing a 10-station rotary tablet compression machine, featuring flat-faced 6 mm punches. Prior to compression, the die and punch surfaces were lubricated with magnesium stearate. Nine formulations with varying quantities of superdisintegrant were developed, and all preparations were stored in airtight containers at room temperature for subsequent analysis.[9,24]

Evaluation of Orodispersible Tablet of Cinnarizine

Thickness

Ensuring uniform tablet size is crucial, and the thickness of the tablets was gauged for this purpose using a Vernier Caliper. Three tablets from each batch were measured in this evaluation.[12]

Hardness

Hardness assessment for each formulation involved testing the hardness of three tablets using the Monsanto hardness tester.

Drug Content Uniformity Study

Five individual tablets were weighed and powdered. The powder, equivalent to 10 mg of Cinnarizine, was then weighed and dissolved in methanol. The volume was adjusted to 100 ml with methanol. From this initial solution, a 10 µg/ml dilution was prepared. The drug content of the resulting solution was determined by calculating UV absorbance at 253 nm.[17]

Weight Variation Test

Twenty tablets were individually weighed, and the average weight was determined by summing the weights of all tablets and calculating the average. Individual weights were then compared to the average weight, and the percentage difference in weight variation should fall within the acceptable limits. The percent deviation was calculated using the following formula:[13,14]

$$\text{Weight Variation} = (Iw - Aw)/Aw \times 100\%$$

where, **Iw** = Individual weight of tablet; **Aw** = Average weight of tablet

Wetting Time

A folded piece of tissue paper was positioned in a petri dish containing 6ml of water. The tablet was then laid on the paper, and the duration for the tablet to fully wet was measured in seconds. The methodology was slightly adjusted by maintaining the water at 37°C. The wetting time, indicating the duration for the tablet to disintegrate when held motionless on the tongue, was subsequently calculated.[13,10]

Disintegration Time

In-vitro disintegration studies were conducted using the Tablet Disintegration Test Apparatus. Each of the six tubes in the basket assembly held one tablet, with a disk added to each tube. This assembly was suspended in a one-liter beaker containing distilled water, maintained at 37±2°C. The basket underwent vertical movement, oscillating through a distance of 5 to 6 cm at a frequency of 28 to 32 cycles per minute. The time taken for the complete disintegration of the tablet was then recorded. This test was performed for tablets of all formulation types (F1-F9).[15,11]

***In- vitro* Drug Release Study**

In-vitro drug release studies were conducted for a duration of 30 minutes on the nine prepared formulations of Orodispersible Tablets using an eight-station USP type 2 apparatus. The agitation speed was set at 50 rpm. Cinnarizine tablets were introduced into 900 ml of 0.1 N HCL at 37 ± 0.5°C. At intervals of 5, 10, 15, 20, 25 and 30 minutes, 10 ml aliquots were withdrawn, filtered through Whatman No. 41 filter paper, and replaced with an equal volume of fresh dissolution medium to maintain the overall volume. The filtered samples were then analyzed spectrophotometrically at 253 nm, and the cumulative percentage of the labeled amount of drug released was calculated.[11,15,16]

RESULTS AND DISCUSSION

Preparation of Cinnarizine -β-cyclodextrin inclusion complex

In an effort to enhance the solubility and permeability of the drug, complexes were formulated using β-Cyclodextrins. The selection of drug-to-carrier ratios (1:0.5, 1:1, 1:1:5) was determined based on a comprehensive literature review, considering successful outcomes observed with a variety of ratios for similar carriers. The complex formation was carried out through the Physical blending method.[10,19]

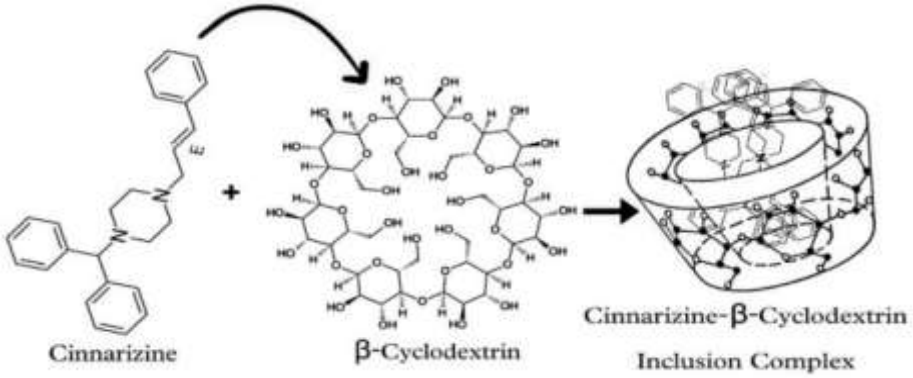


Figure 1: Cinnarizine-β-Cyclodextrin Inclusion complex with Improved Solubility

To evaluate the optimal method for forming the inclusion complex of cinnarizine and β-cyclodextrin, three distinct techniques were employed: the physical blend method, the solvent evaporation method, and the kneading method. The aim was to determine which approach yields the most promising results for the preparation of cinnarizine and β-cyclodextrin inclusion complexes.[7,8]

Table 4: Saturation solubility data of complexes from different method

Sr.No	Methods	Saturated Solubility (µg/ml)	Drug content (%)
1	Kneading method	5.8446	95.68 ± 0.76
2	Solvent evaporation method	7.7840	96.80 ± 0.44
3	Physical blend method	3.6401	96.53 ± 0.56

Our study revealed that the solvent evaporation method resulted in the highest reported saturation solubility of 7.7840 for the inclusion complex of cinnarizine and β-cyclodextrin.Therefore, we consider this method to be the most effective.

Preparation of cinnarizine- β-cyclodextrin inclusion complex by Solvent evaporation method

Cinnarizine- β-cyclodextrin inclusion complex prepared by solvent evaporation method in ratios of 1:0.5, 1:1, and 1:1.5, first, dissolve cinnarizine and β-cyclodextrin separately in Methanol. Then, mix the solutions in the desired ratios, ensuring thorough homogeneity. Evaporate the solvent carefully to obtain the inclusion complex, followed by drying to remove any residual solvent.[10,11]

Saturation solubility data of complexes from different ratios

Figure 5: Saturation solubility data of complexes from different ratios

Sr. No	Ratio of Cinna- β-CD Complexes	Saturated solubility(µg/ml)	Drug Content(%)
1	Cinna- β-CD (1: 0.5)	4.6107	96.68 ± 0.71
2	Cinna- β-CD (1:1)	7.8104	97.93 ± 0.47
3	Cinna- β-CD (1:1.5)	6.1502	97.43 ± 0.37

The table presents saturation solubility data of complexes formed at different ratios of Cinna- β-CD. Among these ratios, the Cinna- β-CD (1:1) ratio stands out slightly with the highest saturated solubility of 7.8104 µg/ml. Despite the minor variations in solubility across ratios, the choice of the 1:1 ratio may be preferable for its marginally higher solubility.[26,10,11]

FTIR Analysis

Fourier transformed infra-red (FTIR) spectra of Cinnarizine and the physical mixture of drug with excipient was taken by using IR Spectrophotometer. The scanning range was 450 – 4000 cm^{-1} and the resolution was 1 cm^{-1}. The IR spectrum of pure drug and physical mixture of drug and excipient were studied. The characteristic absorption peaks of Cinnarizine and absorption peaks of physical mixture are correlates with each other. This indicates that the drug was compatible with the excipient.[11,14]

Figure 2 : FTIR Spectrum of Cinnarizine

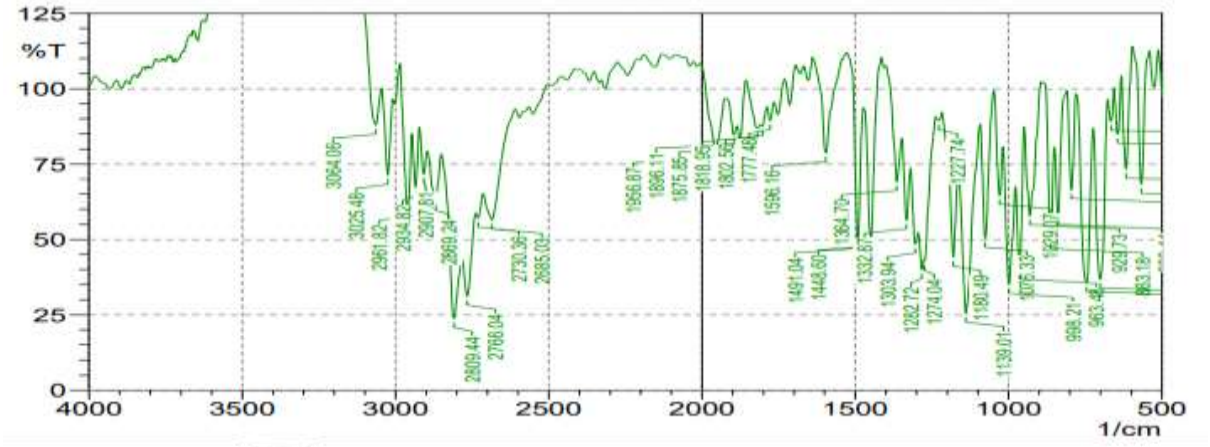
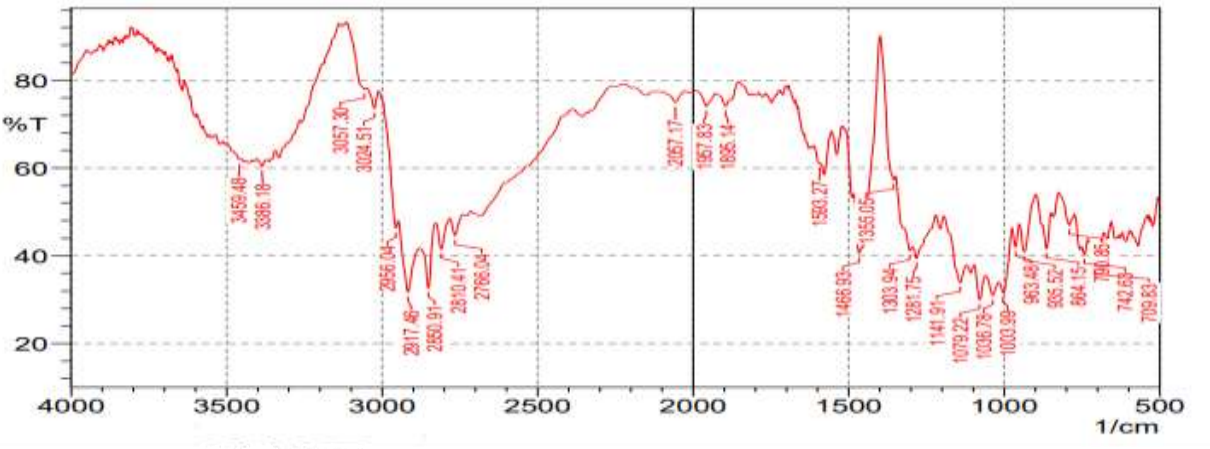


Figure 3 : FTIR Spectrum of Cinnarizine with Excipients



Differential scanning calorimetry (DSC)

The DSC analysis of cinnarizine revealed a distinct peak at a temperature of 124°C. This peak corresponds to a thermal event, likely indicative of either melting, crystallization, or a polymorphic transition of the cinnarizine sample under the experimental conditions.[16,11]

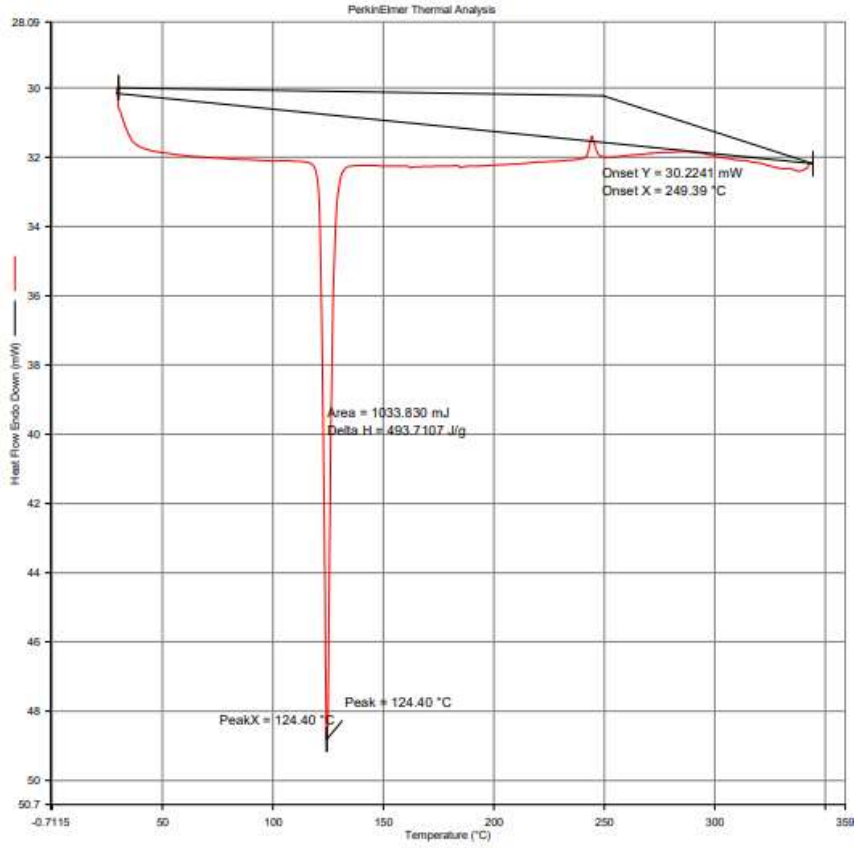


Figure 4: DSC of cinnarizine pure drug.

Evaluation of powder blend

Table 6 : Evaluation of powder blend					
Batch Code	Angle of repose (⁰C)	Bulk density (gm/ml)	Tapped density (gm/ml)	Compressibility Index (%)	Hausners ratio
F1	30.63	0.501	0.609	17.77	1.215
F2	32.14	0.511	0.626	18.66	1.226
F3	31.62	0.513	0.627	20.11	1.26
F4	29.63	0.507	0.605	17.34	1.213
F5	32.22	0.509	0.619	17.69	1.213
F6	32.38	0.521	0.608	14.61	1.174
F7	31.17	0.517	0.620	16.34	1.197
F8	25.82	0.518	0.624	17.38	1.211
F9	28.51	0.525	0.630	16.23	1.255

Angle of Repose (θ):

The angle of repose of various powders mixed blend, prepared with different superdisintegrants, was measured by cylinder method. Angle of repose was found in the range from 25.82 to 32.38 the good flow ability of powder blend was also evidenced with angle of repose which is indicated a good flow ability. [19]

Bulk density: The bulk density of various powder mixed blends. Prepared with different superdisintegrants was measured by graduated cylinder. The bulk density was found in the range

from 0.501 to 0.525. [19,20]

Tapped density:

The tapped density of various powder mixed blends prepared with different superdisintegrants, was measured by measuring cylinder. The tapped density was found in the range from 0.608 to 0.630.

Compressibility Index:

The compressibility index of various powder mixed blends prepared with different superdisintegrants using bulk density and tapped density data, compressibility index was calculated. Which range from 14.61 to 20.11

Hausner ratio: The Hausner ratio of various powder mixed blends prepared with different superdisintegrants, it was calculated by using bulk density and tapped density data. It was found in the range of 1.174 to 1.255.

FORMULATION OF ORODISPERSIBLE TABLET BY DIRECT COMPRESSION TECHNIQUE

Orodispersible tablets were manufactured through the direct compression technique. This was carried out using a 10-station rotary tablet compression machine equipped with flat-faced 6 mm punches. Before compression, magnesium stearate was applied as a lubricant to the surfaces of the die and punch. Nine different formulations, each containing varying quantities of a superdisintegrant, were meticulously prepared. Subsequently, all these formulations were stored in airtight containers at room temperature to facilitate further examination.[21,24]

Table 7: Evaluation of Orodispersible tablets of Cinnarizine:

Formulation Batches	Thicknes (mm)	Hardness (Kg/cm2)	Drug content (%)	Wetting time(sec.)	Disintegration Time (sec.)	Weight Variation (mg)
F1	3.1	2.6	97.42	32.7	31.64	pass
F2	3.1	2.4	98.75	31.37	30.67	pass
F3	3.2	3.0	95.08	30.05	27.66	pass
F4	3.3	2.9	98.52	32.38	29.72	pass
F5	3.0	3.0	97.86	29.71	30.35	pass
F6	3.4	3.0	96.27	31.06	26.68	pass
F7	3.1	3.0	99.32	33.38	32.66	pass
F8	3.2	3.1	99.53	34.69	30	pass
F9	3.4	3.1	98.66	35.06	28.33	pass

Thickness:

The tablet formulations exhibited thickness ranging between 3.1 mm and 3.4 mm, with the thickness variation in formulations (F1 to F9) falling within acceptable boundaries.[10]

Hardness :

The tablet formulations demonstrated hardness levels ranging from 2.4 Kg/cm² to 3.1 Kg/cm². The obtained results fell within acceptable limits, signifying robust mechanical strength

Drug content uniformity study :

The Cinnarizine drug content percentage fell within the range of 97.42 % to 99.53 %, and the findings were deemed satisfactory.

Weight variation

The weight variation of the tablet formulation is falling within acceptable limits. As per the I.P. (Indian Pharmacopoeia), a standard deviation of up to 7.5% is permissible.[24]

Wetting time :

The wetting time for all formulations (F1-F9) was found to be satisfactory, ranging from 29.71 to 35.06 seconds. Among formulations F1 to F9.

Disintegration time

Orodispersible Tablets are expected to disintegrate within three minutes. The disintegration time for formulations F1-F9 fell within the range of 26.68 sec to 32.66 seconds. Notably, among all formulations.[25]

***In-vitro* release studies:**

The Comparative analysis of each formulation was based on in vitro kinetic parameters, which elucidated the release profile. The in-vitro drug release of orodispersible tablets of Cinnarizine for all formulation is given as follows.[10,24]

Table 8: %Cumulative drug Release									
Time	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**	**F9**
0	0	0	0	0	0	0	0	0	0
5	12.3	15.8	20.83	25.81	27.42	29.24	22.14	24.93	25.84
10	22.4	25.3	36.2	34.2	35.2	38.99	29.83	35.44	23.84
15	35.41	42.0	46.26	44.22	46.91	44.82	42.14	44.53	34.72
20	43.2	53.8	56.45	52.51	55.07	56.34	52.24	55.76	47.56
25	57.14	66.9	63.72	68.92	72.14	74.24	76.59	73.83	67.61
30	91.9	87.0	87.55	87.13	85.66	93.66	85.76	90.34	89.72

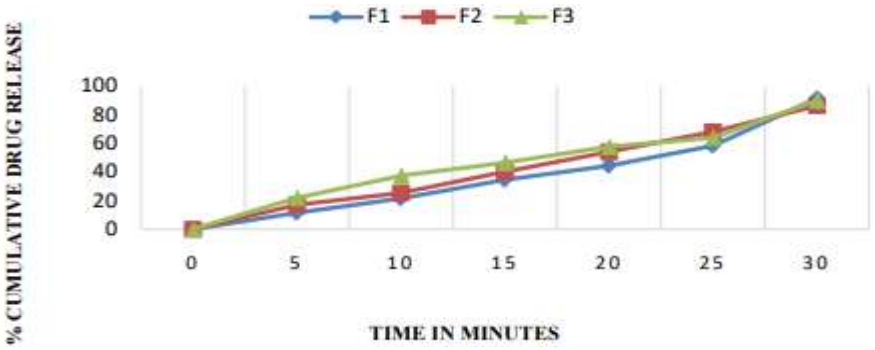


Figure 5. Cumulative drug release of formulation F1-F3.

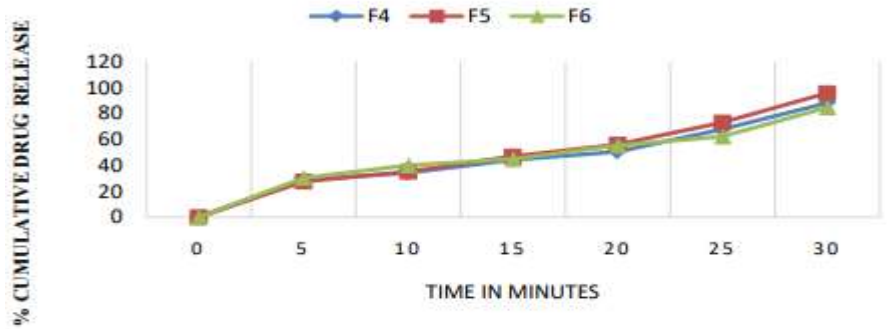


Figure 6. Cumulative drug release of formulation F4-F6.

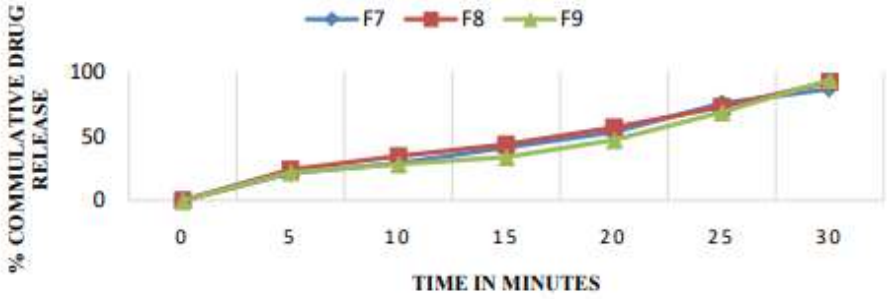


Figure 7. Cumulative drug release of formulation F7-F9

CONCLUSION

In conclusion, the primary challenge associated with the BCS-Class 4 Cinnarizine drug lies in its diminished solubility and permeability. Findings indicate that improving the dissolution rate and bioavailability can be achieved by forming an inclusion complex of Cinnarizine with β-cyclodextrin, employing the direct compression technique along with the super disintegrant sodium starch glycolate. The comprehensive results demonstrate that among the investigated formulations (F1 to F9), Formulation F6, containing 8% sodium starch glycolate with a 1:1 ratio of Cinnarizine-β-cyclodextrin, exhibits a shorter disintegration time and a 93.66% cumulative drug release. Consequently, F6 surpasses others, meeting the criteria for an orodispersible tablet and offering enhanced patient compliance in a cost-effective manner compared to traditional psoriasis treatment.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest

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