

Research Article

Formulation and Evaluation of Fast Dissolving Tablets of Flunarizine HCl by Sublimation Method Using Treated Agar As Superdisintegrant

Ronald Peter*, N. Shashank Nayak, S. Shwetha, K. Kamath and AR. Shabaraya

Department of Pharmaceutics, Srinivas College of Pharmacy, Valachil
Mangalore – 574 143, Karnataka, India.

ABSTRACT

In the present work, Flunarizine hydrochloride, an anti-migraine drug has been formulated into fast dissolving tablets by sublimation method using camphor and menthol as sublimating agents and treated agar as superdisintegrant. Concentrations of the sublimating agents were varied keeping the concentration of superdisintegrant fixed. The aim of the study was to prepare fast dissolving tablets with better drug releasing profile. The comparative evaluation of selected concentrations of sublimating agents on various physico-chemical properties of tablets was performed. Wetting time, water absorption ratio, *In-vitro* disintegration time, and drug release was dependent on the concentration of sublimating agents. The fast dissolving tablets were prepared with 0%-26.5% concentration of sublimating agents with optimum concentration of 10% of treated agar. The blend was evaluated for angle of repose, bulk density, tapped density, compressibility index and hausner's ratio. The tablets were evaluated and compared for thickness, hardness, friability, weight variation, content uniformity, wetting time and water absorption ratio, *In-vitro* disintegration time, dissolution study and FTIR studies. The formulation F8 with 26.5% of menthol and 10% of treated agar was found to be best with a better drug release of 99.72% in 90 secs. We could conclude that, superdisintegrant, menthol was better compared to camphor.

Keywords: Flunarizine hydrochloride, camphor, menthol, treated agar, In-vitro dispersion time.

INTRODUCTION

Swallowing a tablet is a major difficulty encountered in case of geriatric and pediatric patient which leads to poor patient compliance due to unpalatable taste of drug. To troubleshoot these problems a new dosage form known as fast-dissolving tablet, has been developed which rapidly disintegrate and dissolve in saliva. The conventional tablet seems to be most popular because of its ease of transportability and comparatively low manufacturing cost but poor patient compliance in case of pediatrics and geriatrics patients who experienced difficulties in swallowing, in response to this mouth dissolving drugs delivery system (MDDs) were developed as an alternative to tablet, capsules & syrups.¹ For conditions where treatments with FDT formulations are already available, there are studies showing that patients prefer these formulations to oral tablets. We can see that a fast dissolving pharmaceutical form could help to increase patient compliance, in view of its ease of administration, since they

do not need to be taken with liquid like conventional formulations.²

Superdisintegrant are the agents added to tablet and some encapsulated formulations to promote the breakup of the tablet and capsule "slugs" into smaller fragments in an aqueous environment there by increasing the available surface area and promoting a more rapid release of the drug substance. They promote moisture penetration and dispersion of the tablet matrix.³ Superdisintegrant provides quick disintegration due to combined effect of swelling and water absorption by the formulation. Due to swelling of superdisintegrants, the wetted surface of the carrier increases, this promotes the wettability and dispersibility of the system, thus enhancing the disintegration and dissolution.⁴ The presence of a highly porous structure in the tablet matrix is the key factor for rapid disintegration of MDTs. Even though the conventional tablets contain highly water-soluble ingredients, they often fail to disintegrate rapidly because of low porosity.

To improve the porosity, volatile substances such as camphor can be used in tableting process, which is later sublimated from the formed tablet.⁵

Flunarizine hydrochloride is a selective calcium channel blocker and coupled with its antihistaminic property it is claimed to be effective in prophylaxis of migraine. It is effective in migraine by reducing intracellular Ca^{2+} overload due to brain hypoxia and thus prevents the deleterious effects of cellular calcium overload. With a very long half-life, Flunarizine may be given once daily; and drowsiness, the main side effect, can be minimized by taking the daily dose in the evening.⁶

Agar is the dried gelatinous substance obtained from *Gelidium amansii* (Gelidaceae) and several other species of red algae like *Gracilaria* (Gracilariaceae) and *Pterocadia* (Gelidaceae). Agar is yellowish gray or white to nearly colorless, odorless with mucilaginous taste and is available in the form of strips, sheet flakes or coarse powder. Agar consists of two polysaccharides as agarose and agarpectin. Agarose is responsible for gel strength and Agarpectin is responsible for the viscosity of agar solutions. High gel strength of agar makes it a potential candidate as a disintegrant.⁷

In the present study an approach has been made to prepare and evaluate fast dissolving tablets of Flunarizine hydrochloride using various concentrations of sublimating agents such as camphor and menthol along with fixed concentration of treated agar as superdisintegrant.

MATERIALS AND METHODS

MATERIALS

Flunarizine hydrochloride was obtained as a gift sample from Novartis, Mumbai. Agar was obtained as gift sample from Sisco research laboratory Pvt Ltd, Mumbai. Camphor was obtained from Yarrow chem Pvt Ltd, Mumbai and Menthol was obtained from Himedia Pvt Ltd, Mumbai. All other chemicals used were of analytical grade.

METHODS

Preparation of treated agar

Suitable quantity of agar powder (10g) was weighed and added in distilled water (100ml). Agitation was done continuously by a stirrer for one day to swell. The swollen contents were dried on a tray for 3 days at room temperature. The dried powder was then grinded by mortar and pestle. The grinded powder was passed through sieve no.100.⁸

Excipients Compatibility Study

Drug: Excipients compatibility study was carried out for any interference of drug and excipients used for the formulation of mouth dissolving tablet of Flunarizine HCl. The interference study was carried out using FTIR. The infrared absorption spectra of pure drug, physical mixture of polymer and drug and best formulation were performed for polymer drug interaction studies between 4000 cm^{-1} to 400 cm^{-1} .⁹

Preparation of Flunarizine HCl fast dissolving tablets

Various formulations of fast disintegrating tablets of Flunarizine HCl were prepared by using sublimation method. Accurately weighed quantity of Flunarizine HCl, sublimating agents (camphor and menthol), super disintegrating agent (treated agar), aspartame, MCC and mannitol were mixed and passed through the sieve no 44. Finally, magnesium stearate and talc were added as lubricating agent. The tablets were prepared by direct compression method using 6mm flat punches on a 10 station rotary compression machine. In all the formulations, the amount of Flunarizine dihydrochloride and superdisintegrants were kept constant and the levels of sublimating agents were varied. After compression tablets were heated in a hot air oven at 60°C for camphor containing batches and at 40°C for batches containing menthol as sublimating agents, until constant weight was obtained to ensure the complete removal of volatilizable component.¹⁰ The formulation details are given in Table 1.

Characterization of Fast dissolving tablets

Evaluation of blends

Angle of repose

Angle of repose was determined using funnel method⁹. The blend was poured through a funnel that can be raised vertically until a maximum cone height (h) was obtained. Radius of the heap (r) was measured and the angle of repose (θ) was calculated using the formula:¹¹

$$\theta = \tan^{-1} [h/r]$$

Bulk density

Apparent bulk density (pb) was determined by pouring the blend in to a graduated cylinder. The apparent bulk density was calculated using the formula.¹²

$$pb = M/ Vb$$

Where, Vb is the bulk volume and M is the

weight of the powder.

Tapped density

The measuring cylinder containing a known mass of blend was tapped for 100 tap. The volume occupied in the cylinder (V_t) and the weight (M) of the blend was measured. The tapped density (ρ_t) was calculated using formula.¹²

$$\rho_t = M / V_t$$

Compressibility index

The simplest way for measuring of free flow of powder is compressibility, an indication of the ease with which a material can be induced to flow is given by compressibility index (I) which is calculated as follows.

$$I = [(\rho_t - \rho_b) / \rho_t] \times 100$$

Where, ρ_t is the tapped density and ρ_b is tapped volume.

The value below 15% indicates a powder which usually gives rise to good flow characteristics, whereas above 25% indicates poor flowability.¹²

Hausner's ratio

Hausner's ratio is an indirect index of ease of powder flow. It is calculated by the following method

$$\text{Hausner ratio} = \rho_t / \rho_d$$

Where ρ_t is tapped density and ρ_d is bulk density

Lower hausner ratio (<1.25) indicates better flow properties than higher ones (>1.25).¹²

Evaluation of tablets

Tablet thickness

The thickness of three tablets from each batch was determined using a Vernier caliper. The thickness was measured in centimeters.¹³

Tablet hardness

The tablet hardness is the force required to break a tablet in a diametric compression force. The hardness tester used in the study was Monsanto hardness tester, which applies force to the tablet diametrically with the help of an inbuilt spring. The hardness was measured in kg/cm^2 . 3 tablets were taken and their hardness was measured.¹⁴

Weight variation

The procedure described in Indian Pharmacopoeia (IP, 1996)¹⁵ was employed to determine the weight variation of the tablets.

Twenty tablets were selected randomly from each batch and weighed individually on electronic balance (Shimadzu). The individual weighed was then compared with average weight for the weight variations.

Friability

Friability indicates the ability of a tablet to withstand mechanical shocks while handling. Friability of the tablets was determined by using Roche Friabilator and is expressed in percentage (%). Ten tablets were initially weighed (W_i) and placed into the friabilator. The friabilator was operated at 25 rpm for 4 minutes or run up to 100 revolutions and then the tablets were weighed again (W_f). The loss in tablet weight due to abrasion or fracture was the measure of tablet friability. Percent friability (F) was calculated by using the following formula. % friability of less than 1 % is considered acceptable¹⁶.

$$F = \{(W_i - W_f) / W_i\} \times 100$$

Wetting Time

Five circular tissue papers were placed in a Petri dish of 10 cm diameter. Ten milliliters of phosphate buffer 6.8 containing a water-soluble dye, was added to the petridish. The dye solution was used to identify complete wetting of the tablet surface. A tablet was carefully placed on the surface of the tissue paper in the petridish at 25°C. The time required for water to reach the upper surface of the tablets and to completely wet them was noted as the wetting time. This test was carried out in replicate of three. Wetting time was recorded using a stopwatch.¹⁷ Wetting time of best formulation is shown in figure. no.1.

Water absorption ratio

A piece of tissue paper folded twice was placed in a Petridish containing 10ml of water. A pre weighed tablet was placed on the paper. The wetted tablet was then weighed. Water absorption ration R was determined according to the following formula.¹⁸

$$R = (W_a - W_b / W_b) 100$$

Where, W_a = weight of tablet after absorption of water

W_b = weight of tablet before absorption of water

Drug content

Twenty tablets of each batch were weighed and powdered. An amount of powder equivalent to 5 mg of Flunarizine hydrochloride

was dissolved in 100ml of 0.1N HCl, filtered, diluted suitably and analyzed for drug content at 251 nm using UV-Visible spectrophotometer.¹⁹

***In-vitro* disintegration time**

Disintegration time was measured in 900 ml of 0.1N HCl according to the USP 24 method without disc at $37 \pm 0.5^\circ\text{C}$ temperature. The disintegration time of 3 individual tablets were recorded and the average was reported.²⁰

***In-vitro* Dissolution Study**

The release rates of Flunarizine hydrochloride from fast dissolving tablets were determined using United State Pharmacopoeia (USP) XXIV dissolution testing apparatus II (paddle method). The dissolution test was performed using 900 ml of 0.1N HCl, at $37 \pm 0.5^\circ\text{C}$ and 50 rpm. A sample (5 ml) of the solution was withdrawn from the dissolution apparatus at regular intervals of 15 seconds for 2.5 mins. The samples were replaced with fresh dissolution medium of same quantity. The samples were filtered through a 0.45μ membrane filter. Absorbance of these solutions was measured at 251 nm using Jasco V- 630 UV Spectrophotometer. Cumulative percentage of drug release was then calculated.²¹

Stability studies

In order to determine the change in *In-vitro* release profile on storage, stability studies of optimized batch i.e., F8 was carried out at 40°C in a humidity chamber having 75% RH. Samples were withdrawn at regular intervals of 30 days during the study of 60 days. Formulation is evaluated for change in *In-vitro* drug release pattern, hardness, wetting time, weight variation, percent drug content and dispersion time.²²

RESULTS

In this work Flunarizine hydrochloride Fast dissolving tablets have been prepared by sublimation method using various sublimating agents such as Menthol and Camphor. Treated agar has been used as superdisintegrant in its optimum concentration i.e. in 10%w/w in all the formulations. The concentrations of sublimating agents have been varied from 0%-26.5% in different formulations.

Excipients Compatibility Study

Results of IR spectrum of the pure drug Flunarizine HCl, powder mixture of pure drug and superdisintegrants and that of best formulation F8 are represented in figure no. 2,

3 and 4 respectively. The flunarizine HCl has indicating presence of C-F bond, C-N bond, aliphatic C=C bond, aromatic C=C bond, C-H bond in the range of 1000cm^{-1} to 1350cm^{-1} , 1030cm^{-1} to 1230cm^{-1} , at 890cm^{-1} , 730cm^{-1} to 770cm^{-1} and 2850cm^{-1} to 3100cm^{-1} respectively. These peaks indicating the functional groups in Flunarizine HCl are present in the FTIR spectrum of the drug, physical mixture of the drug and superdisintegrant and in the best formulation. Hence, it is concluded that, drug is present in Free State in powder mixture and in the best formulation, not in the form of reaction product. The specific peak values are shown in table no.2.

Evaluation of formulated batches

The nine formulations prepared by direct compression method were then evaluated for pre compression parameters of the powder blend such as angle of repose, bulk density, tapped density, carr's index and hausners ratio and post compression parameters of the compressed tablets such as hardness, friability, disintegration time, weight variation, thickness, drug content, wetting time, water absorption ratio and *In-vitro* drug release.

The results of pre compression parameters and post compression parameters are tabulated in table no.3 and table no.4 respectively.

***In-vitro* dissolution study**

The *In-vitro* studies for all the prepared formulations were done in 900ml of 0.1N HCl for 2.5 mins according to the procedure in section 4.2.9. The results showed that the formulations containing sublimating agents release drug in a faster rate than the rate of release of drug from the formulation without sublimating agents. Formulation using menthol as superdisintegrant in the concentration 26.5%w/w showed better result and complete drug release in 90 secs, while all other formulations took more time for complete drug release from the formulated tablets. The results of the study are tabulated in table no.5. The %CDR v/s time graph of F0 to F4 formulations and F5 to F8 are plotted in figure no. 5 and figure no.6 respectively. Figure no.5 shows F4 as best formulation and figure no.6 shows F7 as best formulation. To compare these two, another figure, figure no.7 was plotted comparing the release pattern of formulation F4 and formulation F8. From the figure no.7 it was found that the formulation F8 was the best among all the formulations prepared.

Stability studies

The stability studies were carried out for 60 days according to section 4.2.10. The results of the stability studies are tabulated in table no.6.

DISCUSSIONS

The results of formulation F0, with no sublimating agents, showed poor post compression parameters, so sublimation technique was used to formulate fast dissolving tablets using camphor and menthol as sublimating agents, thus to produce porous structure in the tablet matrix.

The pre compression parameters of all the formulations didn't show any significant variations which may be influenced by the addition of sublimating agents. It is worthwhile to note, that the addition of camphor and menthol also resulted in increased friability and low hardness probably due to the generation of the porous structure in the tablet matrix. But they were found to be in their limits as in IP 1996. The wetting time and dispersion time of the formulations were decreased as the concentration of the sublimating agents increased. The cumulative drug releases were also increased in each time interval according to the increase in the concentration of sublimating agents. The stability studies showed that the best formulation F8 didn't

show any significant variations in their specific post compression parameters. So it was concluded that the best formulation was stable for a time period of 60 days.

Yet another discussion was that, as the sublimating agent used in this study, menthol, was found to be the best compared to camphor, it has another advantage of pleasant mouth feel. It is an additional advantage in case of the fast dissolving tablets prepared in the study.

From the above work it was concluded that formulation F8 showed maximum drug release within 90 seconds when compared to all other formulation. As all the other parameters of the formulation F8 were also excellent, the concentration of menthol which is used in F8 formulation was found ideal for the sublimation method. Hence the present formulation of fast dissolving tablet of Flunarizine HCl by sublimation method using menthol as sublimating agent and treated agar as superdisintegrant can be used for better patient compliance.

ACKNOWLEDGEMENTS

We are thankful to Srinivas college of Pharmacy for providing the opportunity to carry out our research work successfully.

Table 1: The composition of fast dissolving tablets of Flunarizine Hydrochloride

Ingredients	Formulation Code								
	F0 mg	F1 mg	F2 mg	F3 mg	F4 mg	F5 mg	F6 mg	F7 mg	F8 mg
Flunarizine HCl	5	5	5	5	5	5	5	5	5
Treated agar	15	15	15	15	15	15	15	15	15
Camphor	-	10	20	30	40	-	-	-	-
Menthol	-	-	-	-	-	10	20	30	40
MCC	37	37	37	37	37	37	37	37	37
Mannitol	85	75	65	55	45	75	65	55	45
Aspartame	2	2	2	2	2	2	2	2	2
Talc	5	5	5	5	5	5	5	5	5
Magnesium stearate	1	1	1	1	1	1	1	1	1
TOTAL	150	150	150	150	150	150	150	150	150

Table 2: FT-IR studies of Flunarizine HCl alone and with excipients

Combinations	Peak of C-F bond (nm)	Peak of C-N bond (nm)	Peak of C=C (aliphatic) bond (nm)	Peak of C=C (aromatic) bond (nm)	Peak of C-H bond (nm)
Flunarizine HCl	1338.36	1038.48	837.91	743.42	2920.66
Flunarizine HCl + Treated agar	1396.21	1039.44	836.95	742.46	2921.63
Optimized Formulation F8	1344.14	1055.84	839.84	762.70	2932.23

Table 3: Pre Compression Parameters of Powder Blend

Pre Compression Parameters	Formulation Code								
	F0	F1	F2	F3	F4	F5	F6	F7	F8
Angle of Repose(θ) [*]	14.74	17.35	17.87	18.15	18.73	15.68	16.05	17.11	17.83
Bulk Density (gms/cm ³)	0.942	0.960	0.948	0.991	0.971	0.962	0.947	0.99	0.981
Tapped Density (gms/cm ³)	1.1	1.13	1.09	1.1	1.09	1.12	1.14	1.1	1.11
Carr's Index (%)	14.36	15.05	13.02	9.99	10.91	14.10	16.92	10.00	11.62
Hausners Ratio	1.17	1.18	1.14	1.11	1.12	1.16	1.20	1.11	1.13

^{*}Values are mean of 3 observations

Table 4: Post Compression Parameters of Fast Dissolving Tablets

Post Compression Parameters	Formulation Code								
	F0	F1	F2	F3	F4	F5	F6	F7	F8
Thickness \pm SD (cm) [*]	0.34 \pm 0.0 1	0.35 \pm 0.0 2	0.35 \pm 0.0 1	0.34 \pm 0.0 1	0.34 \pm 0.0 2	0.35 \pm 0.0 1	0.35 \pm 0.0 1	0.34 \pm 0.0 2	0.34 \pm 0.0 1
Hardness \pm SD (Kg/cm ²) [*]	3.51 \pm 0.1 3	3.44 \pm 0.1 1	3.39 \pm 0.1 2	3.11 \pm 0.1 3	2.96 \pm 0.1 5	3.02 \pm 0.1 3	2.83 \pm 0.1 5	2.61 \pm 0.1 4	2.55 \pm 0.1 5
Weight Variation Test \pm SD (mg) [*]	150.3 \pm 1. 12	140.6 \pm 1. 01	130.9 \pm 1. 18	120.2 \pm 1. 2	110.3 \pm 1. 12	140.1 \pm 1. 16	130.4 \pm 1. 15	120.1 \pm 1. 19	110.9 \pm 1. 2
Friability (%)	0.066	0.199	0.295	0.368	0.488	0.371	0.499	0.541	0.691
Disintegration time \pm SD (secs) [*]	49.30 \pm 3. 3	35.20 \pm 2. 5	30.60 \pm 2. 9	28.40 \pm 3. 9	25.30 \pm 2. 4	31.70 \pm 2. 3	28.40 \pm 1. 6	26.10 \pm 2. 2	22.60 \pm 2. 7
Wetting Time \pm SD (secs) [*]	78.43 \pm 1. 3	57.36 \pm 1. 9	53.81 \pm 1. 4	50.25 \pm 1. 1	42.65 \pm 1. 5	51.18 \pm 1. 3	45.62 \pm 1. 1	40.83 \pm 1. 8	33.92 \pm 1. 7
Water Absorption Ratio \pm SD (%) [*]	71.86 \pm 2. 26	81.04 \pm 2. 91	86.93 \pm 3. 12	91.15 \pm 2. 91	92.16 \pm 2. 46	83.33 \pm 3. 26	88.03 \pm 3. 24	91.16 \pm 2. 96	92.84 \pm 2. 15
Drug Content \pm SD (%) [*]	99.43 \pm 0. 21	98.91 \pm 0. 11	100.05 \pm 0.26	100.01 \pm 0.44	99.54 \pm 0. 23	98.99 \pm 0. 19	98.58 \pm 0. 09	100.72 \pm 0.26	100.86 \pm 0.06

^{*}Values are mean of 3 observations. Values are mean of 20 observations.

Table 5: Percentage Cumulative Drug Release of Fast Dissolving Tablets

TIME(sec)	% Cumulative Drug Release								
	F0 (%)	F1 (%)	F2 (%)	F3 (%)	F4 (%)	F5 (%)	F6 (%)	F7 (%)	F8 (%)
0	0	0	0	0	0	0	0	0	0
15	22.64	39.62	41.86	44.82	49.82	47.83	53.94	56.49	59.96
30	28.83	45.82	48.29	50.61	58.02	55.83	61.19	65.32	68.89
45	34.29	49.62	51.83	55.63	62.66	60.63	66.03	70.86	74.53
60	41.93	57.93	59.99	64.03	69.82	66.02	72.88	77.74	81.84
75	49.73	64.42	67.66	70.99	76.02	74.77	80.94	85.05	91.87
90	55.47	68.18	71.23	74.69	80.94	81.23	90.03	94.38	99.72
105	63.72	74.82	76.86	80.03	87.71	87.94	94.39	99.06	
120	71.37	80.61	83.91	87.92	93.85	95.02	99.84		
135	75.83	86.99	88.84	92.51	99.03	99.95			
150	79.72	92.03	95.62	98.99					

Table 6: Stability Studies of Best Formulation F8

Parameters	At 0 days	At 30 days	At 60 days
Hardness \pm SD (Kg/cm ²) [*]	2.55 \pm 0.15	2.01 \pm 0.19	2.00 \pm 0.14
Wetting time \pm SD (secs) [*]	33.92 \pm 1.7	34.72 \pm 1.1	36.09 \pm 1.3
Weight variation \pm SD (mg) [*]	110.9 \pm 1.2	112.9 \pm 1.0	114.9 \pm 1.9
Disintegration time \pm SD (secs) [*]	22.60 \pm 2.7	24.02 \pm 2.1	25.51 \pm 2.9
Percent drug content \pm SD (%) [*]	100.86 \pm 0.06	99.06 \pm 0.26	98.96 \pm 0.03
<i>In-vitro</i> drug release at 90 secs \pm SD (%)	99.72%	99.07%	98.86%

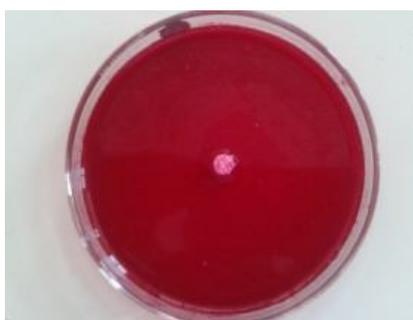
Values are mean of 3 observations. * Values are mean of 20 observations.



at 0 second



at 10 seconds



at 20 seconds



at 35 seconds

Fig. 1: wetting time of best formulation (F8) of fast dissolving tablet in dye (amaranth)

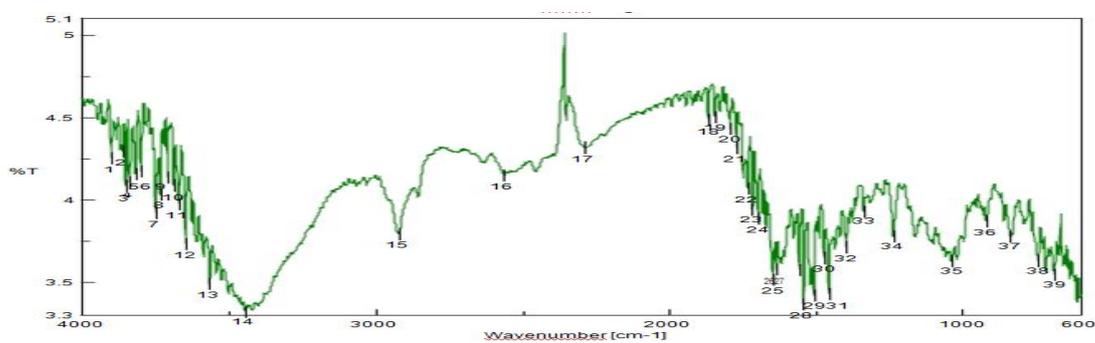


Fig. 2: FTIR of Flunarizine HCl

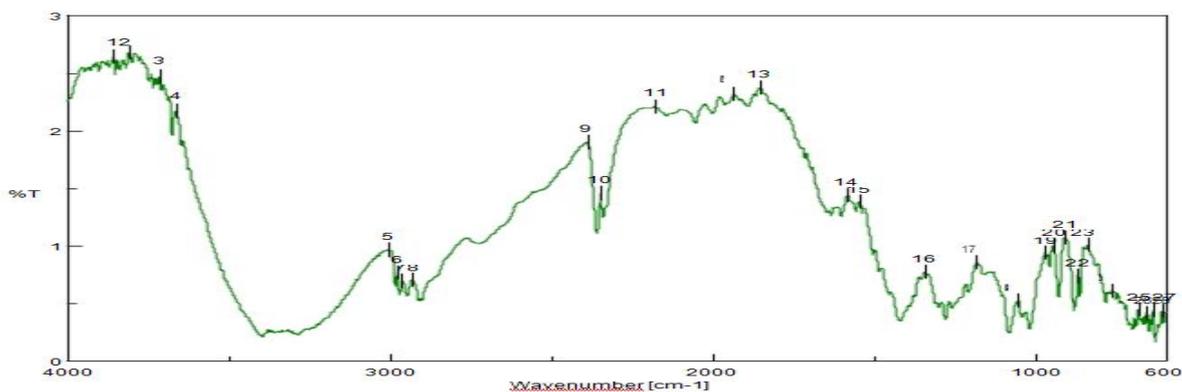


Fig. 3: FTIR of Flunarizine HCl + treated agar

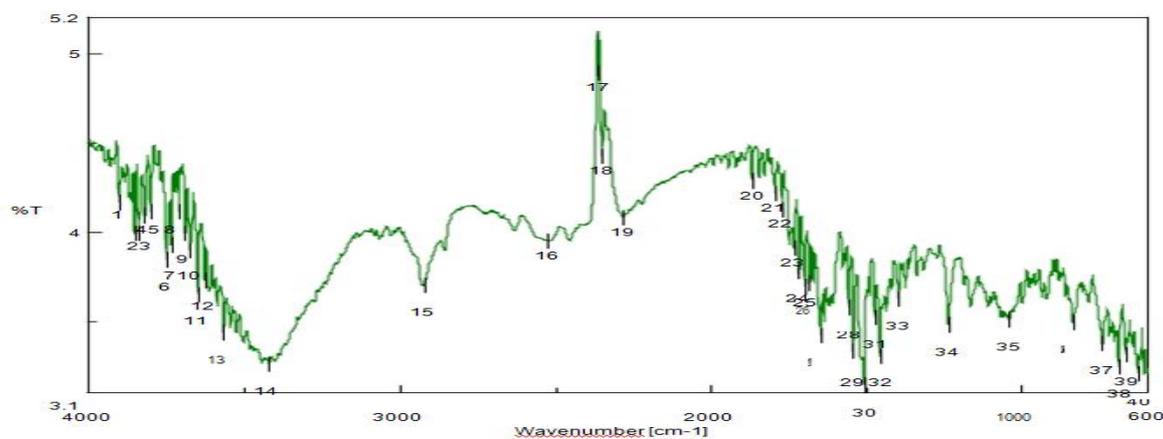


Fig. 4: FTIR of best formulation F8

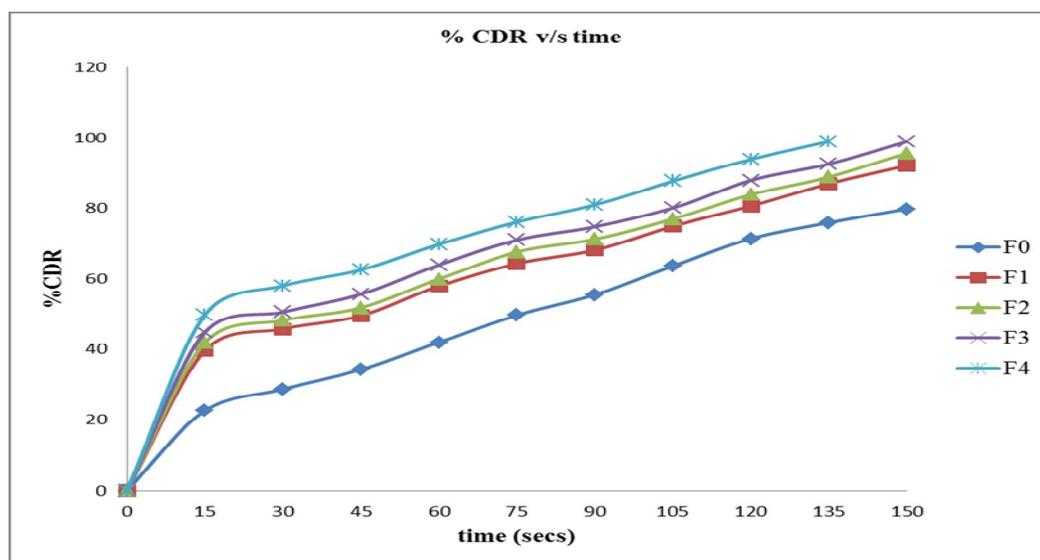


Fig. 5: dissolution profile of fast dissolving tablets F0 – F4

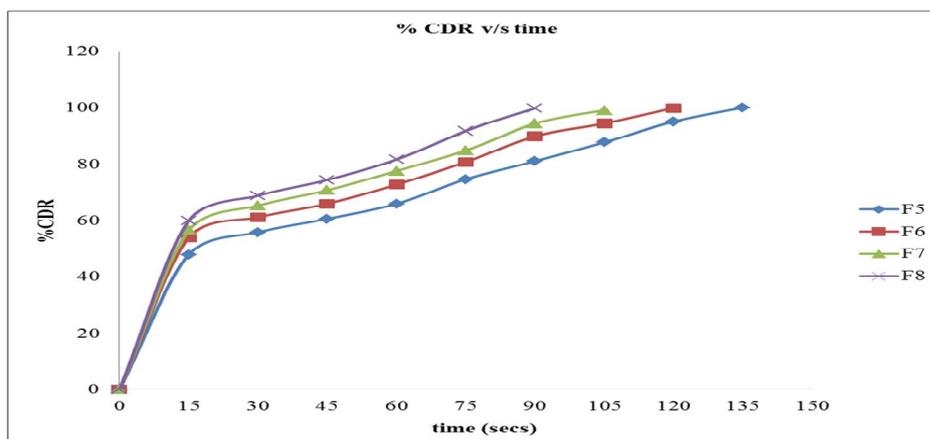


Fig. 6: dissolution profile of fast dissolving tablets F5 – F8

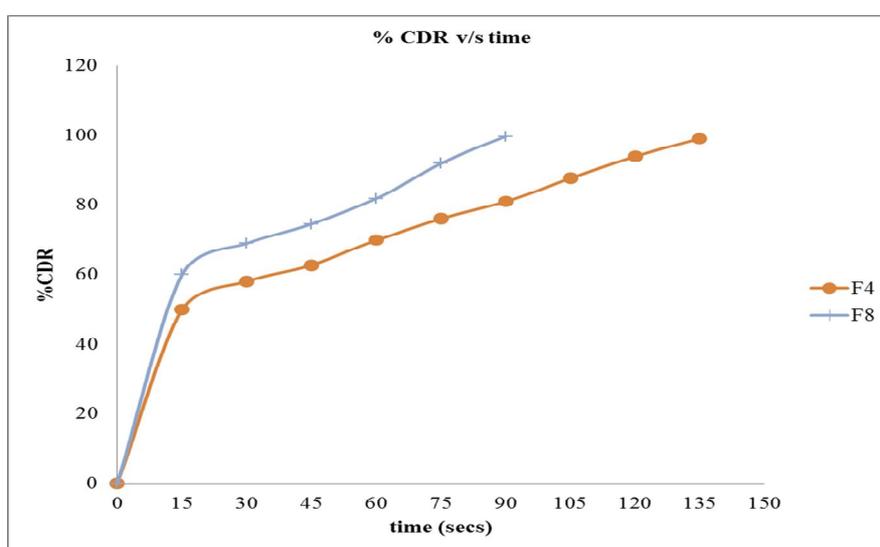


Fig. 7: dissolution profile of fast dissolving tablets F4 and F8

Table and figure titles and legends

TABLE NO.1: THE COMPOSITION OF FAST DISSOLVING TABLETS OF FLUNARIZINE HYDROCHLORIDE.

All the ingredients except the amount of sublimating agents were kept constant throughout the formulations. The amounts of sublimating agents (camphor and menthol) were varied gradually. A formulation (F0) was prepared, without any sublimating agents, to compare the effect of sublimating agents.

TABLE NO.2: FT-IR STUDIES OF FLUNARIZINE HCL ALONE AND WITH EXCIPIENTS

All the functional peaks present in the pure drug was present in both the physical mixture as well as the best formulation. So no interactions were reported.

TABLE NO.3: PRE COMPRESSION PARAMETERS OF POWDER BLEND

All the pre compression parameters were in the limits. Angle of repose was done in triplicate to obtain an average value.

TABLE NO.4: POST COMPRESSION PARAMETERS OF FAST DISSOLVING TABLETS

SD is standard deviation for n = 3 observations for all parameters except weight variation and friability and SD is standard deviation for n = 20 observations for weight variation test.

TABLE NO.5: PERCENTAGE CUMULATIVE DRUG RELEASE OF FAST DISSOLVING TABLETS

The percentage cumulative drug release of formulations showed that, the addition of sublimating agents increased the rate of release of drug from the formulation and as the amount of sublimating agents increased the more rapid is the rate of release. The best formulation (F8) released almost the whole

drug in 90 secs while other formulations took more time for complete drug release.

TABLE NO.6: STABILITY STUDIES OF BEST FORMULATION F8.

SD is standard deviation for n = 3 observations for all parameters except weight variation and SD is standard deviation for n = 20 observations for weight variation test.

Figure no.1: wetting time of best formulation (F8) of fast dissolving tablet in dye (amaranth)

The figure shows the gradual wetting of tablet with amaranth solution at different time intervals.

Figure.no.2: FTIR of Flunarizine HCl.

Shows the different functional peaks of the pure drug.

Figure.no.3: FTIR of Flunarizine HCl + treated agar.

Shows that the functional drug peaks are present in the physical mixture of drug and polymer.

Figure.no.4: FTIR of best formulation F8.

Shows that the functional peaks of drug are present in the best formulation tablet.

Figure no.5: dissolution profile of fast dissolving tablets F0 – F4

Shows the drug release pattern of the formulations F0 – F4

Figure no.6: dissolution profile of fast dissolving tablets F5 – F8

Shows the drug release pattern of the formulations F5 – F8

Figure no.7: dissolution profile of fast dissolving tablets F4 and F8

Shows the comparison between drug release pattern of formulations F4 and F8.

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