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Formulation and Evaluation of Effervescent Floating Tablet of Famotidine

Ravi Kumar*[1], M. B. Patil[2], Sachin R. Patil[1], Mahesh S. Paschapur[3]

[1]Department of Pharmaceutics,

K.L.E.S's College of Pharmacy, Ankola-581314,Karnataka, India,

[2]Department of Pharmacognosy,

K.L.E.S's College of Pharmacy, Ankola-581314, Karnataka, India,

[3]Department of Pharmacology,

K.L.E.S's College of Pharmacy,Ankola-581314, Karnataka, India,

*** *E-mail: ravikumar300@gmail.com***

ABSTRACT: Famotidine has been the most widely used drug for the treatment of peptic ulcer for many decades. The present investigation concerns the development and evaluation of floating tablets of famotidine which, after oral administration, are designed to prolong the gastric residence time, increase drug bioavailability and target the gastric ulcer. A floating drug delivery system (FDDS) was developed using gas-forming agents, like sodium bicarbonate, citric acid and hydrocolloids, like hydroxypropyl methylcellulose (HPMC) and carbopol 934P. The prepared tablets were evaluated in terms of their precompression parameters, physical characteristics, *in vitro* release, buoyancy, buoyancy lag-time and swelling index. The formulations were optimized for the different viscosity grades of HPMC, carbopol 934P and its concentrations and combinations. The results of the *in vitro* release studies showed that the optimized formulation (F12) could sustain drug release (98%) for 24 h and remain buoyant for 24 h. The optimized formulation was subjected to various kinetic release investigations and it was found that the mechanism of drug release was predominantly diffusion with a minor contribution from polymeric relaxation. Optimized formulation (F12) showed no significant change in physical appearance, drug content, total buoyancy time or *in vitro* dissolution study after storage at 45 °C/75% RH for three months. Finally the tablet formulations found to be economical and may overcome the draw backs associated with the drug during its absorption.
Key words: Famotidine, Floating drug delivery system; Hydrocolloids; Gastric residence time; Buoyancy.

INTRODUCTION

The oral route of drug administration is the most convenient and commonly used method of drug delivery. However, this route has several physiological problems, including an unpredictable gastric emptying rate that varies from person to person, a brief gastrointestinal transit time (8–12 h), and the existence of an absorption window in the upper small intestine for several drugs[1-2]. These difficulties have prompted researchers to design a drug delivery system which can stay in the stomach for prolonged and predictable period[3-4]. Attempts are being made to develop a controlled drug delivery system, which can provide therapeutically effective plasma drug concentration for a longer period, thereby reducing the dosing frequency and minimizing fluctuations in plasma drug concentration at steady-state by delivering the drug in a controlled and reproducible manner[5]. Different methodologies have been reported in the literature to increase the gastric retention of drugs, like intra-gastric floating systems, hydrodynamically balanced systems, extendable or expandable and super porous biodegradable hydrogel systems[6]. The floating drug delivery systems result in long lasting intra-gastric buoyancy which may not only provide a sustained site of specific therapeutic action but also may lead to a reduction in side effects and better patient compliance[7].

Helicobacter pylori is a prevalent human specific pathogen, which is now believed to be the causative bacterium for chronic gastritis, peptic ulcer and adenocarcinoma, one of the most common forms of cancer in humans and its eradication requires high concentration of drug within the gastric mucosa for long duration. Thus, floating oral delivery system is expected

to remain buoyant in a lasting way upon the gastric contents and enhance bioavailability of all drugs which are well absorbed from the GI tract.

Famotidine is a histamine H_2-receptor antagonist. It is widely prescribed in gastric ulcers, duodenal ulcers, Zollinger- Ellison syndrome and gastroesophageal reflux disease. In the management of benign gastric and duodenal ulceration the dose is 40 mg daily by mouth at bed time, for 4 to 8 weeks. In gastroesophageal reflux disease the recommended dose is 20 mg by mouth twice daily for 6 to 12 weeks; where gastroesophageal reflux disease is associated with esophageal ulceration, the recommended dosage is 40 mg twice daily for a similar period. For the short term symptomatic relief of heartburn or non-ulcer dyspepsia a dose of 10 mg up to twice daily is suggested. In the Zollinger-Ellision syndrome the initial dose by mouth is 20 mg every 6 hours, increased as necessary; dose up to 80 mg daily have been employed[8]. The low bioavailability (40-45%), short biological half life (2.5-4.0 hours) and associated adverse effects like diarrhoea, dizziness, headache and anorexia etc, which may also exhibits toxic effect in prolong use. To overcome these drawbacks, in the present investigation effervescent floating tablets of different formulation were developed with an objective of achieving 24 hrs floating and drug release time and the effervescent floating tablet was compared with marketed formulation of famotidine. This approach also reduces the unwanted side effects of the drug, the tablet remain buoyant for a long period on the gastric contents, exhibiting a prolonged gastric residence time, resulting in sustained drug release and consistent blood levels of drug.

MATERIALS AND METHODS

Materials

Famotidine was received as a gift sample from Nicholas Piramol India limited, Mumbai. Hydroxypropyl methylcellulose K4M and K15M were obtained as gifts from Colorcon Asia Pvt. Ltd., Goa, India; Carbopol 934P were purchased from BF Goodrich Co., Germany. Magnesium stearate, hydrochloric acid, sodium bicarbonate and citric acid anhydrous were purchased from S.D. Fine-Chem Ltd, Ahmedabad, India. Polyvinyl pyrrolidone K-30 (PVP K-30) was procured from Ottokemi, Mumbai, India. Lactose and purified talc were purchased from E. Merck (India) Ltd., Mumbai. All other ingredients, reagents and solvents were of analytical grade.

Methods

Preparation of Floating Tablets of Famotidine

The ingredients were weighed accurately and mixed thoroughly. Granulation was done with a solution of PVP K-30 in sufficient isopropyl alcohol. The granules (40 mesh) were dried in conventional hot air oven at 45^0C. Drying of the granules was stopped when the sample taken from the oven reached a loss on drying (LOD) value of 0.5 to 1.5 %, as measured by a moisture balance at 105°C. The dried granules were sized through 40/60 mesh, lubricated with magnesium stearate (2 %w/w) and purified talc (1 %w/w), aerosil (1 %w/w) and then compressed on a single punch tablet machine (Cadmach Machinery Ltd., Ahmedabad, India). The tablets were off white, round and flat. The hardness of the tablets was kept constant. Ten formulations were prepared and coded them from F1 to F12. The detail of composition of each formulation is given in Table 1.

Evaluation of Famotidine Granules

The flow properties of granules (before compression) were characterized in terms of angle of repose[9], tapped density, bulk density[10], Carr's index[11] and Hausner ratio.

Physical evaluation of famotidine floating tablets

Two tablets from each formulation were randomly selected and organoleptic properties such as colour, odour, taste, and shape were evaluated. Thickness and diameter of ten tablets were measured using vernier calipers. The prepared floating tablets were evaluated for uniformity of weight using 20 tablets[12], hardness (Monsanto tester)[13], friability using 10 tablets (Roche type friabilator) [13].

Determination of Swelling Index[14]

The swelling index of tablets was determined in 0.1N HCl (pH 1.2) at room temperature. The swollen weight of the tablet was determined at predefined time intervals over a period of 24 h. The swelling index (SI), expressed as a percentage, and was calculated from the following equation

$$SI = \frac{\text{Weight of tablet at time } (t) - \text{Initial weight of tablet}}{\text{Initial weight of tablet}} \times 100$$

In vitro buoyancy studies

In vitro buoyancy studies were performed for all the twelve formulations as per the method described by Rosa *et al*[15]. The randomly selected tablets from each formulation were kept in a 100ml beaker containing simulated gastric fluid, pH 1.2 as per USP. The time taken for the tablet to rise to the surface and float was taken as floating lag time (FLT). The duration of time the dosage form constantly remained on the surface of medium was determined as the total floating time (TFT).

Drug Content Estimation

The drug content in each formulation was determined by triturating 20 tablets and powder equivalent to average weight was added in 100ml of 0.1N hydrochloric acid, followed by stirring for 30 minutes. The solution was filtered through a 0.45µ membrane filter, diluted suitably and the absorbance of resultant solution was measured spectrophotometrically at 265nm using 0.1 N hydrochloric acid as blank.

***In vitro* dissolution studies**

The release rate of famotidine from floating tablets was determined using *United States Pharmacopeia* (USP) Dissolution Testing Apparatus 2 (paddle method). The dissolution test was performed using 900 ml of 0.1N hydrochloric acid, at 37 ± 0.5°C and 50 rpm. A sample (10 ml) of the solution was withdrawn from the dissolution apparatus hourly and the samples were replaced with fresh dissolution medium. The samples were filtered through a 0.45µ membrane filter and diluted to a suitable concentration with 0.1N hydrochloric acid. Absorbance of these solutions was measured at 265 nm using a UV/Visible spectrophotometer. The percentage drug release was plotted against time to determine the release profile.

Comparison with marketed product

The promising formulation was compared with marketed product of famotidine. The evaluation parameters tested and compared were drug content uniformity and *in-vitro* dissolution profile.

***In vitro* drug release kinetic studies**

Kinetic model had described drug dissolution from solid dosage form where the dissolved amount of drug is a function of test time. In order to study the exact mechanism of drug release from the tablets, drug release data was analyzed according to zero order[16], first order[17], Higuchi square root[18], Korsmeyer- Peppas model[19].The criteria for selecting the most appropriate model was chosen on the basis of goodness of fit test. The data were processed for regression analysis using MS EXCEL statistical function.

tability studies

The promising formulation was tested for a period of 12 weeks at 40^0C with 75% RH, for their drug content and other parameters.

RESULTS AND DISCUSSION

Famotidine is a histamine H_2-receptor antagonist. It is widely prescribed in gastric ulcers, duodenal ulcers, Zollinger-Ellison syndrome and gastroesophageal reflux disease. Famotidine had maximum solubility in acidic pH. Famotidine has some adverse effect such as diarrhoea, dizziness, headache and anorexia. Prolonged gastric retention improves bioavailability, reduces drug waste and improves solubility for drugs that are less soluble in high pH environment. Effervescence production, decrease the several local GIT side effect, such as gastric irritation, nausea and gastritis.

Floating tablets Famotidine were developed to increase the gastric residence time of the drug, so that they can be retained in stomach for longer time and help in controlled release of drug up to 24 h. The tablets were made using different gel forming polymers such as CP934P, HPMC K4M and HPMC K15M along with effervescing agent sodium bicarbonate and citric acid to optimize the drug content, *in vitro* buoyancy, swelling index and *in vitro* drug dissolution studies. The selection of viscosity grade of a polymer is an important consideration in the formulation of tablet[20]. All the formulations were prepared by direct compression method.

When a combination of gas entrapping as well as controlled release system is there, the use of disintegrating agent is important which does not quickly break the matrix and allows slow disintegration of the swollen matrix. PVP K30 in an optimized concentration (15mg/tablet) was employed for such unique disintegration properties[21-22]. Talc and magnesium stearate were employed for their glidant and lubricant property.

The prepared tablets of all the formulations were evaluated for precompression parameters like angle of repose, bulk and tapped density and compressibility index and physical characters like tablet hardness, friability, weight variation buoyancy lag time, total floating time, assay, *in-vitro* drug release. The main aim was to optimize the formulation for 24 hours *in-vitro* release and total floating time to more than 24 hours.

Precompression parameters of famotidine granules

The formulations showed good flow property and compressibility index (Table 2). Angle of repose ranged from 23.13 to 31.23, Hausner ratio ranged from 0.056 to 0.146 and the compressibility index ranged from 17.32 to 28.78. The LBD and TBD of the prepared granules ranged from 0.431 to 0.561 and 0.581 to 0.642 respectively. The results of angle of repose indicates good flow property of the granules and the value of compressibility index further showed support for the flow property.

Post compression parameters of famotidine tablets

The shape of the tablets of all formulations remained off white, smooth, flat faced circular with no visible cracks. The thickness and diameter of tablets was measured by vernier calipers and was ranged between 2.9 ± 0.02 to 3.2± 0.01 mm, 10.80 to 11.02 mm respectively. The hardness of the tablets was measured by Monsanto tester (Indian Equipment Corporation (IEC) Mumbai, India) and was in between 5.5 to 6.0 kg/cm^2. The friability was measured by Friabilator (Thermonik, Campbell Electronics, Mumbai) and was found to be 0.32 to 0.87%, which is an indication of satisfactory mechanical resistance of the tablets. The drug content estimations showed values in the range of 98.12 to 101.34% which reflects good uniformity in drug content among different formulations. All the tablets passed weight variation test as the % weight variation was within the Pharmacopoeial limits of ±5% of the weight. The results are shown in table 3.

All the formulations showed values within the prescribed limits for tests like hardness, friability and weight variation which indicate that the prepared tablets are of standard quality.

***In vitro* buoyancy studies**

All the tablets were prepared by effervescent approach. Sodium bicarbonate was added as a gas-generating agent. Sodium bicarbonate induced carbon dioxide generation in presence of dissolution medium (0.1 N hydrochloric acid). The combination of sodium bicarbonate and citric acid provided desired floating ability and therefore this combination was selected for the formulation of the floating tablets. It was observed that the gas generated is trapped and protected within the gel, formed by hydration of polymer (HPMC), thus decreasing the density of the tablet below 1 and tablet becomes buoyant. The tablet swelled radially and axially during *in vitro* buoyancy studies.

All the batches of tablets were found to exhibit short floating lag times due to presence of sodium bicarbonate and citric acid. Decrease in the citric acid level increased the floating lag time and tablets were found to float for longer duration. The tablets with low-viscosity grade HPMC K4M exhibited short floating lag time and floated for longer duration as compared with formulations containing high viscosity grade HPMC K15M. This indicated that the molecular weight distribution or viscosity of the gel-forming polymer HPMC influenced the *in vitro* buoyancy. Reduction in HPMC level in the formulations prolonged the floating lag time and shortened the total floating time. With reference to buoyancy studies results it can be concluded that the batch containing HPMC 4KM polymers showed good floating lag time (FLT) and total floating time (TFT) when compared to batch containing HPMC15KM polymers.

Thus a formulation F12 containing combination of sodium bicarbonate (75 mg) and citric acid (30mg) with HPMC K4M, HPMC K15M and carbopol 934P (100mg) was found to achieve optimum *in vitro* buoyancy and floatability of more than 24 hrs. The results of *in vitro* buoyancy studies are tabulated in table 4.

The pH of the stomach is elevated under fed condition (~3.5), therefore citric acid was incorporated in the formulation to provide an acidic medium for sodium bicarbonate; more over citric acid has an stabilizing effect on famotidine formulation.

Swelling Index studies

Tablets composed of polymeric matrices build a gel layer around the tablet core when they come in contact with water. This gel layer governs the drug release. Kinetics of swelling is important because the gel barrier is formed with water penetration. Swelling is also a vital factor to ensure floating and drug dissolution. To obtain floating, the balance between swelling and water acceptance must be restored[23-24].The swelling index of floating tablets of F1 to F12 is shown in Fig.1. Tablets containing Carbopol 934P (F9 and F10) showed less swelling index at the beginning but higher swelling index was observed at the end of 12 h. While HPMC K4M and HPMC K15M (F1 to F8) swelled rapidly at the beginning in 0.1 N HCl and could not remain their matrix integrity upto 12 h. Tablets containing combination of Carbopol 934P, HPMC K4M and HPMC K15M (F12) showed constant increasing in swelling index upto 12 h.

Combination of HPMC K4M and HPMC K15M resulted in a higher swelling index compared with HPMC K15M alone. The HPMC grade also affects the swelling and hydration with considerably higher swelling index for HPMC K4M than HPMC K15M. HPMC K15M exhibited low swelling index, but there was no decrease in swelling rate. The reason for this appeared to be its high viscosity and high water retention property.

Further, no significant effect of effervescents on swelling indices was observed. Swelling index values start decreasing when polymer erosion starts in the medium.

***In vitro* dissolution studies**

The performance of floating formulations has been reported to be greatly affected by physiological conditions such as food transport, gastrointestinal motility, and so on. A study[25] on floating mini tablets of atenolol has indicated lower bioavailability of drug. The reason for this lower bioavailability is attributed to small size of the dosage form, causing too short of a residence time and a premature exit from the stomach. The tablets in this investigation are much larger in size and are expected to be retained for longer duration in upper GIT.

In vitro dissolution studies of all the formulations of floating tablets of famotidine were carried out in 0.1N HCl. The study was performed for 24 h and cumulative drug release was calculated at every one hour time interval. *In vitro* dissolution studies of all the formulations are shown in figure 2, 3 and 4. Three different polymers and their combinations (Table 1) were used to prepare floating tablets. It was observed that the type of polymer influences the drug release pattern. All the formulations contained equal amount of gas generating agent (sodium bi carbonate) and citric acid.

A significantly higher rate and extent of drug release was observed from the batches based on HPMC K4M. Varying the amount of HPMC K4M affect the drug release.

Drug release from HPMC K15M was lesser owing to its high viscosity and also due to less permeability of water to HPMC K15M. Moreover the HPMC containing tablets F1-F8 could not bear their matrix shape until 24 h and the released the drug before24 h. After 1 h the drug dissolved from floating tablets composed of carbopol 934P, F9 (16.0) and F10 (11.0) was less than tablets containing different grade of HPMC. This showed that HPMC hydrated more rapidly than carbopol 934P in the presence of 0.1 N HCl. Although combination of HPMC K15M and HPMC K4M sustains the drug release for a longer time. As expected, the drug release rate was dependent on the viscosity grade and the concentration of the polymer used. Tablets containing HPMC and Carbopol combination (F12) showed constant drug release up to 24 hr (98). This controlled release of drug from F12 could be attributed to the formation of a thick gel structure that delays drug release from the tablet matrix.

C

omparison with marketed product

The promising formulation (F12) as found by evaluation studies was compared with marketed product. The comparative *in-vitro* dissolution study of optimized formulation (F12) and marketed product are presented in Fig 5.The result showed that the optimized formulation F12 has better control over release rate in comparison to the commercial product. The marketed product released the drug 93% in 12 hours whereas the optimized formulation F12 released the drug 68 % in 12hrs. And the optimized formulation F12 remained floatable in the stomach for 24 hours .and give the maximum released 98.0% at 24^{th} hours.

Analysis of release mechanism

The drug release data of famotidine were fitted to models representing Higuchi's, zero order, first order and Korsmeyer's equation kinetics to know the release mechanisms. The data were processed for regression analysis using MS EXCEL statistical function. The results are shown in Table 5 and graphs in figure 6 to 9.

The kinetic data (Table-5) showed that the release of drug followed diffusion controlled mechanism for the formulations. Diffusion is related to transport of drug from the dosage form in to the in vitro fluid depending up on the concentration. As the gradient varies the drug is released and the distance for diffusion increases. In the present study, in vitro release profiles could be best expressed by Higuchi's equation as optimized formulation (F12) showed good linearity (R^2: 0.9924) indicates that diffusion is dominant mechanism of drug release with these formulations.

Stability study of optimized formulation (F12)

The optimized floating tablets (F12) was selected for stability study on the basis of *in vitro* buoyancy and *in vitro* drug dissolution studies. The tablets were investigated at 40°C/75%RH for 3 months. From the data, the formulation is found to be stable under the conditions mentioned before since there was no significant change in the percentage amount of drug content (Table 6). Thus, it was found that the floating tablets of famotidine (F12) were stable under these storage conditions for at least 3 months.

CONCLUSION

This study discusses the preparation of floating tablets of famotidine. The effervescent-based floating drug delivery was a promising approach to achieve *in vitro* buoyancy. The addition of gel-forming polymer HPMC K4 M, HPMC K15 M, carbopol 934P and gas-generating agent sodium bicarbonate was essential to achieve *in vitro* buoyancy. Addition of citric acid, to achieve buoyancy under the elevated pH of the stomach, caused an enhancement in drug release. The type of polymer affects the drug release rate and the mechanism. Polymer swelling is crucial in determining the drug release rate and is also important for flotation. A lesser FLT and a prolonged floating duration could be achieved by varying the amount of effervescent and using different polymer combinations. The *in vitro* drug release profiles obtained for tablets (F12) made with combinations of HPMC K4 M, HPMC K15 M, carbopol 934P showed lesser FLT (30 s) and a prolonged floating duration (> 24hrs) which was a controlled release characteristic (98%) for 24 h. Good stability was observed for 3 months during stability studies. Since the formulation showed sufficient release for prolonged period, the dose can be reduced and possible incomplete absorption of the drug can be avoided.

Table 1: Composition of different floating tablet formulations of famotidine

Ingredients* (mg per tablet)	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**	**F9**	**F10**	**F11**	**F12**
Famotidine	40	40	40	40	40	40	40	40	40	40	40	40
HPMC (K4M)	100	75	50	25	--	--	--	--	--	--	50	25
HPMC (K15M)	--	--	--	--	100	75	50	25	--	--	50	50
Carbopol 934P	--	--	--	--	--	--	--	--	75	50	--	25
Citric acid	35	35	35	35	35	35	35	35	35	35	35	35
Sodium bicarbonate	70	70	70	70	70	70	70	70	70	70	70	70
PVP K-30	15	15	15	15	15	15	15	15	15	15	15	15
MCC	124	149	174	199	124	149	174	199	149	174	124	124
Talc	4	4	4	4	4	4	4	4	4	4	4	4
Magnesium stearate	8	8	8	8	8	8	8	8	8	8	8	8
Aerosil	4	4	4	4	4	4	4	4	4	4	4	4
Total weight	400	400	400	400	400	400	400	400	400	400	400	400

*All the quantities are in mg

Table 2: Results of Precompression Flow Properties of Granules of Famotidine

Formulation code	Angle of repose(θ)	Bulk density (gm/cm^3)	Tapped density (gm/cm^3)	Carr's ndex (%)	Hausner ratio (H_R)
F1	28.13°	0.486	0.614	18.12	0.154
F2	25.45°	0.468	0.623	19.43	0.142
F3	28.67°	0.431	0.591	22.10	0.065
F4	30.89°	0.463	0.591	24.67	0.110
F5	24.34°	0.521	0.632	17.32	0.146
F6	23.13°	0.541	0.642	18.45	0.098
F7	28.15°	0.561	0.632	21.78	0.141
F8	29.67°	0.421	0.621	28.26	0.056
F9	30.90°	0.458	0.581	25.90	0.078
F10	31.23°	0.437	0.623	28.78	0.121
F11	25.41°	0.483	0.587	26.53	0.088
F12	24.58°	0.510	0.610	21.32	0.112

Table 3: Results of Post Compression Properties of Famotidine Floating Tablets

Formulation code	Thickness (mm)	Diameter (mm)	Hardness (kg/cm^2)	Friability (%)	Drug content (%)	Weight variation (mg)
F1	3.0±0.01	11.00	5.5	0.481	99.12	400±0.25
F2	2.9±0.02	11.02	6.0	0.56	98.34	399±0.30
F3	3.1±0.03	10.80	5.5	0.61	100.12	398±0.28
F4	3.2±0.01	10.90	5.5	0.43	101.34	402±0.34
F5	3.0±0.02	11.00	6.0	0.45	98.12	405±0.25
F6	2.9±0.04	11.00	5.5	0.67	99.45	403±0.22
F7	3.0±0.01	11.02	5.5	0.45	100.43	399±0.44
F8	2.9±0.04	11.00	6.0	0.78	101.91	402±0.32
F9	2.8±0.06	11.00	5.5	0.87	100.12	401±0.46
F10	2.9±0.02	11.00	5.5	0.65	101.34	404±0.66
F11	3.0±0.01	11.00	6.0	0.32	99.34	404±0.22
F12	2.9±0.02	11.00	5.5	0.74	100.12	402±0.44

Table 4: Results of *In vitro* Buoyancy study of Famotidine Floating Tablets

Formulation code	Buoyancy Lag Time (Sec)	Total Floating Time (hrs)
F1	25 s	>14 hrs
F2	35 s	>13 hrs
F3	56 s	>12 hrs
F4	75 s	>12 hrs
F5	60 s	>12 hrs
F6	80 s	>10 hrs
F7	110 s	>8 hrs
F8	125 s	>6 hrs
F9	110 s	>18 hrs
F10	120 s	>20 hrs
F11	35 s	>20 hrs
F12	30 s	>24 hrs

Table 5: Kinetic Release Data of Different Model for Optimized Formulation (F12)

Model	Slope	R^2
Zero order	4.241	0.9538
First order	-0.0769	0.939
Higuchi	23.77	0.9924
Korsmeyer-Peppas	0.7562	0.9767

Table 6: Stability study (40 °C/75%RH) of Optimized Formulation (F12)

Parameters	1st month	2nd month	3rd month
Physical appearance	Off white, smooth, flat faced	Off white, smooth, flat faced	Off white, smooth, flat faced
Weight variation(mg)	402±0.44	402±0.44	402±0.44
Hardness (kg/cm^2)	5.5	5.4	5.3
Friability (%)	0.74	0.73	0.75
Drug content (%)	100.12	99.08	98.12
Buoyancy Lag Time (Sec)	30 s	28s	29s
Total Floating Time (hrs)	24 hrs	23 hrs	24 hrs
Buoyancy on disturbing	float	float	float
In vitro release (%) 24 h.	98.00	97.5	97.00

Figure 1: Results of Swelling Index Studies of famotidine Floating Tablets

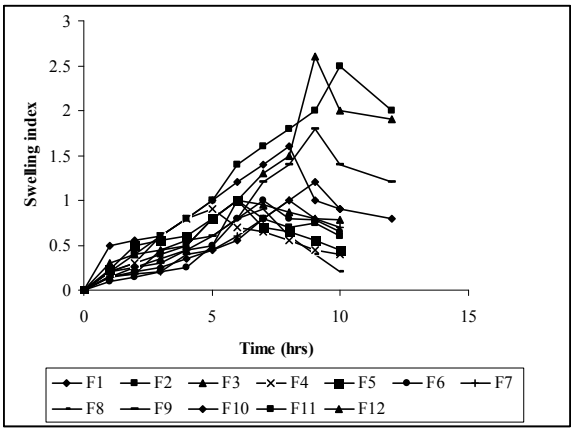


Figure 2: Comparison of *in vitro* dissolution profiles of F1 to F4

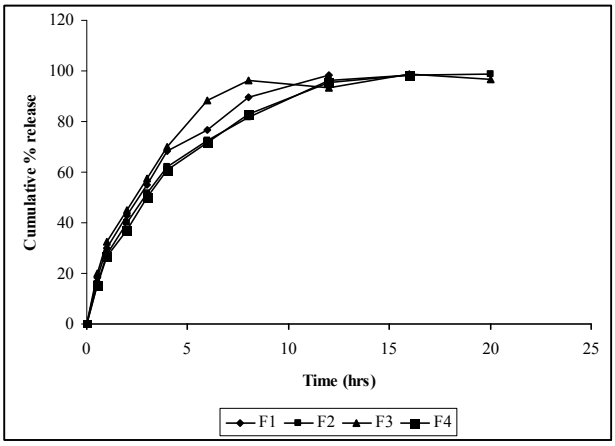


Figure 3: Comparison of *in vitro* dissolution profiles of F5 to F8

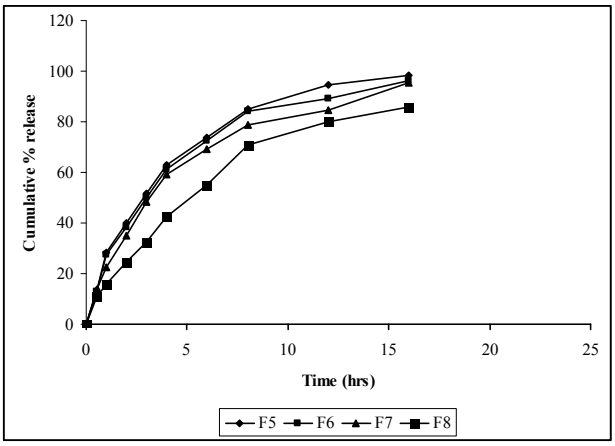


Figure 4: Comparison of *in vitro* dissolution profiles of F9 to F12

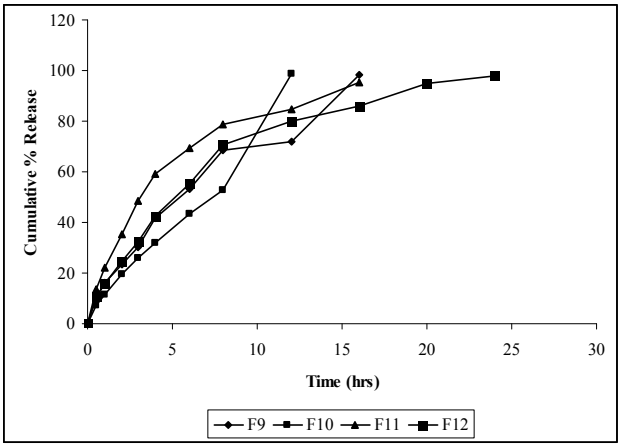


Figure 5: Comparison of *in vitro* dissolution profiles of F12 and marketed product

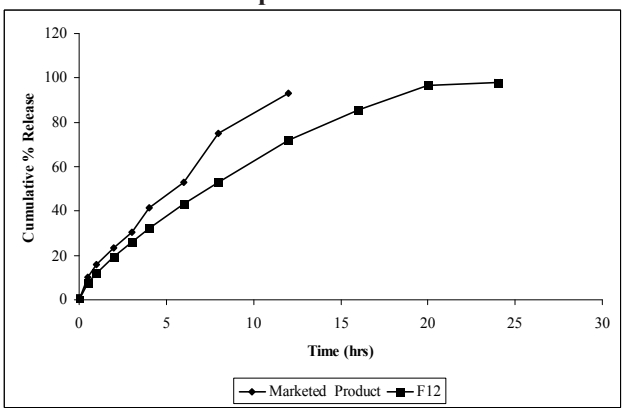


Figure 6: Zero order release kinetics of optimized formulation (F12)

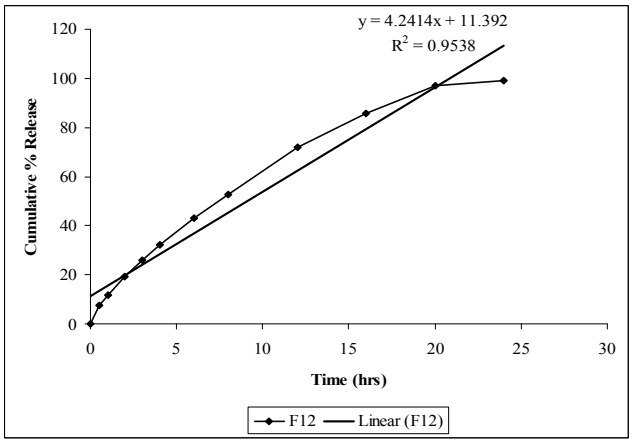


Figure 7: Korsmeyer and Peppas release kinetics of optimized formulation (F12)

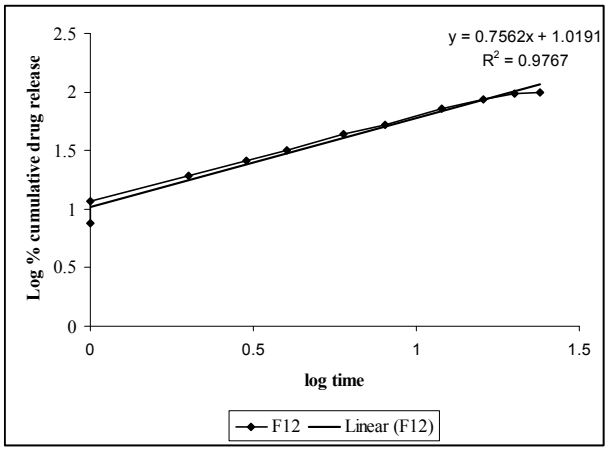


Figure 8: Higuchi matrix release kinetics of optimized formulation (F12)

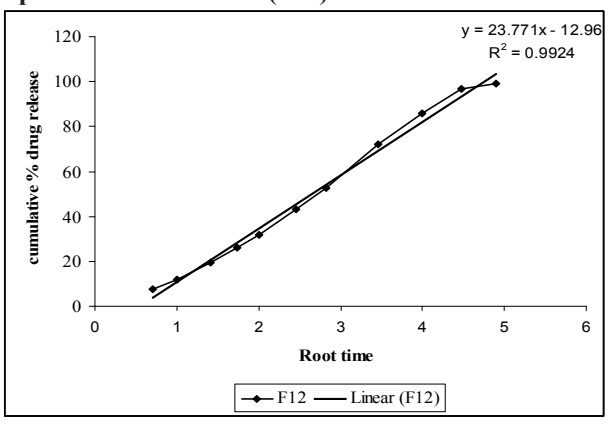
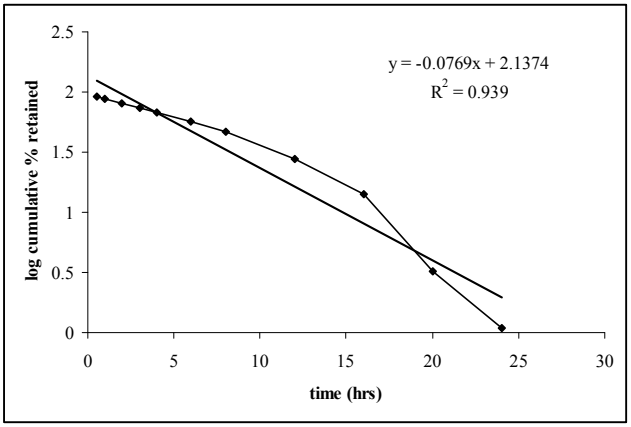


Figure 9: First order release kinetics of optimized formulation (F12)



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