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Research Article

Formulation, Development and Evaluation of Floating Matrix Tablets of Atorvastatin Calcium

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ABSTRACTS

The present study was aimed to prepare a Floating Matrix drug delivery system for the Atorvastatin calcium, andevaluating the various processing parameters including the buoyancy studies and *in vitro* drug release studies. Fifteen formulations containing varying proportions of polymers like HPMC K100M, HPMC K15M, Ethyl Cellulose and Carbopol 934P and fixed amount of gasgenerating agent such as Sodium bi carbonate and Citric Acid and also MCC in varying concentration as a bulking agent. The tablets were prepared by direct compression technique and the prepared tablets remained buoyant for more than 12 hrs in therelease medium. Batch F15 prepared with different proportions of HPMC K4M, HPMC K100 M and Carbopol 934P showed significant difference in 105 secs, Floating lag time, Total floating time more than 18 hrs and 62.11% releaseupto 12 hrs of the drug which shows extended release may be more than 15 hrs. All theformulations exhibited diffusion dominant drug release. F15 batch also showed stable in means of % Drug Content as it shows no significant change performed as per ICH guidelines for 60 Days.

Key words: Floating Matrix tablets, Buoyancy, Sustained release, Atorvastatin calcium.

INTRODUCTION

Most of the orally administered dosage forms have several physiological limitations, such as GI transit time, incomplete drug absorption due to incomplete release of drug from the devices and too short residence time of the dosage forms in the absorption region of GI tract. To overcome these limitations many attempts have been made by scientists by designing various drug delivery systems. Among these systems, Floating drug delivery systems (FDDS) is one of the approaches which remain buoyant due to their lower density that of the GI and intestinal fluids. Both single and multiple unit systems have been developed[1,2]Prolonged gastro retention of the therapeutic moiety may offer numerous advantages, including improvement of bioavailability, therapeutic efficiency and possible reduction of dose[3,4,5]. It has been reported that prolonged local availability of antibacterial agents may augment their effectiveness in treating H. Pyloriinfections[6].

Floating Drug Delivery Systems (FDDS)

FDDS have a bulk density lower that gastric fluid and thus remains buoyant in stomach for prolonged period of time without affecting gastric emptying time. They are also referred to as hydro dynamically balanced systems (HBS) as they are able to maintain their low density. Based on mechanisms of floating, two different technologies i.e., Effervescent FDDS and Non-effervescent FDDS were attempted to release drug. In case of effervescent systems, when they reach the stomach CO_2 is liberated by the acidity of gastric content and is entrapped in jellified hydro colloid. When the liberated gas is expelled from the dosage form it creates pores through which water can easily pass and help sin wetting of the polymers. The CO_2 generated compounds like sodium bicarbonate, calcium carbonate, citric acid/tartaric acid mixtures can be used[7,8,9,10]. Non-effervescent floating dosage forms use a gel forming or swellable cellulose type of hydrocolloids, polysaccharides, and matrix-forming polymers like polycarbonate, polyacrylate, polymethacrylate, and polystyrene. The formulation method includes a simple approach of thoroughly mixing the drug and the gel-forming hydrocolloid. After oral administration this dosage form swells in contact with gastric fluids and attains a bulk density of less than 1. The air entrapped within the swollen matrix imparts buoyancy to the dosage form.

Atorvastatin calcium is a HMG-CoA reductase inhibitor used in the treatment of hyperlipidaemia [11]. It has a oral bioavailability of less than 12%. It also undergoes high first pass metabolism. It is highly soluble in acidic pH and absorbed more in the upper part of the GIT [12]. In order, to improve the absorption and its oral bioavailability, we have attempted to formulate a floating Matrix drug delivery systems using Atorvastatin calcium with varying quantity of HPMC K15M, HPMC K100M, Ethyl cellulose and Carbopol 934P aspolymers. In this present investigation floating Matrix drug delivery of atorvastatin Calcium were developed using Hydroxy propyl methyl cellulose (HPMC K15Mand K100M) has been reported to enhance the controlled release property whereas Ethyl Cellulose and Carbopol 934P are used as a release modifying agent.[7,8,9,10] The objectives of this research project are the development of formulation for atorvastatin Calcium floating tablets and its corresponding in-vitro evaluations; which highly focuses on the floating behaviour and drug release profile of the tablets.

MATERIALS & METHODOLOGY

Materials:-

Atorvastatin Calcium was received as a gift sample from Cadila Healthcare Ltd, Ahmedabad. Hydroxy Propyl Methyl Cellulose K15M and K100M, Carbopol 934P, Ethyl Cellulose, PVP K30, MCC, Aerosil and Magnesium

Stearate was obtained as gift sample from Kaptab Pharmaceuticals, Vadodara. All other ingredients, reagents & solvents were of analytical grade.

Drug – Polymer Interaction [13,14]

It was carried out by FT-IR Infrared spectra of pure drug, polymer, as well as drug-polymer were taken by KBr pellet technique and were recorded in the range of 4000 – 400 cm-1 using FT-IR Spectrophotometer.

Method of preparation of floating tablet (Direct compression method)

Floating tablets containing Atorvastatin calcium were prepared by direct compression technique using different grades of polymers with Sodium bicarbonate and Citric acid. All the ingredients were accurately weighed and pass through sieve 60 #. Then, except magnesium stearate all other ingredients were blended uniformly in glass mortar. After sufficient mixing of drug as well as other components, magnesium stearate was added, as post lubricant and further mixed for additional 2-3 minutes. The tablets were compressed using rotary tablet machine. The weights of the tablets were kept constant for all the formulations. [15]

Evaluation of Floating Tablets of Atorvastatin Calcium

Pre Compression Parameters

Bulk density (BD)

Bulk density was determined by pouring the blend into a graduated cylinder. A quantity of 10 g of powder from each formulation, previously lightly shaken to break any agglomerates formed was introduced into a 50 ml measuring cylinder. The bulk volume and mass of the powder was determined. The bulk density was calculated by using below formula.[16]

$$\text{Bulk density} = \frac{\text{Mass of powder blend}}{\text{Bulk volume of powder blend}}$$

Table 1: Formulation Design of developed Floating Matrix tablets of Atorvastatin calcium

Ingredients	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
Atorvastatin calcium	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
HPMC K100M	40	45	50	55	60	40	45	50	55	60	40	45	50	55	60
HPMC K15M	20	25	30	35	40	20	25	30	35	40	20	25	30	35	40
Ethyl cellulose	---	---	---	---	---	20	25	30	35	40	---	---	---	---	---
Carbopol 934P	---	---	---	---	---	---	---	---	---	---	20	25	30	35	40
MCC	100	90	80	70	60	80	65	50	35	20	80	65	50	35	20
Sodium bicarbonate	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Citric acid	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
PVP K 30	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Magnesium stearate	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Aerosil	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Total weight	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270

Tapped density (TD)

The measuring cylinder containing a known mass of blend was tapped for a fixed time. The minimum volume occupied in the cylinder and the mass of the blend was measured. The tapped density was calculated using the following formula.[17]

$$\text{Tapped density} = \frac{\text{Mass of powder blend}}{\text{Tapped volume of powder blend}}$$

Carr's index

The simplest way for measurement of free flow of powder is compressibility, an indication of the ease with which a material can be induced to flow is given by Carr's index which is calculated as follow.[17]

Carr's index (%) = [(TD – BD) × 100] / TD

Where, BD = Bulk density gm/cm^3

TD = Tapped density gm/cm^3

Hausner's ratio

Hausner's ratio is an indirect index of ease of powder flow. It is calculated by the following formula. Hausner's ratio value is less than 1.5 indicates good flow and greater than 1.5 indicates poor flow property.[16]

$$\text{Hausner ratio} = \frac{\text{Tapped density}}{\text{Bulk density}}$$

Angle of repose

The angle of repose of powder was determined by the funnel method. The accurately 10 g weighed powder were taken in a funnel. The height of the funnel was adjusted in such a way that the tip of the funnel just touches the apex of the heap of the powder. The powder was allowed to flow through funnel freely onto the surface. The diameter of the powder cone was measured and angle of repose was calculated using the following equation.[16]

$$\tan\theta = \frac{h}{r}$$

Where, θ = angle of repose,

h = height of the cone and

r = radius of the cone base

Post Compression Parameters

Tablet thickness

Thickness of tablets is important for uniformity of tablet size. Thickness was measured using micrometer screw gauze on 3 randomly selected samples.[18]

Tablet hardness

The resistance of tablet for shipping or breakage, under conditions of storage, transportation and handling, before usage, depends on its hardness. The hardness of tablet of each formulation was measured by Pfizer hardness tester.[18]

Tablet friability

Friability is the measure of tablet strength. Roche Friabilator was used for testing the friability using the following procedure. Twenty tablets were weighed accurately and placed in the tumbling apparatus that revolves at 25 rpm dropping the tablets through a distance of six inches with each revolution. After 4 min, the tablets were weighed and the percentage loss in tablet weight was determined.[18]

$$\% \text{ Lose} = \left(1 - \frac{\text{Final wt. Of tablets}}{\text{Initial wt. Of tablets}}\right) \times 100$$

Weight variation

Twenty tablets were weighed individually and the average weight was determined. Then percentage deviation from the average weight was calculated. According to IP standards, not more than two of the individual weight deviate from the average weight by more than the percentage shown in the table 10 and none deviates by more than twice that percentage.[18]

Drug content uniformity

Five tablets from each formulation were weighed and taken in mortar and crushed to make powder. A quantity of powder weighing from this equivalent to 20 mg of Atorvastatin calcium was taken in 100 ml volumetric flask and dissolved in 5 ml of methnol & diluted upto 100ml with 0.1 N HCl. It was then shaken vigorously on a Magnetic stirrer for 2 hr & filtered into 50 ml volumetric flask upto the mark by using whatman filter paper. Further appropriate dilutions were made & absorbance was measured at nm 246 nm.[19]

***In vitro* buoyancy determination**

The time interval between introduction of tablet into the dissolution medium &its floatation to the surface of the medium was termed as Buoyancy Lag time (BLT) and the duration upto which the tablet floats on the surface of the medium was termed as the Buoyancy floating time (BFT). Both BLT & BFT were determined using type II dissolution apparatus (paddle type) in dissolution medium 900 ml 0.1 N HCl (PH 1.2) at37 ± 0.5°C.[19,20]

Swelling index

Swelling of tablet involves the absorption of a liquid resulting in an increase in weight and volume. Liquid uptake by the particle may be due to saturation of capillary spaces within the particles or hydration of macromolecule. The liquid enters the particles through pores and bind to large molecule; breaking the hydrogen bond and resulting in the swelling of particle.The extent of swelling can be measured in terms of percentage weight gain by the tablet.Swelling of hydrophilic polymers such as HPMC K100M & release modifying agent Carbopol 934P, ethyl Cellulose greatly depends upon the contents of the stomach and the osmolarity of the medium. These eventually also influence the release slowing action and the residence time. For each formulation, one tablet was weighed and placed in a beaker containing 200ml of 0.1N HCl (PH 1.2). After each hour tablet was removed from beaker, blotted using tissue paper and weighed again up to 6 hours.The percentage weight gain by the tablet was calculated by the formula.[20]

$$\text{Swelling index (S.I)} = \{(Wt-Wo)/Wo\} \times 100$$

Where,

S.I. = Swelling index

Wt = Weight of tablet at time t

Wo = Weight of tablet before immersion

***In vitro* dissolution study**

In vitro drug release of all formulations were carried out using USP- type II dissolution apparatus (paddle type). The dissolution medium 900 ml 0.1 N HCl (PH 1.2) Buffer was placed into the dissolution flask maintaining the temperature of 37 ± 0.5^0C& rpm of 50. One Atorvastatin calcium tablet was placed in the dissolution apparatus. Dissolution studies were carried out for 12 hr. 5ml of the Aliquot was taken at intervals of 1, 2, 3, 6,9, 12, hrs. After collecting the sample, the dissolution medium was replenished with the same volume of fresh medium, and the sample was filtered 1ml of the filtrate was diluted to 10ml with 0.1 N HCl (pH 1.2) and analysed spectrophotometrically at 245 nm.[17,19]

Kinetics modeling of drug dissolution profiles

To analyse the *in vitro* release data various kinetic models were used to describe the release kinetics.The dissolution profile of the all formulations were fitted to zero order, first order and Higuchi to ascertain the kinetic modeling of the drug release.[21]

$$C = K_0 t$$

Where,K_0 = Zero-order rate constant andt = Time

$$\text{LogC} = \text{Log}C_0 - Kt / 2.303$$

Where, C_0 = initial concentration of drug and K = First order constant.

$$Q = K\, t^{1/2}$$

Where, K = Constant and t = Time.

Stability study

The stability study was carried out for optimized formulation as per ICH guidelines (Feb. 2003). Various ICH storage conditions are available which are as 25°C ± 2°C (60% ± 5%RH), 30°C ± 2°C (65% ± 5%RH) and 40°C ± 2°C (75% ± 5%RH). The microspheres of the best formulation were placed in screw capped glass container and stored at various ICH storage condition for a period of 60 days. The samples were analysed for physical appearance and for the drug content at regular interval of 15 day.[22]

RESULT AND DISCUSSION

The present study was aimed to prepare a Floating Matrix drug delivery system for the model drug Atorvastatin calcium, andevaluating the various processing parameters including the buoyancy studies and *in vitro* drug release studies. Fifteen formulations containing varying proportions of polymers like HPMC K100M, HPMC K15M, Ethyl Cellulose and Carbopol 934P and fixed amount of gasgenerating agent such as Sodium bi carbonate and Citric Acid and also MCC in varying concentration as a bulking agent. The tablets were prepared by Direct compression technique.

Preformulation Studies

The IR spectrum of standard drug Atorvastatin calcium and sample drug Atorvastatin calcium shows same peak and IR spectrum of Atorvastatin calcium with various polymers such as ethyl cellulose, carbopol 934P and HPMC was equivalent to the spectra obtained by the addition of polymers. The results revealed no changes seen in the IR

peaks of Atorvastatin calcium, when mixed with polymers. These observations indicate the compatibility of polymers with Atorvastatin calcium.

Table 2 Organoleptic Properties of Pure Drug

Parameters	Observations
Colour	White to off White
Taste	Very Bitter
Odour	Odourless
Λmax	245nm
Solubility	Freely soluble in Methanol, Acetone and 0.1 N Hcl, Slightly soluble in Ethanol and Insoluble in 0.1 N NaOH

The formulations showed good flow property and compressibility index **Table 3**. Angle of repose ranged from 22° to 25° and the compressibility index ranged from 9.03 to 11.06 %. The BD and TD of the prepared granules ranged from 0.528 to 0.579 and 0.571 to 0.648gm/ml 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.

The shape of the tablets of all formulations remained circular with no visible cracks. The thickness ranged from 3.1 mm to 3.5 mm and the average percentage weight variation of 20 tablets from each formulation remained within ±5%. The hardness and percentage friability of all batches remained within the range of 4.1 to 4.5 kg/cm^{2}nd 0.52 to 0.61 % respectively. The drug content estimations showed values in the range of 99.71 % to 98.54 % which reflects good uniformity in drug content among different formulations. 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.

Buoyancy Lag time, Total floating time and Swelling index

On immersion of tablets of different formulations in 0.1N HCl solution at 37±5°C, the tablets floated, and remained buoyant without disintegration, the results of the buoyancy lag time (BLT) and total floating time (TFT) were shown in Table 5.Buoyancy lag time (BLT) and total floating time (TFT) of different formulation were noted. With reference to buoyancy studies results it can be concluded that as the amount of HPMC polymers increase the formulation showed good buoyancy lag time (BLT) and total floating time (TFT). Formulation F15 containing HPMC K15M, HPMC K100M and carbopol 934P showed good BLT of 105 sec and TFT of more than 18 hrs.

Table 5 Floating Behaviour of Prepared Formulations

Batch no.	Buoyancy Lag time (sec)	Total floating time (hrs)	Swelling index after 6 Hr (%)
F1	142	12hrs	63.78
F2	138	12hrs	59.28
F3	132	12hrs	57.34
F4	140	12hrs	54.87
F5	123	12hrs	53.56
F6	134	>16hrs	50.23
F7	125	>16hrs	48.32
F8	119	>16hrs	45.93
F9	115	>16hrs	45.08
F10	114	>16hrs	44.65
F11	127	>18hrs	44.02
F12	119	>18hrs	43.19
F13	111	>18hrs	42.68
F14	108	>18hrs	41.88
F15	105	>18hrs	40.24

Table 3 Physicochemical Properties powder blend

Sr. No	Bulk density gm/ml	Tapped density gm/ml	Carr's index (%)	Hausner's ratio	Angle of repose (°)
AT-1	0.515	0.571	9.81	1.11	22
AT-2	0.524	0.576	9.03	1.10	25
AT-3	0.565	0.627	9.89	1.11	23
AT-4	0.545	0.606	10.07	1.11	23
AT-5	0.58	0.648	10.49	1.12	24
AT-6	0.568	0.631	9.98	1.11	20
AT-7	0.538	0.594	9.43	1.10	22
AT-8	0.563	0.626	10.06	1.11	21
AT-9	0.545	0.606	10.07	1.11	20
AT-10	0.535	0.594	9.93	1.11	23
AT-11	0.551	0.615	10.41	1.12	22
AT-12	0.542	0.602	9.97	1.11	21
AT-13	0.579	0.651	11.06	1.12	20
AT-14	0.541	0.601	9.98	1.11	22
AT-15	0.532	0.591	9.99	1.11	23

The Swelling Index for different formulations were shown in **Table 5**. Batches F1-F5 shows max swelling index comparing to other batches after 6 hrs while Batch F6-F10 shows less swelling index as concentration of EC increases may be due to its hydrophobic nature and acidic insolubility. From Batch F11-F15 shows least swelling index after 6 hrs as the concentration of Carbopol 934 P increases may be due to high viscosity and hydrophilic nature.

***In Vitro* Dissolution studies of Prepared Formulations**

The results of*in vitro* percentage release at different time intervals is plotted against time to obtain release profile (**Figure 1, 2 and 3**). From the *in vitro* drug release studies, Tablets prepared with HPMC K15M and HPMC

K100M coded with F1, F2, F3, F4 and F5 released 96.46 %, 93.28 %, 91.18 %,89.02 % and 87.15% respectively at the end of 12 hrs and Tablets prepared with HPMC K15M, HPMC K100M and EC coded with F6, F7, F8, F9 and F10 released 82.96 %, 77.98 %, 75.03 %, 71.08 % and 66.59 % respectively at the end of 12 hrs where as Tablets prepared with HPMC K15M, HPMC K100M and Carbopol 934 P coded with F11, F12, F13, F14 and F15 released 80.45 %, 75.19 %, 72.27 %, 67.32 % and 62.11 % respectively at the end of 12 hrs. It was concluded that formulation having only HPMC K15M and HPMC K100M (F1-F5) showed quick release when compared to other formulations of HPMC K15M and HPMC K100M with ethyl cellulose because EC is a hydrophobic in nature and insoluble in acidic pH so it swells and releases drug slowly(F6-F10).

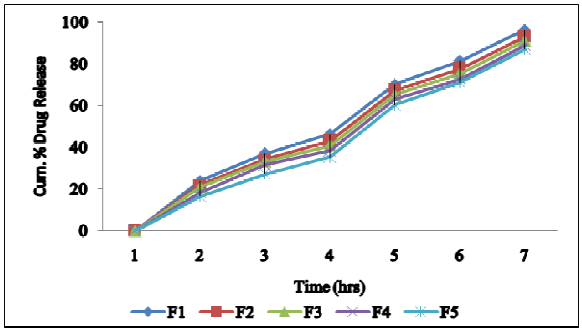

Figure 1 Dissolution Profile of batch F1-F5

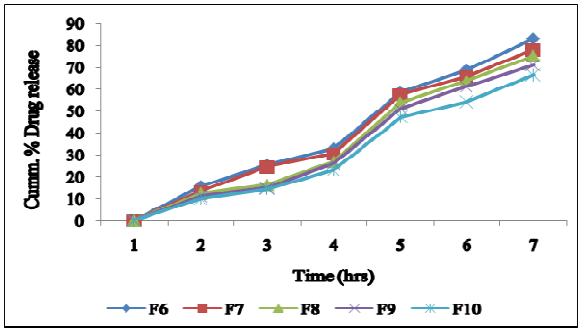

Figure 2 Dissolution Profile of batch F6-F10

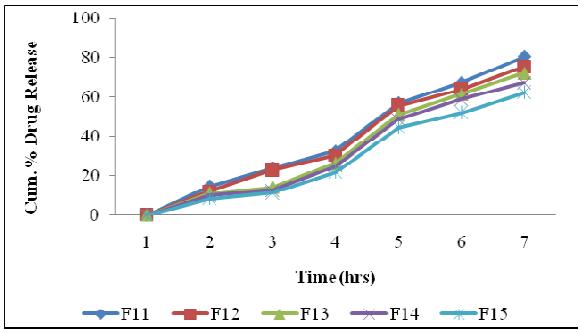

Figure 3 Dissolution Profiles of Batch F11-F15

This is due to less permeability of water to ethyl cellulose. When HPMC K15M and HPMC K100M was incorporated with varying amount of Carbopol 934P was found to be decreased drug release or maximize drug release more than 18 hrs due to Carbopol 934P high viscosity grade polymer and hence overall Carbopol 934P hydrophilic polymer concentration is increase as Batch F11-F15 therefore drug release decrease compare to F1-F5.. In formulation F15, which contained maximum amount of Carbopol 934P and minimum of HPMC K15M and HPMC K100M, drug release was found to be more than all other formulated batches which may be due to erosion of tablets to increased drug release. Hence it was concluded that F15 was the best.

Release Kinetics Analysis

The kinetic data (**Table-6**) 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 all formulations showed good linearity R^2value indicates that diffusion non-fickion is dominant mechanism of drug release with these formulations.

Table 6: Release Kinetic Data

Batch No	Zero Order R^2	First Order R^2	Higuchi R^2
F1	0.9231	0.94	0.9969
F2	0.9314	0.9646	0.9815
F3	0.9361	0.9716	0.98
F4	0.9428	0.9759	0.9777
F5	0.9576	0.9824	0.9724
F6	0.9577	0.9918	0.9684
F7	0.9489	0.9922	0.9644
F8	0.9621	0.9934	0.9451
F9	0.9594	0.992	0.9454
F10	0.9644	0.9889	0.9434
F11	0.9574	0.9951	0.9695
F12	0.9486	0.993	0.9657
F13	0.9629	0.9934	0.9431
F14	0.957	0.9886	0.94
F15	0.9608	0.9862	0.9356

Stability studies

The optimized floating tablet (F15) was selected for stability study on the basis of Drug content, *in vitro* buoyancy and *invitro* drug dissolution studies. The tablets were investigated at 25 °C ± 2 °C (60% ± 5% RH), 30 °C ± 2 °C (65% ± 5% RH) and 40 °C ± 2 °C (75% ± 5% RH) 40 °C / 75% RH for 3 months. The percentage amount of drug content initially found to be 99.71% and after 60days 99.12% at 25 °C ± 2 °C (60% ± 5% RH), 98.96% at 30 °C ± 2°C (65% ± 5% RH) and 98.78% at 40 °C ± 2 °C (75% ± 5% RH). The buoyancy leg time and Total floating time initially found to be 105 sec and > 18 hrs, and after 60 days 109 sec and >18 hrs at 25 °C ± 2 °C (60% ± 5% RH), 110sec and >18 hrs at 30 °C ± 2 °C (65% ± 5% RH) and 112 sec and > 18 hrs at 40 °C ± 2 °C (75% ± 5% RH). The *in vitro* drug release initially found to be 62.11% after 12 hrs and after 60days 63.15% at 25 °C ± 2 °C (60% ± 5% RH), 62.67% at 30 °C ± 2 °C (65% ± 5% RH) and 61.94% at 40 °C ± 2 °C (75% ± 5% RH). From the data, the formulation is found to be stable under the conditions mentioned since there was no significant change in the percentage amount of drug content and drug release percentage. Thus, it was found that the floating tablets of

Atorvastatin Calcium (F15) were stable under these storage conditions for at least 2 months.

Table 4 Various Post- compression Tests of Prepared Formulations

Batch No	Weight variation (gm)	Hardness (Kg/cm^2)	Thickness (mm)	Friability (%)	Drug Content (%)
F1	0.274 ± 0.008	4.3 ± 0.2	3.5 ± 0.03	0.53	99.21
F2	0.271 ± 0.005	4.2 ± 0.3	3.4 ± 0.05	0.58	99.04
F3	0.268 ± 0.002	4.4 ± 0.1	3.2 ± 0.02	0.62	98.97
F4	0.267 ± 0.003	4.2 ± 0.4	3.3 ± 0.04	0.55	98.64
F5	0.272 ± 0.004	4.3 ± 0.3	3.2 ± 0.03	0.58	98.89
F6	0.265 ± 0.002	4.5 ± 0.2	3.4 ± 0.02	0.61	99.23
F7	0.270 ± 0.003	4.2 ± 0.4	3.5 ± 0.04	0.54	99.48
F8	0.277 ± 0.002	4.1 ± 0.3	3.3 ± 0.02	0.55	98.75
F9	0.265 ± 0.005	4.3 ± 0.1	3.2 ± 0.03	0.58	98.96
F10	0.279 ± 0.006	4.5 ± 0.2	3.4 ± 0.02	0.54	99.62
F11	0.269 ± 0.002	4.3 ± 0.3	3.2 ± 0.04	0.52	99.43
F12	0.262 ± 0.004	4.1 ± 0.4	3.1 ± 0.03	0.58	99.16
F13	0.266 ± 0.003	4.3 ± 0.2	3.3 ± 0.02	0.54	98.85
F14	0.271 ± 0.002	4.2 ± 0.1	3.2 ± 0.03	0.51	98.58
F15	0.272 ± 0.005	4.4 ± 0.3	3.4 ± 0.04	0.56	99.71

CONCLUSION

The prepared Floating Matrix drug delivery system for the Atorvastatin calcium containing varying proportions of polymers like HPMC K100M, HPMC K15M, Ethyl Cellulose and Carbopol 934P and fixed amount of gas generating agent such as Sodium bicarbonate

Citric Acid and also MCC in varying concentration as a bulking agent. The tablets were prepared by direct compression technique and the prepared tablets remained buoyant for more than 12 hrs in the release medium. Batch F15 prepared with different proportions of HPMC K15M, HPMC K100 M and Carbopol 934P due to its high viscosity grade polymer and hydrophilic nature showed significant difference in 105 seconds Floating lag time, Floating Buoyancy Time more than 18 hrs and 62.11% release up to 12 hrs of the drug which shows extended release may be more than 15 hrs and stable after 60 Days.

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