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Research

Formulation and evaluation of floating tablets containing for selected antibiotic

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Abstract

Floating tablets were prepared using direct compression with varying ratios of Karaya gum, Carbopol, and Xanthan gum. The preformulation studies included drug description, solubility, pH, and compatibility testing through infrared spectroscopy. Post-compression evaluation parameters included weight variation, thickness, hardness, friability, drug content, tablet density, floating test, swelling index, and in vitro dissolution studies. Results indicated that the formulated tablets met all standard physicochemical parameters. Floating tests demonstrated that the tablets remained buoyant for over 14 hours, while swelling studies showed significant hydration and gel formation, contributing to controlled drug release. In vitro dissolution studies revealed satisfactory drug release profiles, with formulations F2, F5, F8, and F10 showing extended release patterns fitting the Higuchi model, indicative of a diffusion-controlled mechanism. Stability studies confirmed that the floating tablets remained stable under various storage conditions for up to 60 days. In conclusion, the developed Levofloxacin floating tablets demonstrated potential as an effective GRDDS, improving drug bioavailability and offering sustained release, making them suitable for clinical application.

Keywords: Floating Tablets, Levofloxacin, Gastro retentive Drug Delivery System (GRDDS), *invitro* Evaluation, Controlled Release

INTRODUCTION

Oral route remains the preferred route for the administration of therapeutic agents because low cost of therapy and ease of administration leads to higher level ofpatient compliance. The high level of patient compliance in taking oral dosage forms is due to the ease of administration and handling of these forms. Although tremendous advances have been seen in oral controlled drug delivery system in last two decades, this system has been of limited success in the case of drugs with a poor absorption window throughout the GIT (Gastro Intestinal Tract). Drug absorption from the gastrointestinal tract is a complex procedure and is subject to many variables. It is widely acknowledged that the extent of gastro intestinal tract drug absorption is related to contact time with the

small intestinal mucosa. Thus, small intestinal transit time is an important parameter for drugs that are incompletely absorbed. Gastro retention helps to pro-vide better availability of new products with new therapeutic possibilities and substantial benefits for patients.

Controlled release drug delivery systems that retain in the stomach for a long time have many advantages over sustained release formulations. Such retention systems (i.e. GRDDS) are important for the drugs that are degraded in intestine or for drugs like antacids or certain enzymes that should act locally in the stomach. Gastric retention may increase solubility for the drugs which are poorly soluble in intestine due to alkaline pH before they are emptied, resulting in improved bioavailability. These systems are also advantages in improving GIT absorptionof a drug with narrow absorption windows as well as for controlling release of those drugs which are having site-specific absorption limitations.

Floating systems

Floating drug delivery have the property of retaining the dosage units in the stomach for prolonged period of time and are useful for drugs acting locally in the gastro intestinal tract (GIT), drugs which are poorly soluble and unstable in intestinal fluids. Recently various efforts are being made to design floating systems such as Floating Drug delivery systems (FDDS), Swelling and Expanding Systems, Bio adhesive systems, Modified shape systems, High density systems etc. These systems are advantageous in improving GIT absorption of drug with controlled release due to specific site absorption limitations. The main objective of developing these systems is to increase the safety of a product to extend its duration of actionand decrease side effects of drugs. These systems have more flexibility in dosage form design than conventional dosage form. Several approaches have recently been developed to extend gastrointestinal transit time by prolonging residence time of drug delivery system in the GIT.

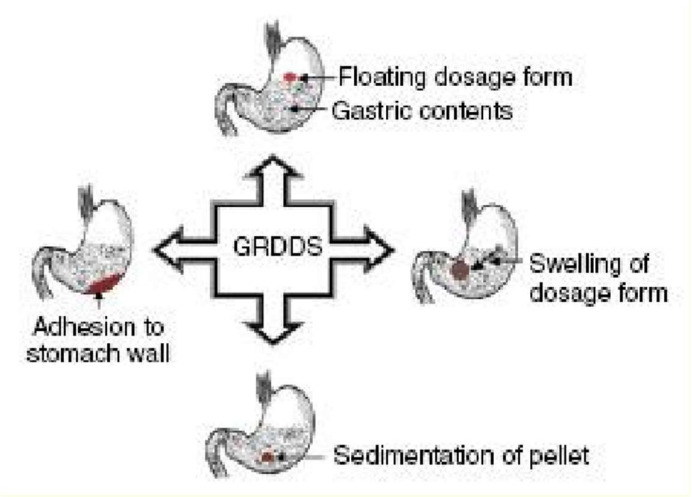

Fig 1: Approches of gastro retentive drug deliverysystems

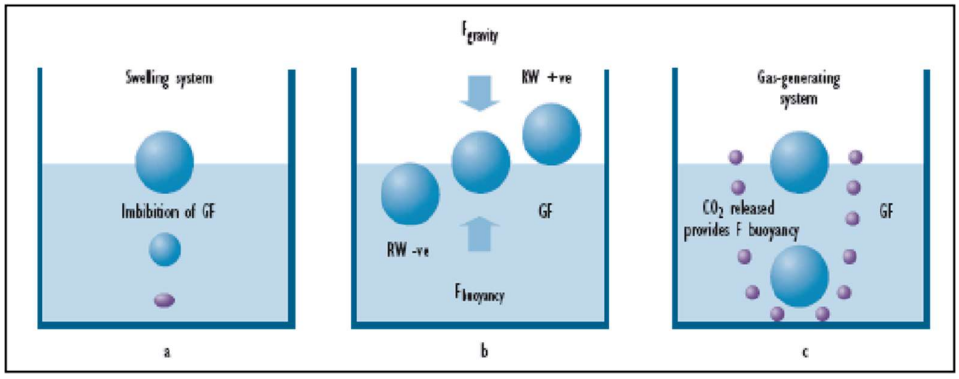

Fig 2: Mechanism of GRDDS

MATERIALS AND METHODS

Materials

Table 1: List of Materials Used

S.No.	Materials	Manufacturer
1	Levofloxacin	Aurabinda Pharma Pvt Ltd., Hyderabad
2	Karaya gum	Yarrow chemicals Ltd., Mumbai.
3	Xanthum gum	Yarrow chemicals Ltd., Mumbai.
4	Carbopol	.Loba chemicals, Mumbai.
5	Sodium bicarbonate	Loba Chemie Pvt. Ltd., India.
6	Lactose	Scientific lab, Erode.
7	Magnesium stearate	Scientific lab, Erode.
8	Talc	Scientific lab, Erode.

Preformulation studies

It is one of the important prerequisite in development of any drug delivery system. Preformulation studies were performed on the drug, which included description, solubility, pH, and compatibility studies.

Description: Description of Levofloxacin was determined.

Solubility: Solubility of Levofloxacin in water, 0.1N Hcl, acetone, acetonitrile anddichloromethane.

pH: pH of Levofloxacin was determined to IP studies. Between 3 to 4.5 in a 2.5%w/v solution.

Compatibility Studies: The compatibility of the drug and polymer under experimental conditions is an important prerequisite before formulation. It is necessary to confirm that the drug does not react with the polymer and affect the shelf life of the product. This can be confirmed by carrying out infrared spectroscopy studies.

Procedure: The obtained drug and polymer were subjected to IP studies. In the present study potassium bromide disc (pellet) method was employed and the obtained IR spectra were analysed comparatively, with reference spectrum of Levofloxacin (Silverstein RM and Webstar FX, 2009 and William Kemp, 2008).

METHODOLOGY

Floating tablets of Levofloxacin were prepared by direct compression technique using varying ratio of polymer such as Karaya gum, Carbopol, Xanthum gum with sodium bicarbonate as gas generating agent. The composition of each formulation is given in Table 2. The formulated tablets are given in Figure 5. Karaya gum, Carbopol, Xanthum gum ratio used in the formulations F_1 is 1:2:3, F_2 is 1:3:2, F_3 is 1:1:1, F_4 is 2:1:3, F_5 is 2:3:1, F_6 is 3:1:2, F_7 is 3:2:1 and F8, F9, F10 is 1:1 respectively.

Sifting: Levofloxacin was passed through sieve no. 20 and collect in a clean bowl. Karaya gum, Carbopol, Xanthum gum and sodium bicarbonate were passed through sieveno. 40 and collect in a clean bowl. Talc was passed through sieve no. 60 and collect in a clean bowl. Finally magnesium stearate was passed through sieve no.60 and collect in a separate clean bowl.

Mixing: Levofloxacin was geometrical mixed with Karaya gum, Carbopol, Xanthum gum and sodiumbicarbonate for 10 minutes. Then talc was added and further mixed for 5minutes.

Lubrication: After sufficient mixing of drug as well as other component, magnesiumstearate was added and further mixed for additional 2 minutes.

Compression: The lubricated granules were compressed by Rotary tableting machine. The weightof thetablet was kept constant for all formulations (Lachman L. et al, 1987).

Table 2: Composition of Levofloxacin floating tablets

Ingredients(mg/tablet)	Batch Code									
	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Levofloxacin	100	100	100	100	100	100	100	100	100	100
Karaya Gum	60	40	20	40	40	60	60	60	60	-
Carbopol	20	40	60	20	20	20	60	40	-	60
Xanthum Gum	40	40	40	60	60	40	-	20	60	60
Sodium bicarbonate	55	60	60	60	60	60	60	55	55	55
Lactose	25	20	20	20	20	20	20	25	25	25
Talc	5	5	5	5	5	5	5	5	5	5
Magnesium stearate	5	5	5	5	5	5	5	5	5	5
Total / mg	310	310	310	310	310	310	310	310	310	310

Evaluation parameters
In-*vitro* Dissolution Studies
Standard calibration curve

Weighed accurately 100 mg of Levofloxacin and dissolved in a suitable quantity of 0.1 N Hcl in a 100ml volumetric flask. Then the volume was made upto 100ml with 0.1 N Hcl, which gives 1000 µg/ml concentration. The standard stock solution was then serially diluted with 0.1 N Hcl to get 5, 10, 15, 20, 25 and 30 µg/ml of Levofloxacin. The absorbance of the solutions was measuredagainst 0.1 N Hcl as blank at 276 nm using spectrophotometer. The absorbance values were plotted against concentration (µg/ml) to obtain the standard calibration curve (Wilard Merritt and Dean settle, 1986).

Cumulative % drug release

In-vitro drug release profile of Levofloxacin was evaluated using (paddle, 900 ml N Hcl, 37±0.5ºC, 50 rpm). One tablet was placed in each of the six dissolution vessels and the system was run. Aliquots of samples were withdrawn after 1st, 2nd, 4th, 8th, 10th and 12th hours. Fresh dissolution medium was replaced to maintain the original volume. The withdrawn aliquots were filtered, suitably diluted with 0.1 N Hcl to obtain concentration of 10µg/ml, and its absorbance measured spectrophotometrically at 276 nm to determine drug release (Brahmakar DM and Jaiswal SB, 2003, Vogels *et al*, 2000).

Kinetics of Drug Release

To study the mechanism of drug release from the matrix tablets, the drug release data were fitted to various kinetic models like zero-order, first order, and higuchi equation and coefficient of correlation values were calculated for linear curves by regression analysis of the above plot. These models used to explain drug releaser mechanism dueto swelling (upon hydration) along with gradual erosion of the matrix.

RESULT AND DISCUSSION

Hydrodynamically balanced tablets of Levofloxacin were prepared and evaluated for their use as gastroretentive drug delivery systems to increase its bioavailability. In the present study, ten formulations were prepared and the compositions of all the batches are shown in Table 7. The formulated tablets were characterized for various physicochemical parameters.

Preformulation studies

Description: Description of Levofloxacin was found to be faintly yellowish to light yellowcrystalline substance.
Solubility: Levofloxacin was found to be soluble in water, 0.1N Hcl and practicallyinsoluble in acetone, acetonitrile and dichloromethane.
pH: pH of Levofloxacin was found to be 3.6
Compatibility Studies: Compatibility studies were performed using FT-IR spectrophotometer and the FTIR spectrum of the obtained drug and drug with polymers were studied. The characteristicabsorption peaks of Levofloxacin obtained at 3335.03cm^{-1}, 3084.28cm^{-1} were seen in the FT-IR spectrum of drug with polymers, indicating compatibility of drug with polymer components. The FT-IR spectrum of the drug and drug with polymers are shown in Fig 3 and 4 respectively.

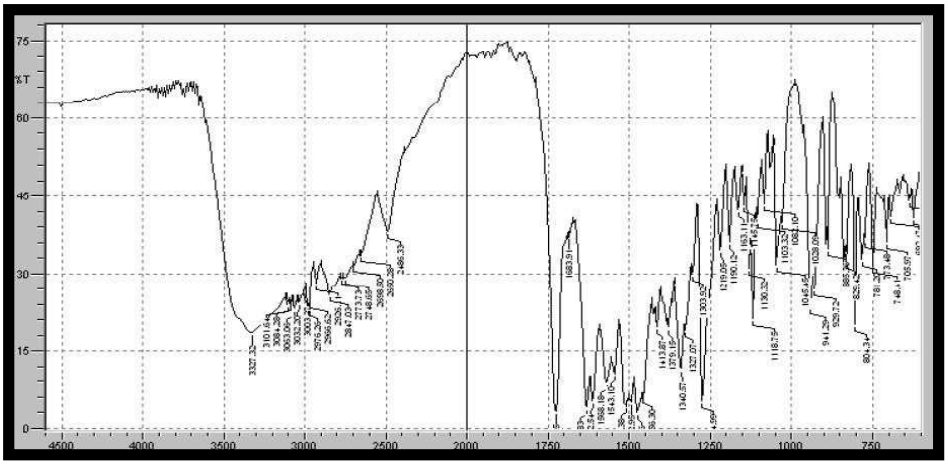

Fig 3: FT-IR spectrum of pure drug Levofloxacin

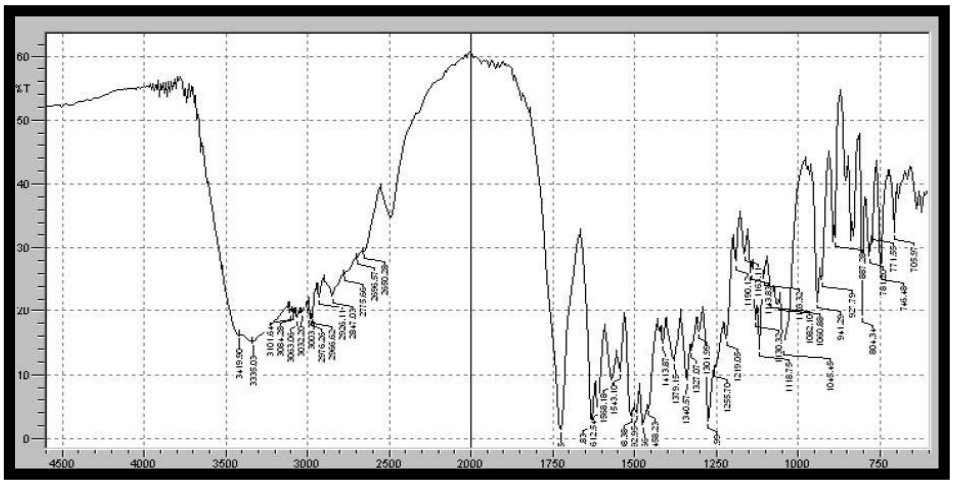

Fig 4: FT-IR spectrum of Levofloxacin with Polymers

Table 3: FT-IR Spectra data: Drug and Drug with polymers

Groups and mode ofvibrations	Frequency (in cm^{-1})		
	Drug	Drug with Polymers	Expected Range
NH stretching	3327.32	3356.45	3500-3300
C-N stretching	1327.07	1354.23	1350-1000
C-F stretching	1379.15	1390.26	1400-1000
C=C stretching	1712.54	1720.12	1720-1708
C=O carboxylic stretching	1728.33	1698.57	1730-1700
C-H stretching	3084.28	3054.18	3050-3010
O-H carboxylic stretching	2976.26	3010.43	3400-2400

Evaluation of floating tablets of levofloxacin

Pre-Compression parameters

The bulk density of granules value is used for determination of compressibility index and hausner ratio. Compressibility index of formulations F1, F3, F6, F7 and F9 values are 17.84%, 18.19%, 17.50%, 18.23% and 17.45% respectively indicate the pair flow property. Formulation F2, F4, F5, F8 and F10 values are 14.13%, 14.50%, 12.60%, 13.51% and 14.50% respectively indicate the good flow property.Hausner ratio of formulations F1, F3 and F4 values are 1.21, 1.22% and 1.22% respectively indicate the pair flow property. Formulations F2, F5, F6, F7, F8, F9 and F10 values are 1.15, 1.15, 1.14, 1.16, 1.14, 1.15 and 1.16 respectivelyindicate the good flow property. Angle of repose of formulations F2, F5, F7 and F10 values are 30.24, 31.65, 31.17 and 30.15 respectively indicate the good flow property. FormulationF1, F3, F4, F6, F8 and F9 values are 27.42, 28.14, 27.34, 28.20, 27.22 and 28.30 respectively indicate the excellent flow property.

Table 4: Pre-Compression Parameters of Levofloxacin

Parameter	Formulation code									
	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Bulk Density (gm/ml)	0.450	0.475	0.452	0.403	0.412	0.422	0.433	0.426	0.451	0.462
Tapped Density (gm/ml)	0.542	0.554	0.482	0.484	0.525	0.555	0.498	0.555	0.485	0.526
Carr's Index (%)	17.84	14.23	18.19	14.50	12.60	17.50	18.23	13.51	17.45	12.76
Hausner Ratio	1.21	1.15	1.22	1.22	1.15	1.14	1.14	1.14	1.15	1.16
Angle of Repose (θ)	27.42	30.24	28.14	27.34	31.65	28.20	31.17	27.22	28.30	30.15

n=3

Post-Compression parameters

Appearance

Microscopic examination of tablets from each batch showed white,capletshape, biconvex, uncoated tablets plain on both sides.

Weight variation

The percentage weight variations of all formulations are shown in Table 12. The tablets passed weight variation test as % weight variation was within pharmacopoeial limits of ±5% of the average weight.

Thickness

The thickness of all seven formulations values obtained from 2.51 mm to 3.51 mm. The thickness of tablets are consumer acceptance and to maintaintabletto tablet uniformity. It's mostly related to tablet hardness.

Hardness

The hardness of formulations F1 and F3 values are 5.4 kg/cm^2. Formulation F4 and F7 values are same 3.5 kg/cm^2. Formulation F2, F5, F6, F8, F9 and F10 values obtained from 4.5 kg/cm^2 to 5.0 kg/cm^2. The hardness of formulations F1 and F3 is highest value compare to other formulations. Formulations F4 and F7 is lowest value compare to other formulations.

Friability

Precentage friability values obtained were less than 1% ensuring that thetablets were mechanically stable.

Drug content

The percentage drug content of the ten batches was found to be 97.53% to 100.40%, which is within acceptable limits indicating dose uniformity in eachbatch.

Table 5: Physicochemical Properties of Levofloxacin FloatingTablets

Batch Code	Hardness (kg/cm^2)**	Thickness (mm)*	Weight variation (%)***	Friability (%)*	Drug content (%w/w)*
F1	5.40±0.25	2.66±0.10	0.328±0.024	0.32	99.89±0.71
F2	4.31±0.25	2.54±0.12	0.339±0.036	0.66	98.52±0.29
F3	5.39±0.27	2.51±0.15	0.320±0.012	0.52	100.2±0.33
F4	3.50±0.20	2.61±0.07	0.321±0.038	0.62	97.70±0.54
F5	4.45±0.27	2.97±0.08	0.319±0.032	0.75	98.65±0.47
F6	4.15±0.25	2.86±0.14	0.320±0.041	0.46	97.53±0.65
F7	3.55±0.20	3.03±0.07	0.322±0.036	0.83	98.28±0.30
F8	4.41±0.19	3.11±0.08	0.328±0.031	0.65	100.40±0.70
F9	4.19±0.27	3.07±0.08	0.320±0.040	0.65	99.92±0.64
F10	4.31±0.20	2.86±0.12	0.339±0.013	0.54	99.53±0.52

n= 3

Tablet density

In order to have good floating behavior in the stomach, density of the system should be less than that of the gastric contents. All ten batches showeddensity in the range of 0.89 – 0.96 g/cm^3. In the study it was clearly observed that the tablets of all batches showedgood floating characteristics after buoyancy lag time. This indicated thatwhen the tablet comes in contact with test medium, it expanded (because of swellable polymer) and also there was formation of CO_2 gas (because of effervescent agent). The tablet floated as density dropped below 1.0 due to the expansion of polymer and upward force of CO_2 gas generation.

Table 6: Density of Levofloxacin Floating Tablets

Parameters	Formulations									
	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Tablet Density (gm/cc)	0.95	0.92	0.95	0.97	0.92	0.91	0.89	0.96	0.90	0.91

Floating test

Carbon dioxide is formed within the tablet containing effervescent agent whenit is brought in contact with acidic medium (0.1 N Hcl). On immersion in 0.1 N Hcl at 37^{o}C, the tablets floated and remained buoyant without

disintegration. The results of floating lag time of all ten formulations within 1 minute. Total floating time of F1, F4 and F9 formulations are more than 10 hours. Total floating time of F2, F3, F5, F6, F7, and F8, F10 formulations are more than 14 hours.

Table 7: Floating Test for Levofloxacin Tablets

Parameters	Formulation									
	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Floating LagTime (FLT) (sec)	25	35	37	55	50	35	45	37	45	33
Total Floating Time (TFT)(hrs)	>10	>14	> 14	>10	>14	>14	>14	>14	>10	>14

Swelling study

Swelling ratio describes the amount of water that is contained within the hydrogel at equilibrium and is a function of the network structure, hydrophilicity and ionization of the functional groups. Swelling study was performed on all the batches for 8 hours. The study showed that swelling of tablet increased up to 4-6 hours for all formulations but after that it decreased. The results of swelling index are given in Table 6.6, while the plot of swelling index against increases with time because polymer gradually absorbs water due to its hydrophilicity. The outermost layer of polymer hydrates, swells and a gel barrier is formed at the outer surface. As the gelatinous layer progressively dissolves and/or is dispersed, the hydration swelling release process is repeated towards new exposed surfaces, thus maintaining the integrity of the dosage form.

Table 8: Swelling Index of Levofloxacin Floating Tablets

Code	Percentage of swelling inTime (Hours)				
	1	2	4	6	8
F1	151.38±1.25	161.72±1.85	189.92±2.32	163.11±3.22	117.18±2.94
F2	130.14±2.45	147.33±2.97	165.44±3.36	155.42±3.92	127.93±3.12
F3	124.54±1.60	132.51±1.94	146.41±2.24	148.23±2.92	139.87±2.22
F4	149.27±0.79	160.51±1.12	176.81±1.75	188.17±2.24	140.16±1.86
F5	131.28±2.37	144.72±2.98	164.28±3.12	157.45±3.87	129.24±2.32
F6	132.22±1.99	149.06±2.13	177.14±2.64	176.75±3.15	130.42±2.18
F7	134.04±1.25	151.42±1.90	181.75±2.35	187.80±3.23	129.71±2.75
F8	142.32±2.75	154.91±2.97	178.40±3.30	181.04±3.76	139.42±2.67
F9	138.74±1.86	149.04±2.26	168.35±2.61	174.12±3.15	133.50±2.54
F10	151.12±2.25	162.47±2.76	170.72±2.97	179.74±3.26	121.28±2.14

n= 3

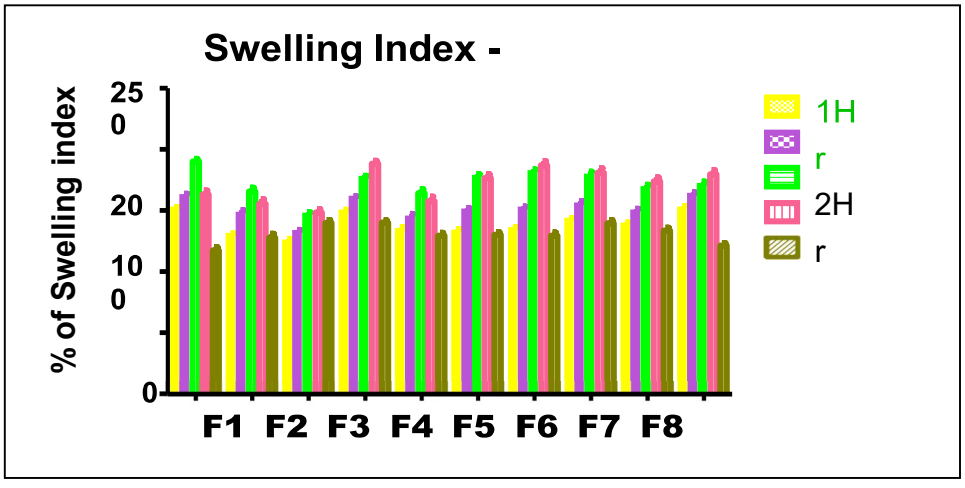

Fig 5: Swelling Index of Levofloxacin Floating Tablets

In-*vitro* Dissolution study

Standard calibration curve of Levofloxacin

The λmax of Levofloxacin in 0.1 N Hcl was found to be 276 nm. The absorbance values are tabulated in Table 10. Levofloxacin obeyed Beer's law in theconcentration range of 5-30 µg/ml with regression coefficient of 0.9993. The standardcalibration curve of Levofloxacin is shown in Fig 6.

Table 9: Absorbance of standard curve of Levofloxacin

S.No.	Concentration (µg/ml)	Absorbance (276 nm)
1	5	0.186
2	10	0.349
3	15	0.562
4	20	0.747
5	25	0.942
6	30	1.124

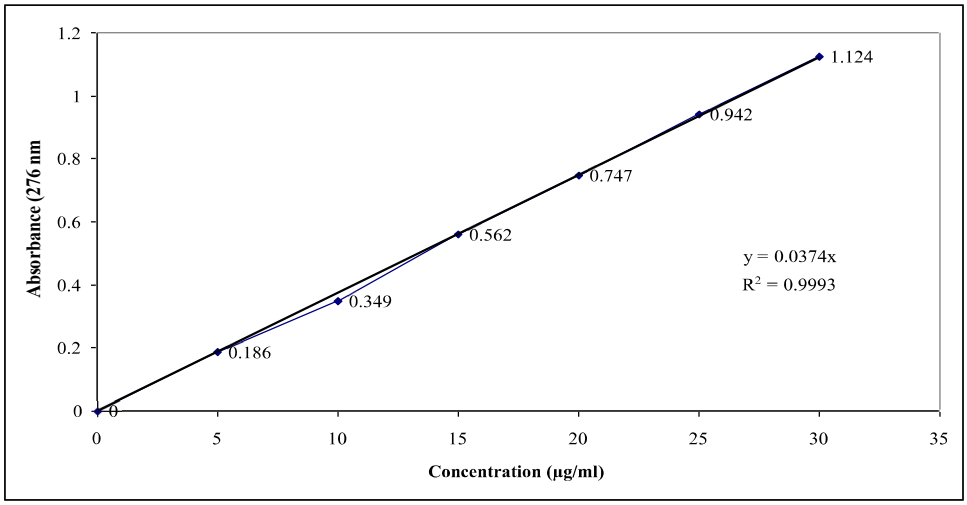

Fig 6: Standard calibration curve of Levofloxacin

Cumulative % drug release

In-*vitro* drug release profile of tablets from each batch using USP dissolution apparatus Type II are shown in Table 6.8. The plot of % cumulative drug released vs. time (hr) was plotted for all formulations and depicted as shown in Figure 11 and 12. In the present study polymers used as hydrophilic in nature; drug release involves (1) hydration and swelling of polymer and dissolution of active ingredients (2) transfer of the dissolved drug and soluble components into the bulk. The results of formulation F_3 (1:1:1), F_7 (3:2:1) and F_9 (1:1) used Karaya gum, Carbopol and Xanthum gum was slow drug release of 73.70%, 74.40% and 80.98% within 12 hours respectively. Formulation F_1 ratio is 1:2:3, F_4 ratio is 2:1:3 and F_6 ratio is 3:2:1 were faster drug release of 98.80%, 97.60% and 96.05% respectively within 8 hours. Formulations F_2, F_5 used Karaya gum, Carbopol and Xanthum gum for the ratio of 1:3:2, 2:3:1 for drug release were 93.36%, 94.20% in 12 hours. Formulations F8, F10 used Karaya with Carbopol (1:1) and Xanthum with Carbopol (1:1) for drug release were 96.38%, 95.32% in 12 hours sustained release manner. The formulations F_2, F_5, F_8 and F_{10} are found to be satisfactory with the dissolution profile results. Hence these formulations are kept for further studies.

Table 10: In-*vitro* drug Release study of Levofloxacin Floating Tablets

Batch No	Cumulative percentage of drug release					
	1 hrs	2hrs	4 hrs	8 hrs	10 hrs	12 hrs
F1	32.29±0.08	45.30±0.21	72.40±0.30	98.80±0.50	-	-
F2	23.32±0.12	31.40±0.01	52.70±0.20	68.40±0.54	81.20±0.78	93.36±0.58
F3	18.70±0.09	23.72±0.13	36.21±0.25	49.97±0.24	67.98±0.45	73.70±0.45
F4	31.10±0.21	40.80±0.14	68.80±0.24	97.60±0.26	-	-
F5	23.40±0.15	31.00±0.21	56.50±0.45	75.50±0.38	84.20±0.25	94.20±0.36

F6	30.00±0.12	43.23±0.28	69.23±0.45	96.05±0.78	-	-
F7	19.90±0.13	31.00±0.21	45.07±0.78	54.34±0.56	65.62±0.56	74.40±0.27
F8	24.00±0.12	41.05±0.16	54.10±0.52	69.50±0.72	83.76±0.45	96.38±0.34
F9	22.02±0.36	33.20±0.21	46.90±0.74	58.78±0.39	69.34±0.62	80.98±0.46
F10	28.00±0.05	49.00±0.25	58.00±0.12	75.62±0.24	88.32±0.25	95.32±0.77

n=3

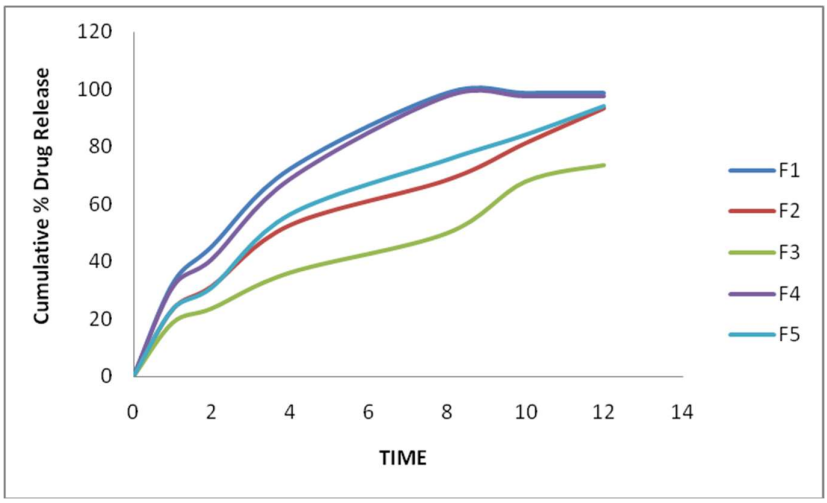

Fig 7: Drug release graph for F1 to F5 Levofloxacin Floating tablets

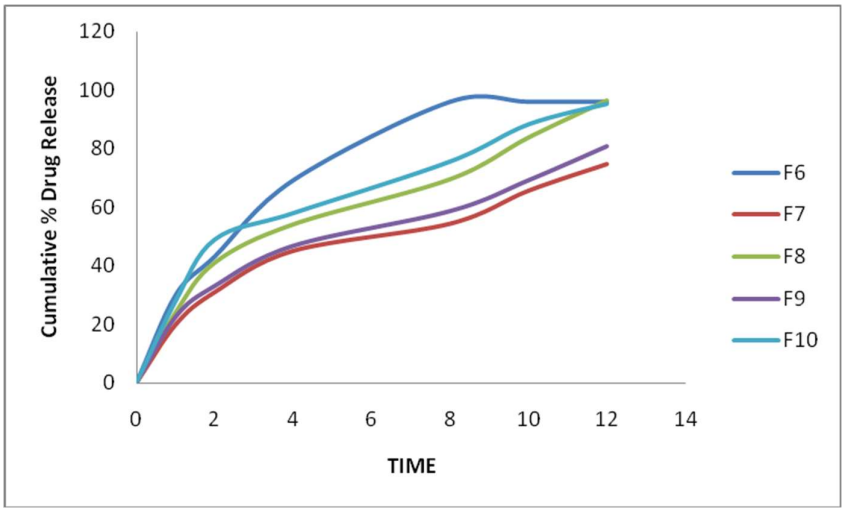

Fig 8: Drug release graph for F6 to F10 Levofloxacin Floating tablets

Kinetics of drug release

Table 11: Kinetics of drug release of R^2 value for F2, F5, F8 and F10

Batch No.	Regression Coefficient (R^2)				
	Zero Order	First Order	Higuchi	Korsmeyer - Peppas	
				R^2	n
F2	0.9760	0.9611	0.9920	0.9834	0.612
F5	0.9820	0.9714	0.9868	0.9918	0.633
F8	0.9727	0.9642	0.9918	0.9840	0.542
F10	0.9466	0.9701	0.9937	0.9879	0.521

The results of dissolution data were fitted to various drug release kinetic equations. Regression coefficient (R^2)

value was highest for higuchi plot release equation in formulations F2, F5, F8 and F10.

Kinetic Release Mechanism

The kinetics of drug release of R^2 values obtained for formulations F2, F5, F8and F10 are tabulated in Table 6.13. The drug release kinetics obtained for formulations F2, F5, F8 and F10 are tabulated in Table 6.9, 6.10, 6.11 and 6.12. Formulation F2 plots of Zero order, First order, Higuchi matrix, Korsmeyer - Peppas and are depicted in Figure 6.7, 6.11, 6.15 and 6.19. Formulation F5 plots of Zero order, First order, Higuchi matrix, Korsmeyer - Peppas and are depicted in Figure 6.8, 6.12, 6.16 and 6.20. Formulation F8 plots of Zero order, First order, Higuchi matrix, Korsmeyer - Peppas and are depicted in Figure 6.9, 6.13, 6.17 and 6.21. Formulation F10 plots of Zero order, First order, Higuchi matrix, Korsmeyer - Peppas and are depicted in Figure 6.10, 6.14, 6.18 and 6.22. The data obtained from the release kinetics fitted with Higuchi model indicated that the release of drug from the tablets was depend on the square root of time. Further, it is important to note that a linear relationship was obtained for a plot of release profile Vs time, and the regression co-efficient was very close to zero (r^2= 0.9920, 0.9868, 0.9918 and 0.9937 for formulations – F2, F5, F8 and F10 respectively) for all the four formulations. The n value obtained from the Korsmeyer-Peppas model showed that the release mechanism was non-Fickian. The 'n' value obtained from 0.521 to 0.633 indicates the non Fickian diffusion.

Stability studies

Stability studies of the prepared formulations were performed at ambient humidity conditions, at room temperature, at 40ºC and in refrigerator for a period upto 60 days. The samples were withdrawn after a period of 15 days, 30 days, 45 days and 60 days and were analyzed for its appearance, hardness, friability, floating test, drug content and in-vitro release.

The results obtained are tabulated in Table 6.14, 6.15 and 6.16. Results revealno significant changes in appearance, floating test and drug content. There was no much variation either in hardness, friability and drug release in F2, F5, F8 and F10 formulations kept at the three storage conditions. Thus from the tables it is evident that F2, F5, F8 and F10 formulations were stable at all three storage conditions up to a period of 30 days. However F2, F5, F8 and F10 showed a decrease in hardness after a period of 30 days, with subsequent increase in friability and in-*vitro* drug release, for samples stored at prevailing room temperature (34±2ºC) and at 40ºC, whereas there was no significant change in F2, F5, F8 and F10 formulations stored in refrigerator. Thus from the above results it can be concluded that Levofloxacin floating tablets are stable when stored at 2 to 8ºC.

SUMMARY

Compounding drugs having narrow absorption window in a unique pharmaceutical dosage form with gastro retentive properties would enable an extended absorption phase of these drugs. After oral administration, such a dosage form is retained in the stomach and releases the drug in a controlled and prolonged manner, so that the drug is supplied continuously to its absorption sites in the upper gastrointestinal tract.

In the present study an attempt was made to formulate Levofloxacin as floating drug delivery system in order to enhance its bioavailability and to localize drug at the absorption site. Floating tablets of Levofloxacin were formulated using sodium bicarbonate asgas generating agent and Gum as water swellable polymer by direct compression technique. FT-IR spectral studies revealed that the drug and polymers used were compatible. These formulations were subjected to various evaluation parameters like weight variation, thickness, hardness, friability, drug content, tablet density, floating test, swelling index, in-*vitro* release studies and stability studies.

The results of all these parameters are tabulated and depicted graphically in the result and discussion section. Evaluation parameters viz. tablet weight variation, thickness, friability and drug content were within acceptable limits for all ten formulations. All Ten formulations showed satisfactory results for tablet density, floating testand swelling studies. Results of in-*vitro* release using USP dissolution apparatus Type II method indicated that the drug release of formulations F2, F5, F8 and F10 are satisfactory. The results of kinetic drug release of formulation F2, F5, F8 and F10 in the R^2values were Higuchi plot model. Stability studies showed F2, F5, F8 and F10 to be stable at room temperature, 40ºC and 2-8ºC for a period of 60 days. F2, F5, F8 and F10 formulations were stable at all three storage conditions up to a period of 30 days. However F2, F5, F8 and F10 showed a decrease in hardness after a period of 30 days, with subsequent increase in friability and in-*vitro* drug release, for samples stored at prevailing room temperature (34±2ºC) and at 40ºC. No significant change was observed in F2, F5, F8 and F10 formulation stored in refrigerator. This suggested that the most suitable storage temperature for Levofloxacin floating tablets is 2-8ºC.

CONCLUSION

Hydrodynamically balanced tablets of Levofloxacin can be formulated with anapproach to increase

gastric residence and thereby improve drug bioavailability. An attempt to develop floating tablets of Levofloxacin using sodium bicarbonate as gas generating agents and natural gums as polymers by direct compression technique was achieved. The formulated tablets showed compliance for various physiochemical parameters viz. tablet dimensions, total floating time, tablet density and drug content. The dissolution studies formulations of F_2, F_5, F_8 were good release and F_{10} formulation was excellent. Data obtained from kinetic treatment revealed F_2, F_5, F_8 and F_{10} formulations follow Huguchi plot model. The 'n' value obtained from 0.521to 0.633 indicates the non Fickian diffusion. The results of stability studies indicated that the most suitable storage temperature for Levofloxacin floating tablets was 2-8^{o}C for a period of 60 days.

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