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PREPARATION AND *IN VITRO* KINETIC RELESAE STUDIES OF CIPROFLOXACIN HYDROCHLORIDE FLOATING TABLETS

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ABSTRACT

The main objective of this work is to improve half life and bioavailability of Ciprofloxacin by increasing the gastric residence time which is achieved by formulating as Ciprofloxacin Hcl floating tablets. These formulations also improve pharmacotherapy of stomach during bacterial infection by releasing the drug locally and results high concentration of drug in stomach. These improved half life of Ciprofloxacin shows prolong action of drug in controlled manner for long period in stomach. The floating tablets of Ciprofloxacin Hcl were prepared by wet granulation technique using various polymers like HPMC K4M, Eudragit 100S and Guar gum with combination of sodium bicarbonate and citric acid as gas generating agent. The work was concluded that Ciprofloxacin floating tablets are used to decrease dose frequency of drug, also avoid fluctuations that caused by conventional tablets and also it helps to reduce the adverse effects caused by ciprofloxacin at higher doses.

KEYWORDS

Ciprofloxacin, Different Polymers, Gas generating agent, Floating tablets and Wet granulation technique.

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INTRODUCTION

Gastro retentive Drug Delivery System

Since the last three decades many drug molecules formulated as Gastro Retentive Drug Delivery System (GRDDS) have been patented keeping in view its commercial success. The bioavailability of drugs with an absorption window in the upper part of the GIT (gastro intestinal tract) is generally limited with conventional pharmaceutical dosage forms[1]. These drugs can be delivered ideally by slow release from the stomach to give a localized effect at the site

of action. Improved efficacy is expected for drugs that are used in the treatment of gastric disorders like ulcers and bacterial infections (H.pylori that resides in the antral region of stomach behind the mucosal layer). Many drugs categorized as once-a-day delivery have been demonstrated to have suboptimal absorption due to dependence on the transit time of the dosage form, making traditional extended release development challenging. Therefore, a system designed for longer gastric retention will extend the time within which drug absorption can occur.

Gastric emptying of dosage forms is an extremely variable process and ability to prolong and control the emptying time is a valuable asset for dosage forms, which reside in the stomach for a longer period of time than conventional dosage forms. Several difficulties are faced in designing sustained release systems for better absorption and enhanced bioavailability.

The residence time of conventional sustained release dosage forms and, thus, of their drug release into the stomach and upper intestine is often short. To overcome this restriction and to increase the bioavailability of these drugs, sustained drug delivery systems, with a prolonged residence time in the stomach, can be used.

Gastro-retentive dosage forms (GRDFs)[2] are designed to be retained in the stomach for a prolonged time and release their active ingredients and thereby enable sustained and prolonged input of the drug to the upper part of the gastrointestinal (GI) tract. This technology has generated enormous attention over the last few decades owing to its potential application to improve the oral delivery of some important drugs, for which prolonged retention in the upper GI tract can greatly improve their oral bioavailability and/or their therapeutic outcome[3].

MATERIALS AND METHOD

Materials

Ciprofloxacin was obtained from MNS laboratory, Hyderabad, India. HPMC K4M and Eudragit 100S were obtained from Reddy's lab, Hyderabad, India. Guar gum was obtained from Yucca enterprises, Mumbai, India. Sodium bicarbonate and Citric acid were purchased from Rankem lab, Gujarat, India. Magnesium Stearate was purchased from Himedia laboratories, Mumbai, India. Starch was purchased from Finar chemicals, Ahmadabad, India. All other chemicals and ingredients were used for study are of Analytical grade.

Method

Preparation of Ciprofloxacin Hydrochloride Floating Tablets[4]

Floating tablets of Ciprofloxacin Hcl were prepared by wet granulation technique using various polymers like HPMC K4M, Eudragit100S, Guar gum with combination of sodium bicarbonate and citric acid as gas generating agent. The composition of each formulation is given in formulation Table No.1. Totally seven batches of granules were prescribed by using different single and combination of polymers. Magnesium stearate used as a lubricant. Ciprofloxacin Hcl is passed through sieve no.20, HPMC K4M, Eudragit 100S, Guar gum, Sodium bicarbonate and citric acid passed through sieve no.40. Magnesium stearate is passed through sieve no 60. The shifted materials of Ciprofloxacin Hcl was geometrically mixed with polymer and sodium bicarbonate and citric acid and blended for 10minutes. Then add starch mucilage slowly drop wise manner to form a coherent mass. The formed coherent mass was sieved manually through sieve no.16 to form granules. Then the granules are collected and dried in hot air oven at 40 ± 2^0C for 2 hours. The dried granules were passed through sieve no.20. Magnesium stearate is added to the dried granules then subjected to pre formulation studies. After the completion of Preformulation studies, the granules of all formulations were compressed into tablets by using tablets punching machine.

EVALUATION PARAMETERS

Pre-formulation Studies

Drug-Polymer compatibility studies

The physical and chemical state of polymers like HPMC K4M, Eudragit 100S, Guar gum and their admixture of polymer and drug used in Ciprofloxacin floating tablets prepared were studied by Fourier Transform Infrared Spectroscopy.

Pre-compression Studies

Bulk Density[5]

It refers to a measurement to describe packing of particles. Bulk density is used to determine the amount of drug that occupies the volume in mg/ml

Procedure

It is the ratio of total mass of powder to the bulk volume of powder. It was measured by pouring the weighed powder in to a measuring cylinder and the initial volume was noted. This initial volume is called bulk volume. The powder was tapped 3 times till a constant volume called bulk density was obtained. From this, the bulk density is calculated according to the formula mentioned below. It is expressed in g/ml and is given by

$$P_b = m/v_b$$

Where,

m = mass of the granules

v_b = bulk volume

Tapped Density[5]

After determining the poured bulk density, Weighed quantity of API was taken into a graduated cylinder. Volume occupied by DRUG was noted down. Then the cylinder was subjected to 500, 750 and 1250 taps in tap density tester (Electro Lab USP II). According to USP, the blend was subjected for 500 taps. % Volume variation was calculated and subjected for additional 750 taps. % Variation is calculated.

$$P_t = m/v_t$$

Tapped bulk density = Mass of powder/Tapped volume of the powder.

Compressibility Index

Weighed API was transferred to 100ml-graduated cylinder and subjected to 500,750 and 1250 taps in tap density tester (Electro lab). The difference between two taps should be less than 2%. The %of compressibility index calculated using formula

$$CI = v_b - v_t / v_b \times 100$$

Hausner's Ratio

It is measurement of frictional resistance of the drug. The ideal range should be 1.2 - 1.5. It is the determined by the ratio of tapped density and bulk density.

$$\text{Hausner's ratio} = v_i / v_b$$

Where,

v_t = Tapped volume

v_i = Bulk volume

Angle of repose

Angle that can be obtained between the free surface of a powder heap and horizontal plane. The angle of repose was measured by allowing the powders to fall over a graph sheet placed on horizontal surface through a funnel kept at a certain convenient height (about 2 cm). The height of the heap was measured and then circumference of the base of heap was drawn on a graph sheet with the help of a pencil. The radius of the circle obtained was measured. The angle of repose is given as,

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

Where,

θ= angle of repose

h= height of the heap

r=radius of the base of the heap

Characterization of Ciprofloxacin Hcl Floating Tablets

The formulated tablets were evaluated for the following physicochemical characteristics:

General appearance[6, 7]

The formulated tablets were assessed for its general appearance and observations were made for shape, color, texture and odour.

Hardness test[6-8]

Hardness of the tablet was determined by using the Monsanto hardness tester. The lower plunger was placed in contact with the tablet and a zero reading was taken. The plunger was then forced against a spring by turning a threaded bolt until the tablet fractured. As the spring was compressed a pointer rides along a gauge in the barrel to indicate the force.

Weight Variation[8]

20 tablets were selected and weighed collectively and individually. From the collective weight, average weight was calculated. Each tablet weight was then compared with average weight to ascertain whether it was within permissible limits or not. Not more than two of the individual weights deviated from the average weight by more than 5% for 500

mg tablets and none by more than double that percentage.The percentage deviation was calculated by using following formula

% Deviation = (Individual weight – Average weight) / Average weight x 100

Friability test[6]

20 previously weighed tablets were placed in the apparatus. Which was given 100 revolutions and the tablets were reweighed. The percentage friability was calculated by using the following formula,

Percentage friability = initial weight-final weight /initial weight × 100.

Estimation of Drug content[9]

20 tablets of each formulation were weighed and powdered. The quantity of powder equivalent to 100 mg of Ciprofloxacin Hydrochloride was transferred in to a 100 ml volumetric flask and volume made up with 0.1N Hcl. Further 1ml of the above solution was diluted to 10 ml with 0.1N Hcl and absorbance of the resulting solution was observed at 277 nm.

Floating test[10]

The tablets were placed in a 100ml beaker containing 0.1N Hcl. The time between introducing of dosage form and its buoyancy on 0.1N Hcl and the time during at which the dosage form remain buoyant were measured.

Buoyancy lag time[11]

The time taken for the dosage form to emerge on surface of medium is Called Floating lag time (FLT). Total duration of time during which the dosage form remains buoyant is called Total floating time (TFT).

***In vitro* dissolution Studies**[6-11]

As the preparation was for floating drug release given through oral route of administration, different receptors fluids are used for evaluation the dissolution profile.

Procedure

900ml 0f 0.1 Hcl was placed in vessel and the USP apparatus XI (Paddle Method) was assembled. The medium was allowed to equilibrate to temp of 37°C $\pm$ 0.5°C. Tablet was placed in the vessel and the vessel was covered the apparatus was operated for 12 hours and then the medium 0.1 N Hcl was taken and process was continued from 0 to 12 hrs at 50 rpm. At definite time intervals of 5 ml of the receptors fluid was withdrawn, filtered and again 5ml receptor fluid was replaced. Suitable dilutions were done with receptor fluid and analyzed by spectrophotometrically at 277 nm using UV-spectrophotometer.

Kinetic Analysis of Dissolution Data[12-19]

The analysis of drug release mechanism from a pharmaceutical dosage form is an important but complicated process and is practically evident in the case of matrix systems. As a model dependent approach, the dissolution data was fitted to five popular release models such as zero order, first-order, diffusion and exponential equations, which have been described in the literature. The order of drug release from matrix systems was described by using zero order kinetics or first orders kinetics. The mechanism of drug release from matrix systems was studied by using Higuchi equation, erosion equation and Peppa's-Korsemeyer equation. The results are given in Table No.2.

Zero Order Release Kinetics

It defines a linear relationship between the fraction of drug released versus time.

$$\mathbf{Q = k_o t}$$

Where,

Q is the fraction of drug released at time t and k_o is the zero order release rate constant.

A plot of the fraction of drug released against time will be linear if the release obeys zero order release kinetics.

First Order Release Kinetics

Wagner assuming that the exposed surface area of a tablet decreased exponentially with time during dissolution process suggested that drug release from most of the slow release tablets could be described adequately by apparent first-order kinetics. The equation that describes first order kinetics is

$$\mathbf{In\ (1\text{-}Q) = -\ K_1 t}$$

Where,

Q is the fraction of drug released at time t and k_1 is the first order release rate constant.

Thus, a plot of the logarithm of the fraction of drug remained against time will be linear if the release obeys first order release kinetics.

Higuchi equation

It defines a linear dependence of the active fraction released per unit of surface (Q) on the square root of time.

$$Q=K_2t^{½}$$

Where,

K2 is the release rate constant.

A plot of the fraction of drug released against square root of time will be linear if the release obeys Higuchi equation. This equation describes drug release as a diffusion process based on the Fick's law, square root time dependant.

Power Law

In order to define a model, which would represent a better fit for the formulation, dissolution data was further analyzed by Peppa's and Korsemeyer equation (Power Law).

$$M_t/M_\alpha = K.t^n$$

Where,

M_t is the amount of drug released at time t and M_α is the amount released at time α, thus the M_t/M_α is the fraction of drug released at time t, k is the kinetic constant and n is the diffusional exponent. To characterize the mechanism for both solvent penetration and drug release "n" can be used as abstracted in Table No.2. A plot between log of M_t/M_α against log of time will be linear if the release obeys Peppa's and Korsemeyer equation and the slope of this plot represents "n" value.

RESULTS AND DISCUSSION

Preformulation Studies

Drug-Polymer compatibility studies

The physical and chemical state of polymers like HPMC K4M, Eudragit 100S, Guar gum and their admixture of polymer and drug used in Ciprofloxacin floating tablets prepared were studied by FTIR.

FTIR studies

The physical mixture of drug and polymer was characterized by FTIR spectral analysis for any physical as well as chemical alterations of drug characteristics. From the result it was concluded that there was no interface of functional groups as principle peak of Ciprofloxacin Hydrochloride were found to be unaltered in the drug polymer physical mixture. The physical parameters of drug as well as excipients concluded that there was no change in peaks of admixture compared with drug which indicates that the drug and excipients are compatible (Figure No.1-5).

Preformulation studies of granules

Angle of repose

The granules of all seven formulations are subjected to angle of repose by funnel method. The value of angle of repose was found in the range of 22º71′-26º15′. The result proved that the granules of all formulations showed excellent flow properties (Table No.3).

Bulk density

Bulk density of all the granules was measured by using measuring cylinder method and the resultant values was found in the range of 0.37-0.85 gm/cm^3. It showed that the bulkiness is within the acceptable limits (Table No.3).

Tapped density

The tapped density of all granules was determined by tapping the measuring cylinder for required times and the values are noted in table and the tapped density values was found in the range of 0.42-0.49 gm/cm^3. The result proven that the tapped density values are within the acceptable limits (Table No.3).

Compressibility index

The compressibility of granules are done by tapped density minus bulk density and divided with tapped density values. And the resultant values are in the range of 9-15. It indicates that the granules showed good flow properties (Table No.3).

Hausner's ratio

It is the ratio of tapped density value to bulk density value and the resultant values of Hausner's ratio of all the formulations is between 1.10-1.18 which indicate that the granules shows good flow (Table No.3).

Characterization of Ciprofloxacin Hcl floating tablets

General appearance

The formulated tablets were evaluated for organoleptic characters. The tablets are circular in

shape, yellowish in colour, with no characteristic odour. All tablets showed elegance in appearance.

Hardness test

The hardness of Ciprofloxacin Hcl floating tablets were measured by Pfizer hardness tester and the values were tabulated in table. The hardness of all tablets in all formulations was within the range of 4.5-5.1 kg/cm². So all formulated tablets passes the test (Table No.4).

Friability test

The friability of Ciprofloxacin Hcl floating tablets were performed by using Roche friabilator and the friability of all formulated tablets was within 1%. It proved that all formulations are within the acceptable limits (Table No.4).

Diameter

The diameter of Ciprofloxacin Hcl floating tablets were measured by using Besto Vernier calipers and there is no deviation in the diameter values of all formulated tablets indicates uniform diameter (Table No.4).

Thickness

The thickness of Ciprofloxacin Hcl floating tablets were measured by using Vernier calipers. Thickness must be controlled to facilitate packaging. The result showed that the tablets of all the formulations show uniform thickness (Table No.4).

Weight variation test

The weight variations of tablets were done by weighing the individual tablet weight and the average weight of 20 tablets which were selected randomly from each formulation batches. No more than two tablets should go more than the preferred deviation. The percentage deviation is 7.5% for more than 130 mg tablets and here actual weight of tablet is 500 mg. So the acceptable deviation was 7.5%, thus all formulation passes the test (Table No.5).

Drug content (%)

The percentage of drug content were done by dissolving individual tablet in 0.1N Hcl and transferred to a 100ml volumetric flask. The absorbance of the resulting solution is measured by Ultraviolet Spectroscopy at 278nm. As per IP, the content uniformity should be in the range of 90-110%. The result showed that the percentage of Ciprofloxacin Hcl in all formulations was ranging from 96-99%. It released that the drug is uniformly dispersed in the formulation and confirms the homogeneous mixing of the drug and the polymer. So all the formulated tablets passes the test (Table No.5).

Buoyancy lag time

It is the time taken during which of dosage form remains buoyant on 0.1N Hcl were measured and the values were listed in table. The buoyancy lag time values were found in the range of 134-166 sec (Table No.5).

Total floating time

It is the total duration of time during which the dosage form remains buoyant is measured and the values were ranges between 356-485 min which was noted in Table No.5.

***In vitro* dissolution studies**

The *in vitro* dissolution studies of all seven formulations of Ciprofloxacin floating tablets were shown in Table No.6 and Figure No.6. The percentage drug release of all formulations after 12 hours using HPMC K4M, Eudragit 100S and Guar gum was found to be 88.12% (F1), 90.68% (F2) and 73.45% (F3) respectively. And the percentage drug release of combination of HPMC K4M with Eudragit 100S is 98.87% (F4), Eudragit 100S with guar gum is 85.67% (F5), HPMC K4M with guar gum is 79.93% (F6) and HPMC K4M with Eudragit 100S and guar gum is 95.45% (F7). From the *in vitro* drug release, it was observes that the maximum drug release was found in formulation F4 is 98.87%. It shows that F4 formulation exhibits optimized drug release when compared with other formulation. The dissolution profile of all formulations of Ciprofloxacin Hcl floating tablets were shown in Table No.6.

The best formulation of F7 was compared with marketed product. From the result the formulation of F7 has better sustained release of drug when it is compared to marketed product (Table No.7, Figure No.7).

Kinetic analysis of dissolution data

To know the mechanism of drug release from these formulations, the data were treated according to Zero

order[12], First order[13], Higuchi's model[15] and Korsmeyer model[16]. The release rate kinetic data for all the formulations are shown in table. When data were plotted according to zero order, the formulation showed high linearity with regression co efficient values (R^2) between 0.993-0.998. Diffusion is related to transport of drug from the dosage matrix into the *in vitro* study fluid depending on the concentrations. This is explained by Higuchi's equations, as the plot showed high linearity with regression co-efficient values (R^2) between 0.878-0.938. By using Korsmeyer model, if n= 0.45, it is Fickian diffusion[16], if n= 0.45-0.89 it is non-Fickian transport[16]. Here all the formulations showed 'n' values between 0.806-0.929. So all the formulations follows non Fickian diffusion transport mechanism[16]. Finally all the formulations follow the mechanism of both diffusion and erosion (Table No.8, Figure No.8).

Table No.1: Formulation of Ciprofloxacin Hcl floating tablets

S.No	Formulation Batches	Ciprofloxacin Hcl	HPMC K4M	Eudragit 100S	Guar gum	Sodium bicarbonate	Citric acid	Starch mucilage	Magnesium stearate
1	F1	250	150	-	-	50	15	25	10
2	F2	250	-	150	-	50	15	25	10
3	F3	250	-	-	150	50	15	25	10
4	F4	250	75	75	-	50	15	25	10
5	F5	250	-	75	75	50	15	25	10
6	F6	250	75	-	75	50	15	25	10
7	F7	250	50	50	50	50	15	25	10

Table No.2: Diffusion exponent and solute release mechanism for cylindrical shape

S.No	Diffusion Exponent	Overall solute diffusion mechanism
1	0.45	Fickian diffusion
2	0.45<n<0.89	Anomalous (non-fickian) diffusion
3	0.89	Case II transport
4	n>0.89	Super Case II transport

Table No.3: Evaluation of granules of Ciprofloxacin Hcl floating tablets

S.No	Formulation code	Angle of repose (Ø)	Bulk density (gm/cm^3)	Tapped density (gm/cm^3)	Compressibility index (%)	Hausner's ratio
1	F1	22.71	0.42	0.49	11.22	1.166
2	F2	22.91	0.386	0.435	11.34	1.126
3	F3	24.52	0.393	0.436	9.86	1.1
4	F4	24.01	0.375	0.429	12.59	1.14
5	F5	25.17	0.3707	0.417	11.16	1.13
6	F6	26.15	0.40	0.448	10.714	1.1
7	F7	24.92	0.85	0.455	15.39	1.18

Table No.4: Evaluation of Ciprofloxacin Hcl floating tablets

S.No	Formulation code	Hardness (kg/cm)	Friability (%)	Thickness(mm)	Diameter (mm)
1	F1	4.85	0.631	4.17	10.19
2	F2	4.8	0.413	5.14	10.8
3	F3	5.1	0.462	5.16	11.0
4	F4	4.75	0.381	4.4	10.7
5	F5	4.5	0.54	4.16	10.9
6	F6	5.0	0.761	4.5	11.0
7	F7	4.8	0.62	4.2	10.8

Table No.5: Weigh variation, Estimation of Drug content, Floating Lag time and floating time of floating tablets

S.No	Formulation code	Weight variation	Drug content (%)	Floating Lag Time (Sec)	Floating Time (hours)
1	F1	498±2.5	98.12	150	10.0
2	F2	496±3.2	97.23	144	10.5
3	F3	497±2.7	98.63	151	8.0
4	F4	499±1.13	99.54	134	12.5
5	F5	498±3.5	97.83	154	9.0
6	F6	495±4.3	97.38	166	9.5
7	F7	497±4.2	99.17	140	11.0

Table No.6: Comparative *in vitro* Dissolution study of Ciprofloxacin Hcl floating tablets (F1-F7)

S.No	Time (hrs)	Cumulative % Drug Release						
		F1	F2	F3	F4	F5	F6	F7
1	1	11.22	9.43	8.24	12.18	9.91	10.51	10.98
2	2	14.3	16.13	10.38	20.9	12.83	12.22	19.06
3	3	19.8	21.51	13.68	27.13	16.86	15.27	24.81
4	4	27.01	29.94	18.7	36.78	24.2	21.38	31.04
5	5	33.73	35.93	25.66	44	31.16	29.82	39.23
6	6	39.84	41.8	30.18	52.43	37.4	36.17	45.58
7	7	47.3	50.23	36.3	60.74	41.8	40.94	51.08
8	8	53.04	58.17	42.04	69.05	50.23	48.15	61.47
9	9	63.92	68.68	51.45	77.24	58.91	54.02	70.52
10	10	71.98	75.28	57.81	85.43	68.07	62.57	81.64
11	11	79.81	82.13	69.91	91.91	76.14	72.47	87.02
12	12	88.12	90.68	73.45	98.87	85.67	79.93	95.45

Table No.7: Comparative Study: Percentage Release of Marketed Sample (Cipro XR 500mg) and Ciprofloxacin Hcl floating tablets

S.No	Time (hrs)	Cumulative percentage drug release (%)	
		Marketed sample	Optimized formulation of Ciprofloxacin Hcl (F4)
1	1	10.23	12.18
2	2	16.57	20.90
3	3	24.06	27.13
4	4	31.85	36.78
5	5	38.92	44.00
6	6	47.73	52.43
7	7	55.81	60.74
8	8	62.34	69.05
9	9	70.71	77.24
10	10	79.11	85.43
11	11	88.19	91.91
12	12	95.61	98.87

Table No.8: Kinetic Analysis of dissolution data

S.No	Formulation code	Regression co-efficient ($R^{2)}$			Korsmeyer' plot	
		Zero order plot	First order plot	Higuchi's plot	R^2	Slope (n)
1	F1	0.993	0.886	0.896	0.970	0.887
2	F2	0.997	0.889	0.910	0.993	0.929
3	F3	0.988	0.880	0.878	0.997	0.868
4	F4	0.998	0.763	0.938	0.996	0.861
5	F5	0.988	0.880	0.878	0.998	0.806
6	F6	0.988	0.880	0.878	0.998	0.825
7	F7	0.995	0.832	0.912	0.990	0.877

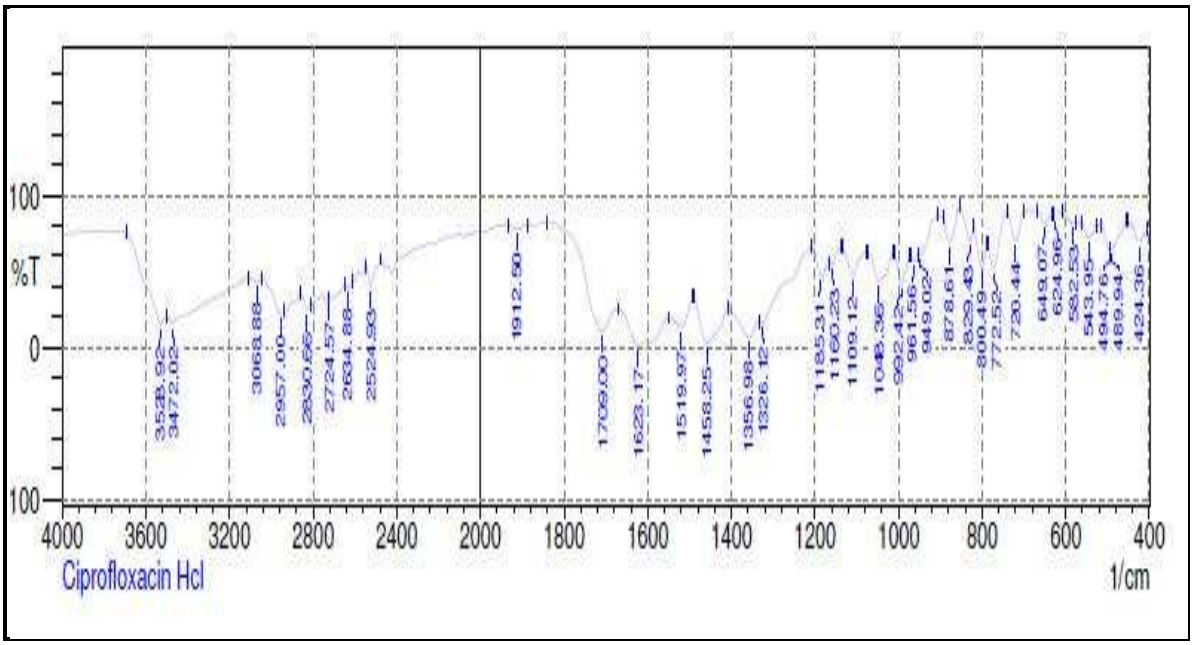

Figure No.1: FTIR Spectrum of Ciprofloxacin Hcl

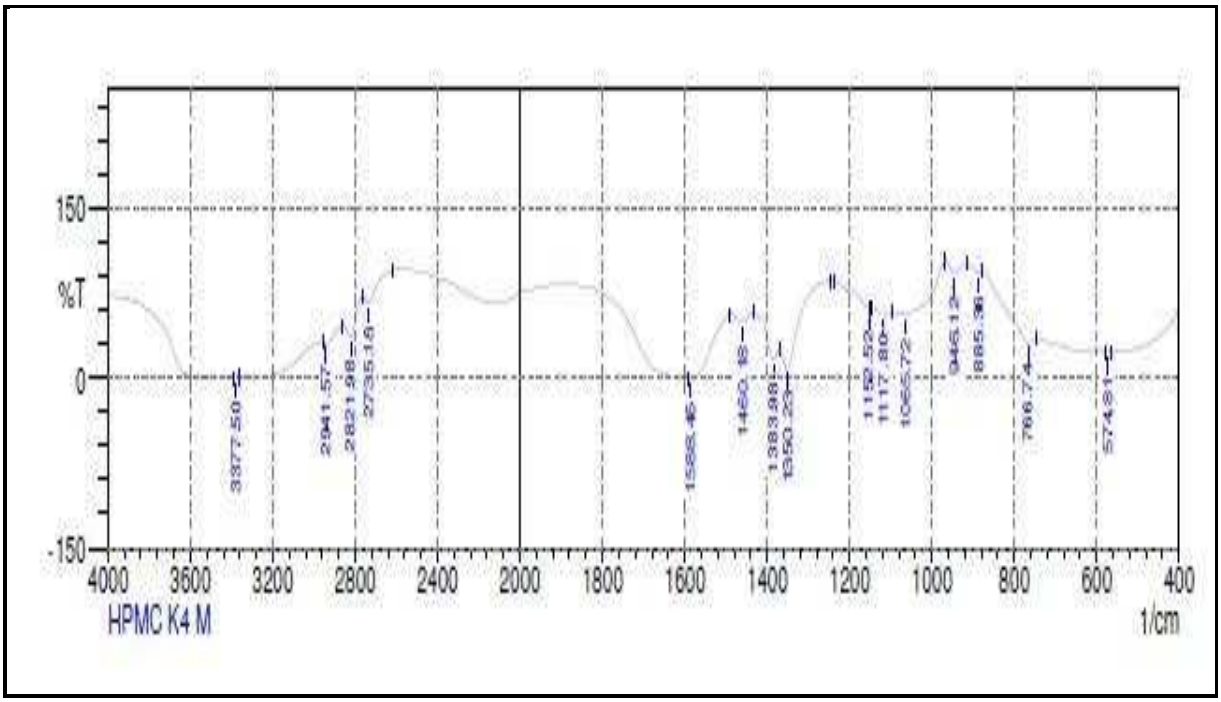

Figure No.2: FTIR Spectrum of HPMC K4M

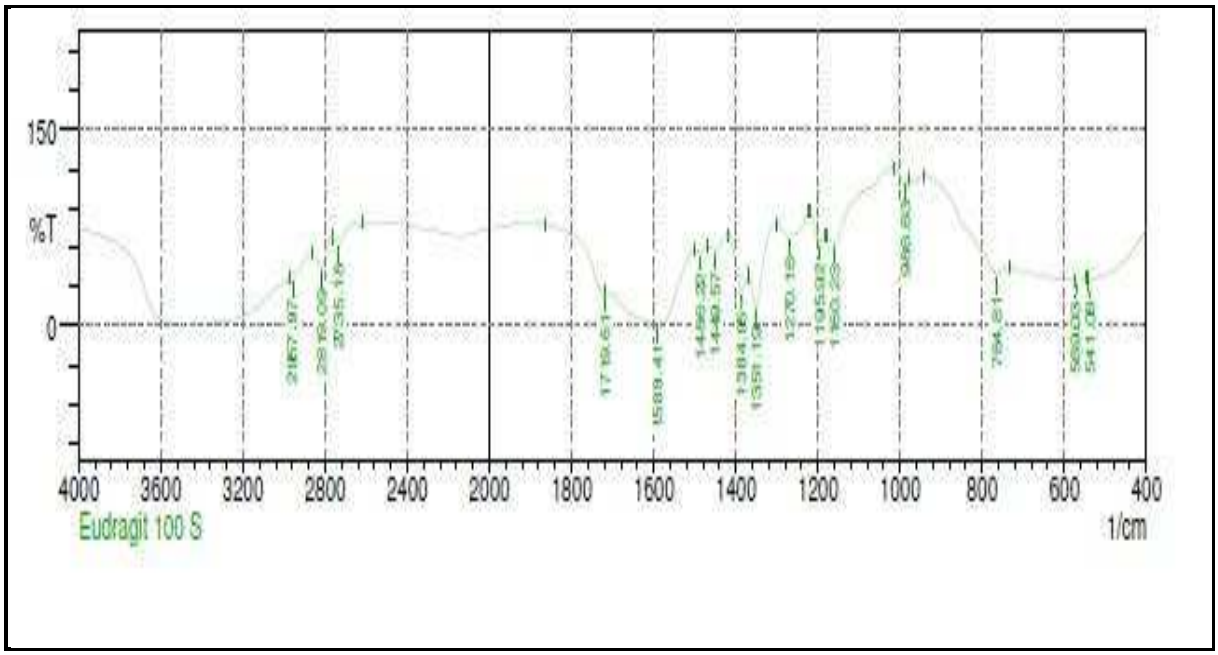

Figure No.3: FTIR Spectrum of Eudragit 100S

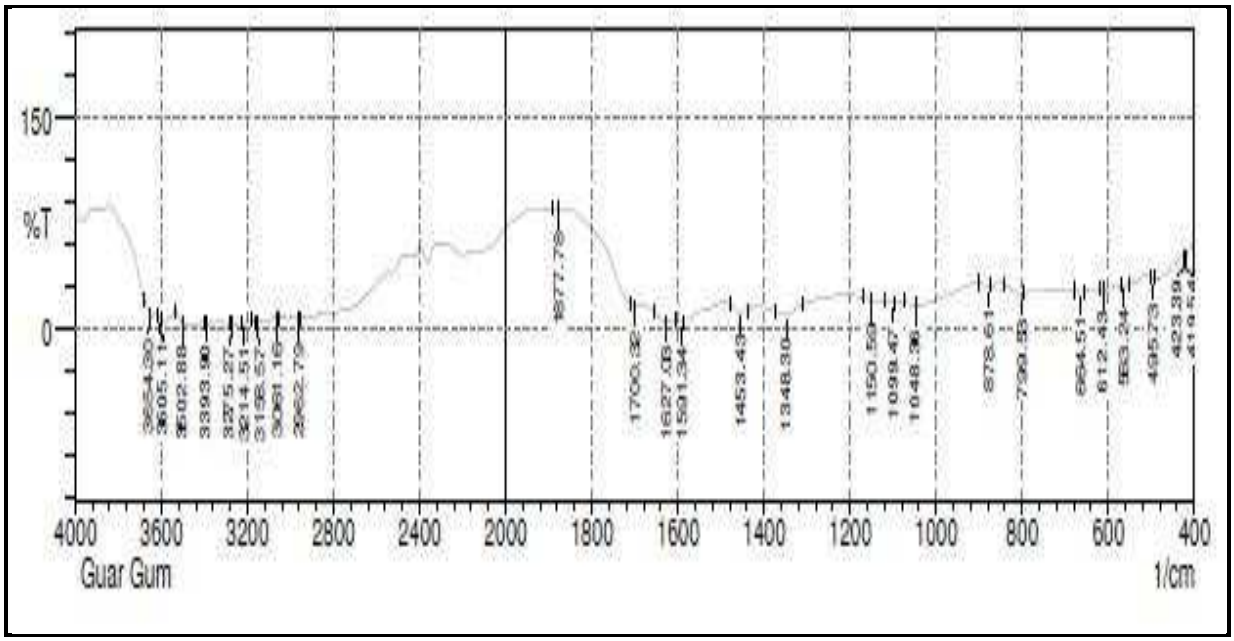

Figure No.4: FTIR Spectrum of Guar gum

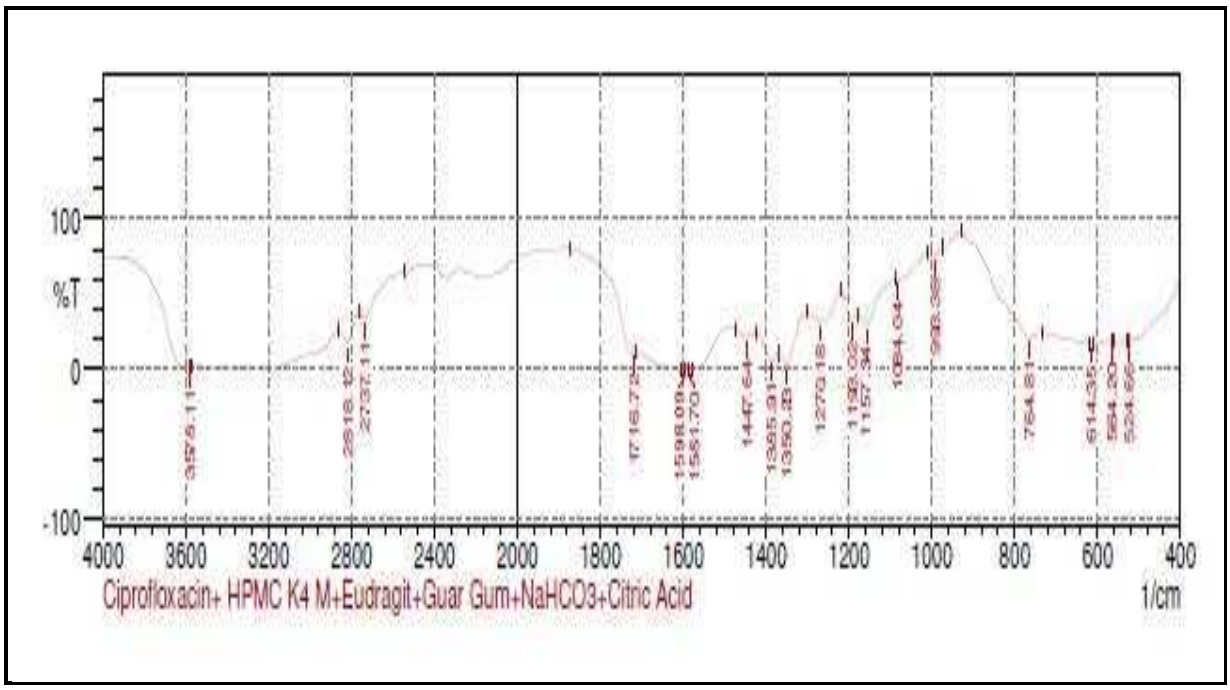

Figure No.5: FTIR Spectrum of Ciprofloxacin Hcl, HPMC K4M, Eudragit 100S, Guar gum, NAHCO3 and Citric acid

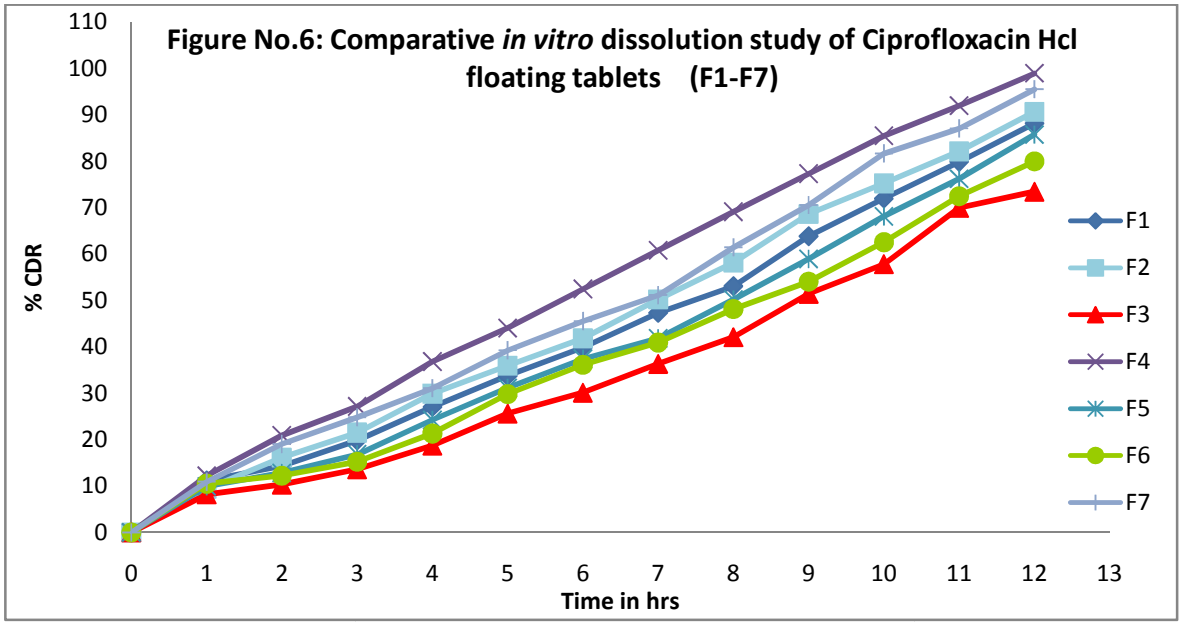

Figure No.6: Comparative *in vitro* dissolution study of Ciprofloxacin Hcl floating tablets (F1-F7)

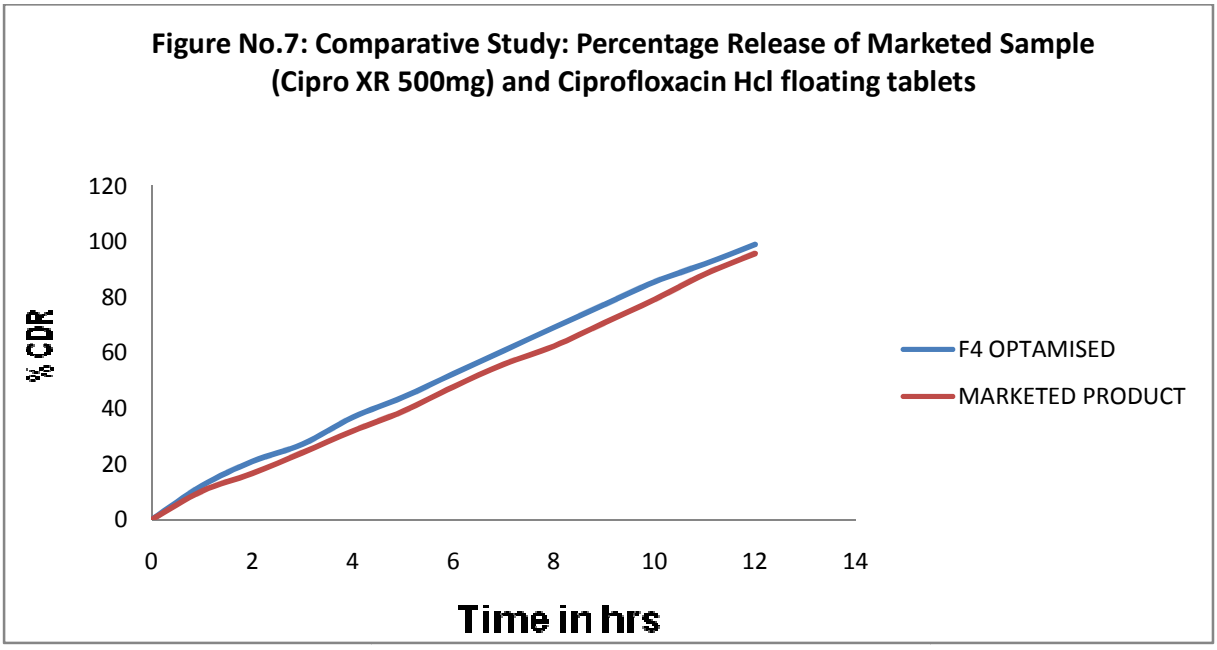

Figure No.7: Comparative Study: Percentage Release of Marketed Sample (Cipro XR 500mg) and Ciprofloxacin Hcl floating tablets

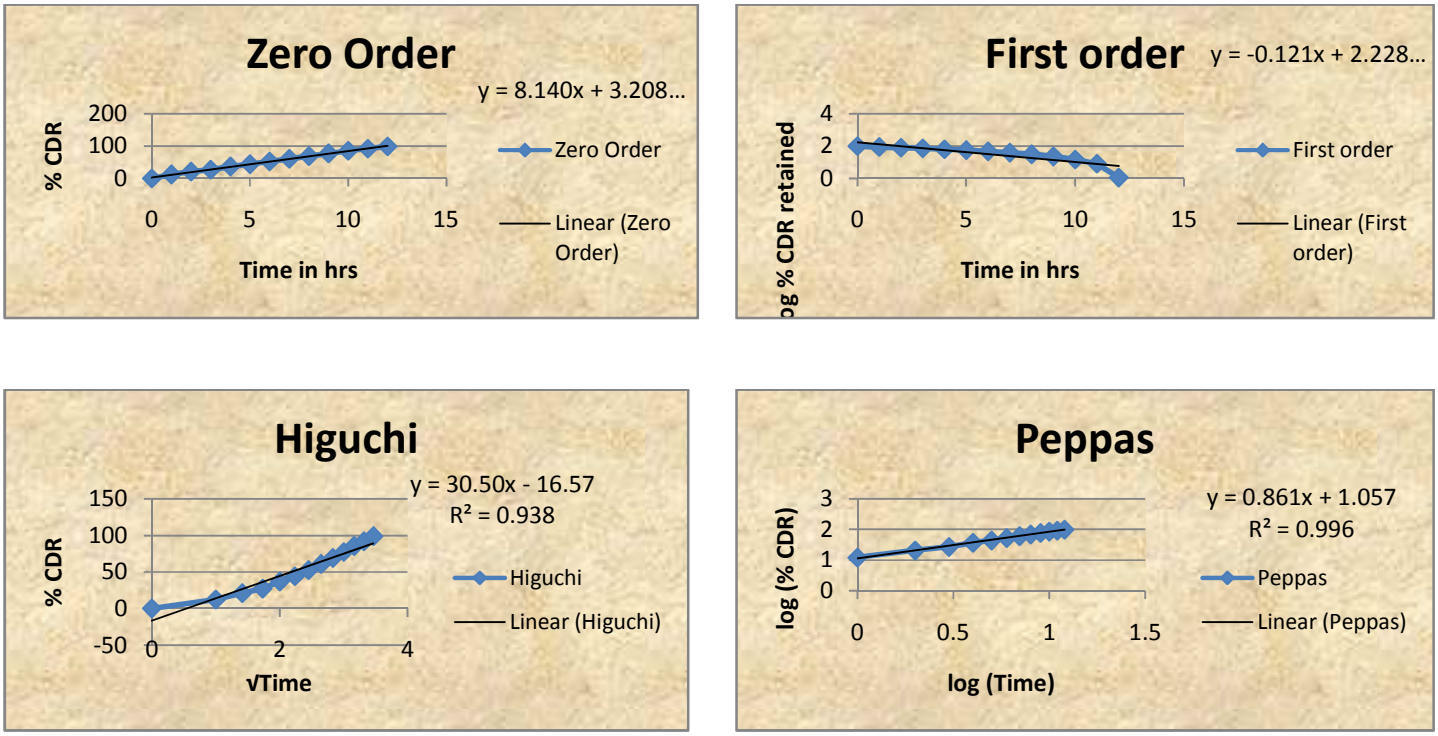

Figure No.8: Release Kinetics for Optimized Formulation (F4): (Ciprofloxacin Hcl + Eudragit 100S+ HPMC K4M)

CONCLUSION

Hydrodynamically balanced tablets of Ciprofloxacin Hcl can be formulated with an approach to increase gastric residence and thereby improves drug bioavailability. An attempt to developed floating tablets of Ciprofloxacin Hcl using HPMC K4M, Eudragit100S and guar gum as different polymers and sodium bicarbonate combination with citric acid as gas generating agent which is prepared by wet granulation technique (F1- F7) was achieved. Preformulation studies such as angle of repose, bulk density, tapped density, compressibility index, Hausner's ratio were performed and the result showed that all the parameters are within the limits. Tablets were prepared by wet granulation method and evaluated for general appearance, hardness test, friability test, uniformity in weight, drug content estimation. All the formulations were found to be good appearance without showing any chipping, capping and sticking defects and other parameters were also passed the test. FTIR Spectroscopic studies indicated that the drug is compatible with all excipients and there is no drug- polymer interaction. When comparing all formulation F4 showed optimized drug release of 98.87% at the end of 12 hours. These optimized F4 formulation showed buoyancy lag time of 134 sec. and floating time of 12.5 hrs respectively. Data obtained from kinetic treatment revealed F4 formulations follow Koresmayer peppas model. The 'n' value is 0.861 indicates the non Fickian diffusion. From the comparative study of optimized formulation of Ciprofloxacin Hcl (F4) with marketed product (Cipro XR 500mg) shows that F4 is have greater release than marketed product. From the above study, it was concluded that Ciprofloxacin Hcl can formulated as Floating drug delivery system which helps to increase gastric residence time there by it increases the bioavailability and half life of Ciprofloxacin Hcl.

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