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FORMULATION AND EVALUATION OF GASTRO RETENTIVE NON-EFFERVACENT FLOATING TABLET OF DICLOFENAC POTASSIUM

ARSHAD S[*1], BASHIR S[2], HUSSAIN M[3] AND IMRAN TARIQ

1: Assistant Professor, Faculty of Pharmacy, The University of Lahore, Lahore, Pakistan, Shumailapharmacist@gmail.com; +923334880898

2: Dean, Faculty of pharmacy, university of Sargodha, Sargodha, Sajidpharm@gmail.com; +923009389717

3: Lecturer, Faculty of pharmacy, university of Sargodha, Sargodha, Asimawan786pk@gmail.com; +923004049689

4: (Assistant Professor), University College of Pharmacy, University of Punjab, Lahore. Pakistan

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ABSRACT

The purpose of this research was to develop a novel gastro retentive floating tablets of Diclofenac potassium by the incorporation of hydrophilic & hydrophobic polymers such as Hydroxypropyl methylcellulose, Xanthan gum, Carnauba wax and Sodium Alginate. The formulation is designed to provide the desired controlled and complete release of drug for prolonged period of time. Floating non-effervescent tablets were formulated by using various materials like Hydroxypropyl methylcellulose (HPMC K15M), Xanthan gum, Sodium Alginate, Carnauba wax and other excipients. The concentration of these agents was also optimized to get desired controlled release of drug. The floating tablet formulations were evaluated for physical characterization such as hardness, friability, weight variation and buoyancy studies and in vitro drug release studies were also carried out. The results of hardness test (3.35-9.98), friability (0-0.8%), weight variation (233.6-307.2) and in vitro buoyancy studies were found to be within official standards provided in USP. The results indicated that the optimized intra gastric floating

tablet(F3) composed, carnauba wax (50 mg), which exhibited 93.31% drug release in 7 h, while the buoyancy lag time was 40 min. Floating tablet (F9) which is composed of 50mg HPMC & 50mg sodium alginate exhibited 93.87% drug release in 7 h & buoyancy lag time was 20min. These intra gastric floating tablets remained buoyant for 24 hrs. In-vitro drug release kinetics evaluated using the linear regression method was found to follow the Higuchi (R2=0.9902) and Peppas models (R^2=0.9945). DSC thermograph and FTIR spectra depicted that there was no the no chemical incompatibility between drug & polymers.

Keywords: Floating Tablets, Diclofenac Potassium, HPMC, Xanthan Gum, Carnauba Wax, Sodium Alginate

INTRODUCTION

Drug delivery is the method or process of delivering complex drugs to achieve a therapeutic effect in humans or animals. It is defined as system of drug delivery (DDS) as a formulation or device that allows the introduction of this therapeutically active article in the body to improve its effectiveness and safety by controlling the rate, time and place of release more in the body. While administering the medication, the dose must be carefully calculated so that the body can use the drug. This could be achieved by a drug delivery system which allows for accurate dosing [1]. Need of drug delivery systems also have to consider the way in which the drug is metabolized in the body. For example, some drugs are destroyed in the gut, which means that they cannot be introduced into the body in such a way. Others may be dangerous in large quantities, which mean that the method of release time should be controlled to provide medication for patient safety. The effectiveness of the drug delivery system is affected, by the length of time it takes to get a drug to implement in its therapeutic effect of the body. Effective new methods of delivery have the ability to reduce the dosage and side effects. [2]

Despite the tremendous progress in drug delivery systems such as inhalation, injection through the skin, nose and other methods, the inevitable truth is that oral drug delivery remains well ahead. There are of course many applications and large markets for non-oral products and the technologies that we provide them. However, if it is a viable option, and will choose the delivery of drugs through the mouth in all but the most exceptional circumstances. [3]

Over the past 30 years, increasing expenses and complexities involved in the marketing

new drug entities, with a concomitant recognition of the therapeutic advantages of sustained drug delivery, greater attention is being paid for development of oral sustained-release drug delivery systems. Goal in the design of sustained release drug delivery system to reduce the frequency of dosing, which reduces the dose and provides uniform drug delivery therefore, sustained-release dosage form is a dosage form that launches one or more of the medications continuously in a predetermined pattern for a specific period of time, either systemically or locally to the target organ. [4]

Delivery of controlled drugs is one which delivers the drug at a pre determined rate, locally or on a systemically, for a specified period of time. Controlled release of the drug only means not prolongation of the duration of drug delivery but also involves the reproducibility of predictable drug release kinetics. It also improves the pharmaceutical, biological and pharmacological properties of drugs that enlarge it utility through reduction in the treatment of side effects. [5]

Development of controlled release systems offers certain challenges to the formulation scientists due to their inability to restrain and localize the drug in targeted areas of the gastrointestinal (GI) tract. [6]

A major constraint in oral drug delivery controlled is that not all drug candidates are absorbed uniformly in all parts of the GIT. Some medications are absorbed in a particular sector of the GIT. It is said that such drug candidates that there will be a ' absorb window '. However, in the case of ' narrow absorption window ' drug, but the drug was released in the region that precedes and in an area close to the window is available for absorption. [7]

The FDDS the most widely used. Can to remain GRDDS in the stomach area for several hours and thus greatly prolong the GRT of the drug. Retention stomach for long periods of time improves bioavailability, reduces drug waster and improves the solubility of drugs that are less soluble in a high pH environment. Gastric retention helps to provide better availability of new products with new therapeutic possibilities and substantial benefits for patients. [8]

MATERIALS AND METHODS

Materials

Diclofenac potassium and xanthan gum were received from Munawar Pharmaceuticals (Pvt) Limited. Sodium alginate and carnauba wax were purchased from local market. Lactose, maize starch, magnesium stearate and Avicel pH 102 were procured from Medisave Pharmaceuticals.

METHODOLOGY:

Development of floating tablet of diclofenac potassium through the wet granulation method. [14, 15]

All ingredients except glidants and lubricants are thoroughly mixed and passed through a sieve 20. It Will be granulated with a solution of the calculated amount of starch in distilled water is sufficient. Wet mass was passed through a sieve 12 and dried at 50 ° C for 2 hours.

Lubrication of granules was carried out with magnesium stearate and Avicel pH 102 and compressed in tablets using a single station punch tablet machine.

Table 1: Composition of Diclofenac potassium floating tablets

COMPOSITION mg/tablets	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Drug	50	50	50	50	50	50	50	50	50	50
HPMC K4M	50	-	-	-	50	-	-	50	50	-
Xanthan Gum	-	50	-	-	50	-	50	-	-	50
Carnauba Wax	-	-	50	-	-	50	50	-	50	-
Sodium alginate	-	-	-	50	-	50	-	50	-	50
Lactose	50	50	50	50	25	25	25	25	25	25
Maize starch	50	50	50	50	25	25	25	25	25	25
Avicel pH 102	15	15	15	15	15	15	15	15	15	15
Mg. stearate	5	5	5	5	5	5	5	5	5	5
Maize starch	30	30	30	30	30	30	30	30	30	30
Total	250	250	250	250	250	250	250	250	250	250

EVALUATION STUDY:

Precompression evaluation

Precompression evaluation of diclofenac potassium granules: [14, 15, 16]

Angle of repose:

The flow properties of granules (before compression) will be characterized in terms of angle of repose, Carr's index and Hausner's ratio.

The angle of repose of powder blend was determined by the funnel method. The accurately weight powder blend were taken in the funnel. The height of the funnel was adjusted in such a way the tip of the funnel just touched the apex of the powder blend. The powder blend was allowed to flow through the funnel freely on to the surface. The diameter of the powder cone was measured and angle of repose was calculated using the following equation.

$$\mathbf{Tan\ \theta = h / r}$$

Where, h and r is the height and radius of the cone powder.

Bulk and tapped density:

Both loose bulk density (LBD) and tapped bulk density (TBD) have been identified. The amount of 2 grams of powder mixture of each formula, previously shaken to break any clumps formed, in 10 ml measuring cylinder. Having observed the initial size of the

cylinder and allowed to fall under its own weight to a hard surface from height of 2.5 cm at second intervals. The tapping continued until observed any change in size. LBD was calculated and TDB using the following equations

LBD = weight of powder blend / untapped volume of packing

TBD = weight of powder blend / tapped volume of packing

Carr's index:

Compressibility index were identified from a mixture of powder by compressibility Carr index. It is a simple test to assess the LBD and TBD of powder and the rate at which packed down. Index Car's formula is as follows:

Carr's Index = [TBD – LBD] / TBD x 100

It is often used Carr index in pharmaceuticals as an indicator of the ability of the powder flow. The Carr index greater than 25 to be an indication of the weak capacity of the flow, and less than 15, the ability of a good flow.

Flow	Angle of repose (θ)	Carr's index (%)
Excellent	<25	5-15
Good	25-30	12-16
Fair to passable	30-40	18-21
Poor	> 40	23-35
Very Poor		33-38
Extremely Poor		>40

Hausner ratio:

Carr index is linked to Hausner ratio, further evidence of the ability of the flow, by the formula,

Hausner ratio = Bulk Volume / Tapped Volume

Post compression parameters:

The form of tablets:

Tablets were examined directly under the magnifying lens to check the form of tablets.[14]

Panel dimensions:

Thickness and diameter of tablets were measured using a calibrated dial caliper. Three tablets of each formulation were picked randomly and dimensions determined. It is expressed in mm and standard deviation was also calculated. [14]

Weight variation test:

Average weights tablets were identified using digital weight balance. Ten tablets were selected randomly from the tablets each batch weighed individually, Calculating the average weight and weight compared to individual tablets average. From this, calculate the percentage of weight difference and then checked for USP specifications.

Does not allow for the following deviation % difference in weight:

Average Weight of Tablets (mg)	Maximum % Difference Allowed
130 or less	10
130 – 324	7.5
More than 324	5

Hardness test:

Hardness indicates the ability of a tablet to withstand mechanical shocks while handling. Hardness of tablets was determined using a Monsanto hardness tester. It is expressed in kg/cm2. Ten tablets were randomly picked from each batch and analyzed for hardness. The mean and standard deviation were also calculated.[14]

Friability test:

It is the phenomenon whereby tablet surfaces are damaged and/or show evidence of lamination or breakage when subjected to mechanical shock or attrition. The friability of core tablets was determined using Roche Friabilator. It is expressed in percentage (%). Ten tablets were initially weighed (Winitial) and transferred into friabilator. The friabilator was operated at 25 rpm for 4 minutes or run up to 100 revolutions. The tablets were weighed again (Wfinal). The % friability was then calculated by,

F= W (initial) – W (final) / W (initial)

% Friability of tablets less than 1% are considered acceptable.[10]

In vitro Buoyancy Studies:

The in vitro buoyancy was determined by floating lag time. The tablets were placed in a 250 ml beaker, containing 100ml of 0.1 N HCl. The time required for the tablet to rise to the surface and float was determined as Floating Lag Time (FLT) and the time period up to which the tablet remained buoyant is determined as Total Floating Time (TFT). (15, 16)

In vitro Dissolution Studies:

In vitro study was conducted United States (USP) Type II (paddle) device in the rotational speed of 50 rpm. It was used exactly 900 ml of buffer solution (pH5.6) as a way to resolve, and it was maintaining the temperature at 37oC ± 0.5oC. Sample was withdrawn (3ML) of the solution of the dissolution of the device in a specified time interval for 12 hours and was replaced by the same volume with the media pre-warmed fresh solution. The samples were filtered through a membrane filter. It was measured absorbance of these solutions at 276nm using a UV spectrometer.

General conditions of the in vitro dissolution studies are as summarized below.

Dissolution of the device: USP Type II, Paddle.

Media solution: buffer solution pH 5.6

Media size: 900 ml

Sampling Volume: 3ML

Rotation speed: 50 rpm

Temperature: 37 ± 0.5 C [11, 12, 13]

USP Specifications for in vitro dissolution of diclofenac sustained release tablets.

Time (h)	Amount Dissolved (%)
1	Not more than 28
2	Between 20 and 40
4	Between 35 and 60
6	Between 50 and 80
8	Not less than 65

Release kinetics studies:

Release mechanisms were studied diclofenac potassium tablets by installing a floating data solution formulation optimization in the following models:

1. Zero order
2. First order
3. Higuchi model
4. Korsemeyer and Peppas equation

Based on the slope and R2 values were obtained from the models listed above mechanism

It was decided to release the drug. [14]

Different kinetic equations (zero system, first order, Higuchi equation & Peppas equation) been applied to the interpretation of the release rate and mechanism of the matrix system .

Zero order rate equation [1] described the regulations where the rate of drug releases independent Focus20:

$C = k_0 t$ [1]

Where K0 is the zero rate system continuously expressed in units of concentration / time and t is the time.

The first equation system [2] described the release in terms of the rate system version is the concentration of 21 dependent.

$\text{Log } C = \text{Log}C_0 - KT / 2.303$ [2]

Where C0 is the initial concentration of the drug and K is the first continuous system.

Description Higuchi 22 drug release Matrix of insoluble as the square root of the time

Process depends on the basis of published Fickian (Eq. [3]):

$Q = KT ½$ [3]

Where k is a constant design reflects System variables.

A simple relationship which he described as drug release mechanism Of the polymeric system (Eq. [4]):

$MT / M \infty = KTN$ [4]

Where Mt / M ∞ is part of the drug was released in

Time t, k is the rate constant and n is the version exponent. [17]

Compatibility studies:

Differential Scanning Calorimety:

DSC is used to characterize the water of hydration. It was get thermal grams of preparations put using a tool DSC equipped

radiator. The analysis was carried out using differential thermal scanning calorimeter with liquid nitrogen cooling accessory. Analysis was performed under purge of dry nitrogen gas (40 cc / min). Sampling of the drug to the mixture of polymer and optimal formulation of dispersion of solids in flat round pans aluminum bottom and heated in the temperature range 50-400 ° C at the heating rate preprogrammed of 10 ° C / min , using alumina according to the reference standards in the calorimeter scanning differential .[16, 09]

Fourier transforms infrared spectroscopy (FTIR):

Analysis of Fourier transforms infrared measurement of pure drug, and mixtures of polymers blended optimization of the formulation and obtain FTIR to prove chemical safety of the drug in the polymer mixture. The mixtures were taken in the samples and diffuse reflectance infrared spectra recorded by the survey in the region of wavelength 400-4000 cm -1 in the spectrometer FTIR. The show peaks in the infrared numbers. [17, 09]

RESULTS AND DISCUSSION:

Preformulation studies:

Standard calibration curves of Diclofenac potassium:

Figure shows the standard calibration curves for Diclofenac potassium with slope, regression co-efficient and intercept. The curves are found to be linear in the Beer's range between 2-10ug/ml at 276 nm.

Formulation development of floating tablets:

Prepared floating tablets of diclofenac potassium using wet granulation method. Before compression, powder mixes suffered Precompression assessment to determine flow characteristics and compressibility.

As is the view of the results of the evaluation Precompression below:

Precompression Parameters:

Evaluation of the powder blends:

Bulk density and tapped density:

Granules were evaluated different combinations for most bulk density (LBD) and tapped bulk density (TBD). And show all of the bulk density and tapped density results in the table. The bulk density and tapped density utilized in all formulations vary from 0.45 to 0.54 g / cc and 0.51 to 0.66 g / cc, respectively.

Values obtained are within the acceptable range, not a big difference exists between bulk density and tapped density. This result helps in calculating Compressibility% of the powder.

Compressibility index

There was selected compression ratio of powder using compressibility Carr index. Carr index fall within the range in some combination of (a) from 12 to 20%, each show combinations compressibility good. The results are shown in Table.

Angle of repose:

The table shows the number (5) and the results that have been obtained for all formulations. Values were found to be in the range of 21.60 0 to 27.60 θ. And showed every corner of the formulation Comfort below 30o which refers to a good flow property of the granules.

Hausner Ratio

It was found Hausner ratio to be in the 1.1-1.2 range as shown in Table 4.

Table 4: Parameters pre-compression of formulations designed

Formula Code	Angle of Repose (θ)	Bulk Density	Tapped Density	Carr's Index (%)	Hausner Ratio
F1	25.23	0.47	0.54	14	1.1
F2	27.60	0.54	0.63	14	1.1
F3	26.99	0.54	0.66	20	1.2
F4	21.87	0.46	0.54	16	1.2
F5	22.66	0.46	0.54	16	1.2
F6	21.60	0.45	0.51	14	1.1
F7	24.23	0.46	0.54	16	1.2
F8	25.19	0.47	0.56	15	1.2
F9	22.23	0.48	0.54	18	1.2
F10	23.69	0.46	0.53	12	1.1

Post compression Parameters:

The form of tablets

Microscopic examination showed the tablets of each batch formulation of a circular shape with no cracks. All formulas are shown the stomach for the floating discs gastroretentive of diclofenac potassium in Figure 19.

Tablet Dimensions

Results were identified thickness of tablets developed using the thickness and test results are shown in the table. Means that the disk diameter and thickness uniform in almost all the formulas and values for tablets ranged from 8.0 to 8.2 and from 4.0 to 4.5 mm, respectively.

Weight variation test

Ten were selected randomly from all discs formulation and evaluation. The average weight was recorded each formulation and appears in the table. Values were almost uniform, and fall within the specifications of USP. Values ranged from 233.63 to 307.21 mg tablets. All passed the test weight variation tablets % as the weight difference within ± 7.5 % of medicines and weight.

Hardness test

Intermediate values are displayed from the hardness of the tablets in the table. The hardness of all formulations in the range of 3.35-9.98 Kg/Cm^2. Values indicates that the

hardness of all formulations was almost uniform, and possesses good mechanical strength with sufficient hardness.

Friability test

Values are given the fragmentation of the stomach tablets in the table 5. Values Ranged, 0 - 0 , 44 % . All values are less than 1% indicating that the tablets all formulas facing compactness and good show enough resistance for Mechanical shock and corrosion.

Table 5: Parameters post-compression of formulations designed

Parameters	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Hardness (Kg/cm_2)	5.55	9.98	8.70	4.18	8.03	3.35	7.40	5.03	6.98	5.38
Thickness (mm)	4.11	4.2	4.57	4.11	4.00	4.25	4.33	4.3	4.21	4.21
Diameter (mm)	8.06	8.065	8.08	8.14	8.08	8.205	8.00	8.10	8.065	8.07
Friability (%)	0	0	0.4%	0.2%	0	0.8%	0.23%	0.18%	0	0.5%
W.variation (mg)	257.7	289.3	307.2	247.6	263.8	233.6	288.2	249.20	256.5	267.8

In vitro Buoyancy Studies:

All prepared floating inside the stomach diclofenac potassium tablets combinations of non-effervescent approach. To indulge in 5.6 buffer solution at 37 ° C +0.5. All non-effervescent tablets floating float at different time and will remain high up to 24 hours without disintegrating.

The diclofenac potassium tablets F1, F2, F3, and F4 contain HPMC, xanthane gum, carnoba wax, sodium alginate respectively. The FLT of F1, F2, F3 and F4 were 45 min., 30 min, 40min & 20 min. respectively. F5 , F6 , F7 , F8 , F9 , F10 formulations are the combination of polymers with active and there FLT were 35 min , 30 min , 25min , 20min , 40min , 25min respectively.

In vitro Dissolution Studies:

In vitro studies have been conducted to resolve all formulations of diclofenac potassium tablets in buffer solution (pH 5.6). Study was conducted for 7 hours, and calculated the cumulative drug release at different time intervals. Tabled for in vitro drug release profiles of the combinations in the table 6. The plot of the cumulative percentage of drug release V / s time (hours) for the fixtures and conspired shown in Figure.

Table 6: Standard calibration curve of Diclofenac Potassium

Sr. No.	Concentration	Absorbance
1.	10	0.108
2.	15	0.21
3.	20	0.32
4.	30	0.51
5.	40	0.69
6.	50	0.88

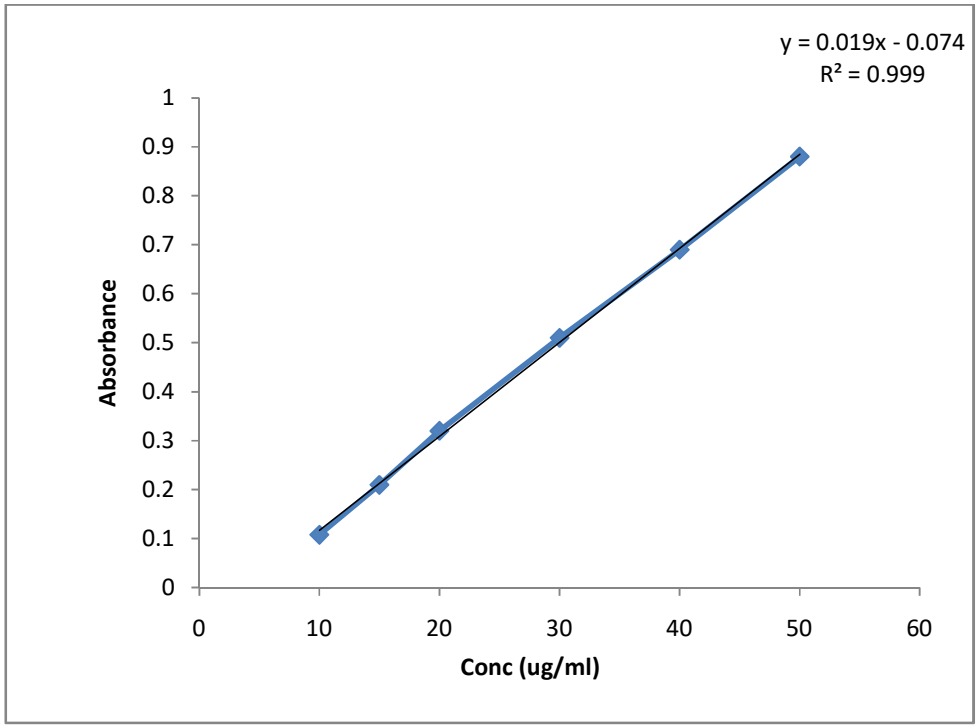

Figure 3: standard calibration curve of Diclofenac Potasium

The effects of various components and its focus on drug release studied. It was noted that this type of polymer affects the pattern of drug release. The effects of various components and its focus on drug release studied. It was noted that this type of polymer affects the pattern of drug release. All the formulations contained equal amount of drug, polymers, Lubricant and Glidant. Formulations, F1, F2, F3, and F4 contain single polymer with same concentration. Formulation, F5, F6 , F7 , F8 , F9 , F10 contain two polymers. F1, F2, F3, F4 showed the release of 74.33%, 82.98%, 93.31%, 84.66% at the end of 7 hours respectively. So different polymers have the different drug release pattern with the drug. In single polymer formulation F3 has more drug release as compared to other formulation. F5 , F6 , F7 , F8 , F9 , F10 showed the release of 81.23% , 83.07 , 72.62% , 93.87% , 91.03% , 78.12% at the end of 7 hours respectively. In combine or double polymer formulation F8 has more drug release as compared to other formulation results of Kinetic Modeling:

Table 7: Release Profile of formulations

Time (hrs)	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.5	10.95	8.92	10.37	26.40	14.87	18.27	6.89	15.15	10.66	6.24
1	13.69	19.63	19.87	31.35	18.58	25.43	9.10	24.04	14.13	13.67
1.5	24.95	33.83	29.41	54.97	23.64	36.80	16.91	36.72	26.36	19.96
2	36.59	27.88	39.68	50.18	33.10	45.81	22.65	46.65	36.78	28.81
3	56.38	37.42	53.48	65.43	44.56	51.73	30.78	55.99	50.97	39.37
4	65.15	51.40	69.71	75.65	59.47	60.81	40.04	65.50	63.06	51.61
5	77.32	68.19	77.23	78.98	70.65	68.15	50.96	73.82	69.24	61.63
6	78.21	70.34	83.34	84.19	75.39	74.93	66.68	84.97	86.46	74.18
7	74.33	82.98	93.31	84.66	81.23	83.07	72.62	93.87	91.03	78.12

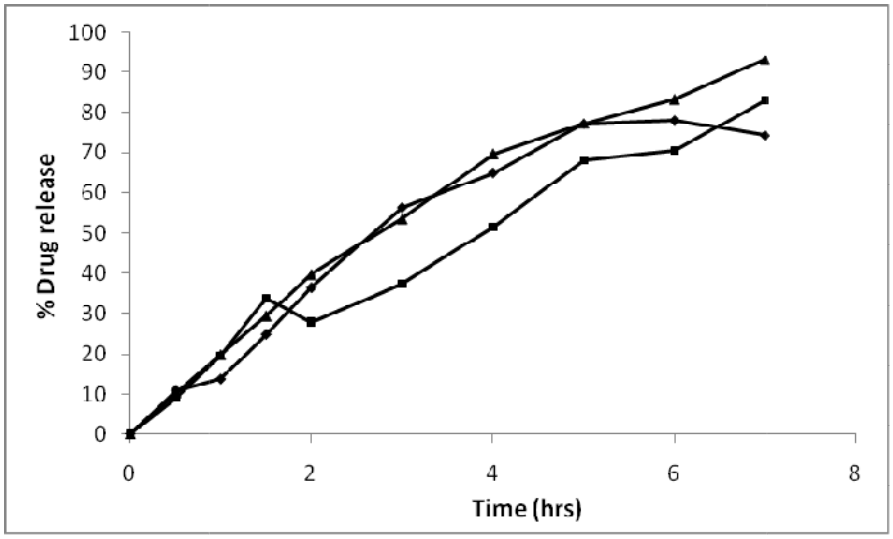

Figure 4: In vitro drug release profile of Formulation F1, F2 & F3

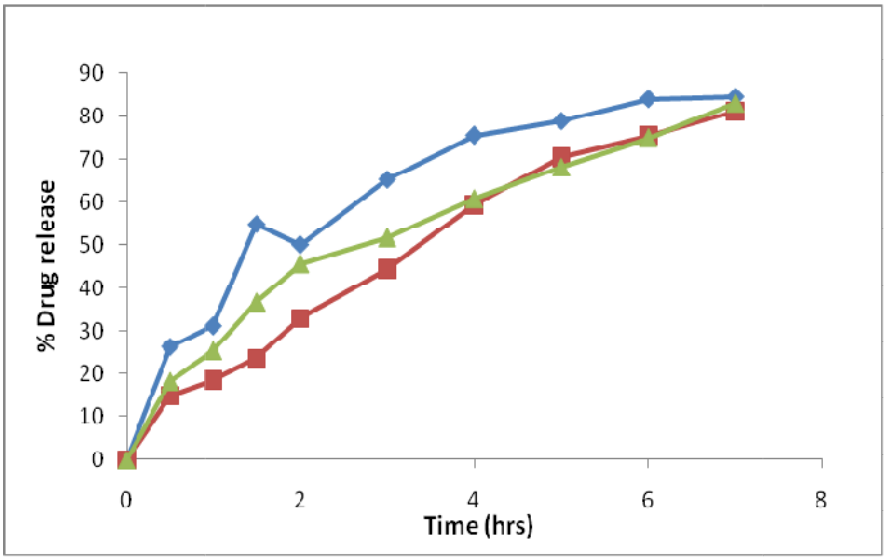

Figure 5: In vitro drug release profile of Formulation F4, F5, and F6

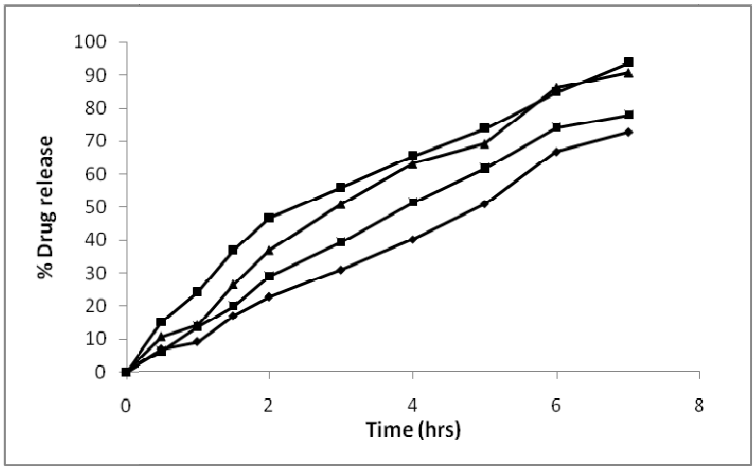

Figure 6:In vitro drug release profile of formulation F7, F8, F9,F10

Mechanism of drug release was determined by putting the release data into kinetic equations. Generally, formulations were found to follow Higuchi square root (R2=0.9902) and peppas models (R2=0.9945). Formulations F2 and F7 release the drug with zero order kinetics. The value of 'n' was in the range 0.470- 0.959 which depicts drug release by anomalous transport and polymer erosion.

Table 8: Model Fitting of the Release Profile Using Four Different Models

Formulation	Zero order R^2	First order R^2	Higuchi R^2	Peppas R^2	Value 'n'
F1	0.8871	0.7889	0.9447	0.9532	0.8414
F2	0.9577	0.8070	0.9558	0.9216	0.7861
F3	0.9688	0.8253	0.9953	0.9902	0.8344
F4	0.8727	0.7758	0.9409	0.9426	0.4707
F5	0.9785	0.9300	0.9817	0.9770	0.7126
F6	0.9629	0.8508	0.9930	0.9888	0.5721
F7	0.9937	0.9109	0.9637	0.9849	0.9415
F8	0.9710	0.8371	0.9951	0.9886	0.6817
F9	0.9786	0.8530	0.9888	0.9803	0.8685
F10	0.9893	0.8454	0.9913	0.9945	0.9596

Differential Scanning Calorimety:

DSC has been used in order to detect any incompatibility in the resulting formulations drug polymer Interaction. And thermograms of pure drug and pure polymers and polymer drug also show formulations in Figure.

In the scheme of DSC heat of pure diclofenac Potassium and showed endothermic peak at 307. Pure HPMC showed the endothermic wide observed peak due to the dehydration process, the temperature range of 107 ° C for Polymers HPMC 32. While pure carnauba wax showed endothermic peak range of melting transition, the temperature at 84 degrees Celsius. [09]

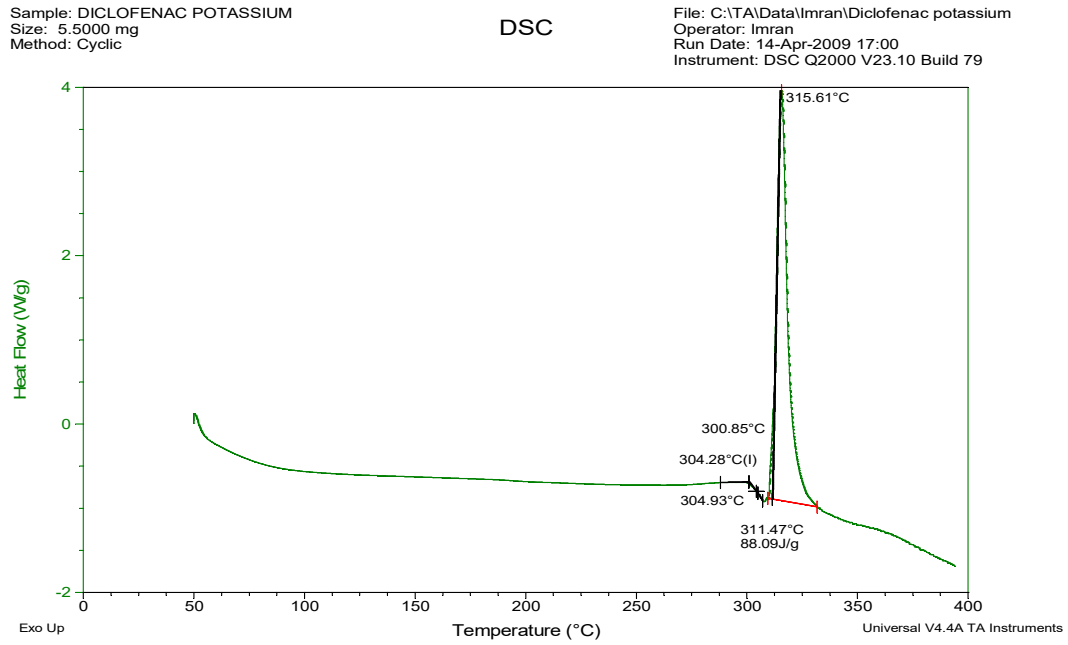

Figure 7: DSC thermograph of diclofenac potassium

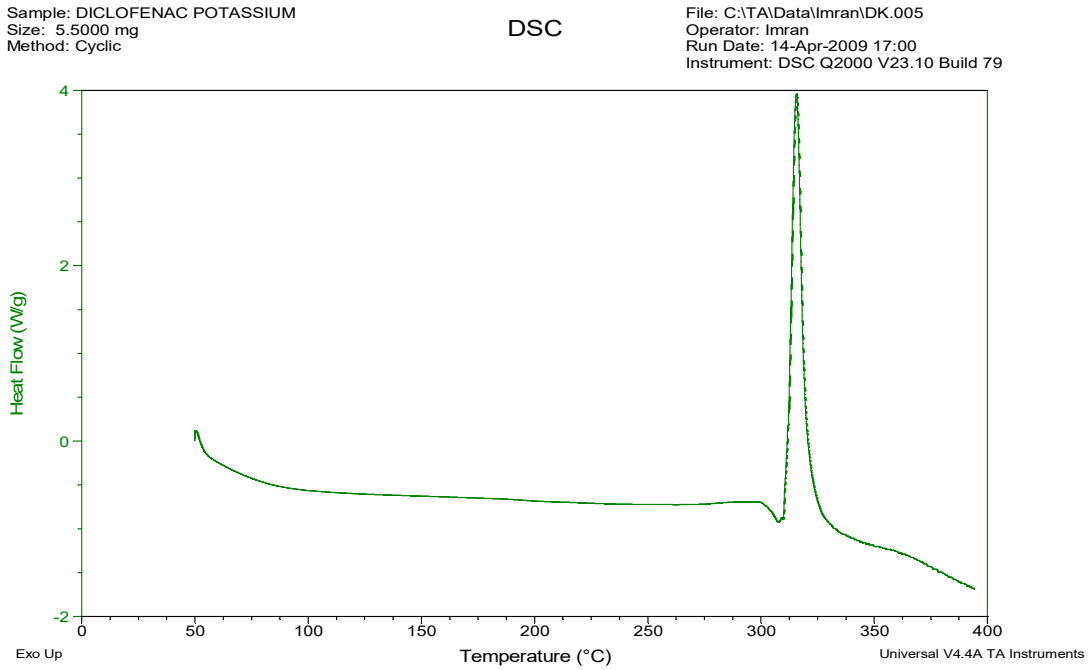

Figure 8: DSC thermograph of diclofenac potassium

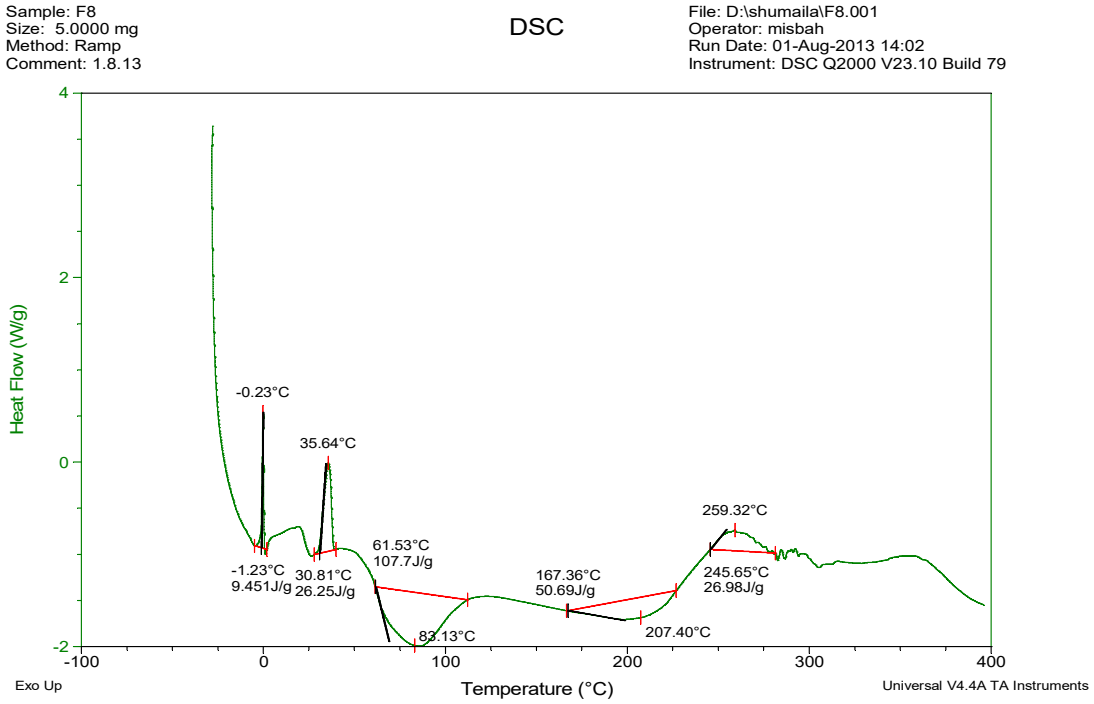

Figure 9: DSC thermograph of formulation 8 (F8)

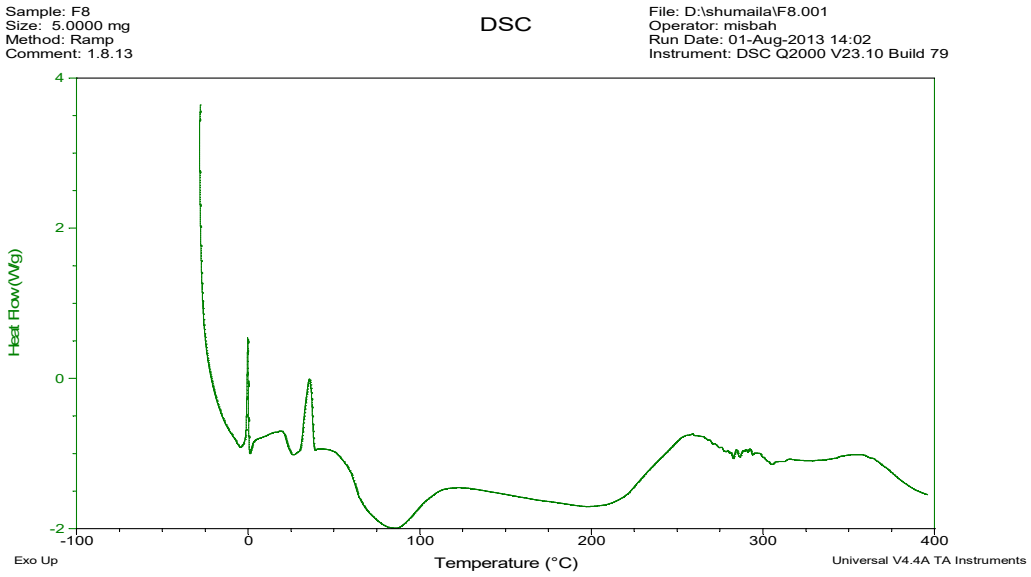

Figure 10: DSC thermograph of formulation 8 (F8)

Fourier transforms infrared spectroscopy:

To make sure of the quality and quantity analysis by FTIR a mixture of pure and blended the polymers used in the composition. The IR spectra of pure drug and pure polymers compared with the infrared spectra of the different formulas Polymer mixtures of drugs.

Infrared spectra of diclofenac potassium exhibited characteristic peaks at 1581.63 cm^{-1} due to the-C = O stretching from the carboxyl ion & at 759.95 cm -1 due to C-Cl expansion.

Showing HPMC distinctive peak in 1053.13 cm^{-1} due to the C-OH stretching vibrations, and distinctive tops in 2881.65 to 2924.09 cm^{-1} due to aliphatic CH is stretching & 3379.29cm^{-1} due to particles hydrogen bonding.

Carnauba wax offered distinct peaks in 2860.43 to 2920.23cm^{-1} due to CH2 stretching vibrations, in 2847.8 cm^{-1} because C-CH3 stretching vibrations while the signal resulting from the carboxyl group appeared in 1722.43cm^{-1}. Sodium alginate shows C=O stretching vibration at 1639.49, the peak in 1018.41cm due to C-OH Stretching vibration. Xanthan gum have the peaks of C-CH_2, C-OH, C=O at the range of 2893.22, 1037.7, 1612.49 to 1722.43 respectively.

In this study, there is no chemical reaction between the diclofenac potassium and polymers which were pointed. We have observed some changes in the peaks, which indicated that there may be some physical interaction related to the formation of from weak to average density of hydrogen bonding between the polymer and the drug, but in the launch of the laboratory studies have shown that this type of interaction did not interfere with the release of drugs from HPMC polymer and carnauba wax. [09]

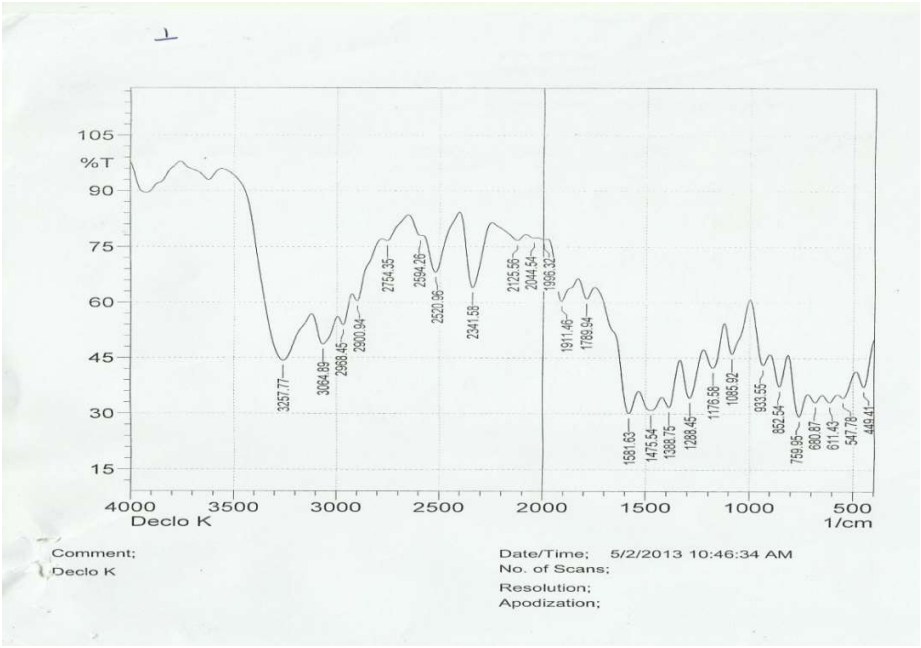

Figure 11: FTIR Spectra of diclofenac potassium

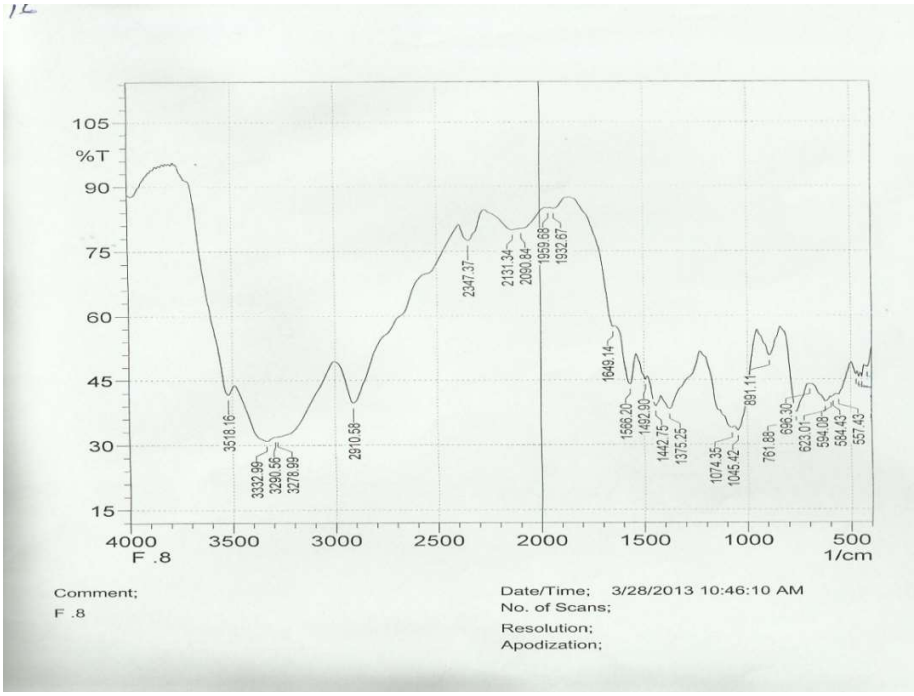

Figure 12: FTIR spectra of formulation 8 (F8)

CONCLUSION

From the results obtained it can be concluded that ; floating drug delivery systems gastro retentive provides a simple and practical approach for achieving an increase in the stomach and accommodation to modify drug release profiles necessary for control , work site - specific and local anesthetics . FTIR spectra of pure and drugs with excipients are identical and do not show a mismatch, and therefore compatible with the drug excipients. DSC thermograph of the drug diclofenac potassium and that the optimal formulation of any polymer HPMC, xanthan gum, carnauba WEX, and sodium alginate show that the polymers are compatible with the drug. Values less than comfortable angle of less than 30 indicates a good flow properties of the powder mixture. All were found tablets are intended to be of circular shape with no cracks. The fragmentation and stiffness within the limits of the standard which shows good mechanical strength of the tablets. Showed diclofenac potassium tablets (F8) satisfactory results with short buoyancy delayed time, long total time of buoyancy and controlled drug release of up to 7 hours. Been explored drug release data on the type of release mechanism followed.

Generally, formulations were found to follow Higuchi square root (R2=0.9902) and peppas models (R2=0.9945). Formulations

F2 and F7 release the drug with zero order kinetics. The value of 'n' was in the range 0.470- 0.959 which depicts drug release by anomalous transport and polymer erosion.

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REFERENCES:

[1] Gaurav Tiwari, Ruchi Tiwari, Birendra Sriwastawa, L Bhati, S Pandey, P Pandey, and Saurabh K Bannerjee Drug delivery systems**:** Int J Pharm Investig., 2(1): 2–11 (2012)

[2] Method in Molecular Biology edited by Kewal K. Jain, vol. 437: Drug Delivery System.

[3] Ratnaparkhi M. P., Gupta Jyoti P. Sustained Release Oral Drug Delivery System, International Journal of Pharma Research & Review, 2(3):11-21(2013)

[4] P. Srikanth, Narayana Raju, S. Wasim Raja, S. Brito Raj. Oral Controlled Drug Delivery International Journal of Advanced Pharmaceutics, 3(1): 51-58.(2013)

[5] K.P.Sampath Kumar, Debjit Bhowmik, Amitsankar Dutta, Shravan Paswan, Lokesh Deb.Recent Trends In Scope And Opportunities Of Control Release Oral Drug Delivery Systems.Issue1 : 2012.

[6] Amit Kumar Nayak Jadupati Malakar and Kalyan Kumar Sen. Gastroretentive drug delivery technologies: Current approaches and future potential. Pharm Educ Res; 1(2): 1-12(2010)

[7] Doshi SM and Tank H M. Gastro Retention - An Innovation over Conventional Poorly Soluble Drugs: .IJPCS ; 1(2):859-866 (2012)

[8] Karan K. Patil , Datta Saptarshi. A Review on Floating Drug Delivery System. Int. J. Pharm. Sci. Rev. Res., 21(1): 276-28 (2013)

[9] Abolfazl Mostafavia, Jaber Emamia, Jaleh Varshosaza, Neal M. Daviesb, Mahboubeh Rezazadeha, Development of a prolonged-release gastroretentive tablet formulation of ciprofloxacin hydrochloride: Pharmacokinetic characterization in healthy human volunteers. International Journal of Pharmaceutics *409: 128–136(2011).*

[10] Arthur Okumu,1 Marie DiMaso,2 and Raimar Löbenberg1,3.Dynamic Dissolution Testing To Establish In

Vitro/In Vivo Correlations for Montelukast Sodium, a Poorly Soluble Drug. Pharmaceutical Research (2008).

[11] Anilkumar J. Shinde, Manojkumar S. Patil and Harinath N. More. Formulation and Evaluation of an Oral Floating Tablet of Cephalexin. Indian J. Pharm. Educ. Res. 44(3): (2010).

[12] Manli Wanga, B, Liang Fanga, Percutaneous absorption of diclofenac acid and its salts from emulgel. Asian Journal of Pharmaceutical Sciences; 3 (3): 131-141(2008)

[13] Mukesh C. Gohel, Pavak R.Mehta, Rikita K. Dave and Nehal H. Bariya, A More Relevant Dissolution Method for Evaluation of Floating Drug Delivery System. Dissolution Technologies; (2004).

[14] Gambhire MN, Ambade KW, Kurmi SD, Kadam VJ, Jadhav KR. Development and in vitro evaluation of an oral floating matrix tablet formulation of diltiazem hydrochloride. AAPS Pharm Sci Tech;8(3):E1-E9(2007).

[15] Saravanan D, Padmavathy J, Rajesh D. Formulation and evaluation of ofloxacin floating tablets using HPMC. Int J Pharm Pharm Sci.;3(1):170-173(2011)

[16] Yadav SK, Kavita.K, Tamizhamani T. Formulation and Evaluation of Floating Tablets of RHCL Using Natural and Synthetic Polymers. International Journal of Pharm Tech Research.;2(2):1513-1519(2010)

[17] Garg R, Gupta GD. Preparation and evaluation of gastroretentive floating tablets of silymarin. Chem. Pharm. Bull.; 57(6) 545—549(2009).