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FORMULATION AND EVALUATION OF FLOATING ORAL *IN-SITU* GELLING SYSTEM OF LOSARTAN POTASSIUM

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Oral *in-situ* gel, Floating formulation, Losartan Potassium, Sustained release

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ABSTRACT: Losartan potassium is used to treat hypertension, and it protects the kidneys from diabetic nephropathy. The drug has a short plasma half-life, inadequate bioavailability, removed rapidly from the blood circulation. These problems can be eliminated by formulating a novel dosage form of a drug in the form of floating oral *in-situ* gel. Present research performed on losartan potassium drug deals with the preparation and valuation of floating oral *in-situ* gel of the polymers used *in-situ* gel formation has many benefits like the sustained effect of drug substance and prolonged action in comparison to conventional drug delivery systems and good patient compliance, good stability and biocompatibility characteristics. The objective of this study was to develop an optimized *in-situ* oral gel of losartan potassium suitable to be administered by an oral route which upon exposure to physiological conditions changes to the gel phase. The aim of developing *in-situ* gel of losartan potassium was achieved through formulation designing of various formulations using various combinations of polymers and a cross-linking agent. Optimization of the prepared formulations for gelling capacity and floating behavior and evaluation of optimized formulations. All the optimized *in-situ* gel formulations exhibited the expected viscosity, pH, *in-vitro* gelling capacity, *in-vitro* floating ability, and sustained drug release.

INTRODUCTION: Losartan potassium belongs to the class of antihypertensive agents called angiotensin II receptor blockers (ARBs). After biotransformation, losartan potassium changes to its longer-acting active metabolite, E-3174. Both the drug and active metabolite are specific in their action, and selective type-1 angiotensin II receptor (AT1) antagonists block the blood pressure increasing effects of angiotensin II *via* the renin-angiotensin-aldosterone system (RAAS).

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The low bioavailability of losartan potassium is due to its incomplete absorption and extensive metabolism. Consequently, a floating type sustained-release in-situ gel formulation was developed to increase the time of the drug release and hence increase the bioavailability of the drug. Oral prolonged release drug delivery recently has been of increasing interest in the pharmaceutical field to achieve improved therapeutic benefits such as reduced dosing, patient compliance, and flexibility in formulation. *In-situ* gel forming systems have been broadly investigated as vehicles for prolonged drug delivery. This interest has been triggered by the benefits shown by *in-situ* forming polymeric delivery systems such as ease of dispensation and decreased rate of administration, better quality of patient compliance and comfort [1-4].

One or combination of different stimuli like pH change, temperature modulation, and solvent exchange are utilized in *in-situ* gel formation [5-9]. So, in-situ gels are administered by oral [10], ocular [11], rectal [12], vaginal [13], injectable [14] and intra-peritoneal route. Both natural and synthetic polymers like gellan gum, alginic acid, xyloglucan, pectin, chitosan, poly (DL-lactic acid), poly (DL-lactide-co-glycolide) and poly-caprolactone are used for formulation development of in-situ forming drug delivery systems [15]. Due to the presence of bioadhesive nature of the polymer, the formed gel formed being lighter floats over the stomach contents or adheres to the gastric mucosa and produce gastric retention of the dosage form and increase gastric residence time resulting in prolonged drug delivery in the gastrointestinal tract. The present research was intended to formulate a liquid solution containing Losartan potassium that shall gel on contact with gastric juice; further the formed gel shall float and remain in the stomach for a prolonged period ensuring improved absorption of the drug.

MATERIALS AND METHODS: Losartan potassium was received as a gift sample from Medley Pharmaceuticals Ltd., (Jammu). Sodium Alginate (SA), Calcium Chloride, Sodium bicarbonate, HPMC, Sodium Citrate, D-sorbitol were purchased from Central Drug House (P) Ltd. New Delhi (India). All other chemicals used in the study were of Analytical Grade.

Preparation of Floating *in-situ* Gel: *In-situ* gel formulation was prepared by simply dissolving a gel-forming polymer (sodium alginate) in distilled water. A crosslinking agent (calcium carbonate) was added that upon inter and intra-polymeric crosslinking resulted in the formation of a gel. Consequently, gel-forming the polymer, sodium alginate; crosslinking agent, calcium carbonate; viscosity enhancer, HPMC and effervescent, sodium bicarbonate was added to distilled water and heated up to 60 ºC with continuous stirring using a magnetic stirrer (REMI equipment). After cooling the solution to up to 40 ºC, the drug (losartan potassium) and flavoring agent (D-sorbitol) were added. The resulting formulations were finally stored in amber colored bottles until further use [16-19]. Sodium alginate solution of different concentrations containing varying amounts of calcium carbonate and other ingredients were prepared. The composition of various formulations prepared is given in **Table 1**.

TABLE 1: COMPOSITION OF FORMULATIONS

Ingredients (% w/v)	Formulation code								
	F1	F2	F3	F4	F5	F6	F7	F8	F9
Losartan potassium	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Sodium Alginate	2	2	2	2.5	2.5	2.5	3	3	3
HPMC K_{100} M	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Sodium citrate	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Calcium chloride	0.1	0.125	0.15	0.1	0.125	0.15	0.1	0.125	0.15
Sodium bi carbonate	1	1	1	1	1	1	1	1	1
D Sorbitol	1	2	3	1	2	3	1	2	3
Distilled Water(q.s)	100	100	100	100	100	100	100	100	100

TABLE 2: AMOUNT OF VARIABLES IN 3^2 FACTORIAL DESIGN BATCHES

Coded values	Actual values (% w/v)	
	X1	X2
-1	2	0.1
0	2.5	0.125
+1	3	0.150

Optimization of Variables Using Full Factorial Design: A 3^2 randomized full factorial design was used to optimize the formulation. In this design, 2 factors were evaluated, each at 3 levels and experimental trials were performed for all 9 possible combinations.

The concentration of sodium alginate (X1) and concentration of calcium chloride (X2) were chosen as independent variables in 3^2 full factorial design. The formulation layout for the factorial design is shown in **Table 2**.

Rheological Studies: In this study *in-vitro* gelation study and viscosity measurements were conducted. The adhesiveness/viscidity of the samples was determined using a digital Brookfield viscometer (Viscolead RVD) using 5 ml aliquot of the sample with spindle number 20, 30, 40 rpm and sample temperature was maintained at 25 ºC before each

measurement. *In-situ* solution (5 ml) of Losartan potassium and artificial simulated gastric fluid (100 ml) were mixed and gelation was observed by visual examination.

***In-vitro* Floating Study:** The *in-vitro* floating study was determined using USP dissolution apparatus (Bells India) having 900 ml of 0.1N HCl. The petri dish containing 10 ml of withdrawn in-situ gelling solution was immersed into dissolution apparatus at 37 ºC. The time is taken by the formulation to emerge on the medium surface, and the time the formulation constantly floated on the dissolution medium surface was noted visually.

Measurement of Water Uptake by the Gel: The in-situ gels formed in 40 ml of hydrochloric acid buffer (pH 1.2) were separated. The initial weight of the gel was calculated and to this weighed gel 10ml of distilled water was added, and after every 30 minutes the water was poured off, and the final weight of gel was recorded, and the difference in the weight was calculated.

***In-vitro* Drug Release Studies:** The *in-vitro* release of drug from floating oral *in-situ* gel solutions was determined by using USP type II (paddle type) dissolution test apparatus (Bells India). Five ml from each formulation was transferred using the disposable syringe. The syringe plunger was depressed slowly to extrude 5 ml into a petri dish having an internal diameter of 4.5 cm already containing 10ml of 0.1 N HCl. The petri dish was then placed on the surface of the dissolution medium and plunged into a dissolution vessel containing 900 ml of 0.1 N HCl (pH 1.2) without much disturbance. The dissolution test apparatus was run at 50 rpm for 10 h at temperature 37 ± 0.5 °C. Five ml samples were withdrawn from dissolution medium at predetermined time intervals of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 h and replaced with 5 ml of pre-warmed fresh medium. Samples were filtered using Whatman filter paper no. 41 and drug contents in the aliquots was determined spectrophotometrically using double beam UV-Visible spectrophotometer (Shimadzu 1650 pc-Japan) at a λ max = 207 nm after suitable dilution.

RESULTS AND DISCUSSION:

Drug-Excipient Interaction Studies: To ascertain that no interaction has occurred between the drug and the polymer or due to conditions of the formulation process, the following interaction studies were carried out.

UV Spectral Analysis: UV spectrum of the drug-excipient blend was compared with the UV spectrum of the pure drug. No change in λ max was observed **Fig. 1** and **Fig. 2**.

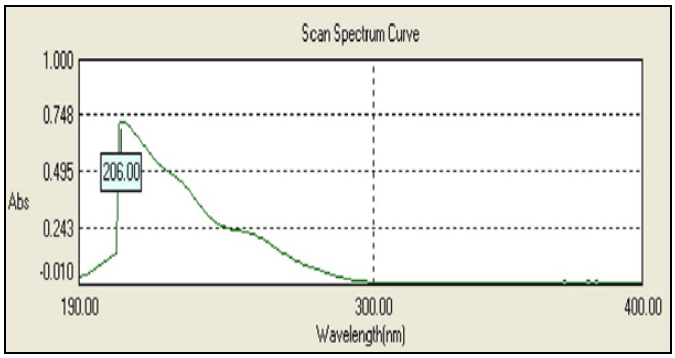

FIG. 1: UV SPECTRUM OF LOSARTAN POTASSIUM (PURE) IN O.1N HCl

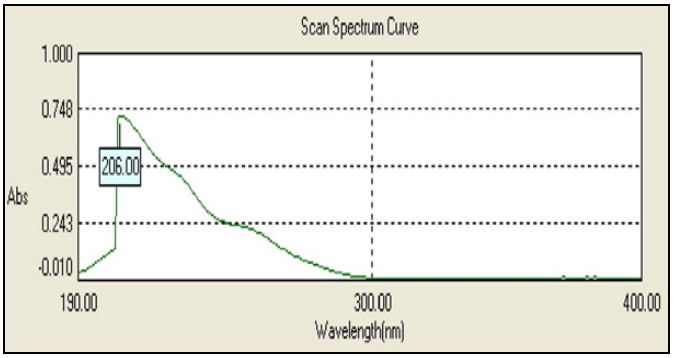

FIG. 2: UV SPECTRUM OF LOSARTAN POTASSIUM ALONG WITH POLYMERS IN O.1N HCl

Fourier Transform Infrared Spectroscopic Studies: Compatibility between the drug and polymers was studied by FT-IR method. Pure Losartan potassium and the formulations prepared were subjected for FT-IR spectroscopic analysis, to establish an interaction between the drug and polymers used. The position of characteristic peaks of pure Losartan potassium was compared with those peaks obtained for formulation. These characteristic bands for Losartan potassium were identifiable, and there was no significant shift or disappearance in the peak positions. This indicated that the drug was intact and has not reacted with the excipients used in the formulation and hence they are compatible. Therefore, it can be concluded that the drug is in free-state and can release easily from the polymeric network in the free form **Fig. 3** and **Fig. 4**.

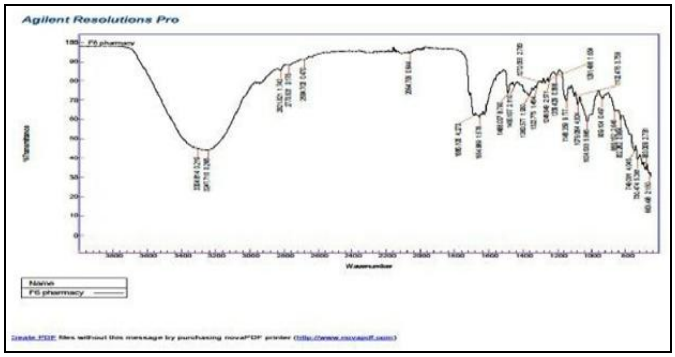

FIG. 3: FTIR OF DRUG POLYMER MIXTURE

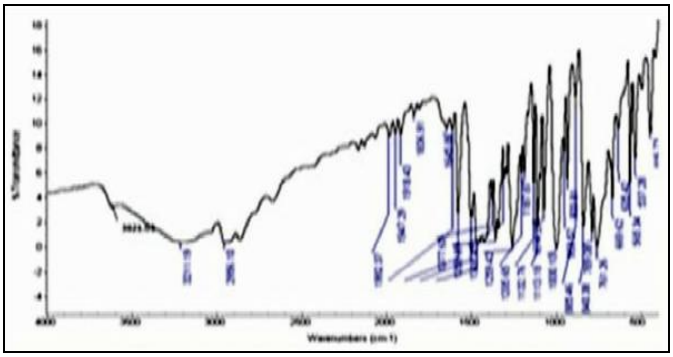

FIG. 4: FTIR OF PURE DRUG

DSC: To further establish the purity of the drug differential scanning calorimetry was performed. The DSC scan is shown in **Fig. 5** and reference scan in **Fig. 6**.

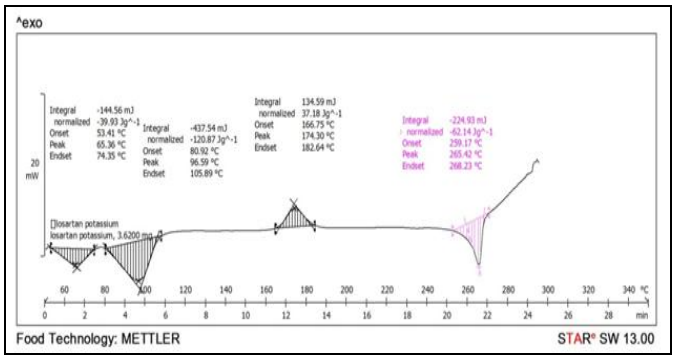

FIG. 3: DSC THERMOGRAM OF LOSARTAN POTASSIUM

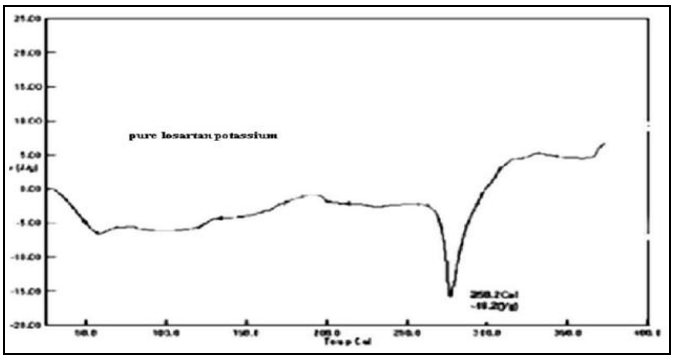

FIG. 4: REFERENCE DSC SPECTRUM OF LOSARTAN POTASSIUM

Evaluation:

Visual Appearance and Clarity: Clarity is one of the most important characteristic features of *in-situ* gel formulations. The prepared formulations were examined for appearance and clarity by visual observation against a white and black background to check the presence of any particulate matter. The physical appearances of all the developed formulations were off white and were clear. All the developed gels showed good homogeneity with the absence of lumps **Table 3**.

TABLE 3: VISUAL APPEARANCE AND CLARITY OF FORMULATIONS PREPARED BY 3^2 FACTORIAL DESIGN

S. no.	Formulation code	Appearance and clarity
1	F1	Clear and white in color
2	F2	Clear and off white in color
3	F3	Clear and off white in color
4	F4	Clear and off white in color
5	F5	Clear and off white in color
6	F6	Clear and off white in color
7	F7	Clear and light yellowish in color
8	F8	Clear and light yellowish in color
9	F9	Clear and light yellowish in color

pH: Measurement of pH is essential for oral preparations; otherwise it leads to irritation to the throat**.** To ensure that the preparation has alkaline pH, the pH of the prepared *in-situ* gelling system after the addition of all the ingredients was measured using digital pH meter. This was previously calibrated by pH 4 and pH 7. The pH values were recorded immediately after preparation. The formulations possessed satisfactory pH value ranging from 7.5 to 8.5 **Table 4** which is suitable to maintain the formulations in a liquid state. Aqueous solutions of sodium alginate are most stable at pH range of 4-10. Below pH 3, alginic acid is precipitated from the alginate solution making the formulation unsightly containing gel and liquid phases.

TABLE 4: pH OF FORMULATIONS

S. no.	Formulation code	Observed pH (±SD)
1	F1	7.5 ± 0.2
2	F2	7.6 ± 0.1
3	F3	7.8 ± 0.20187
4	F4	8.0 ± 0.30
5	F5	8.4 ± 0.264
6	F6	8.1 ± 0.1
7	F7	8.0 ± 0.20817
8	F8	8.5 ± 0.20817
9	F9	7.9 ± 0.15227

Drug Content Uniformity: To ensure the uniform release of drug from the formulation, drug content uniformity in the formulation. 5 ml of liquid solution from all formulations was taken, and 70 ml of 0.1 N HCl was added after that sample was sonicated for 30 min until a clear solution obtained. The volume was diluted to 100 ml and filtered using Whatman filter paper no. 41. 1 ml sample was withdrawn from the prepared solution and diluted to 10 ml with 0.1 N HCl. Contents of losartan potassium were determined spectrophotometrically using double beam UV-Visible spectrophotometer (Shimadzu 1650 pc-Japan) at λ max= 207 nm [13] **Table 5**.

TABLE 5: DRUG CONTENT OF THE FORMULATIONS

S. no.	Formulation code	% Drug content, (±SD)
1	F1	96.03 ± 0.5044
2	F2	97.84 ± 0.6754
3	F3	96.11 ± 0.47721
4	F4	97.25 ± 0.39068
5	F5	97.90 ± 1.05292
6	F6	98.7 ± 0.40632
7	F7	98.49 ± 1.15747
8	F8	99.66 ± 0.09609
9	F9	98.21 ± 0.38786

***In-vitro* Gelling Capacity:** The *in-vitro* gelling capacity of prepared formulations was measured by placing 5 ml of the gelation solution (0.1N HCl, pH 1.2) in a 15 ml borosilicate glass test tube and maintained at 37 ± 1ºC temperature. As the solution comes in contact with gelatin solution, it was immediately converted into a stiff gel-like structure. The gelling capacity of the solution was evaluated by the stiffness of formed gel and period for which the formed gel remains as such. The *in-vitro* gelling was graded in three categories by gelation time and the period for which the formed gel remains [5].

The sodium alginate concentration 0.5%, 1% w/v retained liquid state (free flow) at temperature 25ºC and gel upon exposure to physiological conditions (0.1N HCl). The concentration 1.5% w/v also retained liquid state at temperature 25 ºC and gelled upon exposure to physiological conditions, but it was not stable and dissolved rapidly. However, the solutions of 2% w/v, 2.5% w/v and 3% w/v retained liquid state (free flow) at pH 6.0 and 25 °C and gelled upon exposure to physiological conditions. By *in-vitro* gelling capacity and pourability, sodium alginate concentration was fixed at 2.5% w/v, and this was used for further study.

Increasing concentration of $CaCl_2$ significantly increased gel strength and decreases gelation time due to increase in gel rigidness as the degree of crosslinking of divalent Ca^{2+} ions with the polymer chains increases and thus causing gelation to undergo instantly. By visual observation, floating lag time and gelation, the working concentration of $CaCl_2$ was fixed at 0.125% w/v **Table 6**.

TABLE 6: GELLING CAPACITY OF THE FORMULATIONS

S. no.	Formulation code	Gelling capacity
1	F1	+
2	F2	++
3	F3	++
4	F4	+++
5	F5	+++
6	F6	+++
7	F7	++
8	F8	+++
9	F9	+++

"+ "gels after few minutes, dispersed rapidly; "++"gelation is immediate which remains for few hours; "+++"gelation is immediate which remains for an extended period (>12 hours)

Floating Behavior: The floating lag time and duration of floating time of *in-situ* gels were studied. The *in-vitro* floating study was carried out using 900 ml of 0.1N HCl, (pH 1.2) maintained at 37 ºC. 10 ml formulation was introduced into the dissolution vessel containing medium without disturbance. When the formulation is placed in the medium, the CO_2 released from the formulation was entrapped in the gel network producing buoyant formulation.

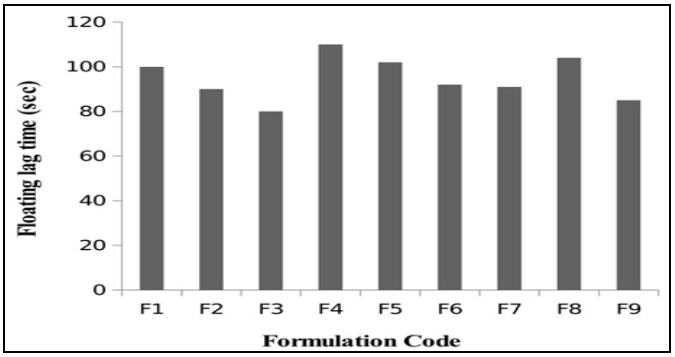

FIG. 7: FLOATING BEHAVIOUR OF FORMULATION

Further, calcium ion reacted with sodium alginate produced a crosslinked *3-D* gel network which swelled and entrapped with more CO_2. This entrapment in the network structure caused the buoyancy and flotation for an extended period.

Further, the gel network retarded the drug release and thus exhibiting sustained release pattern. All the formulations exhibited a very short floating lag time **Fig. 7**. **Table 7** shows floating time and floating lag times of in-situ gel formulations.

TABLE 7: FLOATING BEHAVIOR OF THE FORMULATIONS

S. no.	Formulation Code	Floating Lag Time (Sec)	Floating Duration (h)
1	F1	100	<12
2	F2	90	<12
3	F3	80	>12
4	F4	110	>12
5	F5	100	>12
6	F6	92	>12
7	F7	91	<12
8	F8	104	>12
9	F9	85	>12

Rheological Studies: The two main pre-requisites of *in-situ* gelling systems are optimum viscosity (to ingest orally as a liquid dosage form) and gelling capacity (speed and extent of gelation). Viscosity determination was done for all the formulations using Brookfield viscometer at 3 different rpm (20, 30 & 40 rpm) using spindle no. 8 at 25 °C. From the observations, it was noticed that there was an in an increase in viscosity with an increase in the concentration of sodium alginate. This increase in viscosity can be attributed to a consequence of increasing chain interaction with polymer concentration. Increasing the calcium chloride content in the formulation simultaneously increased the viscosity at all polymer concentrations studied.

Since, the calcium chloride is present as insoluble dispersion in the formulations, an increase in its concentration proportionally increased the number of particles dispersed, thus contributing to the increased viscosity **Table 8**, **Fig. 8**.

TABLE 8: VISCOSITY PROFILE OF FORMULATIONS

S. no.	Formulation code	Viscosity (cp) at pH 6		
		RPM		
		20	30	40
1	F1	170	161.55	153.1
2	F2	190.80	182.35	173.9
3	F3	200.67	192.22	183.77
4	F4	264	255.55	247.1
5	F5	270.35	261.55	253.1
6	F6	288.08	279.63	271.18
7	F7	300.86	292.41	283.96
8	F8	310.96	302.51	294.06
9	F9	330.64	322.19	313.74

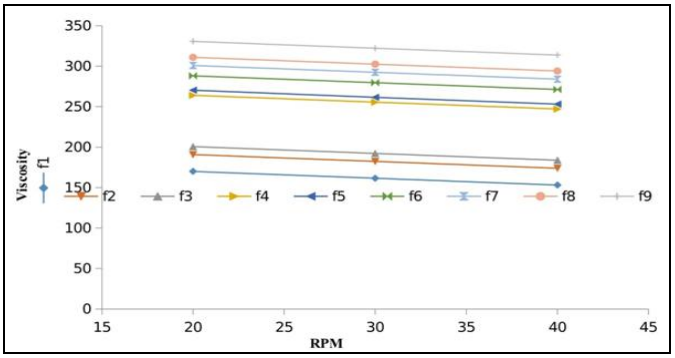

FIG. 8: VISCOSITY PROFILE OF FORMULATION

Measurement of Water Uptake: Release of the drug from the polymer matrix depends on the amount of water associated with the system. The release of the drug may involve the penetration of water into the matrix and simultaneous release of the drug via diffusion or dissolution. The water associated with the formulation at any point in the time can be determined by the thermos-gravimetric analyzer, but in this present study, a simple test was done for the *in-situ* gel formulations. The results of the water uptake study are given in **Table 9**, **Fig. 9**.

TABLE 9: % WATER UPTAKE OF THE GEL

S. no.	Formulation code	%Water Uptake
1	F1	10.7
2	F2	8.7
3	F3	4.6
4	F4	7.9
5	F5	6.7
6	F6	5.2
7	F7	9.1
8	F8	8.8
9	F9	7

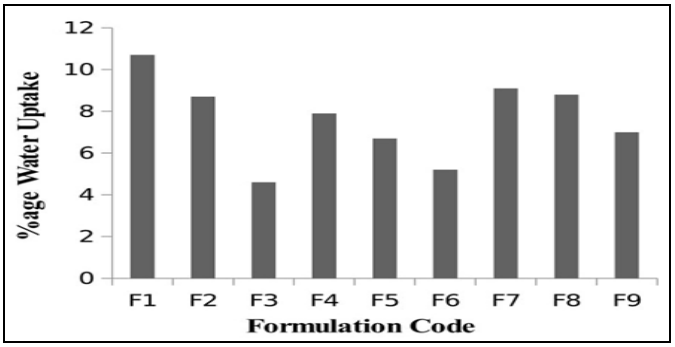

FIG. 9: WATER UPTAKE CAPACITY OF FORMULATIONS

***In-vitro* Drug Release Studies:** The *in-vitro* release of losartan potassium from buoyant *in-situ* gel solutions was studied by using USP type II (paddle type) dissolution test apparatus. Five ml from each formulation was transferred using the disposable syringe. The syringe plunger depressed slowly to extrude 5 ml into a Petri dish with an

internal diameter of 4.5 cm already containing 10ml of 0.1 N HCl. This Petri dish containing formulation was placed on the surface of the medium and plunged into a dissolution vessel containing 900 ml of 0.1 N HCl (pH 1.2) without much disturbance. The dissolution test apparatus was run at 50 rpm for 10 h at temperature 37 ± 0.5 °C. Five ml samples were withdrawn from dissolution medium at predetermined time intervals of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 h and replenished with 5 ml of pre-warmed fresh medium. Samples were filtered using Whatman filter paper no. 41 and drug contents in the aliquots was determined spectrophotometrically using double beam UV-Visible spectrophotometer (Shimadzu 1650 pc-Japan) at a λ max = 207 nm after suitable dilution. The release profile of formulations indicated that the formulations F3, F6, and F9 showed better results amongst all formulations.

The cumulative percentage release from these nine formulations was found to be in between 50.17% to 99.69%. The results indicate that drug release was significantly prolonged by using the in-situ gelling system containing polymers sodium alginate, HPMC and cross-linking agent calcium chloride **Table 10** and **Fig. 10**.

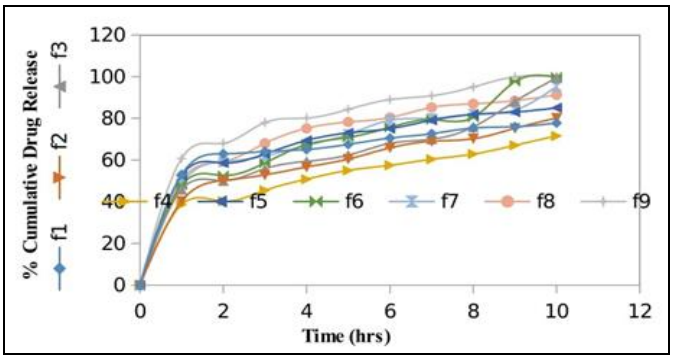

FIG. 10: *IN-VITRO* DISSOLUTION BEHAVIOUR COMPARISION (F1 - F9)

TABLE 10: DRUG RELEASE PROFILE OF FORMULATIONS (F1 TO F9)

	% Cumulative drug release								
Time in (h)	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**	**F9**
0	0	0	0	0	0	0	0	0	0
1	53.00	40.27	45.86	38.75	52.61	48.00	48.5	50.32	60.78
2	63	50.17	50.09	40.26	58.58	52.61	59.19	59.24	68.00k2
3	64.09	52.88	55.86	45.45	62.92	58.58	62.00	68.02	78.00
4	65.09	56.68	59.39	5085	69.43	67.47	67.00	75.21	80.12
5	67.53	60.47	62.37	55.05	73.04	70.88	72.33	78.26	84.31
6	70.53	65.850	68.00	57.49	75.08	75.68	79.08	80.38	89.00
7	72.65	68.995	70.00	60.38	79.08	79.38	80.01	85.26	90.83
8	75.38	70.231	75.89	62.88	81.88	80.48	82.00	87.00	95.06
9	76.00	75.201	88.09	67.07	83.04	97.63	84.03	88.49	99.92
10	77.81	80.19	99.45	71.6	85.05	99.79	95.28	91.29	99.99

Kinetics of Drug Release: To analyse the mechanism of drug release, the in vitro dissolution data of the formulations prepared with the help of factorial design were fitted to mathematical models, Zero Order (Chen and Hao, 1998), First Order (Shah, 1987), Higuchi release model (Higuchi, 1961), and Korsmeyer Peppas model (Korsmeyer, 1983). From the *in-vitro* drug release data the order of the goodness of the fit "R^2 values" and n values were found to be in the order as: zero order > Ist order > Higuchi for all the three formulations F_3, F_6 and F_9. "n" values were found to 0.359, 0.593 and 0.287 respectively **Table 11, 12** and **13**.

TABLE 11: RELEASE RATE PARAMETERS OF FORMULATION F_3

Zero Order		**First order**		**Higuchi**		**Korsmeyer- Peppas**		
K_O	**R^2**	**K_1**	**R^2**	**K_H**	**R^2**	**K_{KP}**	**R^2**	**n**
20.618	0.5887	0.447	0.4859	40.535	0.3338	0.359	0.6674	0.359

K_0**:** Zero order release rate constant; K_1: First order release rate constant; K_H: Higuchi constant; K_{KP}: Korsmeyer Peppas constant

TABLE 12: RELEASE RATE PARAMETERS OF FORMULATION F_6

Zero Order		**First order**		**Higuchi**		**Korsmeyer- Peppas**		
K_O	**R^2**	**K_1**	**R^2**	**K_H**	**R^2**	**K_{KP}**	**R^2**	**n**
0.470	0.7180	0.470	0.7000	42.803	0.5593	38.195	0.8228	0.593

K_0**:** Zero order release rate constant; K_1: First order release rate constant; K_H: Higuchi constant; K_{KP}: Korsmeyer Peppas constant

TABLE 13: RELEASE RATE PARAMETERS OF FORMULATION F_9

Zero Order		First order		Higuchi		Korsmeyer- Peppas		
K_O	R^2	K_1	R^2	K_H	R^2	K_{KP}	R^2	n
24.080	0.9742	0.021	0.6380	47.867	0.5593	61.734	0.9754	0.287

K_0**:** Zero order release rate constant; K_1: First order release rate constant; K_H: Higuchi constant; K_{KP}: Korsmeyer Peppas constant

Stability Studies: The objective of stability studies was to predict the shelf life of a product by accelerating the rate of decomposition, preferably by increasing the temperature and relative humidity. The stability studies for optimized formulation F_3 was carried out at 25 ± 5 ºC / 60 ± 5% RH and 30 ± 5 ºC / 65 ± 5% RH as long term and intermediate storage conditions for a period of 3 months (0, 1, 2 and 3 months sampling). To assess stability, these samples were analyzed and checked for changes in physical appearance and drug content at regular intervals.

The obtained data is presented in **Table 14**. The results indicated that the formulation F_3 did not undergo any major chemical change/interaction during the study period. There was no marked change in the physical properties and drug content during the study period, which indicated that formulation F_3 exhibited good stability during the investigation period.

TABLE 14: STABILITY DATA OF LOSARTAN POTASSIUM *IN-SITU* GEL

Sampling Condition	Sampling Interval (months)	Physical Appearance	Drug Content
25±2 °C / 60 ± 5% RH	1	Off white in color	95.45
25±2 °C / 60 ± 5% RH	2	Off white in color	95.00
25±2 °C / 60 ± 5% RH	3	Off white in color	94.95

CONCLUSION: The *in-situ* gel containing losartan potassium was successfully prepared. The *in-situ* formed gel preserved its integrity without dissolving or eroding for a prolonged period to facilitate sustained release of drugs.

The formulation met all prerequisites to become an *in-situ* gelling floating system that gelled and floated instantaneously in the pH conditions of the stomach. It was observed that the resulting gel remained buoyant for 24 h and slowly released Losartan potassium during the 10 h period. It is concluded that Losartan potassium could be targeted to the stomach and be released slowly over some time.

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