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Formulation and development of edible oil entrapped floating alginate beads of metoclopramide hydrochloride

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ABSTRACT

Metoclopramide hydrochloride (MCP) is commonly used for the management of gastrointestinal disorders. Frequent administration and the undesired side effects (extra pyramidal symptoms)of the drug on the central nervous system due to the fluctuations of its plasma concentrations may lead to patient incompliance, and hence, improper therapy. Therefore, the present work devoted to formulate the drug in sustained release formulations. MCP was incorporated in 12 formulae containing different polymers and/or different polymer ratios. The polymers were HPMC K4M, Sodium alginate, Pectin were added in different amounts. Emulsion gelation method was used to prepare floating alginate beads. Applying various drug release models on the dissolution profiles of all formulations it was proposed that the release behaviour of most formulations governed by Non-Fickian Diffusion Law. In extension to these studies floating lag time, floating time, micromeritic properties, % drug content, %drug entrapment efficiency, swelling index and % weight loss were performed. In vitro release studies were conducted in simulated gastric fluid and cumulative amount of drug release was analyzed by spectrophotometry. From designed set of experiments, it was evident that formulation containing 2% of HPMC K4M sustain the release of drug for longer duration. The floating alginate beads exhibited the expected, drug content, floating lag time, floating time, drug content, drug entrapment efficiency, % weight loss, % swelling index and sustained drug release.From all these studies formulation F8 was confirmed as optimized formulation.

Keywords: Metoclopramide hydrochloride, Gastroretentive floating drug delivery system, Emulsion gelation method, sustained release floating alginate beads.

INTRODUCTION

Drug that is released from a dosage form in a controlled manner in the stomach will empty together with fluids and will have the whole surface area of the small intestine available for absorption [1]. These lead to the development of oral controlled gastroretentive dosage forms possessing gastric retention capabilities [2]. Therefore, Gastroretentive dosage forms i.e. those designed to exhibit a prolonged gastric residence time (GRT), have been potential for controlled drug delivery [3]. Gastroretentive systems can remain in the gastric region for several hours and hence significantly prolong the gastric residence time of drugs [4]. Advantages of gastroretention system are; drugs which are unstable in intestinal fluids, sustain the delivery of drug, maintaining the systemic drug concentration within the therapeutic window, reduced dosing frequency, improved bioavailability of the drug, delivery of drugs with narrow absorption window in the small l intestine, in the treatment of peptic ulcer disease, local action in the stomach and the site specific drug delivery is possible[5] .The patient always wants to minimize the frequency of dosing without compromising the therapeutic benefits[6]. Use of sustained release dosage forms can fulfill this requirement [7]. Metoclopramide hydrochloride is antiemetic and gastro kinetic drug, it is well absorbed undergoes a first pass metabolism which may reduce the systemic bioavailability up to 30%. It needs 3-4 times daily dosing which may leads to non – compliance [8]. We can overcome the problems by formulating as floating alginate beads, a

multiparticulate drug delivery system [9]. It has less dose dumping property. Floating beads having a sustained release composition and formulation of capable of providing drug release over 12 hrs [10].

MATERIALS AND METHODS

Materials

Gift sample of Metoclopramide hydrochloride was obtained from IPCA Laboratories Pvt. Ltd., Mumbai; Sodium alginate, Calcium chloride and HPMC K4M were obtained from Research Lab Fine Chem Industries. Pectin was obtained from LOBA Chemie, Mumbai. And alll other ingredients used were of analytical grade.

Method

Metoclopramide hydrochloride floating alginate beads were prepared using emulsion-gelation method. Metoclopramide hydrochloride, sodium alginate, pectin and HPMC K4M were dissolved in water with stirring. Soybean oil was added to polymer solution. The homogenized mixture was added drop wise into calcium chloride solution with gentle agitation at room temperature. The formed beads were allowed to stand for 30 min. in the solution for curing, then separated by filtration and dried at room temperature.

Process variables and process optimization

To study the contribution of formulation variables on the release profile of metoclopramide hydrochloride alginate beads, the different batches were produced and analyzed for size, shape, drug content, % drug entrapment efficiency, floating lag time, floating time and drug release. The formulation parameters studied were concentration of pectin, concentration of HPMC K4M, % drug entrapment efficiency, drug content, floating lag time and floating time. Three factors were evaluated at low levels and experimental trials were performing at all possible levels and 9 formulations were prepared as shown in Table No.1. Actual physical values of coded variables are given in Table No.2.

Table No.1:Variable in optimization study

Variable	Factor
Independent	
X1	Pectin
X2	HPMC K 4 M
Dependant	
Y1	Invitro drug release
Y2	Floating lag time

Table No.2: Combinations of two independent factors having three levels

Batches	Independent Variables		Actual Values	
	X_1	X_2	X_1(%)	X_2(%)
F1	-1	-	2	-
F2	0	-	3	-
F3	1	-	4	-
F4	-	-1	-	1
F5	-	0	-	2
F6	-	1	-	3
F7	-1	-1	2	1
F8	0	0	3	2
F9	1	1	4	3

Table No.3. Formulation as per factorial design

Formulation code → / Ingredients (%) ↓	F1	F2	F3	F4	F5	F6	F7	F8	F9
Drug (mg)	30	30	30	30	30	30	30	30	30
Sodium alginate (%)	5	5	5	5	5	5	5	5	5
Pectin (%)	2	3	4	-	-	-	2	3	4
HPMC K4M (%)	-	-	-	1	2	3	1	2	3
Soybean Oil(%)	20	20	20	20	20	20	20	20	20
Water (ml)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5

EVALUATION AND CHARACTRIZATION OF BEADS

Physical appearance

All the prepared floating bead formulations of Metoclopramide hydrochloride were checked for their size, shape and colour[11].

Micromeritic properties

The prepared floating bead formulations of Metoclopramide hydrochloride were checked for Bulk density, Tapped density, Angle of Repose, Carr's Index and Hausner ratio [12].

$$\text{Bulk density} = \frac{\text{Mass of Beads}}{\text{Volume of Beads}}$$

$$\text{Tapped density} = \frac{\text{Mass of Beads}}{\text{Tapped bulk of Beads}}$$

$$\text{Carr's Index} = \frac{\text{Tapped bulk densiy} - \text{Untapped bulk density}}{\text{Tapped bulk density}} \text{ X } 100$$

$$\text{Hausner ratio} = \frac{\text{Tapped bulk densiy}}{\text{Untapped bulk density}}$$

$$\text{Angle of Repose (tan } \emptyset \text{)} = \frac{h}{r}$$

Percentage yield

Formulations of Metoclopramide hydrochloride were checked for their percentage yield [13].

$$\text{Percentage yield} = \frac{\text{Total mass of beads}}{\text{Total mass of raw materials}} \text{ X } 100$$

Determination of drug content and drug entrapment efficiency

The floating bead was dissolved in 0.1N Hydrochloric acid under sonication and then filtered. The drug content was analyzed by following using UV-spectrophotometer (V-630, Shimadzu Co Ltd., Japan) at 272 nm after suitable dilution with 0.1N Hydrochloric acid. The percent drug content was determined using formula [14,15]:

$$\text{Percent drug content} = \frac{\text{Actual drug content}}{\text{Total drug amount taken}} \text{ X } 100$$

$$\text{\% Drug entrapment efficiency} = \frac{\text{Actual drug content}}{\text{Theoretical drug content}} \text{ X } 100$$

Floating lag time and Floating time

The bead samples (n=20) were placed in a beaker filled with 50 ml of 0.1 N HCl (pH 1.2) solution. Temperature was maintained at 37^0C. The floating time of beads was observed for 20 hrs. The preparation was considered to have buoyancy in the test solution only when all the beads floated in it. The time the formulation took to emerge on the medium surface (floating lag time) and the time the formulation constantly floated on the dissolution medium surface (floating time) were noted [16].

Swelling studies

Beads were studied for swelling characteristics only those batches were selected which have good drug content and entrapment efficiency more than 50%. Samples from drug loaded beads were taken, weighed and placed in wire basket of USP dissolution apparatus II. The basket containing beads was put in a beaker containing 100 ml of 0.1 N HCl (pH 1.2) at 37^0C. The beads were periodically removed at predetermined intervals and weighed. Then the swelling ratio was calculated as per the following formula [17]:

$$\text{\% Swelling ratio} = \frac{\text{Weight of swollen beads} - \text{Weight of dried beads}}{\text{Weight of swollen beads}} \text{ X } 100$$

Particle size determination
The particle size of beads was determined by the dry state using the optical microscopy method [18].

Weight loss
The weight loss of the beads was determined by following formula [18]:

$$\% \text{ Weight loss} = \frac{\text{Weight of undried beads} - \text{Weight of dried beads}}{\text{Weight of undried beads}} \text{ X } 100$$

Surface characterization
Surface characterization of beads was examined with a Scanning Electron Microscopy (SEM Diya Laboratory Mumbai). Beads were mounted on metal grids using double-sided tape and coated with gold under vacuum [19].

***In vitro* drug release study**
The release of Metoclopramide hydrochloride from sustained release floating alginate beads was determined using USP dissolution apparatus II a t 50 rpm. The dissolution medium used 900 ml of 0.1 N Hydrochloric acid (pH 1.2) and temperature was maintained at 37^0 C. A sample (1 ml) of solution was withdrawn from the dissolution apparatus at 0 min., 1hr, 2hr, 3hr, 4hr, 5hr, 6hr, 7hr, 8hr, 9hr, 10hr, 11hr, 12hr of dissolution. The samples were filtered through Whatman filter paper and analyzed using UV-Visible Spectroscopy. Cumulative % drug release was observed and recorded [19].

BEST FIT KINETIC MODEL FOR OPTIMIZED FORMULATION
The data obtained from study of diffusion kinetics of the optimized formulation was studied to obtain the best fit model. The best fitted model is the one which gives the highest R^2 value and least slope value [20].

RESULT AND DISCUSSION

Appearance
The developed formulation dissolves all the pre-requisite to become an floating alginate bead system and floated instantaneously at the pH condition of the stomach.

Fig.1:Floating alginate bead formulation

Percentage yield
The percentage yield of the floating beads of Metoclopramide hydrochloride was measured.

Table No. 4: Percentage yield of the formulation

Sr.No.	Batch	Percentage yield (%)
1	F1	19.90%
2	F2	22.69%
3	F3	23.28%
4	F4	23.38%
5	F5	22.63%
6	F6	23.00%
7	F7	23.60%
8	F8	26.79%
9	F9	27.60%

The percentage yield of all formulation (F1-F8) has shown in Table No. 4 range 19.90-27.60%.

Micromeritic properties

The micromeritic properties (Bulk density, Tapped density, Angle of repose, Carr's index and Hausner ratio) of different floating beads formulation were measured.

Table No. 5:Micromeritic properties of alginate bead formulations(F1-F9)

Sr.No.	Bulk density	Tapped density (gm/ml)	Angle of	Carr's Index	Hausner Ratio
1.	0.0816	0.0832	15.94	1.92	1.0196
2.	0.0966	0.0984	16.85	1.82	1.0186
3.	0.0988	0.1007	16.16	1.88	1.0192
4.	0.0809	0.0825	14.75	1.93	1.0197
5.	0.0909	0.0928	15.12	2.04	1.0299
6.	0.1017	0.1037	14.03	1.92	1.0196
7.	0.1005	0.1024	18.43	1.85	1.0189
8.	0.1037	0.1057	18.92	1.89	1.0192
9.	0.0985	0.1003	18.09	1.79	1.0182

TheaboveTable5showsBulk density in the range of 0.0809 – 0.1017 gm/ml, Tapped density in the range of 0.0825 – 0.1057 gm/ml, Angle of repose in the range of 14.03 – 18.92^0, Carr's index in the range of 1.79 – 2.04 and Hausner ratio in the range of 1.0182 – 1.0299 forallformulationsF1-F9.

Drug content and Drug entrapment efficiency

The floating beads were dissolved in 0.1N Hydrochloric acid under sonication and filtered. The drug content was analyzed using UV-Visible Spectrophotometer (V-630, Shimadzu Co Ltd., Japan) at 272 nm after suitable dilution with 0.1N Hydrochloric acid. Percent drug content and Percent drug entrapment efficiency was determined using formula;

$$\text{Percent drug content} = \frac{\text{Actual drug content}}{\text{Total drug amount taken}} \text{ X } 100$$

$$\text{\% Drug entrapment efficiency} = \frac{\text{Actual drug content}}{\text{Theoretical drug content}} \text{ X } 100$$

Table No. 6:Drug content of alginate bead formulation(n=3)

Sr.No.	Batch	Contents
1	F1	91.37±1.10
2	F2	90.08±0.96
3	F3	91.62±0.90
4	F4	88.35±0.98
5	F5	92.45±0.89
6	F6	93.10± 0.38
7	F7	96.54± 0.42
8	F8	97.51± 0.42
9	F9	99.67±0.38

The percentage drug content of all prepared formulations was found to be in the range of 88.35-99.67%. Therefore uniformity of content was maintained in all formulations.

Table No.7:Drug Entrapment Efficiency of the alginate bead formulation(n=3)

Sr.No.	Batch	% DEE
1	F1	91.30±0.0200
2	F2	90.40±0.0152
3	F3	91.53±0.0252
4	F4	92.86±0.0351
5	F5	94.83±0.0416
6	F6	98.49± 0.0450
7	F7	99.63± 0.0513
8	F8	99.96± 0.0458
9	F9	98.88±0.0472

The percentage drug entrapment efficiency of all prepared formulations was found to be in the range of 90.40-99.96%. Therefore entrapment efficiency was maintained in all formulations.

Floating lag time and floating time

The gel bead samples (n=20) were placed in a beaker filled with 50 ml of 0.1 N HCl (pH 1.2) solution. Temperature was maintained at 37^0C. The floating time of beads was observed for 20 hrs. The preparation was considered to have buoyancy in the test solution only when all the gel beads floated in it. The time the formulation took to emerge on the medium surface (floating lag time) and the time the formulation constantly floated on the dissolution medium surface (floating time) were noted.

Table No.8:Floating lag time and floating time of alginate bead formulation

Sr.No.	Batch	Floating Lag Time (min.)	Floating Time (hrs.)
1	F1	4:10	>12
2	F2	4:00	>12
3	F3	3:30	>12
4	F4	3:00	>12
5	F5	2:50	>12
6	F6	2:10	>12
7	F7	1:30	>12
8	F8	1:10	>12
9	F9	2:25	>12

The above Table No.8 shows floating lag time in the range of 1:10 - 4:10 min. and floating time > 12 hrs for all formulations F1-F9.

Swelling studies

Beads were studied for swelling characteristics. Only those batches were selected which have good drug content and entrapment efficiency more than 50%. Sample from drug loaded beads were taken, weighed and placed in wire basket of USP dissolution apparatus II. The basket containing beads was put in a beaker containing 100 ml of 0.1 N HCl (pH 1.2) maintained at 37^0C. The beads were periodically removed at predetermined intervals and weighed. Then the swelling ratio was calculated as per the following formula;

$$\% \text{ Swelling ratio} = \frac{\text{Weight of swollen beads} - \text{Weight of dried beads}}{\text{Weight of swollen beads}} \text{ X } 100$$

TableNo.9: Swelling Index of formulation

Sr.No.	Batch	Swelling Index (%)
1	F1	25.00%
2	F2	31.00%
3	F3	34.00%
4	F4	33.00%
5	F5	36.00%
6	F6	37.00%
7	F7	38.00%
8	F8	40.00%
9	F9	42.00%

For F1-F9 batches percent swelling ratio was found to be in the range of 25.00 - 42.00%.

Particle size determination

The particle size of beads was determined by the dry state using the optical microscopy method.

Table No.10:Particle size of formulation (n=3)

Sr.No.	Batch	Particle size (mm)
1	F1	1.38±0.010
2	F2	1.44±0.017
3	F3	1.49±0.015
4	F4	1.23±0.010
5	F5	1.45±0.015
6	F6	1.41± 0.007
7	F7	1.59± 0.026
8	F8	1.20± 0.027
9	F9	1.60±0.020

For F1-F9 batches particle size was found to be in the range of 1.20 – 1.60 mm.

Weight loss

The weight loss of the beads was determined by following formula;

$$\% \text{ Weight loss} = \frac{\text{Weight of undried beads} - \text{Weight of dried beads}}{\text{Weight of undried beads}} \text{ X } 100$$

Table No.11:Percent weight loss of formulation

Sr.No.	Batch	% Weight loss
1	F1	59.96%
2	F2	56.68%
3	F3	58.17%
4	F4	66.97%
5	F5	63.39%
6	F6	60.34%
7	F7	61.66%
8	F8	66.40%
9	F9	68.50%

The above Table 11 shows percent weight loss in the range of 56.68 – 68.50% for F1-F9 formulations.

Surface characterization

Surface characterization of beads were examined with a Scanning Electron Microscopy (SEM, Diya Laboratory Mumbai). Beads were mounted on metal grids using double-sided tape and coated with gold under vacuum.

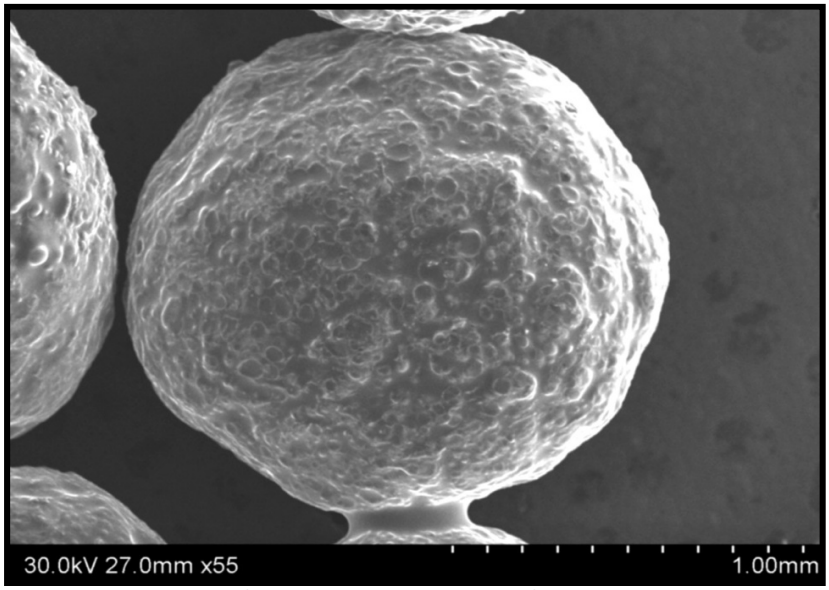

Fig. 2: Surface characterization by SEM of a alginate bead

The SEM result showed that the particle size of formulation was found to be 1.00 mm and beads have regular and spherical shape.

***In vitro* drug release study**

Table No.12: In vitro drug release study

Time (hrs.)	F1	F2	F3	F4	F5	F6	F7	F8	F9
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 hr	3.04 ± 0.0173	2.84 ± 0.0173	3.77 ± 0.0173	3.72 ± 0.0173	3.60 ± 0.0173	3.97 ± 0.0173	3.85 ± 0.02	3.25 ± 0.0007	3.97 ± 0.02
2 hr	5.71 ± 0.0100	7.9 ± 0.0100	7.73 ± 0.0100	8.14 ± 0.0212	7..43 ± 0.0100	8.35 ± 0.0100	8.22 ± 0.02	6.82 ± 0.0100	8.35 ± 0.02
3 hr	8.10 ± 0.0173	11.53± 0.0173	11.49± 0.0173	11.79± 0.0173	10.23± 0.0100	12.48± 0.0173	11.82± 0.02	11.14± 0.0007	12.48± 0.02
4 hr	12.42± 0.0100	14.74± 0.0100	14.24± 0.0100	15.38± 0.0212	11.93± 0.0173	16.88± 0.0173	15.33± 0.02	15.40± 0.0007	16.39± 0.02
5 hr	16.84± 0.0100	22.79± 0.0100	17.88± 0.0173	18.44± 0.0173	14.16± 0.0100	20.38± 0.0100	18.90± 0.02	23.13± 0.0100	19.89± 0.02
6 hr	25.72± 0.0173	31.62± 0.0173	25.06± 0.0100	21.05± 0.0212	23.96± 0.0173	24.01± 0.0173	27.94± 0.02	35.35± 0.0007	29.04± 0.02
7 hr	34.00± 0.0100	41.78± 0.0100	33.51± 0.0100	30.09± 0.0212	32.96± 0.0173	34.10± 0.0100	36.39± 0.02	44.63± 0.0100	38.88± 0.02
8 hr	41.62± 0.0100	52.45± 0.0100	42.43± 0.0173	39.01± 0.0173	42.33± 0.0100	43.35± 0.0100	44.02± 0.02	54.77± 0.0007	47.97± 0.02
9 hr	50.03± 0.0173	62.31± 0.0173	52.52± 0.0173	48.42± 0.0212	51.23± 0.0173	53.27± 0.0173	52.92± 0.02	63.94± 0.0100	57.90± 0.02
10 hr	60.00± 0.0100	71.92± 0.0100	60.86± 0.0100	60.13± 0.0173	62.16± 0.0100	62.44± 0.0100	62.86± 0.02	73.66± 0.0007	66.65± 0.02
11 hr	70.10± 0.0173	80.68± 0.0173	70.56± 0.0173	71.08± 0.0212	73.03± 0.0173	73.37± 0.0173	72.72± 0.02	84.30± 0.0100	76.94± 0.02
12 hr	80.03± 0.0100	90.00± 0.0100	81.41± 0.0173	84.60± 0.0100	84.60± 0.0100	85.86± 0.0100	83.57± 0.02	94.83± 0.0100	87.24± 0.02

Maximum drug release shown b y F8 batch among all the formulations evaluated. The data also suggests that floating bead formulation is capable to produce linear drug release for longer period of time. Drug release profile of formulation F1 to F9 shown in Fig.3 Dissolution profile of formulation F1 to F9 signified an sustained drug release. Out of nine formulations maximum release after 12 hr was found for F8 formulation.

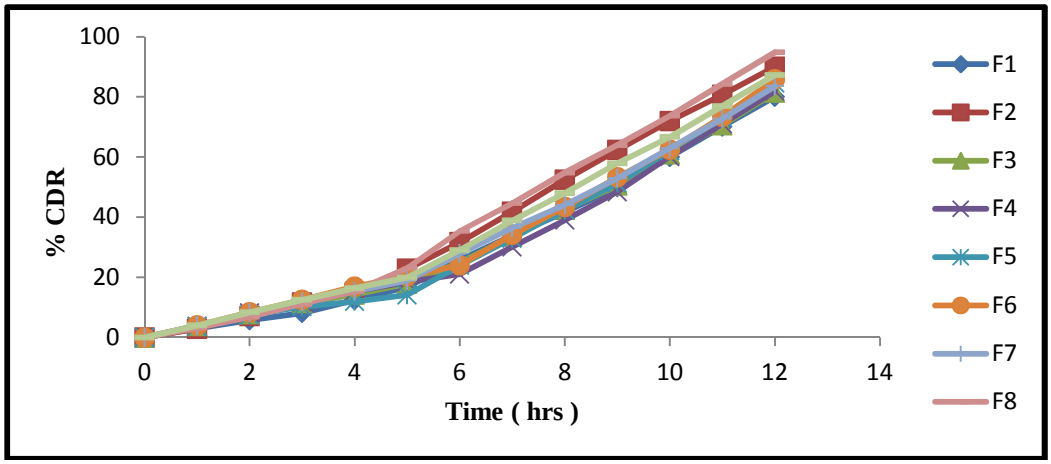

Fig.3:Drug release profile of all formulation F1-F9

DATAANALYSIS

In order to investigate the mode of release from floating beads data were analyzed with following mathematical model.

A. Zero-order kinetic

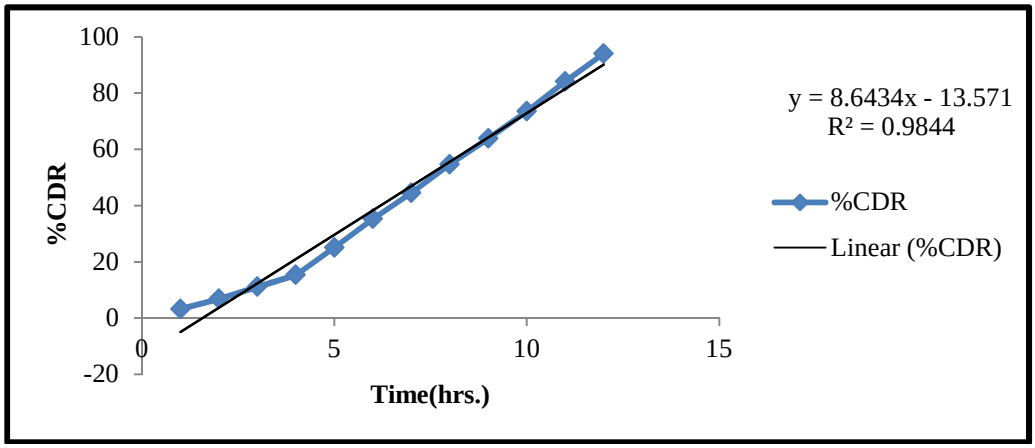

Fig.4: Zero order kinetic of formulation F8 batch

B. First-order kinetic

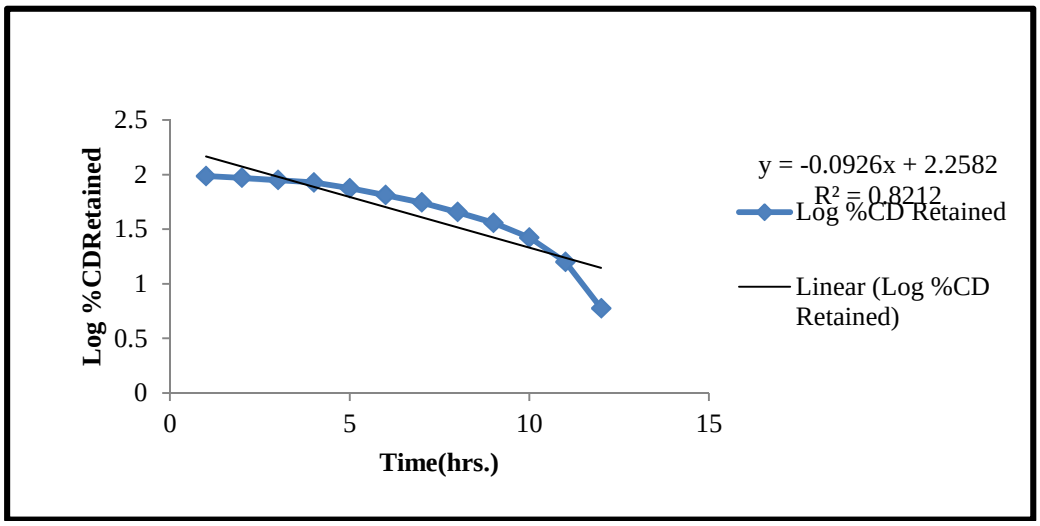

Fig.5:First order kinetic of formulation F8 batch

C. Higuchi equation

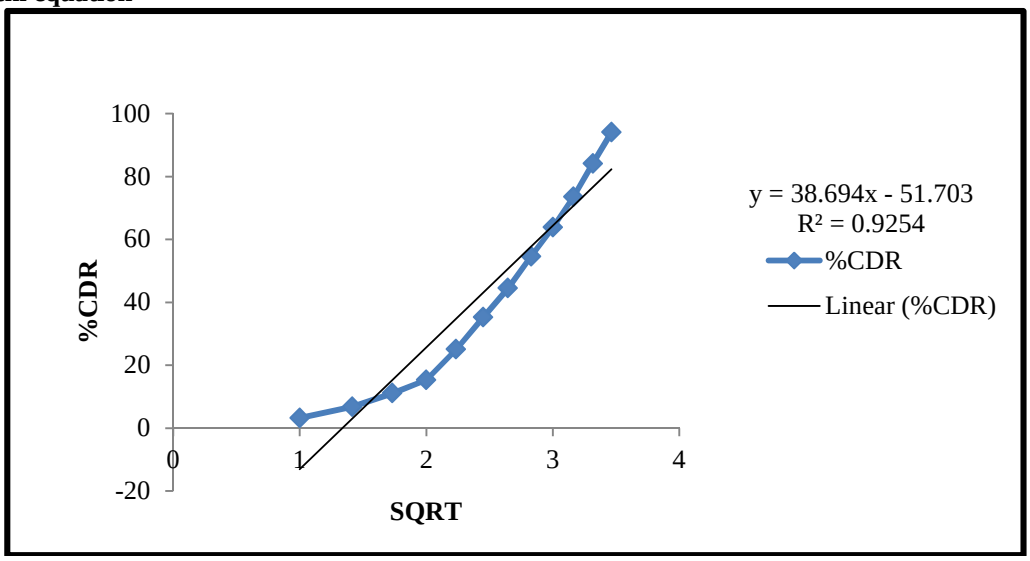

Fig.6:Higuchimodel of formulation F8 batch

D. Korsemeyer-peppas equation

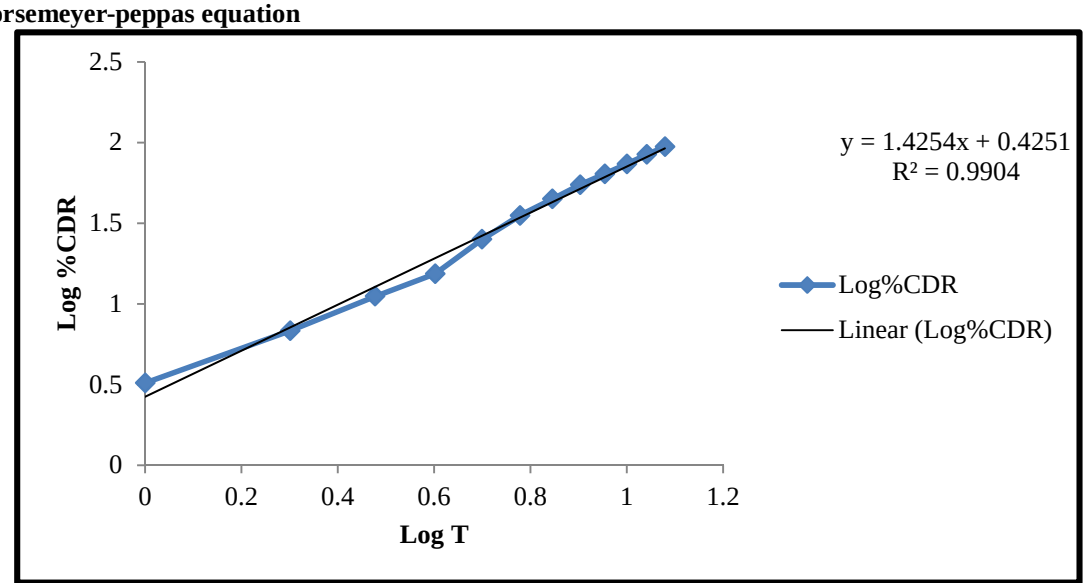

Fig. 7: Korsemeyer-peppas equation of formulation F8 batch

Table No.13: Drug release by using different models for F8 batch

Batch	Kineticmodels				
	Zeroorder	Firstorder	Highuchi	Korsemeyer-Peppas	
F8	R^2	R^2	R^2	R^2	n
	0.9843	0.8211	0.9254	0.9903	1.4253

The classical zero order release curve was found to be linear. The curves plotted according to first order and Higuchi model were also found to be linear. For the Korsemeyer-Peppas release curves R^2 was found to be ≥ 0.75 for all 9 formulations and n value was found to be ≥ 0.5 which indicates that all the formulations show anomalous (Non-Fickian release i.e. swell able matrix). The drug release occurs probably by diffusion and erosion and dissolution. From the above tables it is seen that the best fit model for formulation is Zero order kinetic, such type of model is applicable when sustained release dissolution mechanism are seen. The n value for all formulations is greater than 0.5 which indicated anomalous or non fickian diffusion.

DATA TREATEMENT

Drug release kinetic data of different formulation (F1-F9) are shown in Table No.14.

Table No.14:The drug release kinetics data of different formulation(F1-F9)

Formulation Code	Zeroorder	Firstorder	Higuchi	Korsemayer-peppas
	R^2	R^2	R^2	R^2
F1	0.9678	0.8726	0.8936	0.9770
F2	0.9810	0.8645	0.9195	0.9930
F3	0.9617	0.8589	0.8852	0.9767
F4	0.9410	0.8266	0.8568	0.9700
F5	0.9471	0.8294	0.8622	0.9531
F6	0.9569	0.8241	0.8797	0.9796
F7	0.9689	0.8595	0.8971	0.9818
F8	0.9843	0.8211	0.9254	0.9903
F9	0.9723	0.8543	0.9031	0.9829

COMPARISON OF OPTIMIZED FORMULATION WITH MARKETED FORMULATION

Comparative dissolution profile of optimized formulation with marketed non-floating immediate release formulation was evaluated.

Table No.15: Comparative dissolution profile of optimized formulation with marketed formulation

Marketed formulation		Optimized formulation	
Time (min)	%Drug release	Time (hrs)	% Drug release
5	3.25	1	3.17
10	6.82	2	6.25
15	11.14	3	10.50
20	15.40	4	14.67
25	23.13	5	23.59
30	35.35	6	33.00
35	44.63	7	44.71
40	54.77	8	55.66
45	63.94	9	66.54
50	73.66	10	76.90
55	84.30	11	86.73
60	94.83	12	96.85

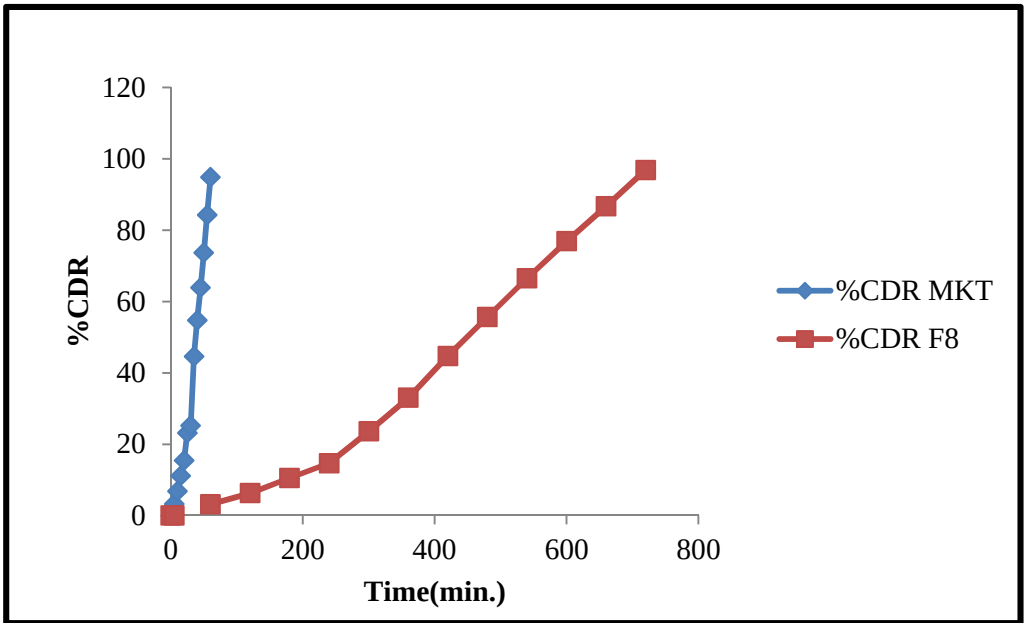

Fig.8:Comparative dissolution profile of marketed and formulated formulation

The newly developed floating formulation of novel floating technique was compared to that of available marketed conventional formulation. In market Metoclopramide hydrochloride is available as Tab. PERINORM (IPCA LABORATORIES LTD. Mumbai).Marketed tablet was available as 3-4 dosage regimes. All its content was released in 60 min. indicating longer and frequent dose administration. While Floating Drug Delivery System of Metoclopramide hydrochloride was able to sustain the release for 24 hrs with constant plasma level of drug.

CONCLUSION

Sodium alginate, Pectin, HPMC K4M and Soybean oil are selected for preparation of floating alginate beads. By preparing the floating alginate beads of Metoclopramide hydrochloride, the effect of different variables on floating alginate beads were studied. The prepared floating alginate beads were evaluated for % drug contents, floating lag time, floating time, swelling index and % drug release in 0.1N Hydrochloric acid. Optimization of formulation variables of Pectin and HPMC K4M were carried out. Two independent variables concentration of Pectin (X_1), concentration of HPMC K4M (X_2) while quantities of soybean oil and water were fixed. Floating alginate beads were prepared and different responses were measured for each trial. The results of dependent variables (responses) like floating % drug release after 12 hrs from nine experiments were used. The Floating alginate beads containing Metoclopramide hydrochloride were prepared. The effect of various process and formulation variables on Metoclopramide hydrochloride floating alginate bead was studied. Prepared Metoclopramide hydrochloride floating alginate beads evaluated for floating time, floating lag time, % drug contents, swelling index and % drug release after 12 hrs. The concentration of Pectin and HPMC K4M had significant impact on % drug release and floating lag time. However the drug release was greatly retarded at 2 %w/v concentration of HPMC K4M and floating lag time was decreased, while at concentrations of 1 %w/v and 3 % w/v of HPMC K4M floating

lag time was increased. As the concentration of Pectin increased from 2%w/v to 4%w/v floating lag time was also increased as compared to HPMC K4M 2 % w/v . % Drug release was found in range of 83.57 to 96.85 %. After evaluation parameters of floating alginate beads, optimized formulation (F8) was selected because of better floating lag time and sustained release of the drug. Optimized formulation (F8) was evaluated for stability study, floating lag time, floating time and % drug release. Hence, floating lag time of formulation was studied and it was found that as concentration of polymer increases the floating lag time also increases. The release rate and evaluation of prepared edible oil entrapped floating alginate beads were studied and found 64.83% drug release after 12 hrs.

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