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Formulation and Evaluation of Gastroretentive Floating Tablets of Sumatriptan Succinate

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A B S T R A C T

The purpose of present investigation was to develop and evaluate floating drug delivery system of an antimigraine drug (sumatriptan), the floating tablets of Sumatriptan were prepared by using HPMC K15M, HPMCE15LV, Carbopol 940 polymers. The precompression and post compression evaluation were performed as per pharmacopoeial standards. The tablets were prepared by direct compression method. Dissolution measurements were carried out in a (USP) dissolution testing apparatus II. Compatibility study was performed by FTIR. The compatibility study of the prepared Sumatriptan floating tablets confirms that there is no interaction between the drug and polymers used. The release data were subjected to different models in order to evaluate their release kinetics and mechanisms. The drug release kinetics was observed by Non-fickian diffusion mechanism. The floating lag time were found to be significantly increased with the increasing concentration of the polymers. After the dissolution study of prepared Sumatriptan floating tablet it was concluded that the formulation with HPMC E15 LV shows better sustained release effect. The release kinetic data implies that the release mechanism of all the formulations was Non-fickian. The developed floating tablets of Sumatriptan may be used to prolong drug release for at least 12h, thereby improving the bioavaibility and patient compliance.

Keywords: Sumatriptan, gastroretentive, floating drug delivery, sustained release.

A R T I C L E I N F O

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1. Introduction

Gastroretentive Drug Delivery System:

Floating drug delivery systems (FDDS) / hydrodynamically controlled systems are low-density systems that have sufficient buoyancy to float over the gastric contents and remain buoyant in the stomach without affecting the gastric emptying rate for a prolonged period of time [1].

Advantages of Floating Drug Delivery System [1]:

a. The principle of HBS can be used for any particular medicament or class of medicament.
b. The HBS formulations are not restricted to medicaments, which are principally absorbed from the stomach. Since it has been found that these are equally efficacious with medicaments which are absorbed from the intestine.
c. The HBS are advantageous for drugs absorbed through the stomach e.g. ferrous salts and for drugs meant for local action in the stomach and treatment of peptic ulcer disease.
d. The efficacy of the medicaments administered utilizing the sustained release principle of HBS has been found to be independent of the site of absorption of the particular medicaments.

Disadvantages of Floating Drug Delivery System [2]:

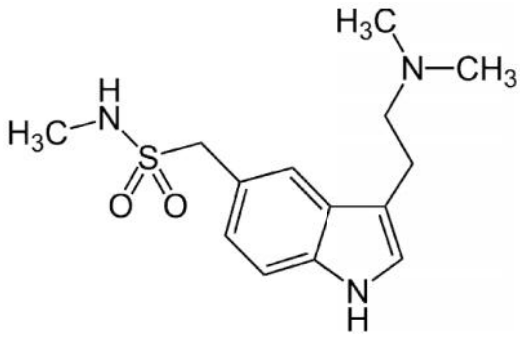
- They are not suitable candidates for drugs with stability or solubility problems in stomach.
- FDDS requires sufficiently high level of fluid in the stomach so that the system can float and thus sufficient amount of water (200-250 ml) of water to be taken together with FDDS Drugs having irritants effect on gastric mucosa are not suitable candidates for FDDS.

Drug Profile [3]:

Sumatriptan:

A serotonin agonist that acts selectively at 5HT1 receptors. It is used in the treatment of migraine disorders. A transdermal patch version of sumatriptan is currently in phase I trials in the U.S.

Structure:



IUPAC name: 1-{3-[2-(dimethylamino) ethyl]-1H-indol-5-yl}-N-methylmethanesulfonamide.
Half Life: 2.5 hours
Chemical Formula: $C_{14}H_{21}N_3O_2S$
MolecularWeight: 295.402 g/mol
Indication: For the treatment of migraine attacks with or without aura.

2. Materials and Methods

Preformulation studies:

It is one of the important prerequisites in development of any drug delivery system. Preformulation studies of the drug were performed, which included melting point determination, solubility and compatibility studies.

Pre-compression evaluation [4]:

Preparation of Sumatriptan floating tablets:

By direct compression method:

Sumatriptan floating was prepared by direct compression technique using drug and variable concentration of polymers (HPMC K4M, HPMC E 15LV, Carbopol940, Sodium Bicarbonate, MCC, Lactose, Mg-sterate, and Talc). The respective powders & optional additives (composition listed in table-5.3) were blended thoroughly with a mortar and pestle. The powder blended was then lubricated with Mg-stearate and purified talc and then compressed on a tablet punching machine.

Post-compression evaluation parameters for formulated tablets:

a. **The tests includes following**
b. Weight variation
c. Hardness
d. Friability
e. Thickness and diameter
f. Drug content
g. In-vitro buoyancy studies

Composition of Sumatriptan Floating Tablets

a. The methods includes,
b. Angle of Repose
c. Bulk Density
d. Tapped Density
e. Carr's compressibility index
f. Hausner ratio

Table 1: Composition of Sumatriptan floating tablet with FLT and TFT

Ingredients (mg)	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**
Drug	25	25	25	25	25	25
HPMCE 15				25	30	45
HPMC K15M	25	30	45			
Carbopol 940						
MCC	65	65	65	65	65	65
$NAHCO_3$	20	20	20	20	20	20
MG -STERATE	2	2	2	2	2	2
TALC	3	3	3	3	3	3
LACTOSE	60	55	40	60	55	40
TOTAL WEIGHT	200	200	200	200	200	200
FLT (Seconds)	93	108	136	42	68	86
TFT (h)	>12	>10	11	>12	>12	>12
Ingredients (mg)	**F7**	**F8**	**F9**	**F10**	**F11**	**F12**
Drug	25	25	25	25	25	25
HPMCE 15 LV	20	20	20			
HPMC K15M				20	20	20
Carbopol 940	10	15	20	10	15	20
MCC	65	65	65	65	65	65
$NAHCO_3$	20	20	20	20	20	20
MG -STERATE	2	2	2	2	2	2
TALC	3	3	3	3	3	3
LACTOSE	55	50	45	55	50	45
TOTAL WEIGHT	200	200	200	200	200	200
FLT (Seconds)	146	164	184	66	97	109
TFT (h)	>10	>11	12	>11	>12	12

3. Results and Discussion

Table 2: Absorbance data for the calibration curve of Sumatriptan in 0.1N HCL

S. No	**Concentration (µg/ml)**	**Absorbance**
1	0	0
2	2	0.08
3	4	0.134
4	6	0.202
5	8	0.272
6	10	0.340

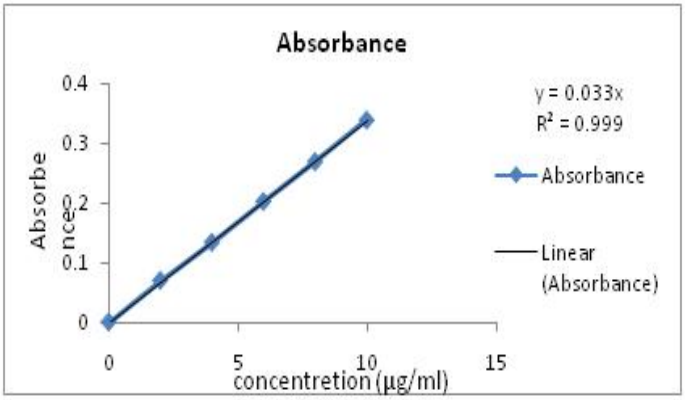


Figure 1: Standard calibration curve of Sumatriptan in 0.1N HCl

Pre-Compression Evaluation of Samaritan Floating Tablets

Table 3: Pre-compression parameters of Sumatriptan floating tablets

Formulation code	Angle of repose (θ) ±SD	Bulk density (gm/cm^3) ±SD	Tapped density (gm/cm^3) ±SD	Hausner ratio (HR)±SD	Carr index (Ic) ±SD
F1	22.46±0.726	0.221±0.010	0.261±0.010	1.180±0.010	15.398±0.596
F2	24.08±0.556	0.223±0.020	0.260±0.010	1.150±0.060	15.794±0.359
F3	22.49±0.471	0.232±0.016	0.270±0.026	1.190±0.010	16.018±0.640
F4	22.64±0.746	0.250±0.010	0.267±0.015	1.127±0.005	11.707±0.514
F5	23.68±0.312	0.232±0.011	0.300±0.010	1.198±0.009	16.678±0.560
F6	22.84±0.665	0.220±0.010	0.262±0.011	1.127±0.006	11.407±0.513
F7	22.26±0.825	0.210±0.010	0.262±0.010	1.180±0.010	15.397±0.593
F8	21.76±0.645	0.230±0.011	0.250±0.010	1.190±0.010	16.016±0.640
F9	21.68±0.346	0.221±0.005	0.281±0.012	1.204±0.004	17.657±0.734
F10	22.79±0.934	0.227±0.010	0.266±0.005	1.175±0.005	15.000±0329
F11	22.91±0.471	0.230±0.010	0.270±0.010	1.170±0.010	14.828±0.550
F12	22.89±0.520	0.225±0.011	0.260±0.010	1.165±0.030	15.399±0.594

All the values are expressed as mean ± SD. (n=3)

Post Compression Evaluation of Sumatriptan Floating Tablets

Table 4: Post-compression evaluation of Sumatriptan floating tablets

Formulation code	Weight variation Average wt in (mg)±SD	Hardness (Kg/cm^2) ±SD	Diameter in (mm) ±SD	Thickness in (mm) ±SD	Friability (%)±SD	Drug content uniformity (%)±SD
F1	199.58± 0.933	4.258± 0.208	9.32± 0.577	2.238± 0.058	0.756± 0.057	99.686±0.613
F2	200.4± 0.882	4.942± 0.115	9.31± 0.577	2.141± 0.067	0.584± 0.055	97.571±0.407
F3	196.6± 0.825	4.856± 0.115	9.64± 0.577	2.231± 0.055	0.757± 0.015	99.040±0.819
F4	200.05± 0.887	5.063± 0.155	9.00± 0.000	2.250± 0.000	0.670± 0.010	99.487±0.147
F5	200.3±0.833	4.800± 0.200	8.66± 0.577	2.271± 0.057	0.769± 0.011	98.590±0.391
F6	200.2± 0.951	4.942± 0.115	8.64± 0.577	2.119± 0.010	0.764± 0.090	97..350±0.306
F7	199.98± 0.887	4.864± 0.115	9.00± 0.000	2.235± 0.049	0.740± 0.060	98.741±0.228
F8	200.2± 0.833	4.464± 0.115	8.65± 0.577	2.874± 0.052	0.767± 0.011	98.148±0.503
F9	200.15± 0.812	4.734± 0.115	8.64± 0.577	2.886± 0.057	0.660± 0.010	98.435±0.119
F10	200.1± 0.852	4.942± 0.115	8.65± 0.577	2.254± 0.000	0.778± 0.017	97.421±0.355
F11	200.14± 0.812	4.643± 0.115	9.00± 0.000	2.200± 0.100	0.660± 0.010	95.514±0.130
F12	200.13± 0.745	4.800± 0.200	8.64± 0.577	2.350± 0.100	0.780± 0.010	96.162±0.678

All the values are expressed as mean ± SD. (n=3)

Different Drug Release Kinetics Model for Sumatriptan FloatingTablets

Table 5: Regression coefficients fit to different drug release kinetics models for Sumatriptan floating tablets.

Formulation code	Zero order	First order	Higuchi	Peppas
	r^2	r^2	r^2	r^2
F4	0.983	0.902	0.979	0.987

Pre-compression Evaluation parameters:

The angle of repose of the drug powder was in the range of 21.68 to 24.08, the Carr's index was found to be in the range of 11.40 to 17.65 indicating compressibility of the tablet. Haunser's ratio was found in the range of 1.12 to 1.20 is good.

Post-compression parameters:

Weight variation:

Prepared tablets were evaluated for weight variation and percentage deviations from the average weight were reported and was found to be within the prescribed official limits.

Friability:

The friability of the formulations as found to be between 0.58 to 0.78 is reported in table and as that of which was found to be within the official requirement (i.e. not more than 1%).

Tablet thickness and hardness:

The thickness of the tablet indicates that die fill was uniform. The thickness depends upon the size of the punch and the weight of the tablet (200 mg). The thickness of the batch from F1-F12 was found to be 2.11-2.87 mm and hardness was found to be 4.2-5.0 Kg/cm2 as reported in table which had good mechanical strength.

***In-vitro* dissolution studies:**

In-vitro dissolution studies were performed for all the batches of tablets containing Sumatriptan using USP XXIII dissolution test apparatus-II at 50rpm, 900ml of 0.1N HCl used as dissolution media. The In-vitro drug release data was given in tables 5.6 to 5.16 and drug release profiles are shown in fig 5.9 to 5.13. Formulations F1, F2 and F3 containing drug and HPMC K4M exhibited 80.403±0.241, 77.428±0.141 and 74.624±0.244 of drug release 12 hours respectively. Formulations F4, F5 and F6 containing drug polymer HPMC E15LV exhibited. 95.089±0.587, 91.633±0.858 and 88.685±0.423 of drug release in 12 hours respectively. Formulations F7, F8 and F9 containing drug and polymers like HPMC E15LV and Carbopol 940 exhibited 87.496±0.518, 81.248±0.348 and 78.474±0.387 of drug release in 12 hours respectively. Formulations F10, F11 and F12 containing drug and polymers like HPMC K15M and Carbopol 940 exhibited 91.634±0.758, 84.654±0.425 and 82.746 ±0.569 of drug release in 12 hours respectively.

Drug content uniformity:

The Percentage of drug content for F1 to F12 was found to 95.514±0.130 to 99.686±0.613 of Sumatriptan, it complies with official specifications.

Drug release kinetics:

F4 The in-vitro drug release data was subjected to analysis according to zero order, first order kinetic equations, Higuchi and Peppas models to ascertain the mechanism of drug release. The results of linear regression analysis of data including regression coefficient are summarized. When the regression coefficient 'r' value of zero order, first order, higuchi and peppas plots it was observed that 0.983 ,0.902,0.979,0.987.indicating drug release from formulation F4 were found to follow zero order kinetics and peppas.

4. Conclusion

From the compatibility studies, it is concluded that HPMC E15LV, HPMC K15M, Carbopol 940 were compatible with drug Sumatriptan and thus suitable for the formulation of Sumatriptan floating tablets. Optimized formula containing HPMC E15LV (F4) showed better release compare to other formulations and it followed zero order kinetics. The non-Fickian diffusion was confirmed as the drug release mechanism from this formulation. From this study, it was concluded that HPMC E15LV can be used in formulation of Sumatriptan sustained release gastro retentive floating drug delivery system. Overall, this study concludes that viscosity of the polymer is a major factor affecting the drug release and floating properties of FDDS.

5. References

1. Gopalakrishnan S. and Chenthilnathan A. Floating Drug Delivery Systems: A Review India. Journal of Pharmaceutical Science and Technology, **2011,** 3(2): 548-554.
2. Shahaa SH, Patelb JK, Pundarikakshudua K, Patelc NV. An overview of a gastro- retentive floating drug delivery system. Asian Journal of Pharmaceutical Sciences, **2009,** 4(1): 65-80.
3. http://www.drugbank.ca/drugs/DB01233
4. Lachman N, Liberman HA, The theory and practice of Industrial Pharmacy. 3rd Edition, Varghese Publishing House, Mumbai, **1987**: 66-88.