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Research Article

FORMULATION AND EVALUATION OF FLOATING TABLETS OF REPAGLINIDE USING HYDROPHILIC POLYMERS

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ABSTRACT

Repaglinide is an oral hypoglycemic agent used in the treatment of type II diabetes mellitus. In the present study, repaglinide was formulated into floating tablets by direct compression method. Tablets were prepared using different grades of hydroxypropyl methylcellulose (HPMC K4M, K15M and K100M), sodium alginate and Carbopol 934P either alone or in combination as release retardants, while sodium bicarbonate was used as a gas-generating agent. Preformulation studies including solubility, melting point and micromeritic evaluation were carried out. The prepared tablets were evaluated for physicochemical properties such as hardness, thickness, friability, weight variation, drug content and swelling behavior. The tablets showed acceptable properties with thickness ranging from 4.60–4.68 mm and hardness between 6.3–7.1 kg/cm². Sodium bicarbonate (14%) produced buoyancy lag time of less than one minute and total floating time of 26–34 hours. The optimized formulations showed sustained drug release up to 24 hours indicating that repaglinide floating tablets may serve as an effective gastroretentive drug delivery system.

Keywords: Repaglinide, Floating tablets, Gastroretentive drug delivery system, HPMC, Sodium alginate.

INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder characterized by persistent hyperglycemia resulting from defects in insulin secretion or insulin action (Alberti, 1999). It is one of the most common endocrine disorders worldwide and its incidence continues to increase rapidly, particularly in developing countries like India. Diabetes mellitus is classified mainly into type I diabetes mellitus, type II diabetes mellitus, gestational diabetes mellitus and diabetes associated with other conditions (American Diabetes Association, 2000). Among these, type II diabetes mellitus accounts for nearly 90% of all cases and is characterized by insulin resistance and impaired insulin secretion. Repaglinide is a meglitinide class oral hypoglycemic agent that lowers blood glucose levels by stimulating insulin release from pancreatic β-cells through inhibition of ATP-dependent potassium channels (Sweetman, 2002). Due to its short half-life and frequent dosing requirement, development of controlled release dosage forms is desirable. Gastroretentive drug delivery systems (GRDDS) have been developed to prolong gastric residence time and enhance drug absorption in the stomach and upper part of the small intestine (Nayak, 2010). Among these, floating drug delivery systems (FDDS) are widely used because they remain buoyant in gastric fluids and release the drug slowly for prolonged periods (Samyuktha, 2010). Floating systems are designed using hydrophilic polymers which swell in gastric fluid and maintain a density lower than gastric contents, allowing the dosage form to float (Fell, 1996). Hydrophilic polymers such as HPMC, Carbopol and sodium alginate are commonly used to achieve controlled drug release. Therefore, the present study was undertaken to formulate and evaluate floating tablets of repaglinide using hydrophilic polymers to improve gastric retention time and sustain drug release.

MATERIALS AND METHODS

Repaglinide was obtained from Sun Pharma, Mumbai. HPMC K4M, HPMC K15M and HPMC K100M were obtained from Colorcon Ltd., Goa. Sodium alginate, Carbopol 934P, magnesium stearate and talc were obtained from S.D. Fine Chemicals, Mumbai. Floating tablets were prepared by direct compression method using a rotary

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compression machine. Repaglinide was blended with polymers, diluents and sodium bicarbonate as gas generating agent. Magnesium stearate and talc were added as lubricants before compression. Preformulation studies included UV spectrophotometric determination of λmax, melting point determination, solubility studies and micromeritic evaluation. Prepared tablets were evaluated for hardness, thickness, friability, weight variation, drug content, swelling index, buoyancy lag time and in vitro drug release.

RESULTS AND DISCUSSION

Table 1. Micromeritic properties of precompressional powder blend of different repaglinide floating tablets.

Formulation Code	Angle of repose (θ)	Bulk density (g/cm^3)	Tapped density (g/cm^3)	Carr's compr. Index (%)	Hausner's ratio
Repaglinide	36.97 ± 0.23	0.22 ± 0.25	030 ± 0.14	27.36 ± 0.20	1.3 ± 0.02
F1	27.05 ± 0.45	0.46 ± 0.45	0.57 ± 0.18	19.06 ± 0.37	1.23 ± 0.05
F2	27.64 ± 0.34	0.51 ± 0.15	0.63 ± 0.16	18.51 ± 0.28	1.22 ± 0.02
F3	28.60 ± 0.26	0.48 ± 0.07	0.60 ± 0.06	19.56 ± 0.31	1.24 ± 0.03
F4	16.69 ± 0.33	0.69 ± 0.09	0.84 ± 0.13	17.80 ± 0.49	1.21 ± 0.08
F5	29.05 ± 0.29	0.35 ± 0.13	0.42 ± 0.08	16.70± 0.19	1.20 ± 0.02
F6	28.81 ± 0.25	0.47 ± 0.16	0.58 ± 0.31	19.14 ± 0.32	1.25 ± 0.06
F7	26.56 ± 0.15	0.48 ± 0.03	0.55 ± 0.18	20.03 ± 0.14	1.26 ± 0.04
F8	27.75 ± 0.33	0.52 ± 0.09	0.66 ± 0.04	21.11 ± 0.25	1.28 ± 0.07
F9	27.75 ± 0.21	0.32 ± 0.11	0.41 ± 0.02	21.95 ± 0.36	1.24 ± 0.02
F10	30.06 ± 0.36	0.48 ± 0.15	0.60 ± 0.05	19.93 ± 0.57	1.26 ± 0.04
F11	26.56± 0.26	0.55± 0.19	0.66 ± 0.06	16.66 ± 0.52	1.20± 0.05
F12	30.06 ± 0.38	0.35 ± 0.02	0.44 ± 0.12	20.80 ± 0.53	1.21 ± 0.08
F13	27.64±0.23	0.54±0.10	0.67±0.08	19.40± 0.13	1.24± 0.02
F14	29.74±0.31	0.32±0.14	0.40±0.12	19.36± 0.27	1.24± 0.04
F15	27.64±0.18	0.37 ±0.12	0.45 ±0.10	17.96± 0.22	1.21± 0.02

Table 2. Physico-chemical evaluation of repaglinide floating tablets.

Formulation Code	Thickness†(mm)	Hardnes + (kg/cm^2	Weight variation* (%)	Friability† (%)	Drug content+ (%)
F1	4.60 ± 0.02	6.3± 0.32	1.45± 0.37	0.25 ± 0.12	98.97 ± 0.86
F2	4.64 ± 0.04	6.5 ± 0.33	1.35± 0.19	0.30 ± 0.09	98.52 ± 0.67
F3	4.62 ± 0.01	6.6 ± 0.34	1.30± 0.16	0.28 ± 0.14	97.50 ± 0.81
F4	4.63 ± 0.03	6.8 ± 0.46	1.25± 0.75	0.34 ± 0.08	93.30 ± 0.66
F5	4.67 ± 0.04	6.4 ± 0.43	2.12± 0.16	0.42 ± 0.08	93.87 ± 0.84
F6	4.64 ± 0.03	6.7 ± 0.31	1.85± 0.49	0.52 ± 0.05	97.95 ± 0.72
F7	4.61 ± 0.02	6.9 ± 0.30	1.54± 0.27	0.58 ± 0.09	95.34 ± 0.42
F8	4.62 ± 0.01	7.1 ± 0.42	1.67± 0.74	0.50 ± 0.03	99.34 ± 0.65
F9	4.68 ± 0.06	6.6± 0.44	1.81± 0.12	0.41 ± 0.06	94.32 ± 0.92
F10	4.67 ± 0.02	6.9± 0.53	2.34± 0.16	0.38 ± 0.10	95.91 ± 0.55
F11	4.64 ± 0.06	6.8± 0.26	1.50± 0.45	0.30 ± 0.06	94.89 ± 0.61
F12	4.66 ± 0.02	6.5± 0.33	1.66± 0.54	0.29 ± 0.14	94.09 ± 0.93
F13	4.69±0.01	6.8±0.24	1.43±0.34	0.34±0.12	96.70±0.76
F14	4.67±0.03	6.7±0.35	1.56±0.21	0.44±0.06	93.07±0.48
F15	4.65±0.05	7.0±0.42	1.28±0.43	0.31±0.01	96.14±0.68

Table 3. *In-vitro* release of repaglinide from floating tablets in 0.1N HCl.

Cumulative release data (%) *								
	F6		F7		F8		F9	
Time (hrs)	Drug released (mg)	% drug released *	drug released (mg)	% drug released *	drug released (mg)	% drug released *	drug released (mg)	% drug released *
0	0	0	0	0	0	0	0	0
1	1.054	11.71	1.378	15.31	1.216	13.51	0.527	5.85
2	1.881	20.90	2.086	23.18	2.045	22.72	0.899	9.99
3	2.462	27.35	2.628	29.20	2.830	31.45	1.597	17.75
4	3.250	36.11	3.172	35.25	3.457	38.42	2.054	22.83
6	4.042	44.91	4.127	45.86	4.536	50.40	2.881	32.01
8	4.716	52.40	4.679	51.99	5.376	59.74	3.834	42.61
10	5.394	59.94	5.479	60.88	6.180	68.67	4.385	48.73
12	6.157	68.42	5.958	66.20	6.866	76.29	5.061	56.24
16	7.495	83.28	7.090	78.78	7.515	83.50	6.230	69.23
20	8.759	97.32	7.944	88.27	8.330	92.55	7.283	80.93
24	_	_	8.884	98.71	8.945	99.39	8.464	94.05

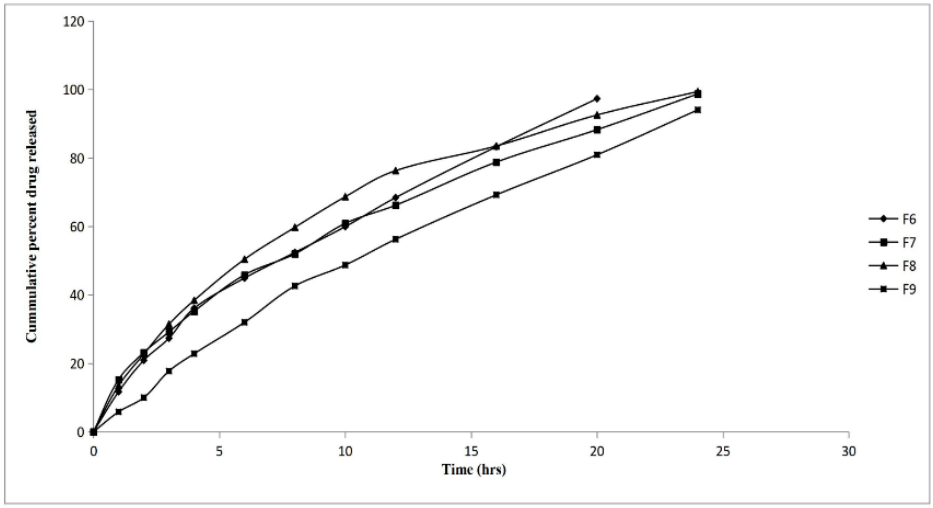

Figure 3. *In-vitro* release of repaglinide from floating tablets in 0.1N HCl.

Table 4. Kinetic analysis of release data from selected repaglinide floating tablets.

F7							F8			
Time (hr)	√ t	Log t	Cumulative drug released*		Cumulative drug retained		Cumulative drug released*		Cumulative drug retained	
			%	Log %	%	Log %	%	Log %	%	Log %
0	0	0	0	0	100	2	0	0	100	2
1	1	0.00	15.32	1.185	84.68	1.928	13.51	1.131	86.49	1.937
2	1.41	0.301	23.19	1.365	76.81	1.885	22.72	1.356	77.28	1.888
3	1.73	0.477	29.20	1.465	70.80	1.850	31.45	1.498	68.55	1.836
4	2	0.602	35.25	1.547	64.75	1.811	38.42	1.585	61.58	1.789
6	2.44	0.778	45.86	1.661	54.14	1.734	50.41	1.702	49.59	1.695
8	2.82	0.903	52.00	1.716	48.00	1.681	59.74	1.776	40.26	1.605
10	3.16	1.000	60.89	1.785	39.11	1.592	68.67	1.837	31.33	1.496
12	3.46	1.079	66.20	1.821	33.80	1.529	76.29	1.882	23.71	1.375
16	4	1.204	78.79	1.896	21.21	1.327	83.50	1.922	16.50	1.217

20	4.47	1.301	88.27	1.946	11.73	1.069	92.56	1.966	7.44	0.872
24	4.89	1.380	98.71	1.994	1.29	0.109	99.40	1.997	0.60	0.220

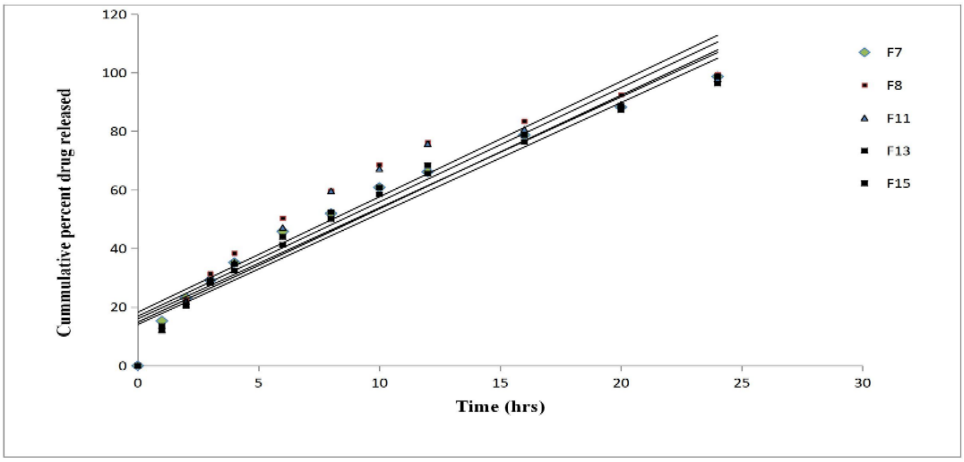

Figure 4. Zero order plots of selected floating tablets of repaglinide.

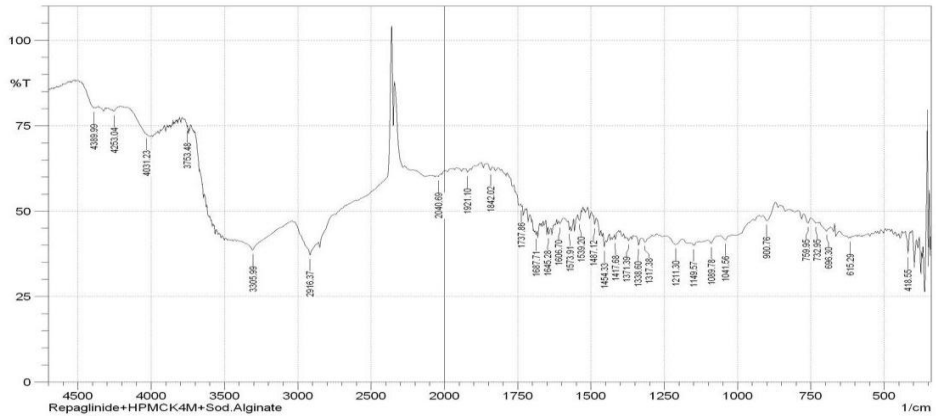

Figure 5. FT-IR spectra of formulation F8 (HPMC K4M + Sodium alginate).

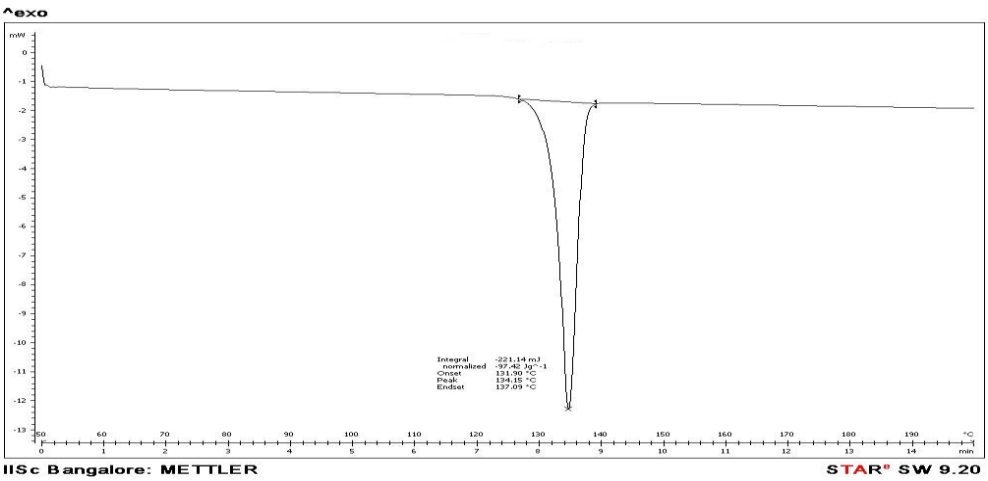

Figure 6. DSC thermogram of repaglinide pure drug.

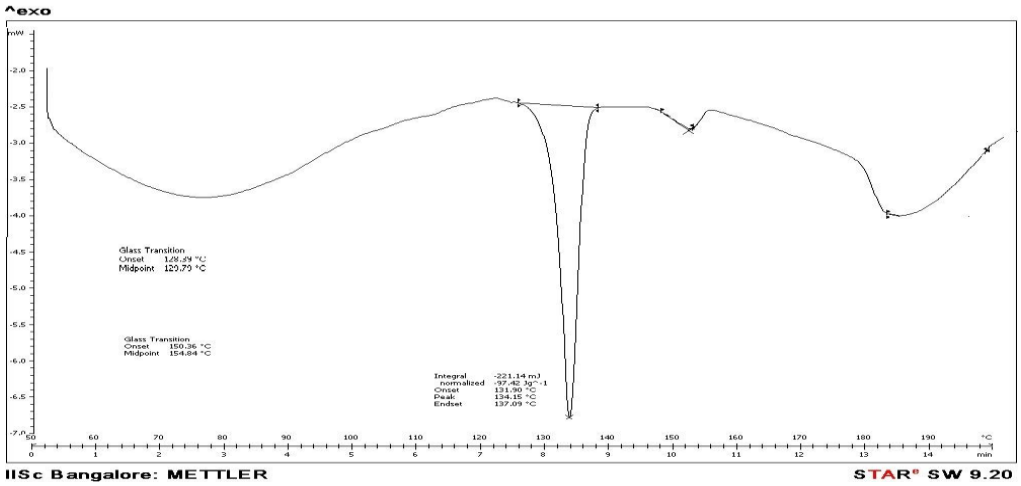

Figure 7. DSC thermogram of formulation F8 (HPMC K4M +Sodium alginate).

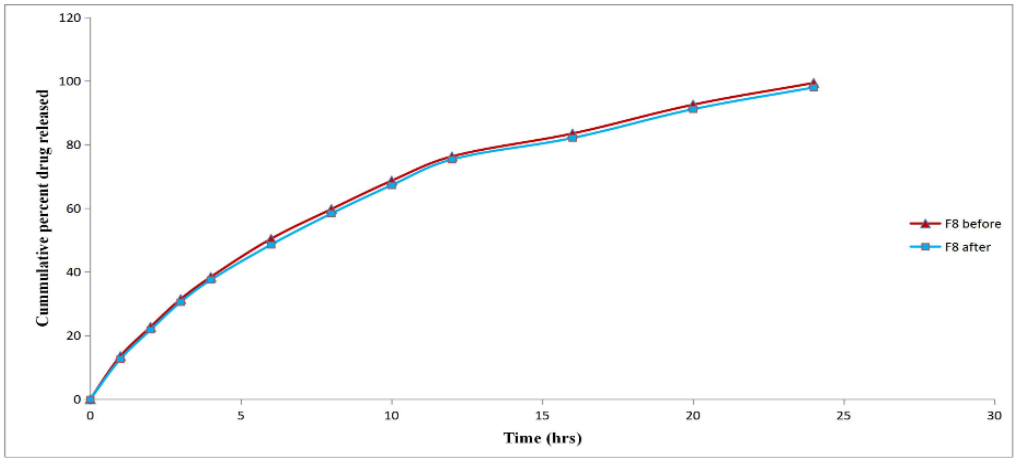

Figure 8. *In vitro* release profile of optimized repaglinide floating tablets in 0.1N HCl after stability studies.

Repaglinide showed maximum absorbance at 243 nm in 0.1 N HCl and the calibration curve exhibited good linearity. Preformulation studies confirmed that the melting point of repaglinide was 134°C which was within reported limits. Micromeritic properties indicated good flow characteristics of the powder blend suitable for direct compression. Prepared tablets showed acceptable physicochemical properties with hardness between 6.3 and 7.1 kg/cm² and drug content between 93% and 99%. Floating drug delivery systems prolong gastric residence time and enhance drug absorption in the upper part of the gastrointestinal tract (Ponchel G, 1998). Repaglinide, due to its short half-life and absorption in the stomach and upper intestine, is a suitable candidate for floating drug delivery systems. Hydrophilic polymers such as HPMC, sodium alginate and Carbopol swell in gastric fluid and form a gel layer around the tablet which controls drug diffusion and release (Jain, 2006). Sodium bicarbonate generates carbon dioxide in acidic medium which gets trapped within the hydrated polymer matrix and maintains tablet buoyancy.

CONCLUSION

Floating tablets of repaglinide were successfully prepared using hydrophilic polymers by direct compression method. The tablets exhibited satisfactory physicochemical properties and prolonged floating behavior. Optimized formulations showed sustained drug release up to 24 hours and may improve therapeutic effectiveness of repaglinide in the treatment of type II diabetes mellitus.

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CONFLICT OF INTERESTS

The authors declare no conflict of interest

ETHICS APPROVAL

Not applicable

FUNDING

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AI TOOL DECLARATION

The authors declares that no AI and related tools are used to write the scientific content of this manuscript.

DATA AVAILABILITY

Data will be available on request

REFERENCES

Alberti, K. G. M. M., & Zimmet, P. Z. (1998). Definition, diagnosis and classification of diabetes mellitus and its complications: Part 1. Diagnosis and classification of diabetes mellitus provisional report of a WHO consultation. *Diabetic Medicine,* 15(7), 539–553.

American Diabetes Association. (2000). Type 2 diabetes in children and adolescents. Diabetes Care, 23(3), 381–389.

Fell, J. T. (1996). Targeting of drugs and delivery systems to specific sites in the gastrointestinal tract. *Journal of Anatomy*, 189(Pt 3), 517–519.

Tamizharasi, S., Rathi, V., & Rathi, J. C. (2007). Preparation and evaluation of microspheres of repaglinide. International *Journal of Pharmaceutics*.

Jain, S. K., Agrawal, G. P., & Jain, N. K. (2006). Calcium silicate based floating microspheres of repaglinide: In vivo investigations. *Journal of Controlled Release*, 113(2), 111–116.

Nayak, A. K., Maji, R., & Das, B. (2010). Gastroretentive drug delivery systems: A review. *Asian Journal of Pharmaceutical and Clinical Research,* 3(1), 1–10.

Sajisha, N., Ravi, T. K., & Jayakar, B. (2009). Formulation and evaluation of microspheres for sustained drug release. Journal of Pharmaceutical Sciences.

Ponchel, G., & Irache, J. M. (1998). Specific and non-specific bioadhesive particulate systems for oral delivery to the gastrointestinal tract. *Advanced Drug Delivery Reviews*, 34(2–3), 191–219.

Samyuktha, R. B., Vedha, H. B., Reddy, B., & Punitha, S. (2010). The recent developments on gastric floating drug delivery systems. *International Journal of PharmTech Research*, 2(1), 15–25.

Sweetman, S. C. (Ed.). (2002). Martindale: The Complete Drug Reference (33rd ed.). London, England: Pharmaceutical Press.