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FORMULATION AND EVALUATION OF MIGLITOL CONTROLLED RELEASE TABLETS

Lakshmi. Prasanna Mortha*, Vivek Pavan Kumar Akula, Rahul Naidu Bandaru, Harsha Buragayala, Bapanna Dora Dammala and Vasu Geddam

Department of Pharmaceutics, VJ's College of Pharmacy, Diwancheruvu, Rajahmundry, Andhra Pradesh, India.

ABSTRACT

The idealized objective points to the two aspects most important to drug delivery, namely, spatial placement and temporal delivery of a drug. Spatial placement relates to targeting a drug to a specific organ of tissue, while temporal delivery refers to controlling the rate of drug delivery.

This study have been showed that Miglitol could be used in controlled release drug delivery system by formulating it has controlled drug delivery system, provides extend duration of action in therapeutic range without reaching toxic levels as in the case of conventional dosage forms. These dosage forms have the ability to reduce the dosing frequency.

By increasing the polymer, release rate of the drug decreases. Formulations F6 gave better release when compared to all formulations. By the results we can confirm that Zero-order of drug release first-order and the mechanism of drug release from extended release tablets is Higuchi model.

Keywords: Conventional Dosage Form, Dosing Frequency and Higuchi Model.

INTRODUCTION

Controlled Drug Delivery Systems

- Controlled drug delivery which delivers the drug at predetermined rate, for locally or systemically for a specific period of time
- Continuous oral delivery of drugs at predictable and reproducible kinetics for predetermined course throughout the GIT.

Potential advantages of sustained drug therapy

1. Avoid patient compliance problems.
2. Employ less total drug.
   A. Minimise or eliminate local side effects.
   B. Minimise or eliminate systemic side effects
   C. Obtain less potentiation or reduction in drug activity with chronic use.
   D. Minimise drug accumulation with chronic dosing.
3. Improve efficiency in treatment
   A. Cure of control condition more promptly
   B. Improve control of condition, i.e. reduce fluctuation in drug level.
   C. Improve bioavailability of some drugs
   D. Make use of special effects, e.g. sustained-release aspirin for relief of arthritis By dosing before bedtime
4. Economy

Matrix systems

A polymer and active agent have been mixed to form a homogeneous system referred to as a matrix system.[7]

To control the release of the drug, which are having different solubility properties hydrophobic, and hydrophilic matrices have been used.

For water-soluble drugs, the hydrophobic and hydrophilic polymeric matrices are mixed. The following physicochemical properties of the drug are influence the design of oral controlled drug matrix systems.

- Solubility
- Partition coefficient and molecules weight.
- Drug stability
- Protein binding.

Review literature

J. Ashtamkar et al.,[8] In the present study, Miglitol 25 mg controlled release matrices were prepared by direct compression and *in vitro* drug dissolution studies were performed to find out the drug release rate and patterns. Hydroxypropylmethyl cellulose, Hydroxypropylcellulose and Hydroxyethylcellulose were used as rate controlling polymers. Hydroxypropylmethyl cellulose was used as primary rate controlling polymer and effects of addition of Hydroxypropyl cellulose and Hydroxyethylcellulose on *in-vitro* drug dissolution were studied. Tablets were formulated using total polymer content as 30, 35 and 40 percent with 20 percent standard polymer content of Hydroxypropyl methylcellulose in all batches and varying the concentration of Hydroxypropyl cellulose and Hydroxyethyl cellulose in the range of 10, 15 and 20 percent. *In-vitro* drug release was carried out using USP Type II at 50 rpm in 900 ml of acidic dissolution medium (pH 1.2) for 2 hours, followed by 900 ml alkaline dissolution medium (pH 7.4) up to 12 hours. Several kinetic models were applied to the dissolution profiles to determine the drug release kinetics.

METHODOLOGY

Research design

The present research work is planned according to the following steps

- Literature Survey
- Selection of Drug, Excipients(Procurement of drugs and excipients)
- Drug Excipient studies
- Pre-formulation studies
  - Angle of repose
  - Bulk and tapped density
  - Hausner ratio
  - Compressible index etc.
- Manufacture of tablets
- Evaluation of tablets
  - Weight variation
  - Hardness
  - Friability
  - Disintegration time
  - Content uniformity
  - In-Vitro dissolution Studies
- Release kinetics

List of materials and suppliers

S.NO	INGREDIENTS	SUPPLIERS
1	Miglitol	Supplied By Pharma Train
2	Ethyl cellulose	SD Fine Chemicals, Mumbai
3	Sodium alginate	SD Fine Chemicals, Mumbai
4	Carbopol	SD Fine Chemicals, Mumbai
5	MCC	SD Fine Chemicals, Mumbai
6	Talc	SD Fine Chemicals, Mumbai
7	Magnesium stearate	SD Fine Chemicals, Mumbai

Formulation table

Ingredients	F1	F2	F3	F4	F5	F6	F7	F8	F9
Miglitol Hcl	25	25	**25**	25	25	25	25	25	25
Ethyl cellulose	25	50	**75**	-	-	-	-	-	-
Sodium alginate	-	-	**-**	25	50	75	-	-	-
Carbopol	-	-	**-**	-	-	-	25	50	75
MCC	94	69	44	94	69	44	94	69	44
Talc	3	3	3	3	3	3	3	3	3
Mg.stearate	3	3	3	3	3	3	3	3	3
Total Weight(mg)	150	150	150	150	150	150	150	150	150

List of equipments

S.NO	NAME OF THE EQUIPMENT	MODEL
1	Electronic weighing balance	Scale-tec
2	Friabilator	Roche FriabilatorElectrolab, Mumbai
3	Laboratory oven	Dtc-00r
4	Compression machine	Cmd(Cadmach)
5	Tablet hardness tester	Pfizer Hardness Tester, Mumbai
6	UV	LabindiaUv 3000+
7	Dissolution apparatus	Electrolab TDT-08L
8	Verniercalipers	Cd-6”Cs

RESULTS AND DISCUSSION

1. Construction of Standard calibration curve of Miglitol in 0.1N HCL

The absorbance of the solution was measured at 240nm, using UV spectrometer with 0.1N HCL as blank. The values are shown in table. A graph of absorbance Vs Concentration was plotted which indicated in compliance to Beer’s law in the concentration range 2 to 10 µg/ml.

Table for Standard Calibration graph values of Miglitolin 0.1N HCL

Concentration (µg/mL)	Absorbance
0	0
2	0.158
4	0.297
6	0.441
8	0.583
10	0.735

Standard plot of Miglitol plotted by taking absorbance on Y – axis and concentration (µg/ml) on X – axis, the plot is shown fig

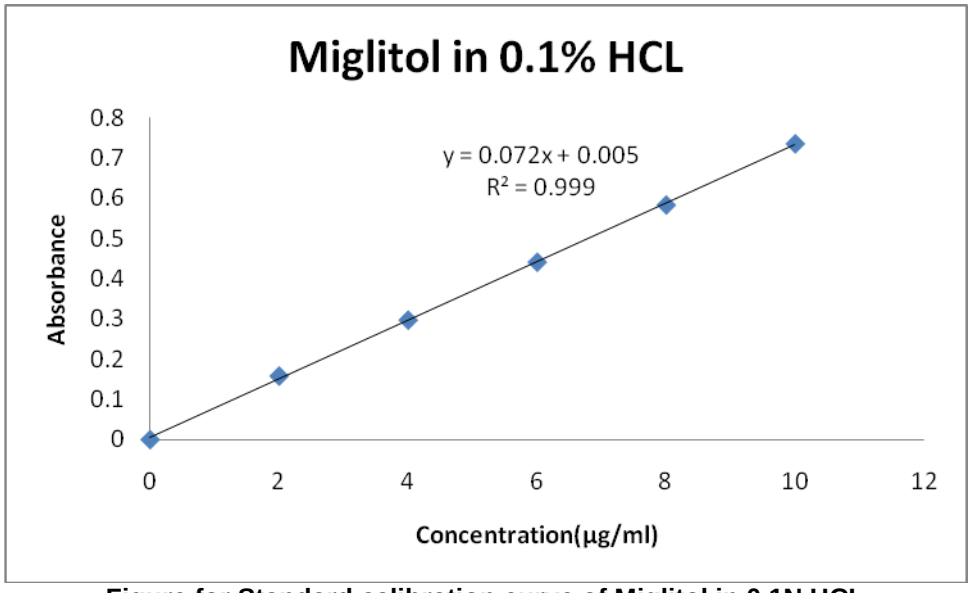

Figure for Standard calibration curve of Miglitol in 0.1N HCL

Inference
The standard calibration curve of Miglitol in 0.1N HCL showed good correlation with regression value of 0.999

2. Construction of Standard calibration curve of Miglitol in 6.8 phosphate buffer
The absorbance of the solution was measured at 240nm, using UV spectrometer with 6.8 phosphate buffer as blank. The values are shown in table. A graph of absorbance Vs Concentration was plotted which indicated in compliance to Beer's law in the concentration range 2 to 10 µg/ml.

Table for Standard Calibration graph values of Miglitol in 6.8 phosphate buffer

Concentration (µg/ml)	Absorbance
0	0
2	0.163
4	0.301
6	0.449
8	0.592
10	0.739

Standard plot of Miglitol plotted by taking absorbance on Y – axis and concentration (µg/ml) on X – axis, the plot is shown

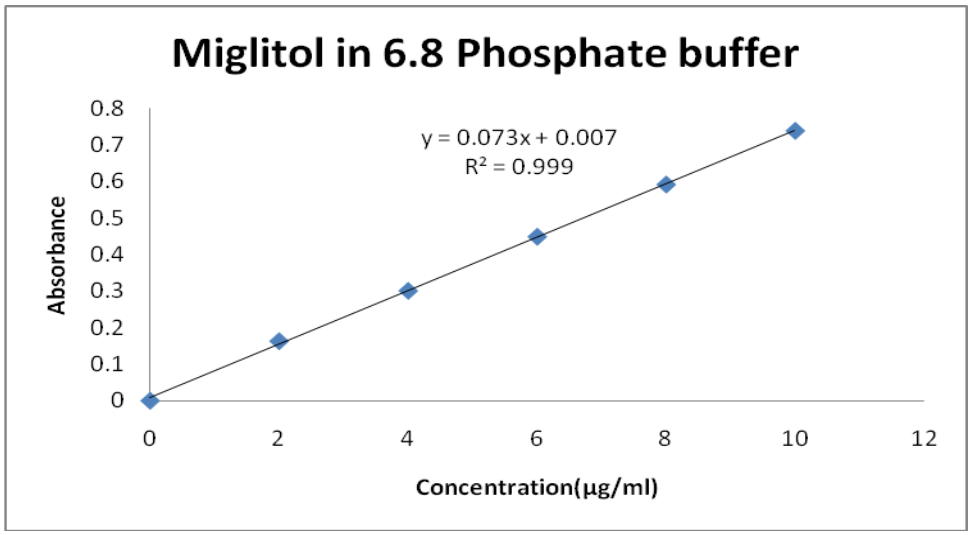

Figure for Standard calibration curve of Miglitol in 6.8 phosphate buffer

Inference
The standard calibration curve of Miglitol in 6.8 phosphate buffer showed good correlation with regression value of 0.999

Table for Pre compression studies of Miglitol CR tablets

Formulation Code	Pre compression studies*,*n=3				
	Angle of repose	Bulk density	Tapped density	Carr's Index	Hausner's Ratio
F1	22.17	0.515	0.522	13.15	1.10
F2	31.11	0.471	0.476	16.23	1.21
F3	25.71	0.505	0.527	14.26	1.15
F4	23.31	0.522	0.519	12.36	1.09
F5	31.11	0.471	0.476	16.23	1.21
F6	25.71	0.505	0.527	14.26	1.15
F7	23.31	0.522	0.519	12.36	1.09
F8	31.11	0.471	0.476	16.23	1.21
F9	31.11	0.471	0.476	16.23	1.21

Inference

- The Miglitol CR tablets were evaluated for their flow properties; the results for the blends of compression tablets were shown in Table.
- The Carr's index and Hausner's ratio were found to be in the range of ≤ 18 and 1.09 to 1.21 respectively, indicating good flow and compressibility of the blends.
- The angle of repose for all the formulations was found to be in the range of 22.17-31.11˚ which indicating passable flow.

Table for Post compression studies of Miglitol CR tablets

Formulation Code	Post compression studies				
	Weight variation	Thickness	Hardness	%Friability	%Drug content
F1	Pass	5.82	5.9	0.59	99.98
F2	Pass	5.91	6.2	0.68	100.21
F3	Pass	5.84	6.3	0.58	99.67
F4	Pass	5.88	5.9	0.59	100.32
F5	Pass	5.84	6.3	0.58	99.67
F6	Pass	5.91	6.2	0.68	100.21
F7	Pass	5.82	5.9	0.59	99.98
F8	Pass	5.91	6.2	0.68	100.21
F9	Pass	5.84	6.3	0.58	99.67

Inference

- The variation in weight was within the limit
- The thickness of tablets was found to be between 5.82-5.91 mm.
- The hardness for different formulations was found to be between 5.9 to 6.3kg/cm^2, indicating satisfactory mechanical strength
- The friability was < 1.0% W/W for all the formulations, which is an indication of good mechanical resistance of the tablet.
- The drug content was found to be within limits 98 to 102 %.

Table for In-vitro Dissolution results for Miglitol CR tablets

Time (Hrs)	F1	F2	F3	F4	F5	F6	F7	F8	F9
0	0	0	0	0	0	**0**	0	0	0
1	21	10	7	23	15	**3**	18	13	7
2	35	18	16	39	28	**8**	31	25	15
4	48	32	28	64	47	**13**	47	43	28
6	64	45	44	78	72	**21**	61	58	43
8	82	57	67	98	85	**36**	75	74	61
12	99	69	82		99	**52**	93	89	72
16		85	93			**71**	99	99	87
20		98	99			**87**			99
24						**99**			

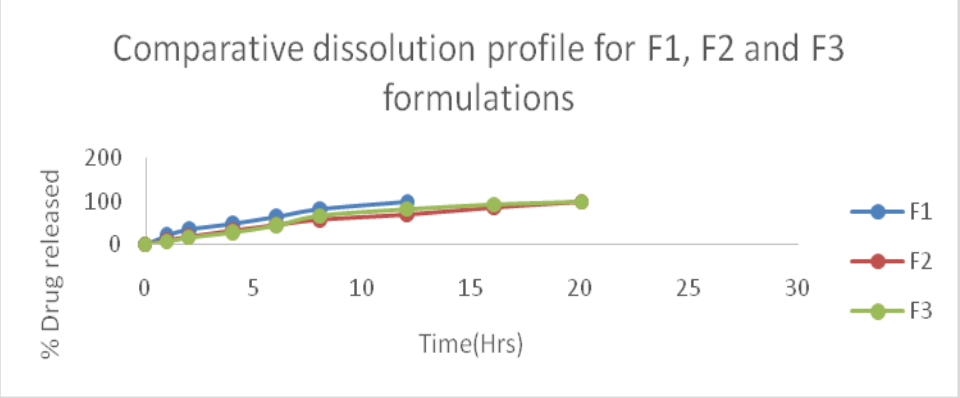

Figure for Comparative dissolution profile for F1, F2 and F3 Formulations

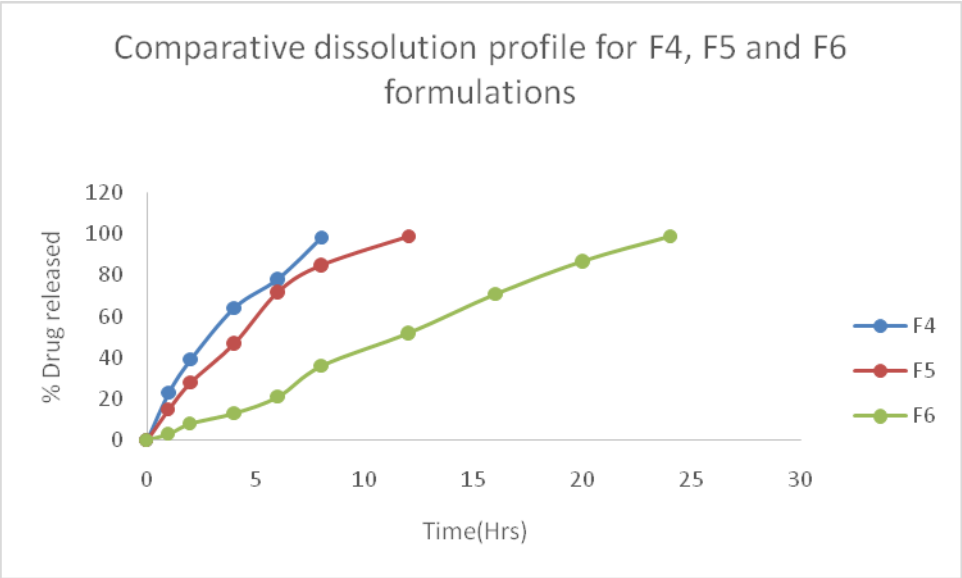

Figure for Comparative dissolution profile for F4, F5 and F6 formulations

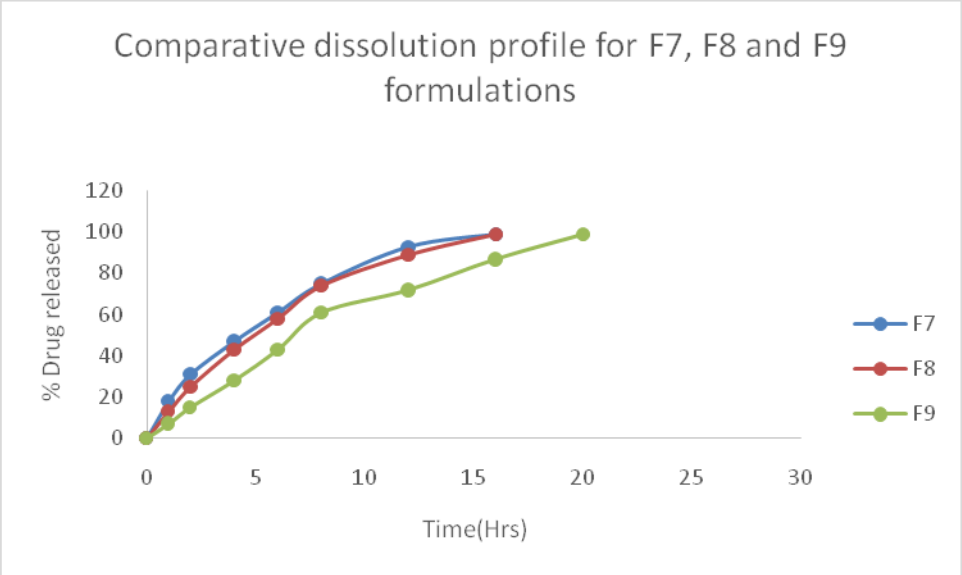

Figure for Comparative dissolution profile for F7, F8 and F9 formulations

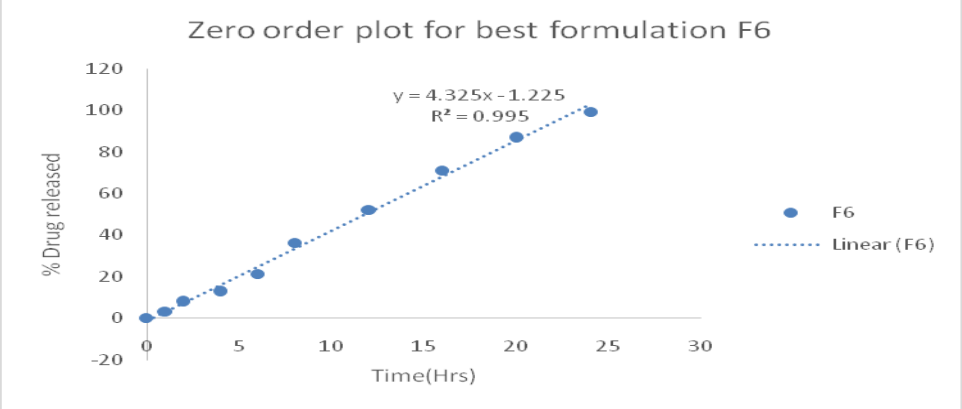

Figure for First order plot for best formulation F6

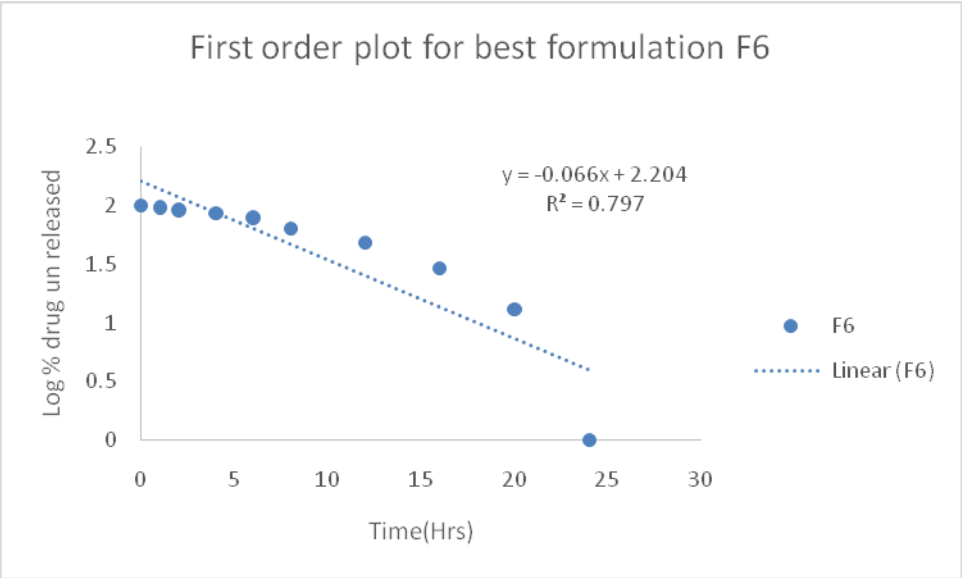

Figure for First order plot for best formulation F6

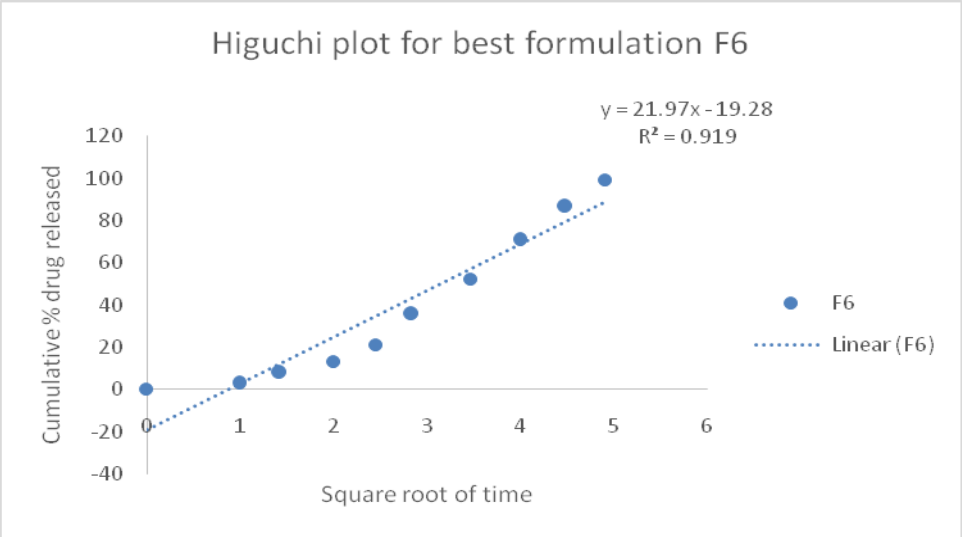

Figure for Higuchi plot for best formulation F6

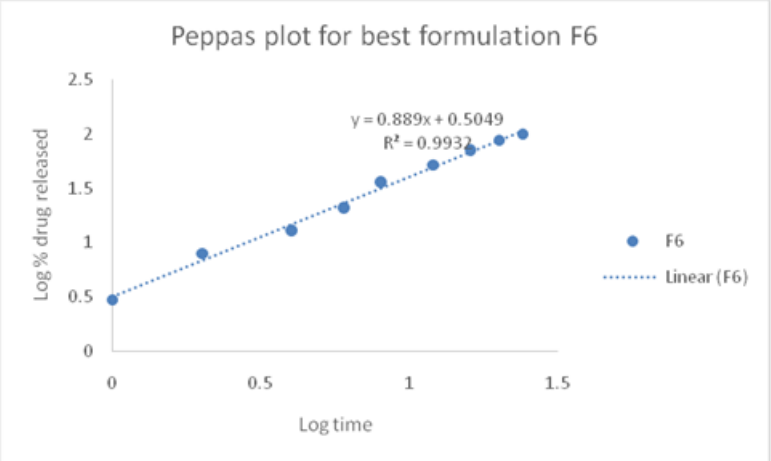

Figure for Peppas plot for best formulation F6

R^2 value and n result table

Formulation Code	R^2 Values				"N" Values
	Zero Order	First Order	Higuchi	Peppas	
F6	0.995	0.797	0.919	0.993	0.889

Inference

- Among the different control release polymers Sodium alginate was showing highest drug release retarding capacity
- F6 was showing the satisfactory results.
- For the F6 formulation diffusion exponent n value is in between 0.45 to 0.89 so they are following non fickian anomalous diffusion model.
- Higuchi plots for F6 formulation are having good correlation values so the drug is releasing diffusion mechanism.

CONCLUSION

The approach of the present study was to make a comparative evaluation among these polymers (Ethyl cellulose, Sodium alginate and Carbopol) and to assess the effect of physico-chemical nature of the active ingredients on the drug release profile.

- The angle of repose, Bulk density, Tapped density and Compressibility index results shown that the formulation is suitable for direct compression method.
- Formulated tablets showed satisfactory results for various Post compression evaluation parameters like: tablet thickness, hardness, weight variation, content uniformity and *in vitro* drug release.
- This study have been showed that Miglitol could be used in controlled release drug delivery system by formulating it has controlled drug delivery system, provides extend duration of action in therapeutic range without reaching toxic levels as in the case of conventional dosage forms. These dosage forms have the ability to reduce the dosing frequency.
- By increasing the polymer, release rate of the drug decreases.
- Formulations F6 gave better release when compared to all formulations.
- By the results we can confirm that or-xder of drug release first order and the mechanism of drug release from extended release tablets is Higuchi model.

REFERENCES

1. Chien Yie W. Novel Drug Delivery System, 2ndedn, revised and expanded". 182.
2. Robinson JR and Lee VHI (eds) (22Edition). New York Controlled Drug Delivery Fundamentals and Applications. 1987;09.
3. Brahmankar DM and Sunil B Jaiswal. Biopharmaceutics and Pharmacokinetics A Treatise. 335-350.
4. Robert E Nortari. Biopharmaceutics and pharmacokinetics An Introduction" 4th edn revised and expanded. 208.
5. Vyas SP and Roop
6. K Khar. Controlled Drug Delivery Concepts and Advances. 155-158.
7. Milo Gibaldi and Donald Perzier. Pharmacokinetics" 2nd edn, revised and expanded. 15;185.
8. Lisa Brannan-Peppas. Polymers in Controlled Drug Delivery. 1997.
9. Ashtamkar J, Nangude S and Chugh N. Formulation And Evaluation of Controlled Release Tablets of Miglitol Using Combination of Hydrophilic Polymers. International Journal of Pharmaceutical Sciences and Research. 2017;0.59 and Sjr. 2017;0.14.