WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 7.523
Volume 6, Issue 7, 1279-1297. Research Article ISSN 2277– 7105

FORMULATION AND EVALUATION OF ORAL FAST DISSOLVING FILM OF GLIPIZIDE

Thonte S.S.[1], Pentewar R.S.[2], Bhusnure O.G.*[3], Gholve S.B.[3], Gaikwad V.M.[2], Pujdekar Akash A.[3]

[1]Channabasweshwar Polytechnic College, Basweshwar Chowk, Kawa road, Latur.
[2]Channabasweshwar Pharmacy College, Dept of Pharmaceutics, Latur (MS), India.
[3]Channabasweshwar Pharmacy College, Dept of Quality Assurance, Latur (MS), India.

Article Received on
10 May 2017,
Revised on 31 May 2017,
Accepted on 21 June 2017
DOI: 10.20959/wjpr20177-8835

***Corresponding Author**
Bhusnure O.G.
Channabasweshwar Polytechnic College, Basweshwar Chowk, Kawa road, Latur.

ABSTRACT

Aim of the present study was to develop the Fast Dissolving Oral Films of Glipizide. It is second-generation sulfonylurea that can acutely lower the blood glucose level. Fast dissolving oral films deliver drug directly in the vascular system and bypasses the hepatic first pass metabolism so dose of the drug may also reduce significantly. Fast dissolving films were prepared using solvent casting method, hydrophilic polymers (HPMC K-15, HPMC E-15, HPMC K- 100) were selected as film forming agents and PEG-400 was used as plasticizer to give flexibility to the films. In FT-IR study no interaction was observed between drug and the excipients. Three blank films were selected for the incorporation of drug. After characterization the drug loaded films and studying their disintegration time & in-vitro drug release studies, among the formulations [F1 - F10] F3, F4, F6, F7 & F9 was selected the best formulation as its disintegration and dissolution time was less and it releases drug to a greater extent from 93% to more than 100% in ten minutes. Formulation F9 was selected best formulation as its disintegration and dissolution time was less and it released drug to a greater extent compared to other formulations. Therefore fast dissolving oral films can play an important role in oral drug delivery.Drug loaded films with both the polymers were stable under 40°C/75% RH conditions.

KEYWORDS: Orally disintegrating film, Glipizide, HPMC, Solvent casting method, Drug release.

INTRODUCTION

Recently Fast dissolving technology have been emerges out as a new drug delivery system that provides a very convenient means of taking medications and supplements.[2] Fast dissolving drug delivery systems were first developed in the late 1970s as an alternative to conventional dosage forms for pediatric and geriatric patients who experience difficulties in swallowing traditional oral solid-dosage forms. The buccal cavity is an attractive route of administration for Systemic drug delivery. Oral mucosa has a rich vascularization and offers higher permeability to many drugs. It has been well known that after buccal and sublingual administration drug solutes are rapidly absorbed in to the reticulated vein and are then drained into the systemic circulation.[3] The concept of Fast Dissolving Drug Delivery System emerged from the desire to provide patient with a conventional mean of taking their medication. Difficulty in swallowing (Dysphagia) is a common problem of all age groups, especially elderly and paediatrics, because of physiological changes associated with these groups of patients.[4]

Glipizide acts by partially blocking potassium channels among beta cells of pancreatic islets of langerhans. By blocking potassium channels, the cell depolarizes which results in the opening of voltage-gated calcium channels. The resulting calcium influx encourages insulin release from beta cells. Clinically, glipizide is a sulfonylurea antidiabetic drug. It is given orally in the treatment of type-2 diabetes mellitus and has the duration of action of up to 24 h. Glipizide is readily absorbed from the gastrointestinal tract with peak plasma concentrations occurring 1–3 h after a single dose. It is extensively bound to plasma proteins and has a half-life of about 2–4 h. It is metabolized mainly in the liver and excreted chiefly in the urine, largely as inactive metabolites.[5] Glipizide acts by partially blocking potassium channels among beta cells of pancreatic islets of langerhans. By blocking potassium channels, the cell depolarizes which results in the opening of voltage-gated calcium channels. The resulting calcium influx encourages insulin release from beta cells

Symptoms of severe hypoglycemia include extreme weakness, blurred vision, trouble speaking, tremors, stomach pain, confusion and seizure.

The fast dissolving drug delivery system is a new drug delivery technique to provide films have acquired great importance in the pharmaceutical industry due to their unique properties & advantages.[6,7] As the fast dissolving film utilizes sublingual route, rapid absorption of the drug is possible, which finally lead to quick onset of drug action. Difficulty in swallowing is

a common problem of all age group, especially elderly and pediatrics, because of physiological changes associated with these groups of patients. Solid dosage form that can be disintegrated, dissolved, or suspended by saliva in the mouth resulting easy swallowing can provide significant benefits to the pediatric and geriatric population, as well as other patients who prefer the convience of easily swallowable dosage form It shows patient compliance, rapid on-set of action; increased bioavailability and good stability make this film popular as a dosage form of choice.

Prepared film were subjected to different evaluation parameters like physical properties, disintegration time, content uniformity and dissolution studies.

MATERIALS AND METHODS

Table-2: Material used with their source

Sr no.	Material	property	Source
1	Glipizide	Pure drug	Supra Chemicals Pvt.Ltd, Mumbai.
2	HPMC K-15,HPMC E-15,HPMC K-100	Film former	Zim laboratories, Nagpur.
3	Tween -80 , SLS	Surfactant	Vamapharma, Nagpur.
4	Propylene glycol, PEG 400, Glycerine.	plasticizer	Loba chemical laboratory ltd, Mumbai.
5	Citric acid	Saliva stimulating agent	Loba chemical laboratory ltd, Mumbai.
Sr no.	Equipment	Model no.	Make
1	Oven rotek	Or-203	Labindia
2	Disintegration apparatus	Da-40	Electrolab
3	Uv-spectrophotometer	Uv-1800	Shimadzu japan
4	Digital balance	Bl-22oh	Shimadzu japan
5	Ph meter	Pico+	Labindia
6	Magnetic stirrer	Lms-28oe	Labtop
7	Screw gauge	Sg-001	Electrolab
8	Sonicator	3-5 l 100h	Pci analytics

Equipments used with their source

Table: 3 Equipments used with their source

Sr no.	Equipment	Model no.	Make
1	Oven rotek	Or-203	Labindia
2	Disintegration apparatus	Da-40	Electrolab
3	Uv-spectrophotometer	Uv-1800	Shimadzu japan
4	Digital balance	Bl-22oh	Shimadzu japan
5	Ph meter	Pico+	Labindia
6	Magnetic stirrer	Lms-28oe	Labtop
7	Screw gauge	Sg-001	Electrolab
8	Sonicator	3-5 l 100h	Pci analytics

preparation & Selection of Blank Film for Formulation

+ -Poor + +-Average + + +-Excellent

Table-4: Formulation Details of Blank fast dissolving film

Ingredients formulation	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
HPMC E-15(mg)	200	250	300	-	-	-	-	-	-	400
HPMC K-15(mg)	-	-	-	200	250	300	-	-	-	-
HPMC K-100(mg)	-	-	-	-	-	-	200	250	300	-
Propylene glycol (ml)	1	1	1	-	-	-	-	-	-	1
Glycerine(ml)	-	-	-	-	-	-	1	1	1	-
PEG-400(ml)	-	-	-	1	1	1	-	-	-	-
Tween-80(ml)	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s
Citric acid(mg)	50	50	50	50	50	50	50	50	50	50
Water	10	10	10	10	10	10	10	10	10	10
Ethanol	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s

Preparation of Fast Dissolving Film

Oral fast dissolving film of containing of Glipizide was prepared by the solvent casting method. The polymers (HPMC E-15,K-15,K-100) and plasticizers (polyethylene glycol, PEG-400, glycerin) was dissolved in about sufficient quantity of distilled water in separate beaker to prevent the excessive air bubbles formation. In the second beaker Glipizide was add and stirr both solution 30 min. Then two solutions mixed together and specified amount of other excipients such as saliva stimulating agent, sweetening agent, flouring agent etc. was added to that mixture as well as sufficient quantity of remaining water & stirred for 1 hour. After stirring kept for 30 min for sonication to remove all air bubbles from final solution. Then the final solution was casted on petri-dish and it was dried in the oven at 45ºC for 12 hr. The film was carefully removed from the Petridish, and cut according to the size required for single dose and testing (Dose: 2 x 2 cm).

Table: 5 Formulation Details of fast dissolving film with drug.

Ingredient(mg/ml)/Formulation	F_1	F_2	F_3	F_4	F_5
GLIPIZIDE(mg)	80	80	80	80	80
HPMC E 15(mg)	200	250	300	-	
HPMC K15(mg)	-		-	200	250
HPMC K 100(mg)	-	-		-	-
PROPYLENE GLYCOL(ml)	1	-	1	-	1
CITRIC ACID(mg)	50	50	50	50	50
PEG-400(ml)	-	1	-	1	-
ETHANOL	q.s	q.s	q.s	q.s	q.s
Water	q.s	q.s	q.s	q.s	q.s

Table: 6 Formulation Details of fast dissolving film with drug.

Ingredient (mg/ml)/Formulation	F6	F7	F8	F9	F10
GLIPIZIDE(mg)	80	80	80	80	80
HPMC E 15(mg)	-	-	-	-	-
HPMC K15(mg)	300	-	-	-	200
HPMC K 100(mg)	-	200	250	300	200
PROPYLENE GLYCOL(ml)	-	1	-	1	-
CITRIC ACID(mg)	50	50	50	50	50
PEG-400(ml)	1	-	1	-	1
ETHANOL	q.s	q.s	q.s	q.s	q.s
Water	q.s	q.s	q.s	q.s	q.s

EVALUATION PARAMETER OF FILMS

The prepared film was evaluated for following specifications.

Visual Inspection

Oral fast dissolving films were inspected manually for their transparency and air bubbles.

Weight

Oral fast dissolving film weighted on analytical balance.

Thickness

Film thickness was measured by using a micrometer screw gauge apparatus. A strip of 2 X 2cm was placed between the thickness rods and thickness was measured in five different positions.

Folding endurance

Folding endurance was measured by manually or practically for the prepared films. Take a 2X2cm films and folded repeatedly at the same place till it broke. The no times the film could be folded at the same place without breaking gave the exact valve of folding endurance.

pH

The PH was determined by dissolving a film in 1-2 ml of distilled water and then the PH of the obtained solution was measured by the PH meter.

Dissolution studies

The release rate of the Glipizide fast dissolving film was determined by the help of USP Dissolution Test Apparatus-II. The dissolution test was performed using 900ml Phosphate Buffer Solution PH 6.8, at 37 ±5ºC with 50 rpm of the paddle speed. Aliquot 5 ml of the

solution was collected from the dissolution apparatus at time interval of 1 min and at the same time add 5 ml or same amount of fresh dissolution medium. The Aliquot filtered through the whatman filter paper. The absorbance of the filtered solution was measured at 275nm. The aliquot should be withdrawn at the zone between the surface of the dissolution medium and the top of rotating paddle not less than 1 cm apart from the vessel wall. Cumulative percent drug release can be calculated by using the equation obtained from the standard curve or % drug release formula. (A = Con. Of Std. / Abs. of Std. X Abs. of sample X volume of dissolution apparatus X Dilution factor / 1000, B = A-Value/Label claim X 100).

RESULT AND DISCUSSION

UV Spectroscopy

The UV spectrum of Glipizide in Phosphate buffer solution PH 6.8 in the range of 400–200 nm. The spectrum indicated that the observed λmax of Glipizide was 275 nm which is matched with pharmacopoeial value.

Preparation of standard Calibration curve of Glipizide

Glipizide showed maximum absorption at wavelength 275nm in PBS PH 6.8. Standard curve was plotted by taking absorption of diluted stock solutions (5, 10, 15, 20, 25 µg/ml) at wavelength 275nm.

Table No.7: Calibration Curve Reading

Conc.(mg/ml)	Abs.
5	0.045
10	0.080
15	0.125
20	0.159
25	0.202

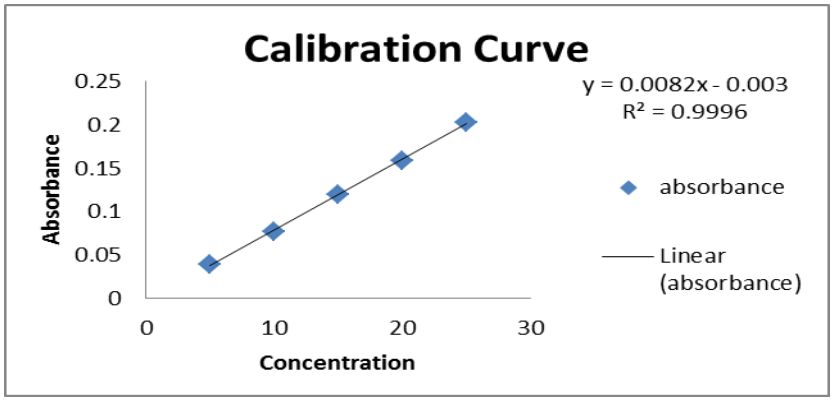


Fig. 3: Calibration curve of Glipizide.

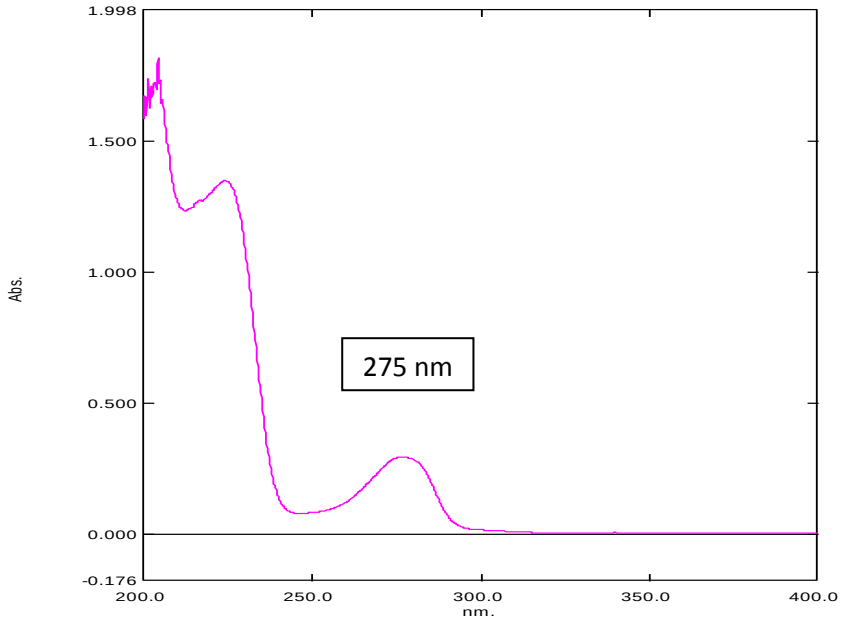


Fig.9: UV Spectra of Glipizide in PBS (P^H 6.8)

FTIR

FTIR studies were carried out for detection of drug polymer interaction. In the present study the IR study of pure drug Glipizide, drug with HPMC K-15,drug with HPMC -100 & drug with HPMC E-15 were carried out to study the compatibility between them.

Observed frequencies	Assignment
1070-1150	-O- Stretching
1020-1220	C-N Stretching (Amine)
1310-1360	C---N Stretching (Ter. Amine)
1395-1440	C-OH Stretching
730-770	C-H Stretching in aromatic ring

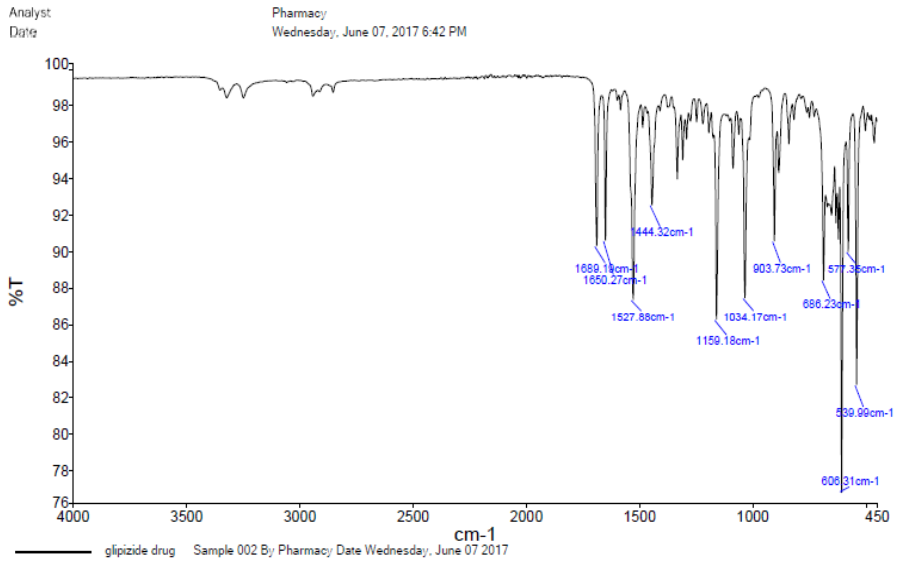


Fig. No.4: FTIR Spectra of Glipizide.

The infrared spectrum of Glipizide + hydroxy propyl methyl cellulose E-15 recorded in a KBr pellet on Perkin Elmer Infrared Spectrophotometer. From the Infrared frequencies & the respective assignments are given below.

Observed frequencies (1/cm)	Assignment
1018.41	C-N Stretching (Amine)
1055.06	Acid

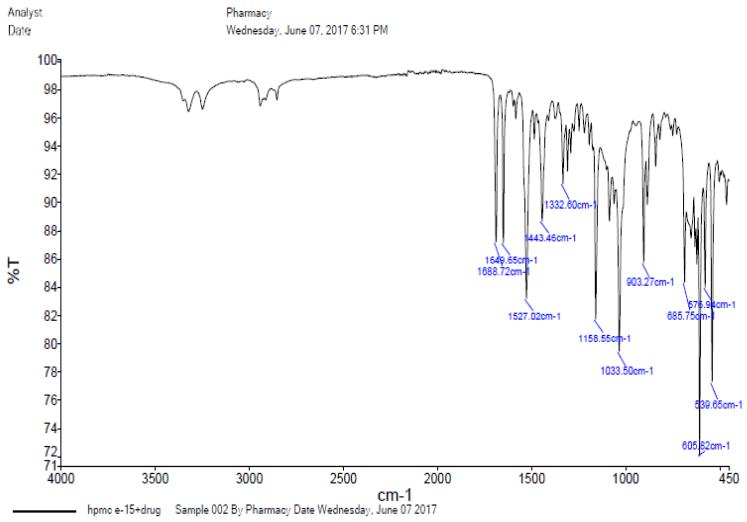
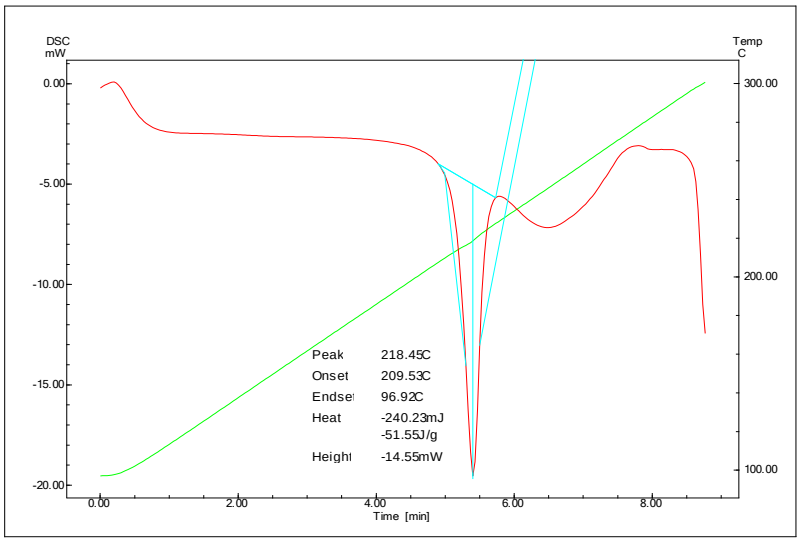


Fig. No.5: FTIR Spectra of Glipizide + HPMC E-15.

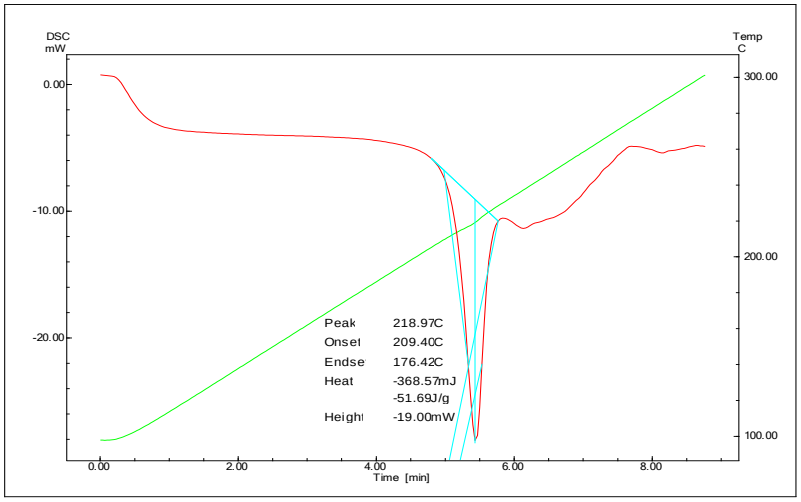
DSC

DSC studies were carried out for detection of drug polymer interaction. In the present study the DSC study of pure drug Glipizide,, drug with polymer HPMC K-15, HPMC K-100 were carried out to study the compatibility between them.

DSC of pure drug Glipizide



DSC Of Glipizide + Excipients



In-Vitro dissolution studies

In present work, an attempt has been made to increase the % drug release of Glipizide with changes in concentration of polymers & plasticizers by solvent casting method.

Table no.8: In-Vitro dissolution study of Glipizide [F1-F5]

Time(min)	% Drug release				
	F_1	F_2	F_3	F_4	F_5
1	25.29	27.38	30.65	26.10	29.51
2	39.54	42.55	41.75	38.53	40.43
3	52.78	55.47	60.98	58.77	62.82
4	68.43	70.03	75.24	71.16	74.44
5	77.12	82.63	88.68	84.06	88.67
6	85.92	90.87	93.01	92.63	94.43
7	94.11	96.43	101.66	99.44	98.22
8	98.56	102.87	114.37	104.78	101.07
9	101.35	111.45	118.53	111.53	108.13
10	103.41	114.07	121.45	115.97	111.39

All values expressed as mean ± SD (n=3), F = Formulation batch.

Table No.9 In-Vitro dissolution study of Glipizide [F6-F10]

Time (min)	% Drug release				
	F_6	F_7	F_8	F_9	F_{10}
1	34.61	27.41	26.87	35.41	30.29
2	45.01	38.53	39.25	44.67	41.72
3	66.25	44.87	45.61	59.94	58.95
4	79.47	69.66	64.75	82.57	80.17
5	91.33	83.20	86.49	94.46	88.39
6	99.76	96.47	90.53	105.01	92.05
7	110.09	102.95	99.74	115.28	99.24

8	115.18	109.27	105.31	121.64	106.61
9	121.63	112.44	109.05	131.19	111.88
10	131.87	116.09	112.64	141.38	114.25

All values expressed as

mean ± SD (n=3), F = Formulation batch.

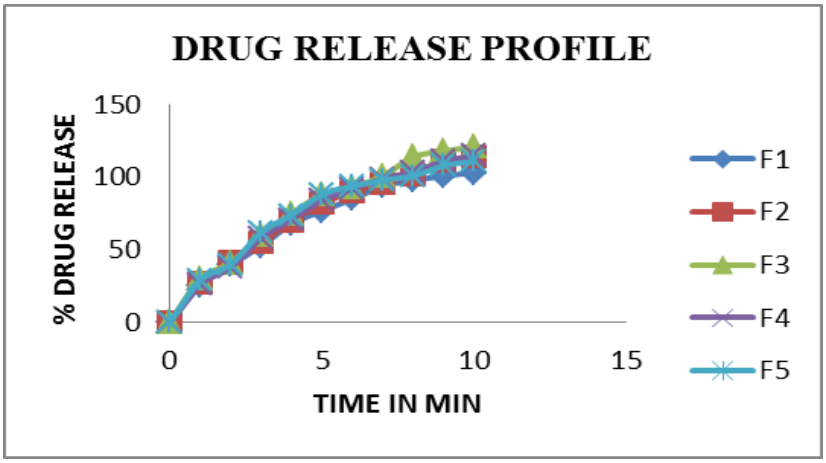


Fig. No.6: In-Vitro dissolution study Glipizide of batches F1-F5.

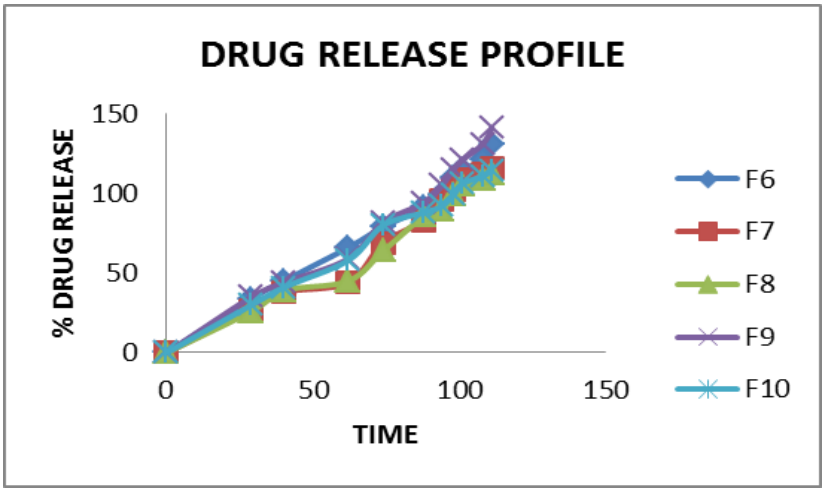


Fig. No.7: In-Vitro dissolution study profile Glipizide of batches F6-F10.

FORMULATION	ZERO ORDER (R)	FIRST ORDER (R)	MATRIX (R)	PEPPAS (R)	HIX-CROW (R)	BEST MODEL FIT
F1	0.8905	0.9567	0.9834	0.9513	0.9732	MATRIX
F2	0.5644	0.9337	0.9554	0.9863	0.9477	PEPPAS
F3	0.8865	0.8878	0.9977	0.9971	0.9874	MATRIX
F4	0.8989	0.9383	0.8090	0.9839	0.9689	PEPPAS
F5	0.9861	0.9764	0.9295	0.9765	0.8324	ZERO-ORDER
F6	0.6393	0.9435	0.9671	0.9801	0.9445	PEPPAS
F7	0.8496	0.9494	0.9742	0.9698	0.9891	HIX-CROW
F8	0.8473	0.9273	0.9119	0.9898	0.8141	PEPPAS

F9	0.9442	0.9893	0.9325	0.9837	0.9825	FIRST-ORDER
F10	0.9685	0.9297	0.9755	0.9848	0.9777	PEPPAS

Marketed Product Testing

Marketed product was tested for different parameter as shown below.

Table No: 10 Marketed product details of GLYNASE.

PARAMETER TO BE STUDIED	RESULT
Brand name	GLYNASE
Strength	5 mg
Marketed by	USV LTD.
Manufactured by	USV LTD
Batch No.	PGEAD03
MFG Date	03/2017
Expiry date	02/2019
Pack Size	Pack in a strip
Description of dosage form	White to off white in round size
Individual weight of tablet	10 mg
Colour	Titanium Dioxide

Table No.11: Dissolution test protocol: GLYNASE-5

Name of drug	Glipizide
Dissolution apparatus	USP TYPE II
00Temperature	37 ± 0.5 ^{0}C
Basket speed	50 rpm
Tablet strength	5 mg
Dissolution medium	PBS P^{h} 6.8
Volume of dissolution medium	900 ml
Detection	275 nm
Volume of sample removed	5 ml
Sampling profile	1 – 5 min

Table No.12 Dissolution profile of Marketed tablet Glynase Vs

Time (min)	% Drug release	
	GLYNASE	F9
1	10.62	35.41
2	15.46	44.67
3	23.85	59.94
4	31.57	82.57
5	36.11	94.46
6	43.21	105.01
7	48.72	115.28
8	55.47	121.64
9	62.89	131.19
10	69.31	141.38

Formulation Batch-F9

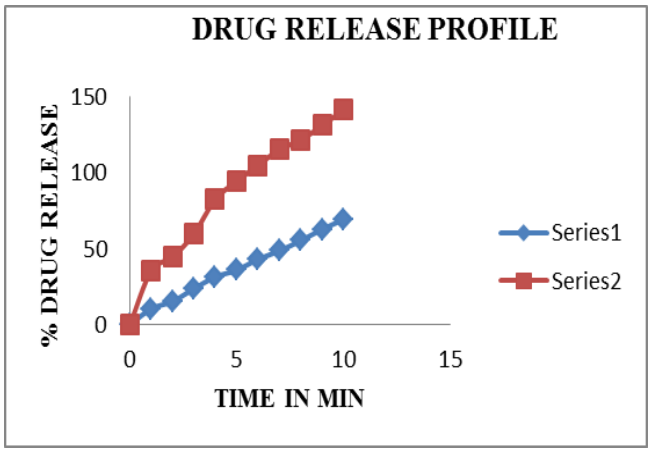


Fig.No: 8 Dissolution profile comparison study of Marketed product with Formulation batch F9 (Comparative study).

STABILITY STUDY

The stability study conducts by ICH guideline. It showed No significance change in properties of the optimized formulation & the drug release. Short term stability studies were performed in a Stability chamber over a period of 3 weeks (21 days) on the promising Fast Dissolving Film formulations F1, F2, F3, F4, F5, F6, F7, F8, F9 & F10. Sufficient number of films formulation were packed in stability container and kept in a Stability chamber at Temperature 45^0c & RH 75%. Samples were taken on 21^{st} day for drug content estimation; also the thickness, weight, folding endurance and In-Vitro disintegration studies were performed to determine the drug release profile.

Table No: 13 Evaluation parameter of Fast dissolving film.

Formulations	Tack Test	Appearance	Weight mean (mg)	Thickness mean (mm)	Folding Endurance mean	D.T. mean (sec)	Surface P^H	Cont.uniformity
F1	Non tacky	Transparent	25	1	110	25	6-7	2.51
F2	tacky	Transparent	12	0.6	128	20	6-7	2.49
F3	Non tacky	Transparent	30	0.8	136	28	6-7	2.48
F4	Non tacky	Transparent	16	1.2	142	19	6-7	2.5
F5	Non tacky	Transparent	14	0.6	91	22	6-7	2.5
F6	Non tacky	Transparent	20	1.2	115	26	6-7	2.49
F7	Non tacky	Transparent	18	1	117	30	6-7	2.51
F8	Non tacky	Transparent	22	0.8	125	19	6-7	2.52
F9	Non tacky	Transparent	15	1	3-4	21	6-7	2.49
F10	tacky	Transparent	17	0.8	27	20	6-7	2.5

All values expressed as mean ± SD (n=3), F = Formulation batch, TH = Thickness, Wt. = Weight.

Table No: 14 Stability parameter (Evaluation) of Fast dissolving films

Formulations	Tack Test	Appearance	Weight (mg)	Thickness (mm)	Folding endurance	D.T (sec)	Surface P^H	Con.uniformity (mg)
F3	Non tacky	Transparent	19	0.6	105	18	6-7	2.51
F4	Non tacky	Transparent	24	0.6	114	24	6-7	2.5
F6	Non tacky	Transparent	19	1.2	105	17	6-7	2.49
F7	Non tacky	Transparent	27	1	148	20	6-7	2.52
F9	Non tacky	Transparent	28	0.8	131	15	6-7	2.5

Table no: 15 In-vitro %release data of stability (Formulation No. F3, F4, F6, F7 & F9).

Time/Formulation (min)	% Drug release				
	F3	F4	F6	F7	F9
1	30.65	26.10	34.61	27.41	35.41
2	41.75	38.53	45.01	38.53	44.67
3	60.98	58.77	66.25	44.87	59.94
4	75.24	71.16	79.47	69.66	82.57
5	88.68	84.06	91.33	83.20	94.46
6	93.01	92.63	99.76	96.47	105.01
7	101.66	99.44	110.09	102.95	115.28
8	114.37	104.78	115.18	109.27	121.64
9	118.53	111.53	121.63	112.44	131.19
10	121.45	115.97	131.87	116.09	141.38

Fig.No.13: 2X2 cm formulation No. F1, F2, F3, F4, F5

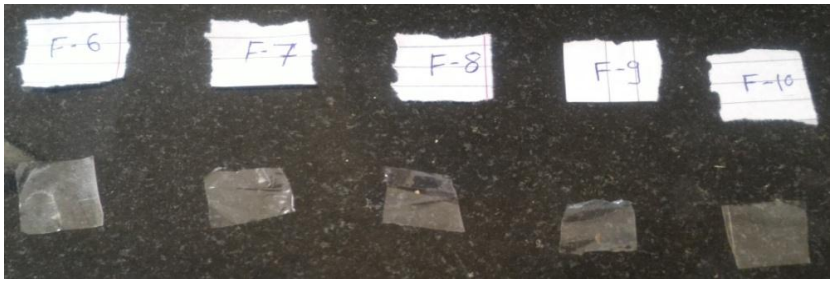


Fig.No.14: 2X2 cm Formulation No. F6, F7, F8, F9, F10.

DISCUSSION

In the present research work Design and characterization of polymeric Fast dissolving film for buccal delivery of Glipizide were prepared Glipizide Fast dissolving film were prepared using HPMC K-15 and HPMC E-15, HPMC K-100 in different concentrations by solvent

casting technique, the prepared fast dissolving film were evaluated for various parameters and the results of these parameters were given in Table No. 20 and they are discussed in detail in the following section of this chapter.

1 Physical appearance and surface texture of fast dissolving film

These parameters were checked simply with visual infection of Fast dissolving film and by feel or touch. The observation suggests that the Fast dissolving film are having smooth surface and they are elegant enough to see.

2 Weight uniformity of fast dissolving film

The weight of Fast dissolving film was determined using digital balance and the average weight of all Fast dissolving film were given in table No-19 Fast dissolving film prepared with HPMC K-15, HPMC K-100 and HPMC E-15 respectively.

3 Thickness of fast dissolving film

The thickness of the fast dissolving film were measured using screw gauge and the average thickness of all Fast dissolving film was given in table No-19 The thickness of the Fast dissolving film prepared with HPMC K-15, HPMC K-10 and HPMC E-15 respectively.

4 Folding Endurance of Fast dissolving film

The folding endurance of the Fast dissolving film was determined by repeatedly folding a small strip of the Fast dissolving film at the same place till it broke and the average folding endurance of all Fast dissolving film was given in table No-19 The folding endurance of the fast dissolving film prepared with HPMC K-15, HPMC K-100 and HPMC E-15 respectively.

5 Surface pH of fast dissolving film

Surface pH was determined by the fast dissolving film were allowed in contact with 1ml of distilled water. The surface pH was noted by pH meter near the surface of fast dissolving film and allowing to equilibrate for 1 min and the surface pH of all fast dissolving film was given in table No-19 The surface pH of the fast dissolving film prepared with HPMC K-15, HPMC K-100 and HPMC E-15 was found to in-between 6-7 P^H (n=3).

6 Drug-Polymers interaction studies of fast dissolving film

Spectrum No1.Pure drug

The infrared spectrum of Glipizide recorded in a KBr pellet on Perkin Elmer Infrared Spectrophotometer. From the Infrared frequencies & the respective assignments given drug are compatible.

Spectrum No2.HPMC E-15

The infrared spectrum of HPMC E-15 recorded in a KBr pellet on Perkin Elmer Infrared Spectrophotometer. From the Infrared frequencies & the respective assignments given drug are compatible.

Spectrum No3.Drug + HPMC E-15

The infrared spectrum of pure drug & hydroxy propyl methyl cellulose E-15 recorded in a KBr pellet on Perkin Elmer Infrared Spectrophotometer. From the Infrared frequencies & the respective assignments given drug are compatible.

Spectrum No4. Drug+ HPMC K-100

The infrared spectrum of Glipizide & HPMC K-100 recorded in a KBr pellet on Perkin Elmer Infrared Spectrophotometer. From the Infrared frequencies & the respective assignments given drug are compatible.

Spectrum No5.Drug+HPMC K-15

The infrared spectrum of Glipizide & HPMC K-15 recorded in a KBr pellet on Perkin Elmer Infrared Spectrophotometer. From the Infrared frequencies & the respective assignments given drug are compatible.

7 Drug Content uniformity of fast dissolving film

Glipizide fast dissolving films prepared with HPMC K-15, HPMCK-100 and HPMC E-15 in various concentrations and were subjected to the uniform dispersion of drug throughout the patch. In each case three Fast dissolving film were used and the average drug content was calculated, the results were shown in table no.19 the drug was dispersed in the range of 2-2.09 (n=3). Suggesting that drug was uniformly dispersed in all fast dissolving film. The S.D. value calculated for such formulation is very less which suggest that the results are reproducible and accuracy in the method used to prepare the fast dissolving film.

8 *In vitro* Drug Release of fast dissolving film

All the Fast dissolving film of Glipizide prepared were subjected to *in vitro* drug release studies for a period of 1-10 min.

The formulation from F1 to F10., which are prepared from different concentrations from 200-300 mg. with respect to three polymers such as HPMC E-15, HPMC K-15 and HPMC K-100. Among them F3, F4, F6, F7 and F9 shows significant % drug release. The % drug release of different formulations shown in table No.20.

9 Stability study

The stability study conducts by ICH guideline. It showed No significance change in properties of the optimized formulation & the drug release. Short term stability studies were performed in a Stability chamber over a period of 3 weeks (21 days) on the promising Fast Dissolving Film formulations F3, F4, F6, F7 & F9. Sufficient number of films formulation were packed in stability container and keptin a Stability chamber at Temperature 45^0c & RH 75%. Samples were taken on 21st day for drug content estimation; also the thickness, weight, folding endurance and in-vitro disintegration studies were performed to determine the drug release profile. The detail *in-vitro*% drug release stability data were shown in table No-21 and Stability parameter (Evaluation) of Fast dissolving films shown in table No-20.

CONCLUSION

From the present research work that is development and evaluation of Glipizide fast dissolving film for buccal drug delivery, the following points can be concluded:

In the beginning, blank polymeric fast dissolving film were prepared using HPMC K-100, HPMC E-15, HPMC K-15, PVA, Eudragit L-100. The concentration of polymer was varied and the best were chosen for further work, Such as HPMC K-100, HPMC E-15 and HPMC K-15.

The prepared fast dissolving film were evaluated for number of parameters like physical appearance and surface texture, weight uniformity, thickness of fast dissolving film, folding endurance, surface pH, in vitro residence time, drug excipients interaction studies, drug uniformityand in vitro drug release.

The fast dissolving film prepared was checked visually for its appearance & surfacetexture. All the prepared fast dissolving film was of smooth surface & elegant texture.

All the prepared fast dissolving film using different concentration of various polymers are weighing in between 200-300 mg.

The fast dissolving film showed folding endurance values in between 5.666 ±4.3204to 142±3.2449.

Similarly surface pH of all the fast dissolving film prepared is ranging in between 6-7pH.

The IR studies indicate that Glipizide showed complete entrapment within the polymer carrier bonding is suggested and there were no chemical interaction. Spectrophotometer From the Infrared frequencies & the respective assignments given FTIR spectrum such as Glipizide & Glipizide + Polymer are compatible.

Similarly, the fast dissolving film are also subjected to drug content uniformity study and it lies in between 2-2.09 mg (n=3) which suggestthat uniform dispersion throughout thefast dissolving film.

A good % drug release was observed for formulation F3, F4, F6, F7 & F9 in time 1-10 min.

The in vitro drug release study was carried out for all the fast dissolving film and release profile were subjected to various kinetic equations like Highuchi diffusion equation, First order equation, Zero order equation and Peppas exponential equation. There regression coefficient values of this kinetic equation are very nearer to one (1) suggesting that plots are fairly linear and slope values is (>1) more than one in all the cases suggest that drug was released by diffusion mechanism following super case-II transport.From the above results it can be concluded that Glipizide can be delivered in the form of fast dissolving film. Release pattern of drug from these fast dissolving films can be altered by using different formulation variables.

Finally the stability study conducts by ICH guideline. It showed No significance change in properties of the optimized formulation & the drug release.

ACKNOWLEDGEMENTS

Authors are thankful to Management of Channabasweshwar Pharmacy College, Latur for providing research facilities.

REFERENCE

1. http://en.wikipedia.org.
2. Biradar SS. Bhagvati ST, kuppasad IJ. Fast dissolving drug delivery systems; a brief review. Internet J Pharmcol, 2006; 4(2).
3. J.D. Smart, Buccal drug delivery, Expert Opin. Drug Deliv, 2005; 2: 507–517.
4. Lindgren S, Janzon L. Prevalence of swallowing complaints and clinical findings among 50-79 year old men and women in an urban population. Dysphagia, 1991; 6: 187-192.
5. Sweetman, SC. Martindale: The complete drug reference. 36th ed. London: Pharmaceutical Press, 2009; 441.
6. Liang AC, Chen LH. Fast dissolving intraoral drug delivery systems. Exp Open There Patents, 2001; 11: 981–986. http://dx.doi.org/10.1517/13543776.11.6.981.
7. Borsadia S, O'Halloran D, Osborne JL. Quick dissolving films-A novel approach to drug delivery. Drug Deliv Technol, 2003; 3: 63–66.
8. M. Carnaby, and M. Crary, 2005; 13: 970–1975.
9. T. Morita, 2003; 123: 665–671.
10. Y.Wu, C. Weller, L. Hamouz, F. Cuppett, and M. Schnepf, 2002; 44: 347–394.
11. A. Hambleton, F. T. Karbowiak, and A. Voilley, 2008; 9: 1058 1063.
12. Frey, 2006; 92–93.
13. A. Mahapatra, P. Murthy, J. Sahoo, S. Biswal, and S. Sah, 2009; 43: 39-45.
14. B.Vondrak, Barnhart and Scott, 2008; 1-5.
15. U. Vollmer, and P. Galfetti, 2006; 64-67.
16. Amir H. shojaei. Buccal mucosa as a route for systemic drug delivery: Are view; J. Pharmceut Sci., 1998; 1(1): 15-30.
17. Amir H. shojaei. Buccal mucosa as a route for systemic drug delivery: A review; J. Pharmceut Sci., 1998; 1(1): 15-30.
18. Tora-ToraDerrikson principles of anatomy and physiology 2nd edition edited by Bonnie Roech, Published by John wily & sons Inc., 2007; 902-908.
19. Ross &Wilson. Anatomy and physiology in health and illness 9th edition edited by Anne Waugh & Alison Graw Published by Churchill livingstone, Edinberg, 2001; 289-293.
20. Chatter jee C. C. Human anatomy and physiology 10th edition Published by medical alliend agency, Calcutta, 1985; 427-435.
21. Kharenko E. A, Larionova N. I and Demina N.B. Mucoadhesive drug delivery system (Review). Pharmaceutical chemistry Journal, 2009; 43(4): 200-209.

22. Mashru RC, Sutariya VB, Sankalia MG, Parikh PP. Development and Evaluation of Fast Dissolving Film of Salbutamol Sulphate. Drug DevInd Pharma, 2005; 1: 25-34.
23. Chan SY, Chen LL, Chetty D, inventors. Orally Dissolving Films. US patent 20060198873A1. 2006 Sep 7.
24. Umekar MJ, Yeole PG. Research Paper: Characterization and evaluation of natural copal gum-resin as film forming materialist J Green Pharma., 2008; 2: 37-42.
25. Dixit RP, Puthli SP. Review Oral strip technology: Overview and future potential. J Controlled Release, 2009; 139: 94-107.
26. Garsuch VI. Preparation and characterization of Fast Dissolving Oral Films for paediatric use. Inaugural Dissertation to Heinrich Heine University, Dusseldorf, Germany, 2009; 3.
27. Indian Pharmacopoeia. Govt. Of India. Ministry of Health and Family Welfare, Published by The Indian Pharmacopoeia commission, Ghaziabad, 2007; 2: 672-674(b).
28. Agarawal V, Kothari B, Moe DV. Drug Delivery: Fast Dissolve System. In, Swarbrick J. (ed) Encyclopedia of Pharmaceutical Technnology. 3rd ed. New York: Informa Healthcare, 2007; 2: 1104-1114.