international Journal of Pharmaceutical research and Applications
Volume 6, Issue 6, pp: 472-485 www.ijprajournal.com ISSN: 2456-4494

Formulation and Evaluation of Mouth Dissolving Film of Ondansetron Hydrochloride by Using Superdisintegrant

Ravi.SK*[1], V. Chandrakala[1], S. Srinivasan[2], Kaviya[2]
Department of Pharmaceutics, East Point College of Pharmacy, Bidarahalli, Bangalore, Karnataka, India.

Submitted: 22-11-2021 Revised: 04-12-2021 Accepted: 06-12-2021

ABSTRACT

The mouth dissolving films of Ondansetron hydrochloride were prepared by Solvent casting method. The film's disintegration time was decreased by using super disintegrants. The prepared films were evaluated for various parameters like film thickness, folding endurance, drug content, dispersion test, uniformity of weight, surface pH measurement, moisture loss study, in vitro drug dissolution study, disintegration time and stability study. Starch, Croscarmellose, microcrystalline cellulose were used as super disintegrating agents. Hydroxypropyl methyl cellulose used as a polymer. The physicochemical parameters like pre formulation and Post formulation evaluation were performed as per pharmacopoeia standards and compatibility study was done by FTIR method. The FTIR spectral analysis showed that there was no drug interaction with formulations additives of the film as there is no variation and shift in bands, it can be justified there is no interaction between drug and polymer. Obtained satisfactory results for preformulation tests such as solubility, melting point. Post formulation parameters like thickness, disintegration, uniformity of weight, folding endurance, dispersion test, uniformity of drug content, *In vitro* drug release study showed good results. Formulation F2 showed good results throughout the study. Short term stability studies on the formulations F2 indicated that there are no significant changes in drug content and in vitro drug release study. From the results it was concluded that the mouth dissolving films of Ondansetron hydrochloride containing combination of Hydroxypropyl methylcellulose and Starch (F2) showed less disintegration time and *In vitro* drug release study is faster than the combination of Hydroxypropyl methylcellulose-Croscarmellose and Hydroxypropyl methylcellulose-Microcrystalline cellulose combination.

KEYWORDS: Mouth dissolving films, Ondansetron hydrochloride, super disintegrant, solvent casting method.

I. INTRODUCTION

Oral route of administration is the most convenient and preferred route of administration among the various other delivery systems. More than 70% of drugs are available in the market in the form of oral drug delivery systems due to pain avoidance and versatility (to accommodate various types of drug candidates).[1] Mouth dissolving films (MDFs) are one of the simplest preparations.It is an ultrathin strip of postage stamp size with an active agent and other excipients developed on the basis of transdermal patch technology.

MDFs by solvent casting method is the simplest and cheapest method of preparation. Whereas the other dosage forms like tablets require various granulation processes, punching, and coating. Liquid preparations such as syrup should maintain the stability of the product to overcome disadvantages associated with above solid and liquid preparations Mouth Dissolving Films (MDFs) were developed.[2]

Mouth dissolving dosage form has become increasingly important because of their unique properties. They quickly disintegrate and dissolve, and can be administered without water, making them particularly suitable for pediatrics and geriatric patients. Mouth dissolving films (MDFs), have gained popularity not only in breath strips but also in personal care, food and drugs.[3]

Nowadays MDFs are well proven and accepted technology for the systemic delivery of active pharmaceutical ingredients. MDFs can be used for various categories of drugs such as antiulcer, antiasthmatic, antiepileptic, hypertension, heart attack, motion sickness, antitussive, paralysis, mental disorders, and repeated emesis.[4]

II. EXPERIMENTAL

Materials and Methods

Materials

Ondansetron hydrochloride, Hydroxypropyl methylcellulose, Starch, Croscaramellose,

international Journal of Pharmaceutical research and Applications
Volume 6, Issue 6, pp: 472-485 www.ijprajournal.com ISSN: 2456-4494

Microcrystalline cellulose were received as a gift sample by Srini Pharmacy. Mannitol, Citric Acid, PEG 400, Peppermint oil, Calcium chloride are used for the film formulation all reagents and chemicals used were laboratory grade. Double distilled water was used throughout the study.

Preformulation studies

The preformulation is the first step in the rational development of a dosage form of drug substance alone and combined with excipients. The overall objective of the preformulation is to generate useful information to design an optimum drug delivery system.

1. Organoleptic properties of Drug[25, 34]

The sample of Ondansetron HCL was evaluated for its organoleptic properties such as color, odor, and appearance.

2. Determination of solubility[26, 35, 36]

Solubility of the drug was determined by adding about 5 mg of Ondansetron HCL to 10ml of different solvents and sonicated for 10min and inspected visually for solubility and compared with standard.

3. Determination of Melting point[26, 35, 36]

Melting point of pure Ondansetron HCL was determined by an open capillary method. The capillary was closed at one end by fusion and was filled with Ondansetron HCL repeated tappings. The capillary tube was placed in a melting point apparatus. The temperature was set to automatically increase the temperature. The rise in the temperature was viewed. The temperature at which the drug started melting was recorded.

Determination of λ_{max} ofOndansetron HCL[26, 35, 36]

The solution of Ondansetron HCL containing concentration 10µg/ml was prepared using phosphate buffer pH 6.8 and UV spectrum was taken using Elico spectrophotometer. The solution was scanned in the range of 200-300. The absorption maximum was found to be 253 nm.

Preparation of standard stock solution of Ondansetron HCL

Standard calibration curve of ondansetron HCL was prepared by dissolving accurately weighed 100mg of Ondansetron HCL in 100ml volumetric flask and the volume was made up to 100ml by using phosphate buffer pH 6.8 solution to obtain a stock solution of 1000 µg/ml (SS-*I*). From this stock solution, 1ml withdrawn and diluted with 100ml by using phosphate buffer pH 6.8 to obtain a stock solution of 10µg/ml (SS-*II*). Different aliquots of Ondansetron HCL in the range 1-5ml were pipetted into different 10ml volumetric flasks and volumes were made up to 10ml with phosphate buffer pH 6.8 to get concentration of 2,4,6,8,10 µg/ml. The absorbance of these drug solutions were measured at 253 nm. The calibration curve was plotted as concentration vs. absorbance.

Fourier transform infrared (FTIR) spectroscopy[18]

Compatibility studies of the drug and the polymers were carried out using an FTIR spectrometer. Part of the sample is mixed thoroughly with 3 parts of dried potassium bromide and it was compressed into thin pellets. The pellets are then scanned under the region from 4000$cm^{-1}$to 400cm^{-1}

Preparation of Mouth dissolving films[29]

Polymer HPMC and Super disintegrants were weighed accurately and dispersed in water. Then plasticizers were added for different formulations, mixed well till a clear solution was obtained. Then the drug was added to the polymeric solution. Remaining ingredients citric acid, mannitol and peppermint oil were added and stir continuously for 15min in the magnetic stirrer. After the solution was placed on ultra-sonication for 30min (to remove the air bubble). 15ml of prepared solution was cast on a glass plate which can be covered 10×30 Cm=300Cm^2 area i.e. 10cm width of film and 30cm length of the film. Casting solvent then allowed to evaporate for 24h to obtain dry film. After 24hrs, the dried patches were taken out packed in self-sealing covers and stored in a desiccator for further studies. The dose of Ondansetron hydrochloride is 25mg in 2×2cm film i.e. 4 Cm^2 area.

1875 mg of drug

300 Cm^2 area of the film

Each film 2×2=4 Cm^2

Each 4 Cm^2 film contains 1875×4/300=25 mg of the drug

international Journal of Pharmaceutical research and Applications
Volume 6, Issue 6, pp: 472-485 www.ijprajournal.com ISSN: 2456-4494

Table No. 01: Composition of Mouth dissolving film of Ondansetron hydrochloride.

	Batch	Drug (mg)	HPMC (mg)	Super disintegrant (mg)	PEG 400 (ml)	Citric Acid (mg)	Mannitol (mg)	Peppermint Oil (ml)	Water (ml)
Starch	**F1**	1875	1217	183 (5%)	0.6	200	200	0.5	10
	F2	1875	1126	274 (7.5%)	0.6	200	200	0.5	10
	F3	1875	1035	365 (10%)	0.6	200	200	0.5	10
CC	**F4**	1875	1381	18.2 (0.5%)	0.6	200	200	0.5	10
	F5	1875	1309	91 (2.5%)	0.6	200	200	0.5	10
	F6	1875	1218	182 (5%)	0.6	200	200	0.5	10
MCC	**F7**	1875	1217	183 (5%)	0.6	200	200	0.5	10
	F8	1875	1035	365 (10%)	0.6	200	200	0.5	10
	F9	1875	852	548 (15%)	0.6	200	200	0.5	10
HPMC	**F10**	1875	1400	00	0.6	200	200	0.5	10

CC: Croscarmellose HPMC: Hydroxypropyl methylcellulose
MCC: Microcrystalline cellulose PEG400: Polyethylene glycol 400

Figure No. 01: Formulation placed on Ultra sonicator to remove air bubble

international Journal of Pharmaceutical research and Applications
Volume 6, Issue 6, pp: 472-485 www.ijprajournal.com ISSN: 2456-4494

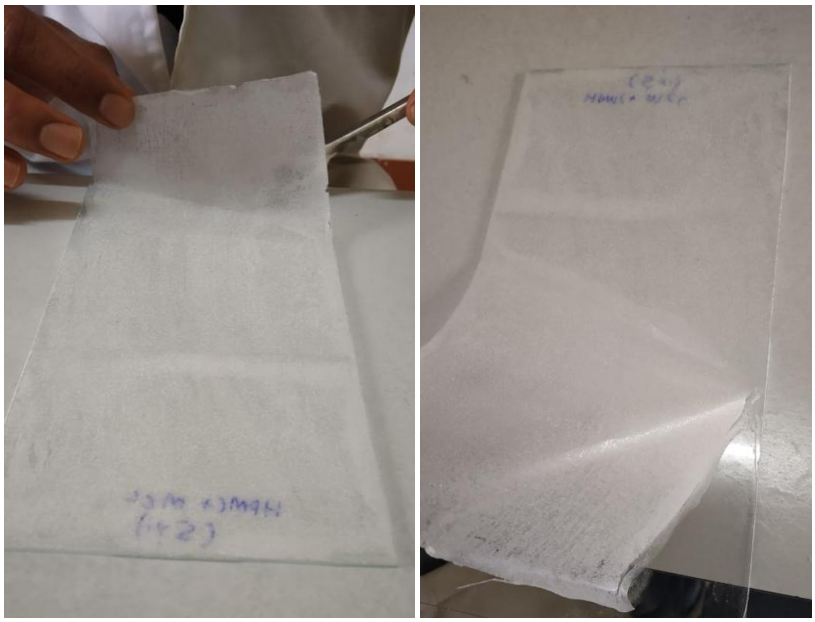

Figure No. 02: After the drying film removed from the film former

Evaluation of mouth dissolving film of Ondansetron HCL[1, 2, 3, 8, 21, 23, 24, 30, 34]

1. Physical appearance

All the prepared films were visually inspected for color, flexibility and smoothness.

2. Drug content

Drug content for all batches were determined by UV Spectrophotometric method. For this 2×2cm strip from each batch was cut and dissolved in 50ml of phosphate buffer pH 6.8. The solution was filtered through whatman filter paper and diluted by pipetting 1ml of this solution to a 25ml volumetric flask with phosphate buffer pH 6.8. The resulting solution was measured spectrometrically at 253 nm by using an ELICO spectrophotometer.

3. Thickness

The thickness of the Films was determined by using Digital vernier Calipers. The thickness of the film increases with the increase in the concentration and the molecular weight of the polymer. Three Films were randomly taken from each formulation, mean and standard deviation values were calculated. It is expressed in mm.

4. Folding endurance

The films were folded at an angle of 180° at the same place up to 100 times without cracking and was noted as folding endurance. The studies were performed in trice and the average mean was calculated.

5. Disintegration

Disintegration time was determined visually in a petri dish containing a pH 6.8 phosphate buffer with swirling every 10 seconds. The disintegration time reported was the time when the film starts to break. (Petri dish method)

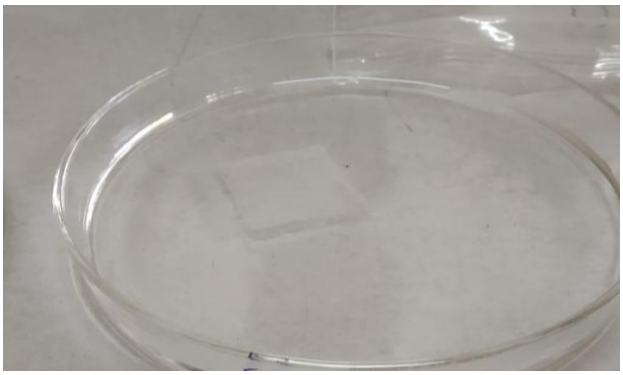

Figure No. 03: film placed in disintegration for Disintegration

international Journal of Pharmaceutical research and Applications
Volume 6, Issue 6, pp: 472-485 www.ijprajournal.com ISSN: 2456-4494

6. Weight variation

All prepared Films were calculated for weight variation. Randomly selected ten Films were weighed individually and together in a single pan balance. The average weight was noted and standard deviation calculated.

7. Moisture loss studies

The percentage moisture loss study was carried out to check the physical stability and integrity of the films. In the present study the moisture loss capacity of the film was determined by placing the known weight and predetermined by placing size of the film in a desiccator containing anhydrous calcium chloride for three days. The films were removed and reweight and the percentage moisture loss of the film was measured by using the following formula

Percentage moisture loss = initial weight – final weight / final weight × 100

8. Surface pH

An acidic alkaline pH may cause irritation to the oral mucosa. It is determined to keep the surface pH as close to neutral as possible. The film is slightly wet with the help of water. The pH is measured by using a digital pH meter. The procedure was performed in triplicate and average with the standard deviation was calculated.

9. Tensile strength

A tensile strength of film determined by a device has a rectangular frame with two plates made up of iron. The 4 cm was taken and one end of the film was sandwiched between the iron plates and fixed. The other end was connected with the hanging end of the thread. The force needed to fracture the film was determined by measuring the weight loaded in the pan. The weight corresponding to breaking the films was taken as tensile strength.

The following equation was used to calculate the tensile strength

Tensile strength = Load×100 / Thickness of film × width

10. Dispersion test

A film equivalent of 25mg of Ondansetron HCL was placed in 200ml of 6.8 pH phosphate buffer and was stirred for 3 min. then the resulting solution was passed through sieve number 22. No residue was left hence the film passed the dispersion test.

11. Percentage Elongation

The initial length of the film was measured on scale and a pointer is attached to a freely movable thread. Increase in length at the time of break of the film was recorded and % elongation was calculated by the following formula.

% elongation = increase in length / initial length × 100

12. *In vitro* dissolution studies

Table. No. 02: *In vitro* dissolution studies

Apparatus.	USP Dissolution apparatus type II.
Dissolution Medium.	Phosphate buffer pH (6.8)
Temperature.	37±5°C
RPM.	100 rpm
Vol. withdrawn and replaced.	1ml every 30 sec
ʎmax	253 nm
Blank Solution.	Phosphate buffer pH (6.8)
Duration of study.	7min
Volume of dissolution media.	300ml

Procedure

In vitro drug release was studied using LabIndia Dissolution Apparatus (LABINDIA DS 8000, India), in 300ml phosphate buffer pH 6.8, maintained at 37±5℃ for 7 minutes, at 100 rpm. 1ml of sample was withdrawn after specified time from the dissolution medium. Collected samples were analyzed spectrophotometrically at a measured wavelength of 253 nm, and cumulative percent drug release was calculated. Drug release profile was studied using percentage drug release versus time (Sec) plot.

13. Stability Studies

Accelerated (40°c / 75% RH) and real time (30°c / 65% RH) stability study was carried out as per ICH guidelines. The saturated solution of Nacl was prepared to maintain 75% RH and kept in a

international Journal of Pharmaceutical research and Applications
Volume 6, Issue 6, pp: 472-485 www.ijprajournal.com ISSN: 2456-4494

desiccator which contin formulated film and the desiccator placed in a hot air oven to maintain 40°c temperature. The saturated solution of KI was prepared to maintain 65% RH and kept at room temperature in a desiccator. At time intervals 0,7,14,28,42,60 days. The films were evaluated for change in physical parameters, drug content and drug release. From the stability study F2 formulation was found to be no changes in the physical appearance, drug content and drug release.

III. RESULTS AND DISCUSSION

Preformulation studies

Preformulation studies of Ondansetron HCL was carried based on the following parameters

1. Organoleptic properties of Drug

The drug was identified based on the organoleptic properties.

Ondansetron HCL is anodourless, White to off white amorphous powder.

2. Solubility of drug

Ondansetron HCL was freely soluble in 0.1N HCL, Methanoland phosphate buffer pH 6.8. Sparingly soluble in ethanol. Slightly soluble in water.

3. Melting point of Drug

The melting point of the Ondansetron HCL was found to be 231°C. The normal range of the melting point of Ondansetron HCL is 231-232°C, which shows that the melting point of the drug was lying between the ranges. The melting point indicates the purity of the drug

Calibration curve of Ondansetron HCL

For the preparation of the calibration curve samples were prepared from a stock solution (2,4,6,8,10µg/ml). The absorbance of the samples was taken at 253 nm. The calibration curve of Ondansetron HCL is presented in Figure No 04 and data are presented in Table No: 03 and 04

Table No. 03: Absorbance data for calibration curve of Ondansetron HCL

SI. NO.	CONCENTRATION (µg/ml)	ABSORBANCE.
1.	2	0.0862
2.	4	0.1024
3.	6	0.1228
4.	8	0.1624
5.	10	0.1754

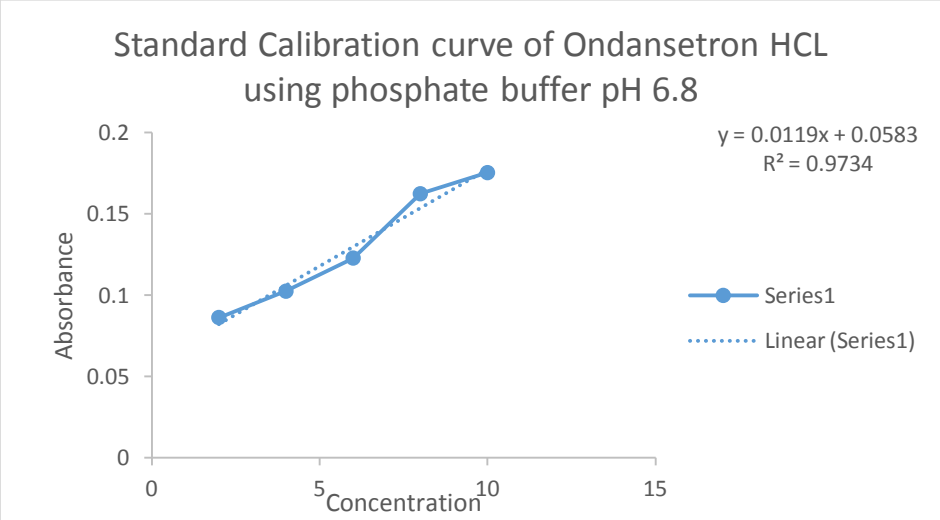

Figure No. 04: Calibration curve of Ondansetron HCL.

international Journal of Pharmaceutical research and Applications
Volume 6, Issue 6, pp: 472-485 www.ijprajournal.com ISSN: 2456-4494

Table No. 04: Statistical data for calibration curve

Serial No.	Parameters	Value.
1.	λmax (nm)	253
2.	Beer law limits.	2-10
3.	Slope	0.0119
4.	Constant	0.0583
5.	R^2	0.9734

Fourier transform infrared (FTIR) interaction studies:

Compatibility studies of the drug and the polymer were carried out using the Shimadzu-FTIR spectrometer. The infra red of Ondansetron HCL and physical mixtures with ondansetron HCL, polymer HPMC and super disintegrant MCC, Starch, CC, Mannitol, citric acid were recorded by FTIR spectrometer as shown in figure No. 05 and 06 and the interpretation of the spectrum is shown in Table No:05.

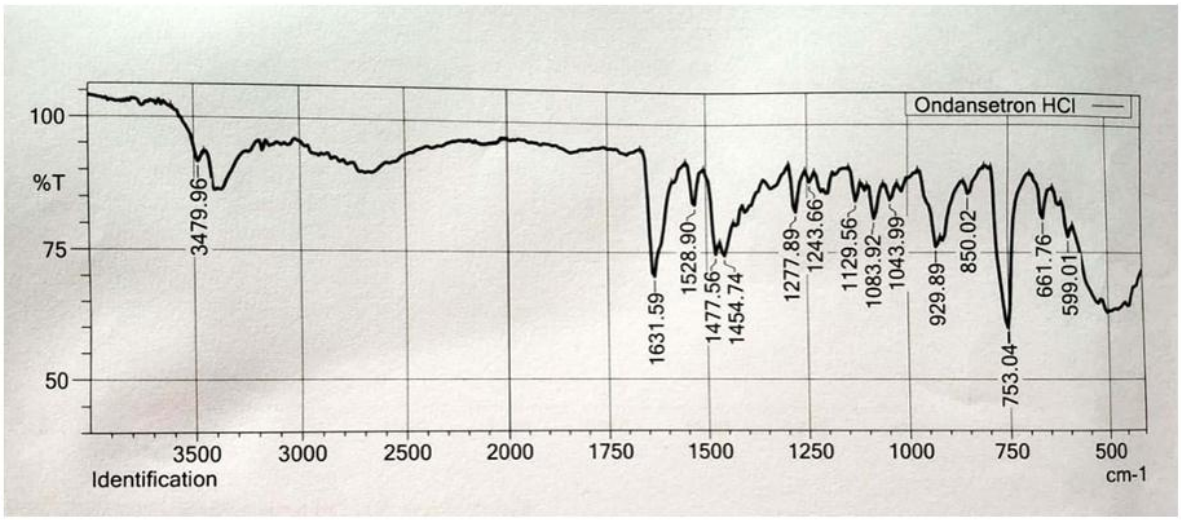

Figure No. 05: FTIR Spectrum of Ondansetron Hydrochloride

international Journal of Pharmaceutical research and Applications
Volume 6, Issue 6, pp: 472-485 www.ijprajournal.com ISSN: 2456-4494

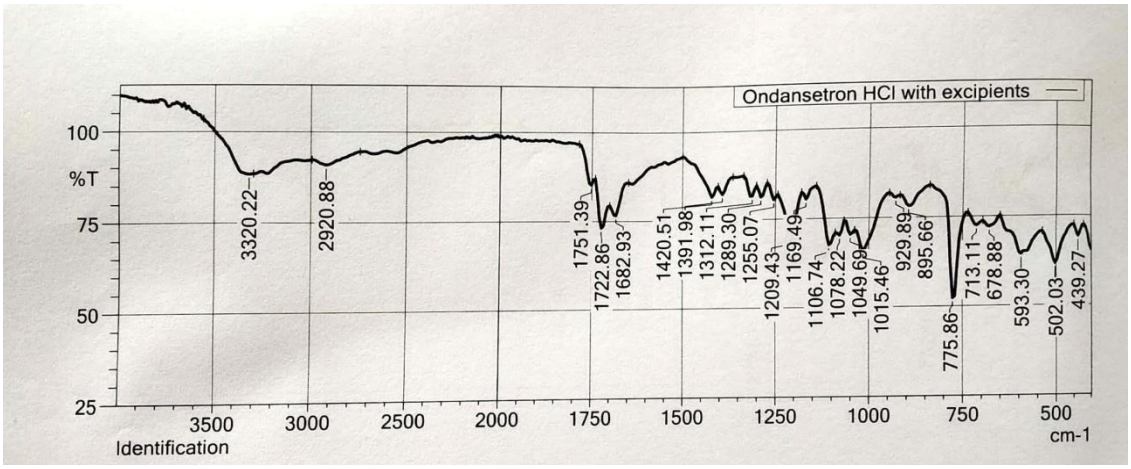

Figure No. 06: FTIR Spectrum of Ondansetron Hydrochloride with excipients

Table No. 05: Interpretation of FTIR spectrum.

Functional group	Observed frequency (cm^{-1}) pure sample	Observed frequency (cm^{-1}) with excipients
C-Cl Stretching	753. 04	775.86
C-H bending	929.89	929.89
S=O Stretching	1129.56	1169.49
COOH Stretching	1277.89	1289.30
CH Bending	1454.79	1420.51
C=O Stretching	1631.59	1682.93
N-H Stretching	3479.96	3320.22

Evaluation of Mouth dissolving films:

Table No. 06: Physical appearance and Drug content of the formulated films

SL NO.	Formulation	Physical appearance	Drug content (%)
1.	F1	White, smooth, Uniform & Flexible	97.37 ±0.85
2.	F2	White, smooth, Uniform & Flexible	99.40 ±0.36
3.	F3	White, smooth, Uniform & Flexible	97.97 ±0.95
4.	F4	White, smooth, Uniform & Flexible	97.47 ±0.85
5.	F5	White, smooth, Uniform & Flexible	97.77 ±0.68
6.	F6	White, smooth, Uniform & Flexible	95.90 ±0.62
7.	F7	White, smooth, Uniform & Flexible	96.23 ±1.07
8.	F8	White, smooth, Uniform & Flexible	96.77 ±1.45
9.	F9	White, smooth, Uniform & Flexible	96.20 ±0.95
10.	F10	White, smooth, Uniform & Flexible	98.57 ±0.45

All value are mean of three reading ± standard deviation

The prepared films of all formulations were evaluated and results shown in table No. 6,7,8,9. All the films were evaluated for their physical appearance and they were found to be white, smooth, uniform and flexible. The drug content estimation data for all the formulations were found to be 95.90±0.62 to 99.40±0.36. The drug content was uniform in all the film formulations indicating uniform distribution of drug. Percentage drug content was found to be highest for combination of HPMC and starch compared to other combinations (F2 - 99.40±0.36). Which was determined using an ELICO spectrophotometer.

international Journal of Pharmaceutical research and Applications
Volume 6, Issue 6, pp: 472-485 www.ijprajournal.com ISSN: 2456-4494

Table No. 07: Evaluated for Thickness, folding endurance, disintegration time, Uniformity of Weight variation, moisture loss.

Formulation Code	Film Thickness (mm)	Folding endurance	Disintegration Time	Uniformity Weight (mg)	Moisture Loss
F1	0.119±0.007	99±5	13.27±1.86	66.80±0.10	2.18±0.07
F2	0.102±0.003	100±5	11.43±0.67	61.60±0.10	1.15±0.01
F3	0.116±0.004	100±5	19.80±1.57	64.83±0.06	2.63±0.02
F5	0.121±0.004	98±5	24.33±0.65	68.27±0.15	2.75±0.04
F5	0.116±0.006	100±5	23.67±1.19	67.40±0.10	1.90±0.03
F6	0.112±0.004	100±5	25.10±1.91	65.53±0.12	2.25±0.01
F7	0.118±0.007	99±5	15.40±1.05	69.43±0.15	1.85±0.03
F8	0.128±0.006	98±5	15.17±1.47	82.43±0.06	2.61±0.02
F9	0.130±0.006	98±5	28.10±1.71	87.60±0.10	2.25±0.04
F10	0.125±0.004	98±5	20.83±1.50	67.63±0.15	2.01±0.01

All value are mean of three reading ± standard deviation

The Film thickness was evaluated by using vernier caliper the thickness increases with the increase in the concentration of polymer the thickness was found to be 0.102 ±0.003mm to 0.130±0.006mm and the results was found to be within the limits. The folding endurance of all the formulations were measured manually and it was found to be 98±5 to 100±5. It shows good flexibility. Folding endurance results indicated that the film would not break. The disintegration time of all the formulations was found to be 11.43 ±0.67sec to 28.10±1.71sec. The combination of HPMC and starch showed fast disintegration compared to other combinations (F2 11.43±0.67). Prepared Films were evaluated for weight variation. Percentage deviation from the average weight was found to be within the prescribed official limits. The weight depends on the concentration of the polymer. The weight variation was found to be 61.60 ±0.10mg to 87.60 ±0.10mg. The moisture loss of films was found to be 1.15±0.01 to 2.75±0.04. The less moisture loss in the formulations helps the films to remain stable, brittle and free from complete drying.

Table No. 08: Evaluated for Surface pH, tensile strength, percentage elongation.

Formulation code	Surface pH	Tensile strength (kg/mm^2)	Dispersion Test	Percentage elongation
F1	6.75±0.025	1.021±0.2	Passed	153.23±2.14
F2	6.80±0.031	1.332±0.1	Passed	126.42±1.44
F3	6.72±0.021	0.903±0.3	Passed	110.33±2.54
F4	6.90±0.008	0.813±0.5	Passed	125.54±3.14
F5	7.07±0.051	1.143±0.3	Passed	155.52±1.59
F6	6.81±0.014	1.021±0.2	Passed	132.63±2.72
F7	6.70±0.025	0.865±0.1	Passed	164.37±3.09
F8	6.54±0.032	0.942±0.5	Passed	129.43±2.43
F9	6.61±0.016	1.232±0.2	Passed	130.35±2.55
F10	6.82±0.009	1.012±0.3	Passed	145.22±2.16

All value are mean of three reading ± standard deviation

The surface pH of all the films was found to be 6.54±0.032 to 7.07±0.051. Since the surface pH of all the film was found to be around neutral pH, there will not be any kind of irritation to the mucosal oral cavity. The tensile strength of film was found to be 0.813±0.5 to 1.332±0.1. The film passed the dispersion test. The percentage elongation of film was found to be 110.33±2.54 to 164.37±3.09. This represents the elasticity of the film.

international Journal of Pharmaceutical research and Applications
Volume 6, Issue 6, pp: 472-485 www.ijprajournal.com ISSN: 2456-4494

Table No. 09: *In Vitro* Dissolution study

Time (Sec)	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
30	18.19	24.05	17.45	13.49	13.63	14.91	21.36	18.34	15.80	21.78
60	20.69	31.97	19.33	16.90	15.74	16.53	23.25	24.08	17.79	23.90
90	21.97	36.13	24.60	22.67	21.19	29.92	24.89	30.62	20.11	31.66
120	23.69	41.06	33.02	24.30	28.98	34.72	27.32	34.34	24.37	44.58
150	24.13	51.32	39.90	29.56	32.93	39.28	33. 40	38.84	27.35	49.85
180	32.26	57.06	45.50	33.55	37.67	45.43	37.67	45.17	32.92	52.58
210	37.00	59.52	52.16	37.29	43.46	51.07	47.95	51.00	36.58	58.90
240	52.29	66.55	56.50	45.98	47.72	58.56	55.14	57.89	43.47	62.94
270	63.27	73.10	59.03	50.54	52.76	66.86	60.53	63.76	54.58	68.27
300	82.00	79.41	63.91	58.22	58.34	72.05	66.46	68.62	62.82	74.90
330	86.64	82.96	72.19	66.72	68.56	73.07	69.81	76.59	65.93	78.73
360	91.05	88.80	79.20	73.42	75.22	78.54	78.37	84.07	73.56	86.67
390	92.12	96.43	85.45	79.62	81.89	80.63	83.05	85.90	79.93	89.77
420	95.25	98.52	90.42	86.89	89.62	88.21	92.70	91.34	88.64	95.96

All value are mean of three reading ± standard deviation

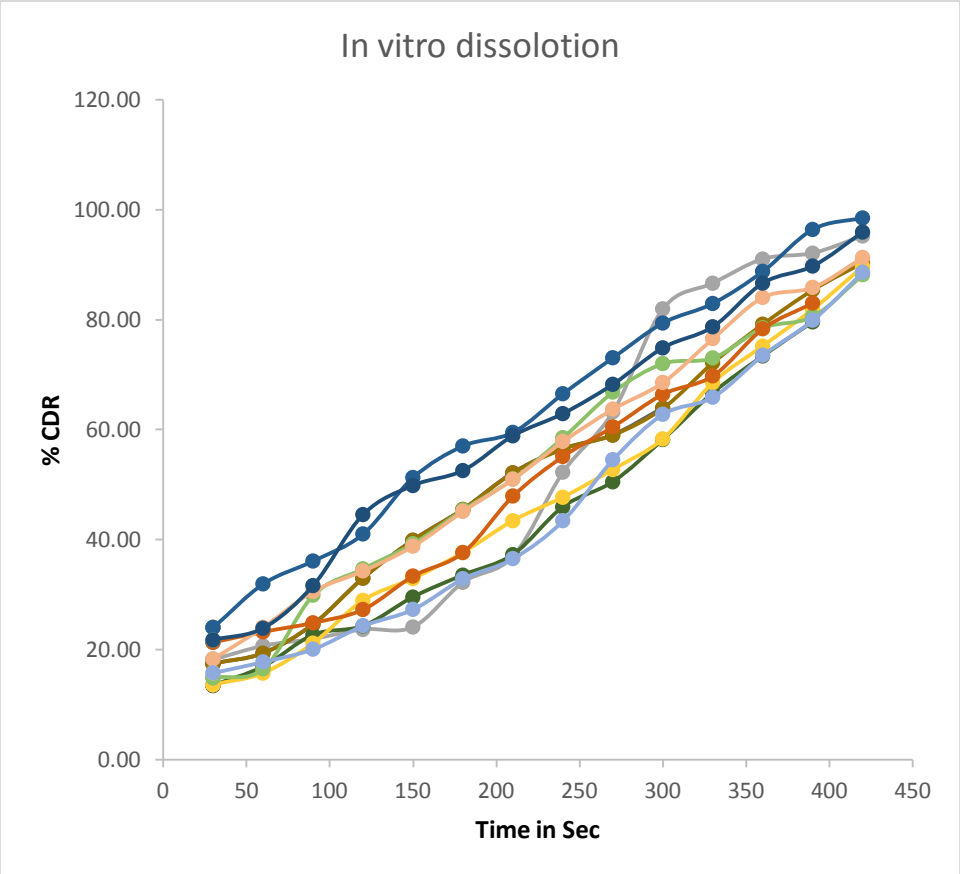

Figure No. 07: *In vitro* dissolution profile of ondansetron hydrochloride from all films

Drug release profile was studied using percentage drug release versus time (Sec) plot. Formulations F1, F2, F3 and F4 showed 95.25%, 98.52%, 90.42% and 86.89%. Release of drug respectively at 7 min. Formulations F5, F6, F7, F8, F9and F10 showed 86.89%, 88.21%, 92.70%, 91.34%, 88.64% and 95.96% respectively. F2 formulation showed the best drug release compared to other combinations.

international Journal of Pharmaceutical research and Applications
Volume 6, Issue 6, pp: 472-485 www.ijprajournal.com ISSN: 2456-4494

Stability studies for optimized formulations.

Table. No. 10: Stability studies of F2 formulation at Real time 30°c/ 65%RH and Accelerated 40°c/75% RH

Time in days	Real time (30°c/ 65%RH)		Accelerated (40°c/75% RH)	
	% drug release	Drug content (mg)	% drug release	Drug content (mg)
0	99.6	98.52	99.6	98.52
7	99.48	98.09	99.36	98.11
14	99.2	97.41	98.88	97.38
28	98.96	97.3	98.72	97.13
42	98.44	96.9	97.96	96.7
60	98.2	96.1	97.24	96.03

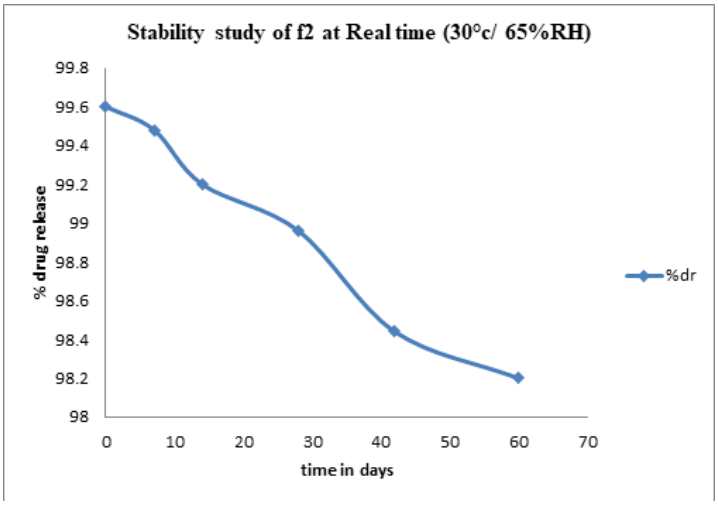

Figure No. 08:Stability study of F2 atReal time (30°c/ 65%RH)

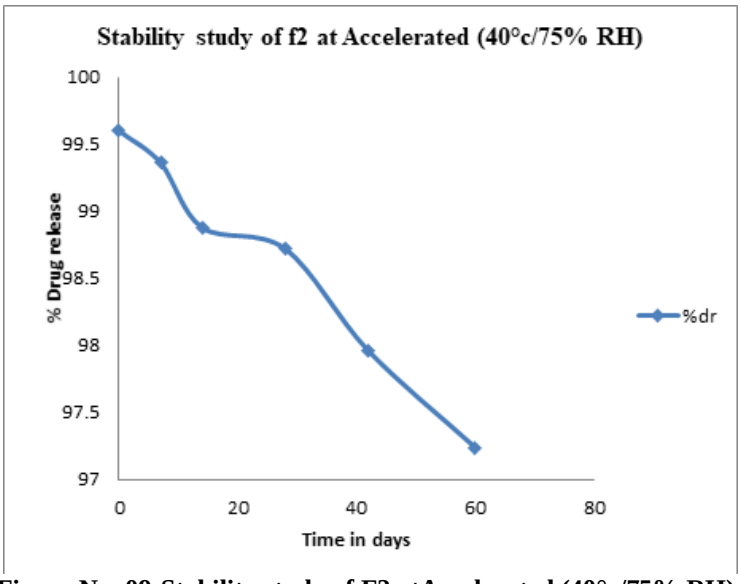

Figure No. 09:Stability study of F2 atAccelerated (40°c/75% RH)

The results of the Stability study for F2 formulation are given in Table No. 10. The stability studies carried out as per ICH guidelines for 2 months the results showed that the formulations were stable and intact without any interaction. F2 were subjected for stability studies the results observed were not much varied in integrity of the Films at different temperature conditions. There was no significant change in drug content and in-vitro release study.

IV. CONCLUSION

Mouth dissolving films of Ondansetron HCL were successfully formulated by employing Solvent casting method, using different superdisintegrants.The characterization of drug was done and the physicochemical parameters evaluation were performed as per pharmacopeia standards and compatibility study was done by FTIR method. The FTIR studies indicated that the drug was compatible with the carriers, polymers and other excipients used in the dosage form. HPMC was used as a polymer to obtain desired film properties. Starch, Croscarmellose, and MCC were used as a Superdisintegrant. Citric Acid was used as a Saliva stimulating agent to increase the rate of production of saliva that would aid in the faster disintegration. PEG 400 was used as a plasticizer for enhancing mechanical property i.e. tensile strength. Based on the *In vitro* disintegration time and dissolution studies formulation F2 Containing HPMC and superdisintegrant starch were found to be promising and showed a disintegration time 11.43±0.67sec and drug release profile 98.52% respectively, when compared to the other formulations. It was concluded that the MDFs of Ondansetron formulations containing HPMC and Superdisintegrant Starch showed least disintegration time and *In vitro* drug release was faster than the other formulation.

REFERENCE

[1]. Kulkarni parthasarathi,keshavarao, Dixit mudit, Gunashekara K, Shahnawazanis, Singhmangla N and Kulkarni ajay. Formulation and evaluation of Mouth dissolving film containing Rofecoxib. International Research journal of Pharmacy, 2011;2(3): 273-8.

[2]. Pallavipatil, S.K. Shrivastava. Fast Dissolving Oral Films: An Innovative Drug Delivery System. International Journal of Science and Research, 2014;3:2088-2093.

[3]. Mahesh shinde, VikasChoure, ShahadevRathod, ArvindBirajdar and Amithjadhav. Formulation and evaluation of oral fast dissolving film of Cinnerizine. Indo American journal of Pharmaceutical Sciences, 2018; 05(04):2316-2325.

[4]. Arunaarya, Amrishchandra, Vijay sharma and Kamlapathak. Fast dissolving oral films: An innovative drug delivery system a

[5]. nd dosage form. International journal of ChemTec Research, 2010;2(1):576-583.

[6]. Priyankanagar, Iti Chauhan, MohdYasir. Insights into polymers: Film formers in mouth dissloving films. Drug Invention today, 2011; 3(12): 280-9.

[7]. Meenudahiya, Sumitsaha and Aliasgar F. Shahiwala. A review on mouth dissolving films.NationalInstitue of Pharmaceutical Education and Research, 2009; 6:476-496.

[8]. Prasanna p. ghodake, Kailas M. Karande, Riyaz Ali Osmani, Rohit R. Bhosale, and Bhargav R. Harkare. Mouth dissolving films: innovative vehicle for oral drug delivery. International journal of Pharma Research and Review, 2013; 2(10): 41-7.

[9]. Raghavendrarao N. G and Suryakar V. B. Formulation and evoluation of Montelukast sodium muciadhesivebuccal patches for chronic asthma attacks.International journal of Pharma and Bio Sciences.2010; 1(2):1-14.

[10]. Magdy I. Mohamed, Mohamed Haider, Muaadh A. Mohamed Ali: BuccalMucoadhesive films containing Antihypertensive drug: Invitro/ in vivo evoluation. Journal of Chemical and Pharmaceutical Research, 2011; 3(6):665-686.

[11]. Ashish Gorle, Prafullapatil, RajveerBhaskar, Monika Ola: Development and evaluation of buccal film containing antihypertensive agent.ThePharma Innovation Journal, 2015; 4(1):53-60.

[12]. Muhammad Hanif, Muhammad Zaman and Veshchaurasiya. Polymers used in buccal film: a review. 2015; 18(2):105-111.

[13]. Chalamaiah M and Sharma PK. Preformulation and formulation aproches for buccal films. Journal of Bioequivalence and Bioavailability, 2016; 8(5): 246-8.

[14]. Ms. Mital S Panchal, MrHirenpatel, Mrs. AartiBagada, Dr. KR Vadalia. Formulation and evoluation of mouth dissolving film of Ropinirole hydrochloride by using pullulan polymers. International Journal of

Pharmaceutical Research and Allied Sciences, 2012; 1(3):60-72.
[15]. Jui Trivedi, Jankipatel, Dr. Upendrapatel. Formulation development and evaluation of fast dissloving film of Cinnerizine. International Journal of Pharmaceutical Research and Bio-Science, 2014;3(2):639-652.
[16]. Anjumpathan, Mahesh kumargupta, Neeteshkumarjain, Ankitadubey and Ankitagrawal. Formulation and evaluation of fast dissolving oral film of promethazine hydrochloride using different surfactant. Journal of innovations in Pharmaceuticals and Biological sciences, 2016;3(1):74-84.
[17]. Harshalashokpawar and Swati Ramesh kamat. Development and Evaluation of mouth dissolving film of Ondansetron hydrochloride using HPMC E5 in combination with taro gum and other commercially available gums. Journal of Molecular Pharmaceutics and organic process Research, 2017;5(1):138.
[18]. Alpesh R. patel, Dharmendra S. Prajapati, Jignyasha A. Raval. Fast dissolving films (FDFs) as a newer venture in fast dissolving dosage forms. International Journal of Drug Development & Research, 2010; 2(2):232-246.
[19]. Avinash Kumar Gali. Fast dissolving dosage forms. International journal of Pharmaceutical Science Invention, 2013; 2(11): 14-7.
[20]. Muhammad Bilal Hassan mahboob, TehseenRiaz, Muhammad Jamshaid, Irfan Bashir and SaqibaZulfiqar. Oral films: A comprehensive Review. International current Pharmaceutical Journal, 2016; 5(12):111-117
[21]. SaritaRana, L. Raju, VinayDhatwalia, VirendraYadav. Formulation and evaluation of Domperidone fast dissolving film by using different polymers. International journal of pharma research and health sciences, 2014; 2(5): 374-8.
[22]. Muhammad irfan, SumeriaRabel, quratuainBukhtar, Muhammad Imran Qadir, FarhatJabeen and Ahmed Khan. Orally disintegrating films: A modern expansion in drug delivery System. Saudi Pharma J, 2016; 24(5):537-546.
[23]. Agarwal Jyoti, Jindal Keshav, Singh Gurpeet. Formulation and evaluation of Oral fast dissolving films of Granisetron Hydrochloride using different polymers. International research journal of Pharmacy, 2015; 6(10):724-728.
[24]. Ali MS, Vijendra C, Sudheer Kumar D and Krishnaveni. Formulation and evaluation of fast dissolving oral films of Diazepam. Journal of Pharmacovigilance, 2016; 4(3):1-5.
[25]. Parul Saini, Anoop Kumar, Pankaj Sharma, SharadVisht. Fast disintegrating Oral Films: A Recent trend of Drug Delivery. International Journal of drug Development and Research, 2012; 4(4):80-94.
[26]. Yogyata S. Pathare, Vishakha S. Hastak, Amruta N. Bajaj. Polymers used for Fast disintegrating oral films. A review. International Journal of Pharmaceutical Sciences Review and research, 2013; 21(1): 169-178.
[27]. M koland, VP Sandeep, and NR Charyulu. Fast dissolving Sublingual Films of Ondansetron Hydrochloride: Effect of Additives on in vitro Drug Release and Mucosal permeation. Journal of young pharmacists, 2010; 2(3): 216-222.
[28]. Renuka R. Tiwari, umashankar M.S, Dhamodharan N. Recent update on oral films: A bench to market potential, 2018; 10(6): 27-3.
[29]. Suganda. Wafers: An innovative advancement of oro-dispersible films. International journal of applied pharmaceutics, 2016; 8(1): 1-7.
[30]. Muhammad Bilal Hassan mahboob, TehseenRiaz, Muhammad Jamshaid, Irfan Bashir and SaqibaZulfiqar. Oral films: A comprehensive Review. International current Pharmaceutical Journal 2016; 5(12): 111-117.
[31]. K. Senthilkumar, C. Vijay. Formulation development of mouth dissolving film of Etoricoxib for pain management. Hindawi Publishing Corporation Advances in pharmaceutics 2015; 10: 1-11.
[32]. K.M. Maheshwari, Pavankumardevineni, SravanthiDeekonda, Salma Shaik, nagapravallikauppala and Buchi N. Nalluri. Development and evaluation of mouth dissolving films of Amlodipine Besylate for enhanced therapeutic efficacy. Journal of Pharmaceutics 2014; 10: 1-10.
[33]. Seager H. Drug delivery products and zydis fast dissolving dosage forms. J pharm. Phamacol 1998; 50:375-382.

[34]. International Journal of Pharmacy and Pharmaceutical sciences ISSN 2011 3(1): 0975-1491.
[35]. Uddhav S Bagul. (2006). Current status of tablet disintegrants. A rev Retrieved march 5, 2011 from pharmainfo.net.http//www.pharmainfo.net/review/current-status-tablet-disintegranta- a review.
[36]. ShohrehAlipour, SaharAkbari, FatemehAhmadi. Development and in vitro evaluation of fast dissolving oral films of ondansetron hydrochloride. Trends in Pharmaceutical sciences 2015; 1(1):25-30.
[37]. SiddhantThakur, Vandana Arora sethi, Abdul WadoodSiddoqui, Lalit Kumar Tyagi. Development of mouth dissolving films of Ondansetron Hydrochloride by using Factorial Experimental Design. International Journal of Drug Delivery Technology 2019; 9(4):517-524.
[38]. John OluwasogoAyorinde, Michael AyodeleOdeniyi, OlalekanBalogun- Agbaje. Formulation and evaluation of Oral Dissolving Films of Amlodipine Besylate using of Starches with Hydroxypropyl methyl cellulose. Polimery w Medycynie 2016; 46(1): 45-51.
[39]. Lakshmi C.S.R, Patel Hitesh P, AkulSagar. Formulation and evaluation of oral dispersible tablets of cinnarizine using Sublimation technique. International journal of pharmaceutical sciences review and research 2011; 6(2): 178-184.
[40]. HassanienSagban, K. Yehia Ismail. Formulation and evaluation of orodispersible film of sildenafilcitrate. International Journal of Pharmacy and Pharmaceutical Sciences 2014; 6(2): 81-86.
[41]. Iman Sabah Jaafar. Formulation and in vitro evaluation of fast dissolving film of Metoclopramide hydrochloride. International journal of ChemTech Research 2017; 10(4): 26-38.