ISSN 2582-6441 [Online]
RESEARCH JOURNAL OF PHARMACY AND LIFE SCIENCES
LET OTHERS KNOW YOUR RESEARCH
RJPLS
An International Peer Reviewed Journal

Research Article

Formulation and Evaluation of Fexofenadine HCl Fast Dissolving Tablets

Malaya Kumar Dalai, Shakti Samantasinghara, Rashmiranjan Nayak, Meenakshi Behera, Ritanjali Ghadei

Royal college of pharmacy and Health Sciences, Berhampur-2, Odisha.

ARTICLE INFO

Date of submission: 05-08-2022
Date of Revision: 11-08-2022
Date of acceptance: 14-08-2022

Key Words:
Super disintegrants, wetting, test for dispersion

ABSTRACT

Fexofenadine HCl is an antihistamine drug used in the treatment of hay fever and similar allergy symptoms. It does not readily pass through the blood-brain barrier and causes less drowsiness than first generation histamine-receptor antagonists. Rapid dispersible Tablets of Fexofenadine HCI immediate release tablets were designed to increase the dissolution rate by using super disintegrants. Different formulations of Fexofenadine HCl were prepared by direct compression method. These formulations were evaluated for hardness, thickness, friability, weight variation, disintegration time, and in vitro dissolution study. The USP paddle method was used to study the drug release from the formulations while keeping the temperature at 37 °C for 60 minutes. As super disintegrants, sodium starch glycolate, Ac-di-sol, and polyplasdone XL were utilized in concentrations of 3 percent, 6 percent, and 9 percent. As a result, only the ratio of super disintegrants was altered in each formulation, while all other excipients and the active ingredient (fexofenadine HCI) remained the same. According to USP, 0.001N HCI was utilized in this instance as the dissolution medium, and absorbances were measured using a UV spectrophotometer at 258 nm. By using FTIR studies revealed no interactions between the drug and excipients used. The best results are obtained using 6% of polyplasdone XL.

***Corresponding author:**
Malaya Kumar Dalai
Royal College of Pharmacy and Health Sciences, Andhapasara Road, Berhampur - 760002, Ganjam, Odisha
E-mail: mkdalai9040@gmail.com

INTRODUCTION:

There are numerous pharmaceutical dose forms, including pills, granules, powders, and liquids. Typically, a pill is made to be chewed or swallowed whole in order to provide patients with a precise amount of medication. Under light pressure, the pills, which comprise tablets and capsules, may maintain their shapes. However, some patients, particularly pediatric and geriatric patients, have difficulty swallowing or chewing solid dosage forms. Many pediatric and geriatric patients are unwilling to take these solid preparations due to fear of choking. Consequently, orally dissolving pills have been developed. Fast dissolving tablets are a novel type of dosage form for oral administration that formulators have developed to address these medical needs. This innovative technology causes the dosage form containing the active pharmaceutical ingredients to dissolve quickly, typically in only a few seconds. Giving the patient the greatest convenience possible without the need for water. A peripheral and selective HI-antagonist, fexofenadine is a second generation long acting H_1-receptor antagonist (antihistamine).

Orally delivered medications' bitter taste frequently discourages patients from taking their medications, especially children and the elderly. Unfortunately, the majority of drugs have a naturally bitter taste that can cause mouth or throat burning. Particularly, a bitter taste can reduce patient compliance, which lowers the efficacy of medication.

According to European Pharmacopoeia, the Fast Dissolving Tablet should disperse/disintegrate in less than three minutes. The main strategy used in the creation of Fast Dissolving Tablet is the use of super disintegrants like cross linked carboxymethyl cellulose (croscarmellose), sodium starch glycolate (Primogel, Explotab), polyvinylpyrrolidone (Polyplasdone), etc. that offer instantaneous disintegration of tablets after placing them on the tongue, releasing the medication in saliva. Recent adoption of the phrase "Oro dispersible tablet" by the European Pharmacopoeia, which refers to a tablet intended to be taken in the mouth before being swallowed, highlights their expanding significance. Some medications' bioavailability may be boosted by oral cavity absorption as well as by pregastric absorption of saliva containing scattered medications that enter into the stomach. Additionally, less medication than in a conventional tablet is vulnerable to first pass metabolism. The processes of freeze-drying, spray-drying, tablet moulding, sublimation, sugar-based excipients, tablet compression, and disintegration addition are used to create fast-dissolving tablets.

The elderly presently constitutes up a sizable segment of the world's population as a result of longer life expectancies. These people's physiological and physical capabilities will gradually deteriorate. A non-sedating anti-histamine, fexofenadine HCl, is used to treat allergic disorders like seasonal allergic rhinitis and urticaria systemically.

Fexofenadine HCl was suggested as a model drug for formulation development. Due to its high permeability and low solubility, fexofenadine HCl is classified as category II in the biopharmaceutical classification system. This shows how highly bioavailable it is, further indicating that it would be the ideal choice for a quick medication delivery method. It is advised for treating simple seasonal allergic rhinitis symptoms in adults and children 2 years of age and older, as well as uncomplicated cutaneous indications of chronic idiopathic urticaria in adults and children 6 months of age and older. These problems typically affect pediatrics patients since palatability is their main concern.

The low solubility of fexofenadine, particularly in stomach circumstances, presents another challenge in the formulation of fexofenadine in oral pharmaceutical formulations (solubility of 0.2 mg of fexofenadine HCI per ml of pH 1.2 aqueous buffer solution).Therefore, it is extremely desirable to create coated fexofenadine granules with taste-masking qualities that also allow for rapid release of the active ingredient from the granules and rapid absorption in the body following oral administration.

MATERIALS AND METHODS:

Materials:

All the chemicals obtained and used are of analytical grade. Fexofenadine Hydrochloride, Magnesium stearate, Talc, Cross Povidone, Sodium Starch Glycolate, Mannitol, PEG-4000, Polyplasdone.

Methods:

Preparation of standard solutions: Stock solutions of Fexofenadine HCl were prepared by dissolving the drug in 0.001N HCl. These stock solutions were diluted to desired strengths by buffer solution (0.001N HCl) to get the working standard solution.

Formulation design:

Methods:

Orally disintegrating tablets were prepared by direct compression method using single punch tablet machine. The formulations were developed by using various ratios. Formulation design for orally disintegrating tablet by direct compression using super disintegrants: The super disintegrants in 3%, 6%, and 9% concentrations were used to develop the tablets. All the ingredients were passed through sieve having mesh no. 30. All the

ingredients were placed in a motor pestle. The mixed blend of excipients was compressed using a single punch machine to produce convex faced tablets weighing 250, 255 and 260 mg for 3%, 6% and 9% concentrations respectively. A minimum 20 tablets were prepared for each formulation. Before compression, the surfaces of the die and punches were lubricated with talc. All the preparations were stored in airtight containers at room temperature for further study. Effect of different super disintegrants with various concentrations was used to study in vitro. dissolution characteristics and disintegration time of the formulation.

TABLE No.:1 Formulation for Fexofenadine Hydrochloride Fast Disintegrating Tablet

Composition	Formulation Trials (Quantity in mg)								
	F1(3%)	F2(6%)	F3(9%)	F4(3%)	F5(6%)	F6(9%)	F7(3%)	F8(6%)	F9(9%)
Fexofenadine HCl	60	60	60	60	60	60	60	60	60
Polyplasdone XL	7.8	15.6	23.4	-	-	-	-	-	-
Ac-di-sol	-	-	-	7.8	15.6	23.4	-	-	-
SSG	-	-	-	-	-	-	7.8	15.6	23.4
Mannitol	177.2	169.4	161.6	177.2	169.4	161.6	177.2	169.4	161.6
PEG-4000	5	5	5	5	5	5	5	5	5
Mg Stearate	5	5	5	5	5	5	5	5	5
Talc	3	3	3	3	3	3	3	3	3
Aspartame	2	2	2	2	2	2	2	2	2
Colour	q. s	q. s	q. s	q. s	q. s	q. s	q. s	q. s	q. s
Flavour	q. s	q. s	q. s	q. s	q. s	q. s	q. s	q. s	q. s
Total weight	260	260	260	260	260	260	260	260	260

Evaluation parameter Of Fexofenadine Hydrochloride Oral Dispersible Tablet:

Weight variation test:

Twenty tablets were randomly selected from each formulation and their average weight was calculated. Using digital balance. Then individual tablets were weighed and the individual weight was compared with an average weight.

Thickness Measurement:

Method:

Randomly 10 tablets were taken from each formulation and their thickness was measured using a digital screw gauge,

(Digimatic outside micrometer, Mitutoyo, Japan). The individual tablet was paced between two anvils of screw gauge and sliding knob was rotated until the tablet was tightly fitted. The digital reading displayed was noted.

Hardness and Friability:

Method (Hardness):

The tablet hardness of different formulations was measured using a Monsanto hardness tester. The tester consists of a barrel containing a compressible spring held between two plungers. The lower plunger was placed in contact with the tablet and a zero was taken. The upper plunger was then forced against the spring by turning a threaded bolt until the tablet fractures. As the spring is compressed, a pointer rides along a gauge in the barrel to indicate the force. The force of fracture is recorded, and the zero-force reading is deducted from it. Generally, a minimum hardness of 4 kg is considered acceptable for uncoated tablets. The hardness for ODTs should be preferably 1-3 kg.

Method (friability):

This test is performed using a laboratory friability tester known as Roche Friabilator. 10 tablets were weighed and placed in a plastic chambered friabilator attached to a motor, which revolves at a speed of 25 rpm, dropping the tablets from a distance of 6 inches with each revolution. The tablets were subjected to 100 revolutions for 4 mins. After the process, these tablets were dedusted and reweighed. Percentage loss of tablet weight was calculated.

Wetting time and water absorption ratio:

Method:

Five circular tissue papers were placed in a Petri dish with a 10 cm diameter. Ten millimeters of water containing Eosin, a water-soluble dye, was added to the Petri dish. The dye solution is used to identify the complete wetting of the tablet surface. A tablet was carefully placed on the surface of tissue paper in the Petri dish at room temperature. The time required for water to reach the upper surface of the tablets and completely wet them was noted as the wetting time. To check for reproducibility, the measurements were carried out in replicated (n=6). The wetting time was recorded using a stopwatch.

Figure 1: Wetting time and water absorption ratio

Disintegration Time:

Disintegration time is considered to be one of the important criteria in selecting the best formulation. To achieve correlation between disintegration time In vitro and In vivo (in oral cavity) several methods were proposed, developed and followed at their convenience. One of the simple methods followed is described below.

Method:

Disintegration time was also measured using a modified disintegration method. For this purpose, a Petri dish (10 cm diameter) was filled with 10ml of water. Tablet was carefully put in the center of the Petri dish and the time for the tablet to completely disintegrate into find particles was moved using a pump watch.

Dissolution test:

Method:

Drug release from RDTs was studied by using USP type-II dissolution rate test apparatus at 50rpm (USP XXIII Dissolution Test Apparatus) using 900ml of phosphate buffer pH 6.8 as dissolution medium. RDTS of desired formulation were taken and placed in the vessels of dissolution apparatus. Samples were collected from the vessels at different time intervals, replenished with same volume of the blank solution and analyzed using UV-Visible spectrophotometer. Drug concentration was calculated from the standard graph and expressed as % of drug dissolved or released. The release studies were performed in replicates and means values were taken.

Table No.2: Details of invitro drug release study:

Apparatus used: USP XXIII dissolution test apparatus

Dissolution Medium: 6.8 pH Phosphate buffer

Dissolution Medium Volume: 900ml

Temperature: 37+0.5 ^{0}C

Speed of paddle: 50 rpm

Time intervals: 5,10,15,20,30,45,60 mins

Sample Withdrawn: 5ml

Absorbance Maximum λ max: 258nm

Drug polymer compatibility studies:

Fourier-Transformed Infrared (FTIR) Spectrophotometer technique has been used to study the physical and chemical interaction between the drug and excipients used. The FT-IR spectrum of pure drug a different excipient and the optimized tablet were studied. There was no significant difference between the absorption peaks of pure drug and optimized formulation. The results concluded that there was no interaction between pure drug and excipients.

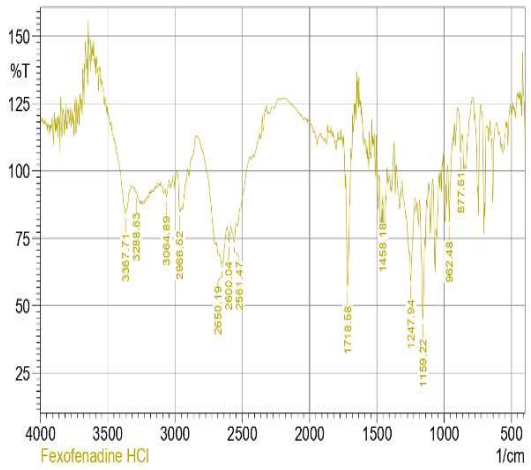

Figure 2: FT-IR spectra of Fexofenadine Hydrochloride.

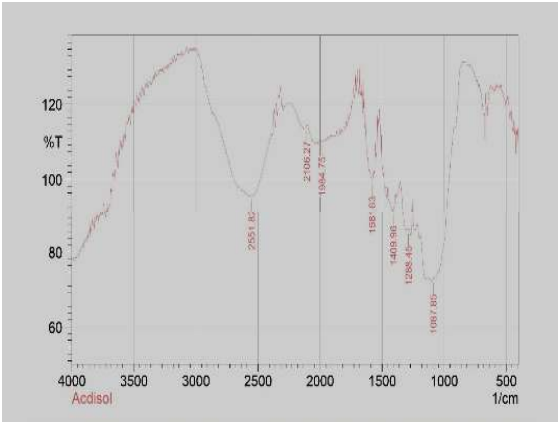

Figure 3: FT-IR spectra of Ac-di-sol

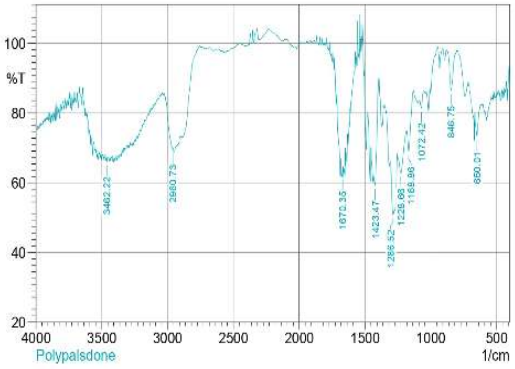

Figure 4: FT-IR spectra of Polyplasdone

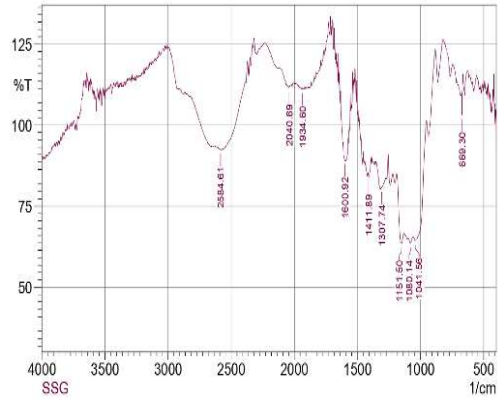

Figure 5: FT-IR spectra of Sodium Starch Glycolate

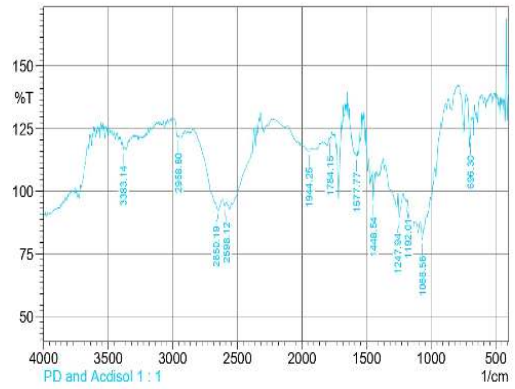

Figure 6: FT-IR spectra of Fexofenadine Hcl:Ac-di-sol:: 1:1

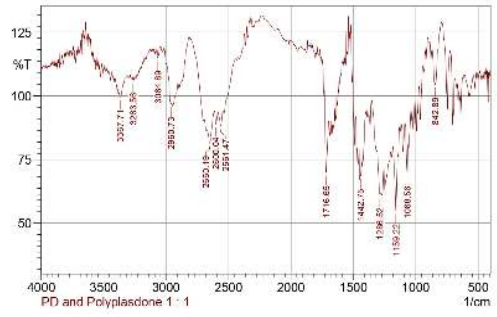

Figure 7: FT-IR spectra of Fexofenadine HCl: Polyplasdone: 1:1

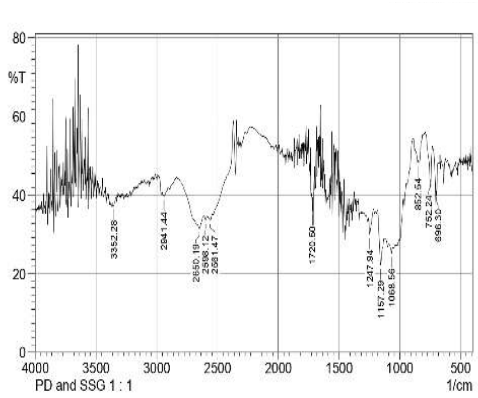

Figure 8: FT-IR spectra of Fexofenadine HCl: Sodium Starch Glycolate: 1:1

Table No. - 3 Determination of absorption maximum λ max

SI. No.	Concentration (µg/ml)	Absorbance
1	5	0.140
2	10	0.276
3	15	0.423
4	20	0.545
5	25	0.696
6	30	0.811
7	35	0.943
8	40	1.074

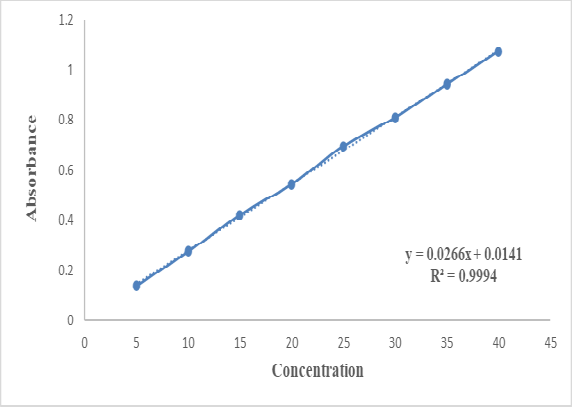

Table No: 4 PERCENT IN VITRO DRUG RELEASE OF DIFFERENT BATCHES

Time (min)	Batch 1	Batch 2	Batch 3	Batch 4
1	19.83	27.45	41.92	31.12
2	31.42	33.67	59.15	42.76
3	36.9	44.62	71.99	56.17
4	43.35	52.8	78.7	64.76
5	48	58.05	85.12	78.86
10	51.82	62.1	88.62	85.56
15	55.87	67.87	90.37	91.7
20	64.45	72.56	94.17	94.76
25	78.89	79.05	95.63	98.35
30	95.98	96.78	98.67	-

RESULTS AND DISCUSSION:

Physical parameter study: All the formulations showed uniform thickness .The average percentages of deviation of all tablets formulations were within the limit. In this study the percentage friability for all the formulatons were below 1%, Indicating that the friability was within the prescribed limits. All the tablet formulations showed acceptable pharmacotechnical properties and complied with the compendial specification for weight variation, hardness and friability , disintegration time.

CONCLUSIONS:

Fast dissolving Tablet of fexofenadine hydrochloride were prepared using polyplasdone XL, Ac-di-sol and sodium starch glycolate as super disintegrants in different concentrations by direct compression method. Preformulation

studies of fexofenadine hydrochloride were performed. From the FT-IR study, the interference was verified and found drug and the used excipients are compatible. Finally, it can be concluded that fexofenadine hydrochloride can be formulated as fast dissolving tablets successfully using polyplasdone XL as super disintegrant at it 6% of tablet weight. It can be used as a convenient formulation for pediatric, geriatric, bedridden and psychotic patients.

REFERENCES:

1. Abilash K., Dinesh G., Janartanan S., Praveena J., Vanitha G., Gokul Manikandan P. and Jeevanandham S.: Formulation and evaluation of Mouth Dissolving films of Fexofenadine HCL by Solvent Casting Method. World Journal of Pharmaceutical Research Volume 11, Issue 4, 1699-1721, March 2022.
2. Surya Prasad Sathya CH., Manasa Mohana: Formulation and Evaluation of Fexofenadine HCL Rapid Dispersible Tablets by Using Direct Compression Method. International Journal of Recent Advances in Multidisciplinary Topics Volume 2, Issue 7, July 2021.
3. Krosuri Kumar Pavan, Geetha Dakka, Reddy Dastagiri Y., Challa Madhusudanachetty: Formulation and Evaluation of Taste Masking Fexofenadine Oral Disintegrating Tablets. British Journal of Pharmaceutical and Medical Research Vol.05, Issue 04, Pg.2451 - 2463 July - August 2020
4. Abilash K, Dinesh G, Janarthanan S, Praveena J, Vanitha G – An Overview on Mouth Dissolving Films: International Journal of Pharmaceutical Research and Applications, 2022; 7: 1077-1085.
5. Tarke SR and Shanmugasundaram P: Formulation and evaluation of fast dissolving tablets of antihypertensive drug. Research Journal of Pharmacy and Technology 2017; 1(10): 155-160.
6. Pandey A and Jain S: Formulation development and evaluation of fast dissolving acelofenac tablets. World Journal of Pharmacy and Pharmaceutical Sciences 2017; 6(3): 1276-1283.
7. Indian Pharmacopeia, 2014; 1,2: 185,1785.
8. Shendge S Raosaheb, Salunkhe Kishor, Girish Kashid: Formulation and Evaluation of Fast Dissolving Sublingual Film Of Antihistamine Drug: European Journal Of Molecular & Clinical Medicine, 2020; 7: 2134-2143
9. Damodar R, Movva B, Mallikarjun PN, Pasumarthy C, Kona N and Varsha PV: Formulation and

evaluation of fast dissolving tablets of diclofenac sodium by novel hole technology. Journal of Molecular Pharmaceutics and Organic Process Research 2014; 2(2): 1-6.

10. Gunda RK and Kumar JNS: Formulation development and evaluation of moxifloxacin HCl fast dissolving tablets. Pharm Methods, 2017; 8(2): 160-167.
11. Raymond, C.R., Paul, J.S. and Paul, J.W., Handbook of Pharmaceutical Excipients. Pharmaceutical Press and American Pharmaceutical Association. 9th edition, 2020.
12. Aulton M.E., Modified release per oral dosage forms, Pharmaceutics - The Science of Dosage form Design. 5th edition,2018, New York: Churchill Livingstone.
13. Reddy Ramanji K., Madhu Chandaka Dr., Omar Mohammed Dr., Ahirrao Vanji Sachin, Lakshmi Jhansi P.: Formulation and Evaluation of Mouth Dissolving Tablet of Fexofenadine hydrochloride. Indo American Journal of Pharmaceutical Sciences, 2017, 4 (09), 3230-3242.
14. Desale KY, Bankar VH, Gaikwad PD, Pawar SP. Review on: Fast dissolving / disintegrating tablets. International Journal of Pharmaceutical Sciences Review and Research. 2011: Volume 11, Issue 1, 152-158.
15. Kakade SM, Mannur VS, Ramani KB. Formulation and evaluation of mouth dissolving tablets of losartan potassium by direct compression techniques. International J of Research and Pharmaceutical Sciences, 2010: Volume 3, Issue 1, 290-295.
16. Desale1 Y K, Gaikwad1D P, Bankar1 H V, Pawar1 P S.: Formulation and Characterization of Fexofenadine hydrochloride Fast Dissolving Tablet by using various Super disintegrants. International Journal of Drug Delivery 4 (2012) 82-88.
17. Kuchekar BS, Atul BC, Mahajan HS. Mouth dissolving tablets: A novel drug delivery system, Pharma Times .2003; 35: 7-9.
18. Kaushik D, Saini TR, Dureja H. Development of melt in mouth tablets by sublimation technique. J Pharm. Res.2004; 3: 35-37.
19. Kuchekar BS, Atul BC, Mahajan HS. Mouth dissolving tablets: A novel drug delivery system, Pharma Times .2003; 35: 7-9.
20. Dobetti L. Fast-melting tablets: Developments and technologies. Pharma Tech 2001: 44-50.
21. Chang RK, Guo X, Burnside BA, Cough RA. Fast dissolving tablets. Pharm Tech 2000: 24(6): 52-58.