WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 10, Issue 14, 1098-1108. Research Article ISSN 2277– 7105

FORMULATION EVALUATION AND CHARACTERIZATION OF FAST DISSOLVING TABLET OF DEFLAZACORT

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Article Received on
06 October 2021,

Revised on 26 October 2021,
Accepted on 16 Nov. 2021

DOI: 10.20959/wjpr202114-22350

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ABSTRACT

Better compliance to the patient of osteoarthritis is a prime importance of formulation and development team, this can be achieved formulating fast dissolving tablet. Fast Dissolving tablets of Deflazacort were formulated by employing the direct compression method. The prepared fast dissolving tablets were evaluated for various parameters like weight variation, hardness, friability, disintegration time, drug content, wetting time, *in-vitro* drug release, and FTIR. Pre-formulation studies of Deflazacort drug were performed. The FTIR studies revealed that there is no chemical interaction with excipients. Percentage weight variation and drug content uniformity were found to be within the approved range of all the formulations. Evaluation parameters like hardness and friability indicated good mechanical resistance of the tablets for all the formulations. The Deflazacort FDT were subjected to various post compressed evaluation parameters and based on that, it was concluded each formulation was found to be an optimized formulation, except for F1 & F2, providing a quick onset with faster absorption, showing a better therapeutic effect.

KEYWORD: Fast Dissolving Tablet, Deflazacort, Osteoarthritis.

INTRODUCTION

Since the beginning of time, earth has seen better of both worlds, on one hand, the devasting calamities destroying an entire race to the geography of the world, to advancements and evolution in pretty much every single thing that existed on this planet. From non-living beings to advanced organisms that ruled over time. But, evolution in the field of science has seen some of the most advanced evolution over time.

From the beginning of the civilizations, we saw keen interest in the field of medicine. It has seen some of the most advanced developments in its fields. From modern-day advanced therapies to the advanced pharmaceutical world to back it up, the field of medicine is one of the most rapidly evolving branches of science.

But, even with this evolution and advancements, we still are facing many challenges due to our habitat, lifestyle, genetics, and many more.

Due to our rapid lifestyle, many disorders and diseases are now becoming a routine for the population. One of these disorders is osteoarthritis.

Fast Dissolving Tablets (FDT) or orally disintegrating tablets (ODT) has emerged as alternative oral dosage forms. These are novel types of tablets that disintegrate/dissolve/ disperse in saliva within few seconds. Fast dissolving tablet should disperse/disintegrate in less than three minutes. The basic approach used in development of FDT is the use of super disintegrants like Crospovidone (Insolubele polymer of N-vinayl-2-pyrrolidone), Croscarmellose (A cross- linked polymer of caboxymethylcellulose), Sodium starch glycolate and Pregelatinized starch etc. which provide instantaneous disintegration of tablet after putting on tongue, thereby releasing the drug in saliva. The bioavailability of some drugs may be increased due to absorption of drugs in oral cavity and also due to pre gastric absorption of saliva containing dispersed drugs that pass down into the stomach. Moreover, the amount of drug that is subjected to first pass metabolism is reduced as compared to standard tablets.

Advantages of FDTs

Fast disintegrating tablets (FDTs) are meant for administration to the patients who cannot swallow, such as the elderly, stroke victims, bedridden patients, patients affected by renal failure, and patients who refuse to swallow, such as pediatric, geriatric, and psychiatric patients. By the use of FDTs, rapid drug therapy can be achieved, allowing an increase in

bioavailability/rapid absorption through pregastric absorption of drugs from the mouth, pharynx, and esophagus as saliva passes down. FDTs are suitable for administration and patient compliance for disabled, bedridden patients, and for travelers and busy people for whom water is not accessible all the time. This new formulation also helps in changing the perception of medication as bitter pill, particularly in pediatric patients. The risk of choking or suffocation during oral administration of traditional formulations due to physical obstruction is avoided, thus providing enhanced safety. New business possibilities like product differentiation, product promotion, patent extension, and life cycle management become easy after the introduction of FDTs. The FDTs are often formulated for existing drugs to extend the patent life of the drug through product differentiation.

Deflazacort is an oxazoline derivative of prednisolone with anti-inflammatory and immunosuppressive activity. Studies have shown deflazacort to be as effective as prednisone or methylprednisolone in patients with rheumatoid arthritis.

Now, the present research aims to formulate, evaluate, characterize a fast-dissolving tablet of deflazacort, using various concentrations of super disintegrants, using the direct compression method. Through our research, we will be able to improve the solubility, dissolution rate, bioavailability, and taste masking to improve patient compliance, hence providing quick onset and reduction in pain due to osteoarthritis.

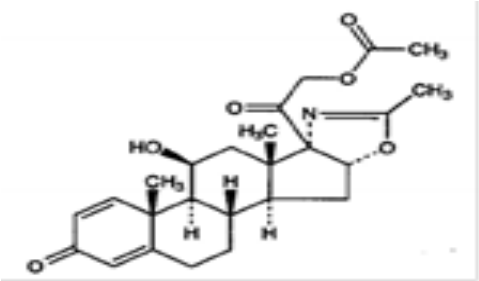


Fig. 1: Structure of deflazacort.

MATERIALS AND METHOD

- **Materials:** Deflazacort was obtained as a gift sample from Strides Acrolabs, Banglore, Karnataka, Sodium Starch glycolate, Croscarmellose sodium, and crospovidone were obtained from the Octis Research Lab, Uttrakhand, Microcrystalline cellulose was obtained from the High Purity Laboratory Chemicals, Mumbai, Maharashtra, mannitol, sucrose, magnesium stearate, and talc were obtained from Universal Scientific

Appliances, Madurai, Chennai.All chemicals used obtained were of either AR/LR grade or the best possible pharma-grade supplied by the manufacturer.

➢ **Methodology**

- **Pre-formulation studies:** An exhaustive pre-formulation study was performed to suffuse the physicochemical properties of the drug molecule which further helps in establishing a robust dosage form. The pre-formulation study was done with the following parameters:
  - **Organoleptic properties:** It was the initial evaluation during the pre-formulation studies, assessing visually the color, odor, and taste
  - **Melting Point:** It is one of the reliable physical properties of a drug and can be advantageous during drug discovery and development. The melting point was determined using an open-capillary method
  - **Solubility:** Aqueous solubility is an important factor in determining systemic absorption, and hence, in turn determining the therapeutic effect. Solubility was determined in water, methanol, ethanol, chloroform, and ethyl acetate.
  - **Partition coefficient:** An important physicochemical factor determining the rate of absorption and hence onset and bioavailability. The equal volume of n-octanol and double distilled water was saturated for a period of 24 hours. 10mg of Deflazocort were added to the mixture and stirred for1hour.

Separating the set w/o layers with the help of separating the funnel. The aqueous phase was suitably diluted and the absorbance was taken at λmax 244nm.The partition coefficient was calculated as the ratio between the concentration of the drug in n-octanol and that of water using thee quation.

Po/w=(COil/Cwater)equilibrium

- **Determinations of λmax & preparation of standard curve:** A Standard solution of Deflazacort was prepared by dissolving accurately weighed100 mg of Deflazacort with little quantity of 0.1N HCl solution in a100ml volumetric flask.The volume was made upto100ml with 0.1N HCl to obtain ans stockvsolutionvofv100 mcg/ml.from the avabove solution several dilutions are made to obtain 50, 75, 100, 125, 150 mcg/ml solutions.The absorb ance of the drug solutions was estimated at λ max at 244nm.
- **Drug excipient compatibility** FTIR spectroscopy wascarried for pure drug and polymers to know any chemical Interactions between polymers and drugs.The sample of pure drug,

polymers, and physical mixture of drug and polymers were dispersed in 200mg of KBr powder and compressed into pellets at a pressure of 6000 kg/cm2 and analyzed. Spectral measurements were obtained by powder diffuse reflectance on an FT-infrared spectrophotometer(Shimadzu, FT-IR, Japan) in the range 4000–400 cm^{-1}.

- **Formulation of deflazacort FDT:** This was formulated using direct compression method. Following formulation table was followed during the preparation of deflazacort FDT:-

Table 1: Formulation of deflazacort FDT.

Ingredients	F1	F2	F3	F4	F5	F6	F7	F8	F9
Deflazacort	30	30	30	30	30	30	30	30	30
Croscarmallose sodium	8	12	16		-	-	-	-	-
Sodium Starch Glycolate	-	-	-	8	12	16	-	-	-
Crospovidone	-	-	-	-	-	-	8	12	16
Mannitol	43.8	33.8	23.8	43.8	33.8	23.8	43.8	33.8	23.8
Magnesium stearate	5	5	5	5	5	5	5	5	5
Talc	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Sucrose	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Microcrystalline cellulose	12	18	24	12	18	24	12	18	24
Total weight of tablet	100	100	100	100	100	100	100	100	100

- **Post-compressed evaluation**
  - **Weight variation:** Twenty tablets were randomly selected and individually weighed. The average weight of 20 tablets was calculated.The individualtablet weights were compared to the average weight.
  - **Hardness:** The hardness of the tablet was measured on a Monsanto hardness meter in arrange between7and9kg/cm^2.The hardness of the tablet mirrors the differences in density and porosityof the tablet,which should produce differentdrug release patterns.
  - **Friability:** This was performed to determine the tablet's ability to withstand the mechanical shock during packaging, production, and transport.Apre-weighed sample (20tablets) was placed in the crusher and run for100 revolutions. Then the tablets were weighed again and the friability percentage was calculated using the formula.

F=1–Wo/W×100

Where,Wo=Weight of the tablet before the test,W=Weight of tablet after the test.

- **Drug content:** To evaluate the efficacy potential of a tablet,the amount of drug per tablet must be controlled from one tablet to an other and from one batch to an other .To perform the test,10 tablets were crushed with mortar. An amount equivalent to100mg of drug was dissolved in100ml. Methanol is filtered and diluted to 50µg/ml and analyzed, spectrophotometrically at 285nm.The drug concentration was determined using a standard calibration curve.
- **Water absorption:** A piece of tissue paper folded twice was placed in a small petridish containing 6ml of water .A tablet was placed on the paper and the time required for complete wetting was measured.The wetted tablet was then weighed. Water absorption ratio is indicated by R,which iscalculated by using the equation below:

R=10×Wa-Wb/Wb

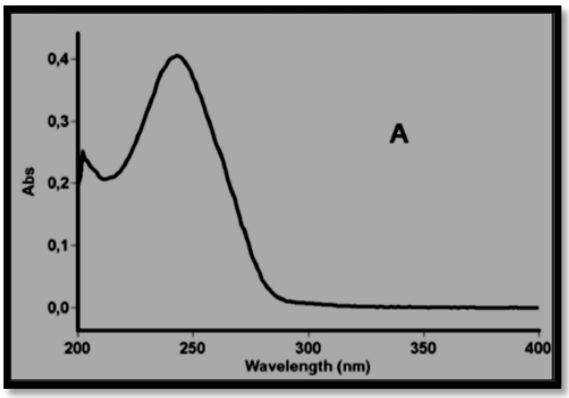
- ***In-vitro drug release:*** The *in-vitro* dissolution test was performed using the IP type-I dissolution test apparatus.The drug release study was conducted in 0.1NHC1 for 5minutes in a 900 ml dissolution medium, maintained at 37±0.5°C, and stirred at100 RPM. Periodically, 5ml of samples were removed and filtered through the Whatman filter paper and the samples were replaced by the equivalent volume of dissolution medium. The concentration of Deflazocort was measured spectrophotometrically at 244nm.

RESULTS AND DISCUSSION

- **Organoleptic evaluation:** Deflazacort API was crystalline powder and found to have a slight buff to off-white color with a sweet taste. It didn't have any odor associated with it.
- **Melting point:** The melting point of the drug is calculated by the open capillary method. The melting point of Deflazacort came out to be 254°C.
- **Solubility:** The solubility of the drug Deflazacort is seen soluble in methanol and acetone where as it is freely soluble in dichloromethane and acetic acid.
- **Partition coefficient:** The partition coefficient of Deflazacort is calculated as mean± SD and the results were

Concluded as 204±84L.

- **λ max & Standard curve of Deflazacort**



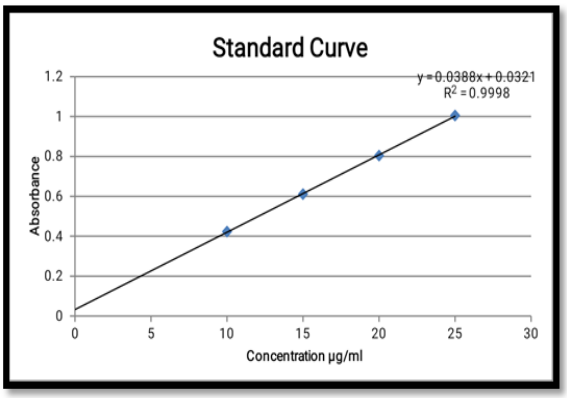


Fig 2 & 3: λ max and Standard curve of deflazacort.

- **Drug compatability studies**

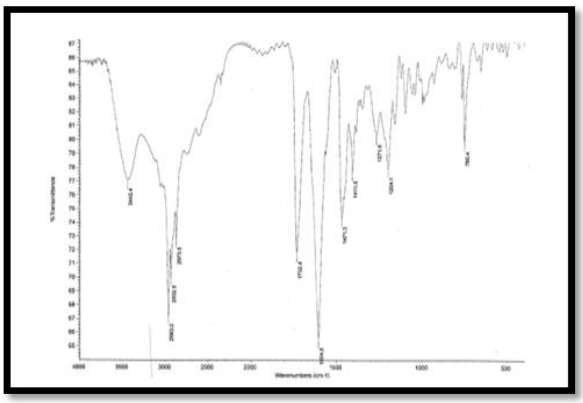


Fig. 4: FTIR spectra of deflazacort.

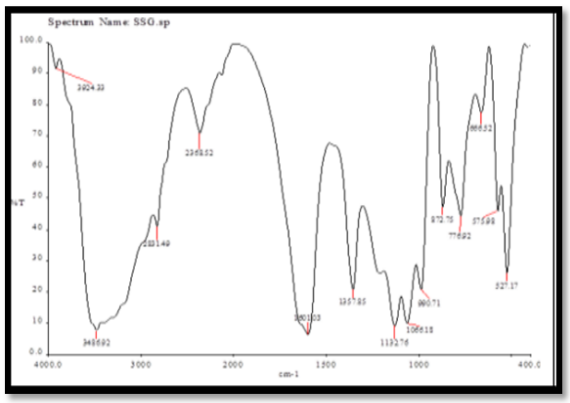


Fig. 5: FTIR spectra of croscarmellos.

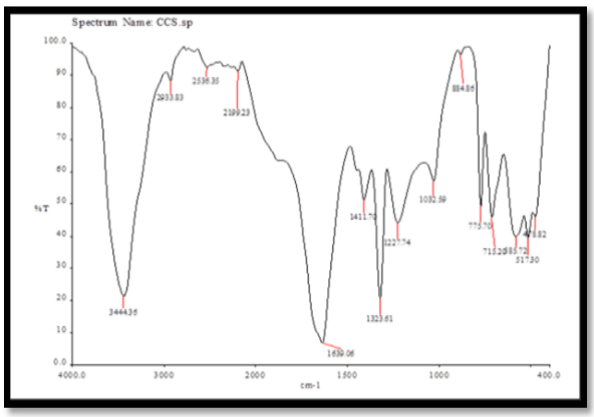


Fig. 6: FTIR spectra of crospovidone

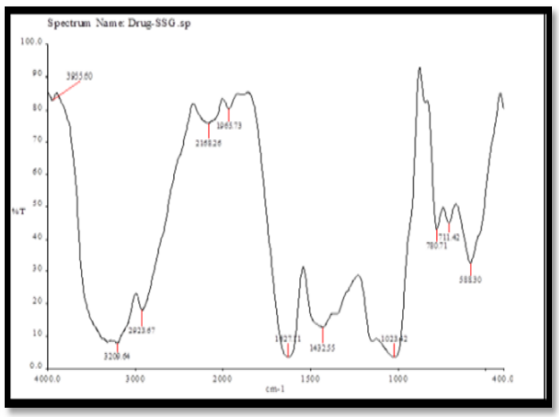


Fig. 7: FTIR spectra of deflazacort +Crospovidone +croscarmellose

- **Pre-compressed evaluation studies:** Factors including density, porosity drug content, and flowability were studied. Results are tabulated below**:**

Table 2: Pre-evaluation parameters of deflazacort.

Formulation Code	Angle of repose (˚)	bulk density (g/cm3)	Tapped density (g/cm3)	Carr's index (%)	Housner index	Drug content (%)
F1	30.49	0.3367	0.4439	24.13	1.30	96.91
F2	31.39	0.3613	0.4435	18.52	1.21	96.68
F3	30.68	0.3759	0.4654	19.21	1.22	96.91
F4	30.53	0.3623	0.4659	22.22	1.27	96.44
F5	30.24	0.3620	0.4655	22.21	1.27	96.68
F6	30.65	0.3905	0.4649	15	1.18	96.20
F7	30.55	0.3759	0.4443	15.38	1.17	96.68
F8	30.53	0.3912	0.4657	15.98	1.18	95.97
F9	30.45	0.3915	0.4462	16	1.19	99.96

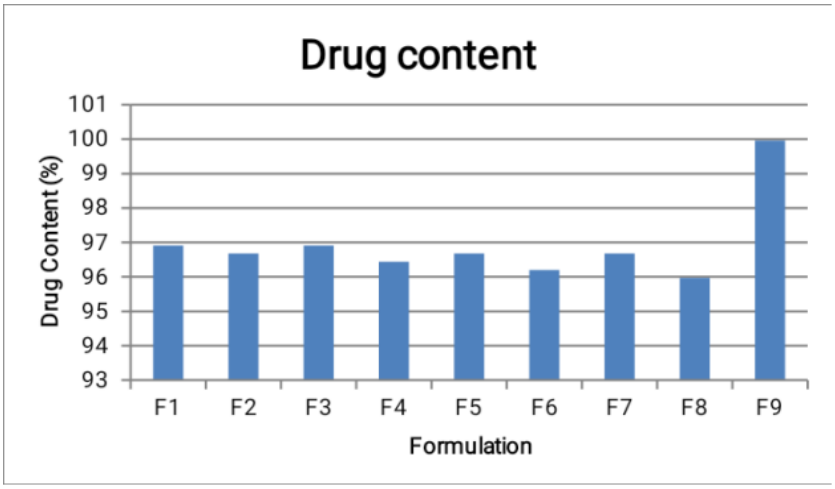


Fig. 8: Drug content studies of deflazacort.

- **Post compressional evaluation studies:** These factors were evaluated for the Deflazacort FDT for the quality test of the tablet. Results were tabulated below:-

Formulation Code	Hardness (Kg/cm^2)	Weight Variation (mg)	Friability (%)	% Drug release 5 minutes	Water absorption (%)
F1	3.0±0.03	102±0.03	0.17±0.03	99.17±1.6	16
F2	3.1±0.04	105±0.04	0.20±0.03	99.44±1.3	91
F3	3.0±0.72	108±0.72	0.42±0.05	98.64±2.9	104
F4	3.2±0.04	106±0.04	0.19±0.03	99.42±3.2	37
F5	3.0±0.07	99± 0.07	0.18±0.09	99.17±2.9	152
F6	3.0±0.05	98±0.05	0.21±0.07	99.44±2.1	71
F7	3.0±0.04	91±0.03	0.44±0.05	99.64±2.7	73
F8	3.1±0.03	92±0.04	0.23±0.03	100.2±3.3	89
F9	3.2±0.05	90±0.05	0.43±0.04	98±3.1	88

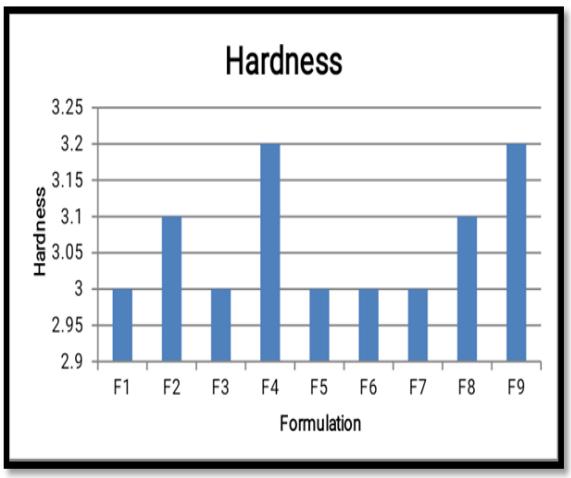


Fig. 9: Results of hardness test.

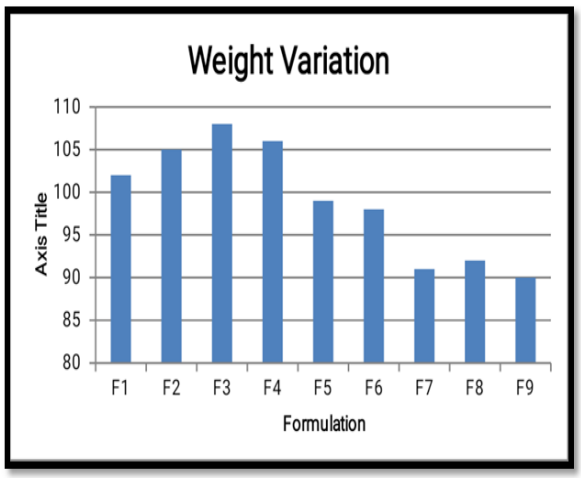


Fig. 10: Results of weight variation.

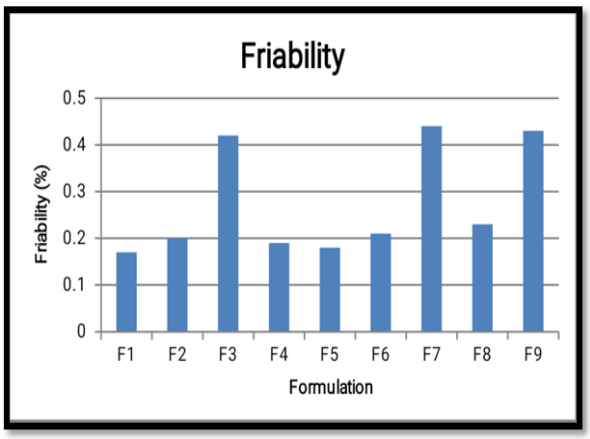


Fig. 11: Results for friability test

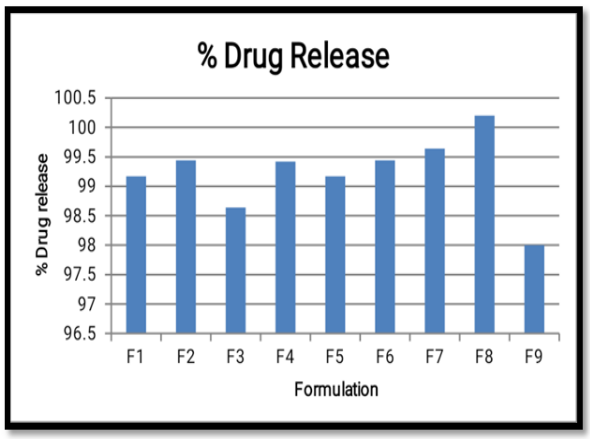


Fig. 12: Results for % drug release of deflazacort FDT.

CONCLUSION

The Deflazacort FDT were subjected to various post compressed evaluation parameters and based on that, it was concluded each formulation was found to be an optimized formulation, except for F1 & F2, providing a quick onset with faster absorption, showing a better therapeutic effect.

Osteoarthritis is one of the common joint-related problems in today's world due to various factors like lifestyle, habitat, working environment, herditry, etc. With rugged movement in joints, extreme pain is observed by the patients. To reduce this, painkillers with quick onset are required. With conventional oral dosage forms, quick onset is not obtained. Now, the availability of FDTs can lead to quick onset with better therapeutic results. With the results of the present research work, we can conclude that Deflazacort, an NSAID as Fast dissolving tablet, can provide much better resultsreducing the pain in patients with osteoarthritis over conventional oral dosage form.

BIBLIOGRAPHY

1. Adamo F, Valentina B,Gian C, Celestino R, Carlos A. Fast dispersible/slow Releasing ibuprofen tablets. Euro J of Pharm and Biopharm, 2008; 69: 335–341.
2. Ahmed I S,Nafadi M M, Fatahalla F A.Formulation of a fast-dissolving ketoprofen tablet using freeze-drying in blisters technique, Drug Dev. Ind Pharm, 2006; 32(4): 437-442.
3. Bhowmik D, Chiranjib B, Krishnakanth, Margret RC. Fast Dissolving Tablet: An Overview. J Chemical and Pharm Res, 2009; 1(1): 163-177.
4. Bhowmik D,Jaiswa lJ,DubeyV,ChandiraM. Fast dissolving tablet: A review on Revolution of novel drug delivery system and new market opportunities.Scholar ResLibrary, 2009; 1(2): 262-276.
5. Chang R, GuoX, Burnside BA, Couch R. Fast-DissolvingTablets.Pharm Tech, 2000; 24(6): 52-58.
6. Chaudhari KPR, Radhika S. Effect of superdisintegrant on the dissolution rate of sparfloxacin. Int J Pharm Excipients, 2000; 4: 181-184.
7. Divate S, Kunchu K, Sockan GN.Fast disintegrating tablets–An emerging trend, ISSN0976–044X, 2011; 6(2): 222-234.
8. Fars KA.Evaluation of spray and freeze dried excipients bases containing accelerators for the formulation of metoclopramide orallydisintegratingtablets. SaudiPharm J, 2007; 15(2): 105-119.

9. Gupta, Kumar A, Mishra DN, Singh SK. Formulation of rapid mouth dissolving Tablets of Cetirizinedi HCl using sublimation method. Int J Pharm Sci, 2011; 3(1): 285-287.
10. Iman SA, MonaHE, In vitro and in vivo evaluation ofa fast-disintegrating lyophilized dry emulsion tabletcontaininggriseofulvin.Euro J Pharm and Biopharm, 2007; 32: 58–68.
11. Lakade SH.Formulation development & evaluation of mouth dissolving tablets of Ondansteron hydrochloride, AsianJPharm, 2007; 1(2-3): 150-153.