WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 5.990
Volume 4, Issue 12, 763-774. Research Article ISSN 2277– 7105

FORMULATION CHARACTERIZATION AND EVALUATION OF MOUTH DISSOLVING TABLET OF LISINOPRIL BY USING DEHYDRATED BANANA POWDER AS A NATURAL POLYMER

R. B. Saudagar*

India.

Article Received on
08 Oct 2015,

Revised on 29 Oct 2015,
Accepted on 18 Nov 2015

***Correspondence for Author**
R. B. Saudagar
India.

ABSTRACT[1]

The purpose of this research was to introduce and evaluate natural excipient that has versatile property in the oral disintegrant and immediate release formulations. This natural excipient was used as disintegrant in the formulation of orodispersible tablets of some model drugs such as lisinopril, Physicochemical studies such as swelling power and solubility, particle size distribution and some other physical evaluations was done on the natural excipient to ensure the suitability to incorporate for such formulation. Five formulations of each drug were formulated in different ratios of natural excipient and Croscaramellose (Superdisintegrant) and the final formulation of all drug used natural excipient alone as binder, diluent and disintegrant. All the formulations are subjected for *invitro* evaluations such as wetting time, water absorption ratio, *invitro* dispersion time and disintegration time, etc. Almost same results were obtained on formulations with or without the super disintegrant. Therefore, we conclude that the natural excipient proposed can be used as binder, diluent and disintegrant in oral disintegrating tablets and immediate release dosage forms. Mainly the natural excipient used is biocompatible, cost effective and provides as nutrition supplements.

KEYWORDS: Natural excipient, Patient friendly dosage form, Diluent, Disintegrant, Binder, *In vitro* stu.

INTRODUCTION[2]

Recent advances in novel drug delivery systems (NDDS) aim to enhance safety and efficacy of drug molecule by formulating a convenient dosage form for administration and to achieve better patient compliance. One such approach is fast dissolving tablets. **Lisinopril** is a drug of

the angiotensin converting enzyme (ACE) inhibitor class that is primarily used in treatment of hypertension, congestive heart failure, heart attacks and also in preventing renal and retinal complications of diabetes. The present study involved the comparison between various synthetic superdisintegrants in combination Dehydrated banana powder (DBP). Banana is also called Plantain. DBP is prepared from the variety of banana called Ethan and nenthran (nenthra vazha) belonging to the family Musaceae. It contains vitamin A so used in the treatment of gastric ulcer and diahorrea. It also contains vitamin B6 release rate of drug from the tablet formulation increases and used in the treatment of chronic disorder at the initial stage of chronic attack. The unripr fruit contains tannins. the enzymes present in the banana is amylase, invertase, protease, catalase, peroxidase because of non-toxicity and are renewable source. If the natural source is abundantly available then the resultant excipients is also economical. With this view, the research was undertaken in the area of natural excipients.

MATERIALS AND METHODS

Lisinopril were obtained as a gift sample from Modern Lab., Indore (M.P). Croscarmellose sodium, crospovidone, sodium starch glycolate, mannitol, magnesium stearate were purchased from S.D. Fine Chemicals, India.

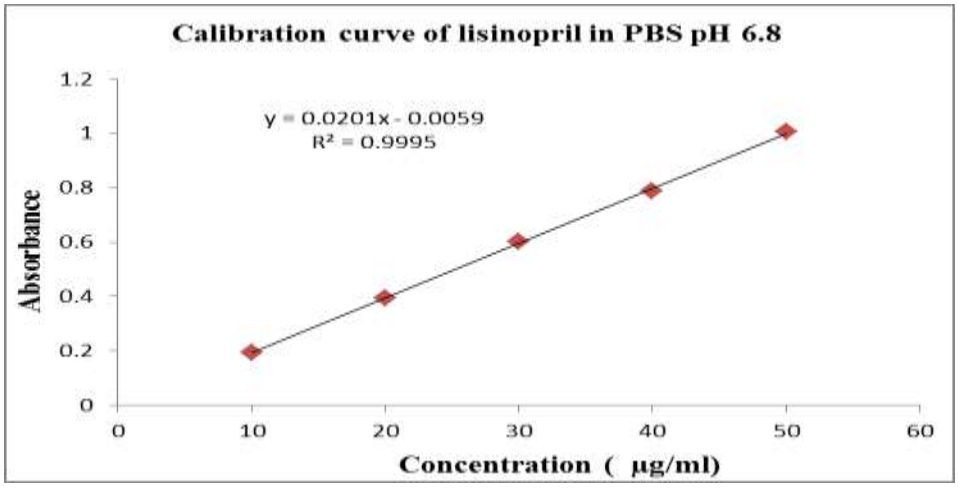
Materials

Table No. 1: List of Materials.

Sr.No.	Material	Supplier
1.	Lisinopril dihydrate	Meckloides, pharma.
2.	Dehydrated banana powder	Tiruanantapuram Karanataka.
3.	Sodium starch glycolate	Meckloides pharma.
4.	Mannitol	Loba Chemie, Mumbai
5.	Microcrystalline Cellulose	Loba Chemie, Mumbai
6.	Magnesium Stearate	Pure Chem Laboratories, Pune
7.	Sodium Saccharine	Research Laboratories Fine Chem Industry, Mumbai

METHODS

Direct compration method is the easiest way to manufacture tablets. Conventional equipment, commonly available excipients and a limited number of processing steps are involved in direct compression. Also high doses can be accommodated and final weight of tablet can easily exceed that of other production methods. Directly compressed tablet's disintegration and solubilization depends on single or combined action of disintegrants, water soluble excipients and effervescent agent.



Fifure: 1 calibration of lisinopril in various solvent.

Drug excipients interaction study[3]

Infra red spectrometry is a useful analytical technique utilized to check the chemical interaction between the drug and the other excipients used in the formulations. The samples (drugs blended with DBP and stored at room temperature for a week) were powdered and intimately mixed with dry powdered potassium bromide. The powdered mixture was taken in a diffuse reflectance sampler and the spectra recorded by scanning in the particular wavelength region (4000 – 400 cm-1) using Shimadzu FTIR spectrometer. The IR spectrum of drug was compare with that of the physical mixture of the drug and excipients used to check for any possible drug-excipients interaction.

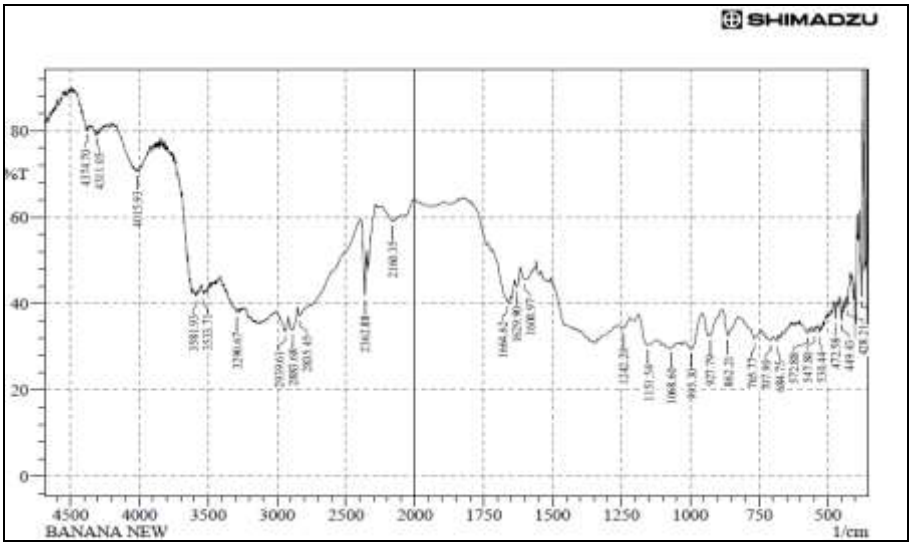


Figure: FTIR spectra of lisinopril.

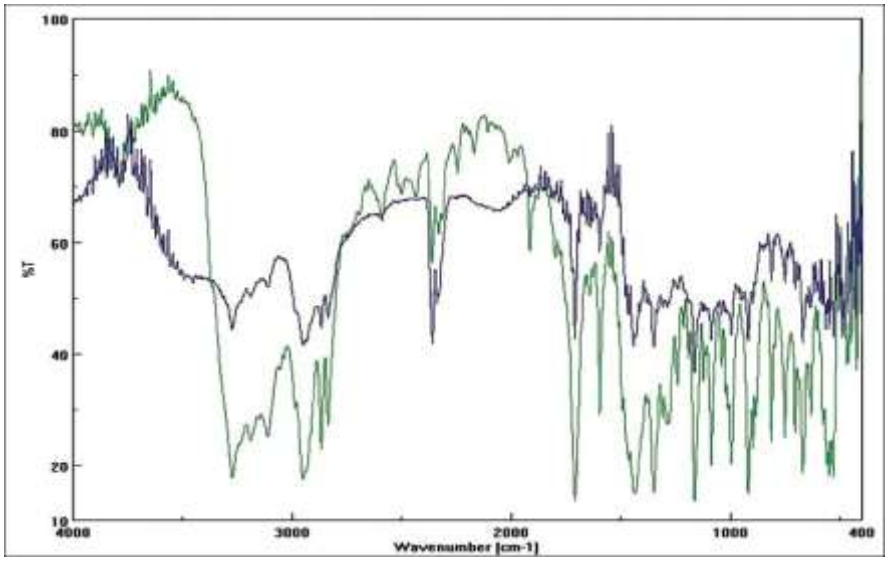


Figure: FTIR spectra of dehydrated banana powder.

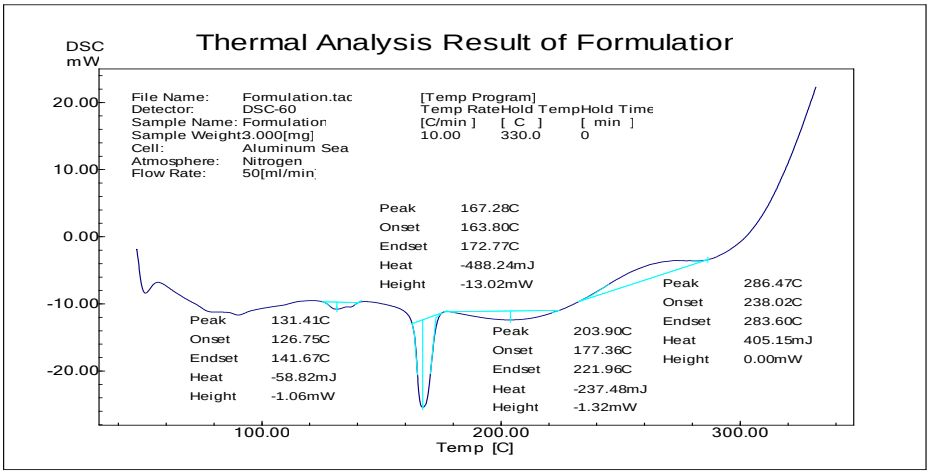


Figure: Ftir of Mixture.

Figure: DSC Thermogram of Physical Mixture Formulation of mouth dissolving tablet (10 mg) Preparation of fast disintegrating tablets.

Punch diameter: 8 mm

Average tablet weight: 250 mg

Punch shape: Flat

Tablet batches were prepared by using direct compression method. All the product and process variables like mixing time and hardness are kept as practically constant. Quantity of drug, microcrystalline cellulose, sodium starch glycolate, banana powder, sodium saccharine and mannitol were accurately weighed and mixed by gentle triturating with magnesium stearate. Then blend was compressed into tablets using flat faced punches of 9mm diameter by keeping hardness in between 2 to 3 kg/cm^2.

Table No. 2: Formula for mouth dissolving tablet of lisinopril.

Ingradients	P1	P2	P3	P4	P5	P6
Lisinopril	10	10	10	10	10	10
Banana powder	60	70	80	-	-	-
SSG	-	-	-	7	9	12
Mannitol	120	110	100	173	171	168
Microcrystalline cellulose	50	50	50	50	50	50
Magnesium stearate	5	5	5	5	5	5
Sodium saccharine	5	5	5	5	5	5

EVALUATION PARAMETERS

Evaluation of the tablets

All prepared matrix tablets were evaluated for its uniformity of weight, hardness, friability and thickness according to official methods.

Hardness

The crushing strength of the tablets was measured using a Monsanto hardness tester. Three tablets from each formulation batch were tested randomly and the average reading noted.

Friability

Ten tablets were weighed and placed in a Roche friabilator and the equipment was rotated at 25 rpm for 4 min. The tablets were taken out, dedusted and reweighed. The percentage friability of the tablets was measured as per the following formula, Percentage friability = Initial weight – Final weight x 100 Initial weight.

Weight Variation

Randomly, twenty tablets were selected after compression and the mean weight was determined. None of the tablets deviated from the average weight by more than ±7.5% (USP XX).

Drug content

Twenty tablets were weighed and powdered. An amount of thepowder equivalent to 20mg of Lisinopril was dissolved in 100ml of 0.1N hydrochloric acid, filtered, diluted suitably and analyzed for drug content at 246nm using UV-Visible spectrophotometer (UV 160 Shimadzu, Japan).

Wate abssorption ratio (R)

The weight of the tablet prior to placement in the petri dish was noted (*wb*) utilizing a Shimadzu digital balance. The wetted tablet was removed and reweighed (*wa*). Water absorption ratio, *R*, was then determined according to the following equation.

Invitro dispersion time[18]

Invitro dispersion time was measured by dropping a tablet in a 10ml measuring cylinder containing was cerried out.

***In vitro* disintegration time**

10 ml of water at 25°C was placed in a petri dish of 10 cm diameter. The tablet was then carefully positioned in the center of the petri dish and the time required for the tablet to completely disintegrate into fine particles was noted.

Table No. 3: Evaluation of Powder Blend for Flow Properties.

Batch Parameter	F1	F2	F3	F4	F5	F6
Angle of repose (°)	35.71 ±0.49	34.74 ±0.54	36.52 ±0.58	36.39 ±0.71	35.71 ±0.49	34.74 ±0.54
Bulk density (g/ml)	0.7855 ±0.01	0.784 ±0.008	0.804 ±0.009	0.805 ±0.007	0.7855 ±0.01	0.784 ±0.008
Tap density (g/ml)	0.844 ±0.01	0.843 ±0.012	0.845 ±0.012	0.849 ±0.016	0.844 ±0.01	0.843 ±0.012
Carr's index (%)	4.853 ±0.25	4.721 ±025	4.877 ±0.19	4.906 ±0.31	4.853 ±0.25	4.721 ±025
Hausner's ratio	1.07 ±0.08	1.057 ±0.16	1.19 ±0.20	1.193 ±0.20	1.07 ±0.08	1.057 ±0.16

Table No. 27: Physical evaluation of formulations of F1 to F4.

Formulation code	Hardness Kg/cm^2 ± S.D.	Thickness (mm) ± S.D.	Weight variation (mg) ± S.D.	% Friability	%Drug Content ± S.D.	In-vitro DT (Min.)
F1	2.16 ±0.2886	2.896 ±0.015	5.44	0.512 ±0.014	99.51 ±0.56	1.75 ±0.147
F2	2.16 ±0.2886	2.896 ±0.015	2.29	0.227 ±0.014	100.51 ±0.56	1.54 ±0.147
F3	2.16 ±0.2886	2.896 ±0.015	2.92	0.251 ±0.014	98.51 ±0.56	1.45 ±0.147
F4	2.16 ±0.2886	2.896 ±0.015	2.45	0.245 ±0.014	99.51 ±0.56	1.74 ±0.147
F5	2.16 ±0.2886	2.896 ±0.015	5.35	0.212 ±0.014	99.46 ±0.56	1.68 ±0.147
F6	2.16 ±0.2886	2.896 ±0.015	5.78	0.312 ±0.014	99.92 ±0.56	1.51 ±0.147

Invitro drug release studies

In-vitro drug release rate of lisinopril mouth dissolving tablets were carried out using United State Pharmacopoeia (USP) XXIV dissolution testing apparatus (Paddle method). The dissolution test was carried out using 900 ml of 6.8 pH phosphate buffer, at 37±.50C and 50 rpm. A sample (5 ml) of the solution was withdrawn from the dissolution apparatus at 1, 2, 3, 4, 5, 6, 7 and 8 min. The samples were replaced with fresh dissolution medium of same quantity. The samples were filtered through Whatman filter paper No 40 and analyzed for lisinopril after appropriate dilution by UV spectrophotometer at 215 nm. The percentage drug release was calculated using an equation obtained from the calibration curve. The results are presented in figures. The dissolution testing was carried out in triplicate.

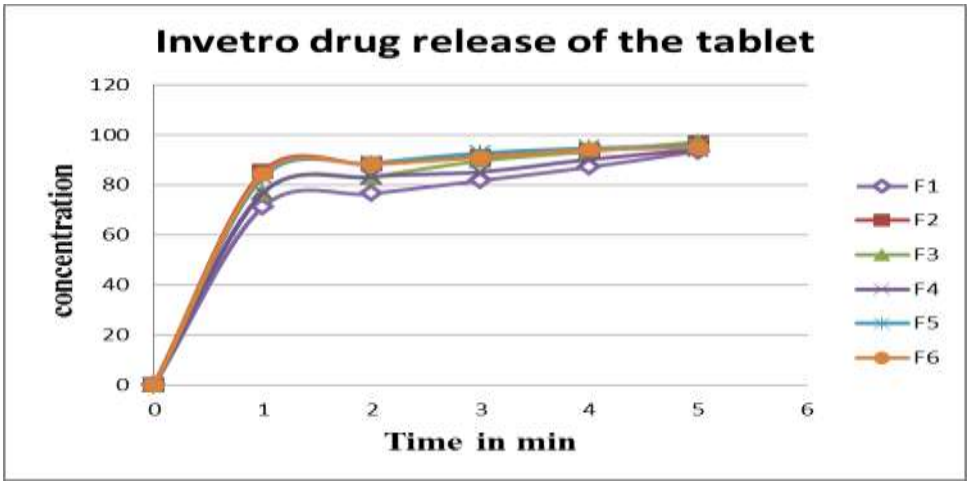


Figure: In-vitro dissolution study of lisinopril in PBS pH 6.8.

SEM Images of Musa paradisiaca L. (SP2) Powder.

SUMMERY AND CONCLUSION

9.2 SUMMERY

Fast dissolving tablets get dissolved or disintegrated in mouth quickly. This characteristics feature is useful for patient compliance. The time required for complete wetting was few seconds hence tablets disintegrate rapidly in oral cavity. Thus the release rate of lisinopril can be significantly enhanced by super disintegrating agent. lisinopril is an Angiotensin II receptor blocker, used in treatment of moderate to severe hypertension. It is white crystalline powder and practically soluble in water it is reported to be rapidly and fully absorbed following oral administration but lisinopril t_{max} is achieved at about 12 hrs with oral administration suggesting a need for a delivery system with rapid achievement of t_{max}. The present research work deals with the investigation of dehydrated banana powder as a natural

superdisintegrants. This natural excipient was used as disintegrant in the formulation of orodispersible tablets of some model drugs such as lisinopril, Physicochemical studies such as swelling power and solubility, and some other physical evaluations was done on the natural excipient to ensure the suitability to incorporate for such formulation. six formulations batches were formulated in different ratios of natural excipient. SSG (Superdisintegrant) were used for comparision. All the formulations are subjected for *invitro* evaluations such as wetting time, water the purpose of this research was to introduce and evaluate natural excipient that has disintegrating property in the oral disintegrant and immediate release formulations. Evaluation such as absorption ratio, *invitro* dispersion time and disintegration time, etc. Almost different results were obtained with natural polymer and synthetic polymer.

9.2 CONCLUSION

The F1, F2 and F3 batches were formulated using DBP alone which showed almost equal and better results in terms of the evaluations such as disinterrating time, wetting time, water absorption ratio, *in vitro*dispersion time and percent drug release with the formulation contain superdisintegrant (SSG). Swelling and Solubility study showed that the DBP have enough swelling and solubility properties and from the results obtained from the formulations indicated that the DBP can be incorporated alone as disintegrant in the formulation of orodispersible tablets of some model drugs such as lisinopril, Physicochemical studies such as swelling power and solubility, particle size distribution and some other physical evaluations was done on the natural excipient to ensure the suitability to incorporate for such formulation. six formulations of each drug were formulated in different ratios of natural excipient and SSG (Superdisintegrant). Hence it can be concluded that natural super disintegrants should be preferred as having nutritive value as well as cost benefit in formulation and development of orodispersible tablet than synthetic polymer.

REFERENCE

1. A. Bharathi et al, Formulation and evaluation of Telmisartan orodispersible tablets by using banana powder, 2014; 2(1): 982-984.
2. Wallis, TE. Textbook of Pharmacognosy; CBS publishers and distributors; New Delhi; 5th Ed., 2005; 51-52.
3. rajeshree panigrahi et al effect of combination of natural super disintegrants on fast dissolving tablet of lisinopril, 2012; 1(3): 73-78.

4. Evans, WC. Trease and Evans Pharmacognosy; Elsevier publication; 15th Ed., 2002; 442.
5. Jarald, EE., Jarald SE. Textbook of Pharmacognosy and Phytochemistry; CBS publishers and distributors, New Delhi, 2009; 482-483.
6. Ali, M. Pharmacognosy (Pharmacognosy and Phytochemistry), CBS publishers and distributors, New Delhi, 2008; I: 755-756.
7. Anand padole et al, Buccal tablet of lisinopril by direct compression method, 2012; 2(2): 30-38.
8. Deepali D Wagh Method Development of lisinopril hydrochlorothiazide in combined dosage form by hplc, 2012; 4: 1571-1574.
9. Parul Saini, et al. Natural Polymers used in Fast Disintegrating Tablets: A Review International Journal of Drug Development & Research, October-December 2012; 4(4): 18-27.
10. Umekar MJ et al. Fast Dissolving Tablet Using Natural Superdisintegrants International Journal of Research in Pharmaceutical and Biomedical Sciences, 2013; 4(2): 459-460.
11. Prabakaran L et al. formulation development of patient friendly dosage form: all in one natural excipient as binder, diluent and disintegrant International Journal of Pharmacy and Pharmaceutical Sciences, 2011; 2(3): 97-102.
12. Senthil Kumar Krishnan. et al spectrophotometric methodfor estimation of lisinopril in tablet International journal of universal pharma and biosciences, 2012; 1(2): 88-90.
13. Manisha Masih spectrophotometric simultaneous estimation famlodipine besylate and lisinopril dihydrate in tablet dosage forms Journal of Biomedical and Pharmaceutical Research, 2014; 3(4): 25-29.
14. Rajeshree Panigrahi Formulation and Evaluation of Fast Dissolving Tablet of Lisinopril International Journal of Research and Reviews in Pharmacy and Applied science, 2(1): 65-81.
15. Mere sing prepration and evaluation of powder of unripe fruit of various varitirs of musa paradiasisca as a tablet disintegrants, 3: 113-125.
16. D noel preetham development of UV spectrophptometric method for estimation of lisinopril in bulk pharmaceutical formulation, 2014; 257-259.
17. Simultaneous spectrophotometric estimation of lisinopril, international journal of institutional pharmacy and life science, 2012; 85-93.
18. Ganipisetty Lakshmi Aswini development and validation by hplc, research journal for pharmaceutical research scholar, 2014; 3(3): 704-712.

19. Sai krashna P, formulation and evaluation of lisinopril dehydrate transdermal gels, journal of applied pharmaceutical science, 2011; 181-185.
20. Senthil, A. et al. Formulation and evaluation of mouth dissolving tablet of flunarizine dihydrochloride by using superdisintegrants; International Research Journal of Pharmacy, 2010; 1(1): 267-276.
21. Akbari, BV. et al. Design, development and characterization of mouth dissolving tablet of cinnarizine using superdisintegrants; International Journal of Pharm Tech Research, Jan-Mar 2010; 2(1): 97-105.
22. V. maslarska, development of analytical method for determination of lisinopril tablets using hplc, international journal of Pharma and Bio Sciences, 2013; 4(4): 163-167.
23. Bala, R. et al. Development and characterization of taste masked mouth dissolving tablet of zolpidem tartrate; International Research Journal of Pharmacy, 2010; 1(1): 417-427.
24. Thube, KN. Formulation and evaluation of mouth dissolving tablet of metoprolol tartrate, 2010; 43-53.
25. Soodam, SR. et al. Formulation and evaluation of fast dispersible tablet of sertraline using different superdisintegrants; International Research Journal of Pharmacy, 2010; 1(1): 132-137.
26. Basu, B. et al. Formulation and evaluation of fast dissolving tablet of cinnarizine using superdisintegrants blend and subliming agent; Journal of Advanced Pharmaceutical Technology and Research, Oct-Dec 2011; 2(4): 266-273.
27. Chaturvedi, AK. et al. Fast disintegrating tablet technology: newly prospects; International Journal of Pharmaceutical Science and Research, 2011; 2(12): 3046-3050.
28. Chawdary, B. Formulation and evaluation of fast disintegrating tablets of amiloride hydrochloride, 2010; 3-7.
29. Chauhan, PN. et al. Formulation and evaluation of mouth dissolving tablet of gliclazide; International Research Journal of Pharmacy, 2011; 2(9): 188-191.
30. Devane, MA. et al. Formulation and evaluation of desloratadine orodispersible tablets by using β-cyclodextrin and superdisintegrants; Journal of Pharmacy Research, 2011; 4(10): 3327-3330.
31. Gada, SN. et al. Design and evaluation of mouth dissolving tablet of diethylcarbamazine citrate, 2010; 15-26.
32. Gohel, AM. et al. Formulation and evaluation of fast dissolving tablet of an antihypertensive drugs, 2010; 10-28.

33. Moffat, AC. Clark's analysis of drugs and poisons; 3rd Ed.; Pharmaceutical press; London, 2005; 2: 1714.
34. Sweetman, SC. Martindale: The complete drug reference; 35th Ed.; Pharmaceutical press; London, 2007; 1190-1191.
35. The Merck Index; An encyclopedia of chemicals, drugs and biological; 14th Ed.; published by Merck research laboratory; Division of Merck and company; USA, 2006; 1754.
36. Suresh B.B., Quick Dissolving Films-A Novel Approach to Drug Delivery, Drug Delivery Technology, 2003; 3(3): 1-6.
37. United States Pharmacopoeia Pending Monograph; Draft 1- for public comment; The United States Pharmacopoeia, 2011; 1-2.
38. Indian pharmacopoeia; Government of India; Ministry of health and family welfare; The Indian Pharmacopoeial Commission; Ghaziabad, 2010; 2 and 3: 1625, 1633, 1695, 2082, 2135.
39. Phani Kumar, GK. et al. Isolation and evaluation of tamarind seed polysaccharide being used as a polymer in pharmaceutical dosage forms; Research Journal of Pharmaceutical, Biological and Chemical Sciences, 2011; 2(2): 274-290.
40. Indian Pharmacopoeia; Government of ministry of health & family welfare; The Indian Pharmacopoeia Commission, Ghaziabad, 2010; 1: 1593.
41. Rowe, RC., Shesky, PJ., Owen, SC. Handbook of pharmaceutical excipients; 5th Ed.; Pharmaceutical press, 2006; 608-610, 404-405, 663-665, 424-427, 129-132.
42. British Pharmacopoeia; Medicinal and pharmaceutical standards, 2009; 2: 1274, 1287, 1880.
43. United States Pharmacopoeia/National Formulary; The official compendia of standards; United States Pharmacopoeia; Asian Ed., 2008; 3: 2586.
44. Pavia, LD. Lampman, GM. Kriz, GS. Introduction to spectroscopy: a guide of students of organic chemistry; Brooks/Cole Thomson Learning; 3rd Ed., 26-90.
45. P. Rajeevkumar et al Studies on musa paradisiaca Starch as a Pharmaceutical Excipient journal of chemical and pharmaceutical and pharmaceutical research, 2010; 2(4): 284-290.
46. Kale, SR. Kale, RR. Practical biochemistry and clinical pathology; 1st year diploma in pharmacy; 17th Ed.; Nirali Prakashan, 2007; 11-12.
47. Sharma saurabh, et al. fast dissolving drug delivary syateme, 2011.

48. Basawaraj s. patil, development and evaluation of time contolled pulsatile release lisinopril tablets, 2012; 2(1): 30-35.
49. S.r. dhaneshwar, application of high performance thin layer chromatography densitometry for the simultaneous determination of amlodipine besylate and lisinopril, international journal of pharmacy and technology, june 2011; 2(3): 2353-2367.
50. Arun raj.r, comparative evaluation of potato starch and banana powder as disintegrating agents in aceclofenac tablet formulation, jan 2013; 5(2): 205-207.
51. Wealth of india a dictionary of raw material and industrial product s,raw material pharmacogonosy reprinted, 2009; 6: 452-467.
52. Md tausif alam et al, fda-approved natural polymers for fast dissolving tablets, hindawi publishing corporation journal of pharmaceutics, 2014; 2-5.
53. Agham a. sameer, development and characterization of sublingual tablet of lisinopril, asian pracific journal of tropical biomedicine, 2012; 257-259.