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FORMULATION AND EVALUATION OF FAST DISSOLVING TABLETS OF ACECLOFENAC BY USING ISPAGHULA HUSK POWDER AS NATURAL SUPER DISINTEGRANT

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Abstract:

Fast disintegrating tablets (FDTs) are meant for administration to the patients who cannot swallow, such as elderly, stroke victims, bedridden patients, patients affected by renal failure, and the patients who refuse to swallow, such as pediatric, geriatric, and psychiatric patients. The present study is aimed to prepare orally disintegrating tablet of a model drug – Aceclofenac, using Ispaghula powder as natural super disintegrant, to conduct incompatibility studies by using Fourier-transform infrared spectroscopy (FTIR), to evaluate the prepared tablets for weight variation, friability, hardness, disintegration and dissolution tests, and also to compare the results with tablets prepared by using synthetic disintegrate crosspovidone. Post hoc analysis revealed that all the formulations have shown the results of pre-compression as well as post compression parameters within the acceptable limits and FTIR studies showed that there are no incompatibilities between the drug and excipients used in the formulation. Thus the study leads that Plantago ovata (Ispaghula) can be successfully used as natural super disintegrate.

Keywords: *Aceclofenac, Ispaghula husk powder, FTIR, disintegration test, dissolution test.*

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INTRODUCTION:

The concept of Fast dissolving Drug Delivery System emerged from the desire to provide patient with conventional means of taking their medication. Because of physiological changes associated with, especially, elderly and pediatrics are quite unable to swallow (Dysphagia), rather this common problem of all age group patients. Solid dosage forms that can be disintegrated, dissolved, or suspended by saliva in the mouth resulting in easy swallowing can provide significant benefits to the pediatric and geriatric population, as well as other patients who prefer the convenience of easily swallows able dosage forms. This tablet disintegrates instantaneously when placed on tongue, releasing the drug that dissolves or disperses in the saliva [1].

Recently, pharmaceutical preparations used for the elderly patients have been investigated to improve the treatment compliance and quality of life of such patients. A tablet which can rapidly disintegrate in saliva (rapidly disintegrate tablet) is an attractive dosage form and a patient-oriented pharmaceutical preparation [2]. The mouth dissolving tablets have attracted the interest of many researchers. Many elderly patients have difficulty swallowing tablets, capsules, or powders. To alleviate this problem, these tablets are expected to dissolve or disintegrate in the oral cavity without drinking water. The disintegrated mass can slide down smoothly along the esophagus with the help of saliva, so even people who have swallowing or chewing difficulties can take it with ease [3] .There are two different types of dispersible tablets which have to be distinguished: one dosage form disintegrates instantaneously in the mouth, to be swallowed without the need for drinking water, while the other tablet formulation can readily be dispersed in water, to form dispersion, easy to ingest by the patient [4]. By the use of FDTs rapid drug therapy intervention can be achieved. FDTs are convenient for administration and patient compliant for disabled, bedridden patients and for travelers and busy people who do not always have access to water. Recently the European Pharmacopoeia [5] adopted the term or dispersible tablet as a tablet to be placed in the mouth where it disperses rapidly before swallowing and which disintegrates in less than 3 minutes.

MATERIALS AND METHODS:

Table 1: List of Materials used in the study

S.NO	Ingredient Name	Supplier
1.	Aceclofenac	Yarrow chem products
2.	Ispaghula powder	Apex International
3.	Microcrystalline cellulose	Leisha pharma solutions
4.	Lactose	Antares Chem Private Limited
5.	Magnesium stearate	Remedy labs

Table 2: List of instruments used in the study:

S.NO	Instrument Name	Company
1.	UV spectrophotometer	Systronics
2.	Electric balance	Essae
3.	pHmeter	Elico
4.	Dissolution apparatus	Electro lab
5.	Tapped density apparatus	Rolex

PROCEDURE

I) Calibration curve:

Calibration curve for aceclofenac was constructed by preparing the stock solution of 1 mg/ml by dissolving 100 mg of drug in small volume of pH 0.1NHCL buffer and making the volume upto 100 ml with same buffer in a volumetric flask.100 mg of pure aceclofenac was weighed and transferred into 100 ml volumetric flask. Drug was dissolved in buffer and volume was made upto 100 ml. The concentration of drug was 1 mg/ml. From this stock solution 1 ml was taken in a 100 ml volumetric flask and volume was made upto the mark with buffer. Thus aceclofenac of strength 10$\mu g/ml$ was obtained.

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II) Standard solutions:
Standard solutions of different concentrations of aceclofenac were prepared by diluting suitable quantities (2, 4, 6, 8, 10ml) of stock solution with pH 0.1N HCL buffer to get 2,4,6,8 and 10 $\mu g/ml$ solutions. The absorbance of the above concentrations was measured at 275 nm using UV spectrophotometer against the respective blanks [6].

Pre-compression properties
All the fast dissolving tablet formulations were evaluated for angle of repose, bulk density, tapped density, Carr's index and Hausner's ratio.

1. Angle of repose:
The angle of repose of powder mixtures of formulation were determined by fixed funnel method. The accurately weighed powder mixture was taken in a funnel. The height of the funnel was adjusted to such that the apex of the heap of the powder just touched the funnel tip. The powder was allowed to flow through the funnel freely onto the surface of graph sheet. The height and diameter of the powder con was measured and the angle of repose was calculated using the below formula [7].

$\tan\theta = h/r$

$$\theta = \tan^{-1}\left(\frac{h}{r}\right)$$

Where θ, is the angle repose, and h is the height in cm and r is the radius in cm.

2. Bulk density:
Bulk density of powder mixture was determined using graduated cylinder. The volume occupied by the sample was recorded [8]. Bulk density is calculated using the formula:

Bulk density, $\rho b = M/V_b$

Where M is weight of the sample V_b is the volume of sample.

3. Tapped density:
Tapped density of all types of powder mixture was determined by using the below formula. The cylinder with powder mixture was tapped from height of 2 inches until a constant volume is obtained [9].volume occupied by the sample after tapping was recorded and tapped density was calculated using the formula

Tapped density, $\rho t = M/V_t$

Where M is the weight of the sample, V_t is tapped volume of sample.

4. Carr's Index (%):
The compressibility index has been proposed as an indirect measure of bulk density, size and shape, surface area, moisture content and cohesiveness of material because of all these can influence the observed compressibility index [10]. The simplest way for measurement of free flow of powder is carr's index, an indication of the ease with which a material can be induced to flow.

5. Hausner's ratio:
Hausner's ratio is an indirect index of case of powder flow. It is calculated by the following formula.

Hausner's ratio=Tapped (ρt)/bulk density (ρb)

Preparation of fast dissolving tablets of Aceclofenac:
The critical parameters to formulate a fast dissolving tablet are choice of super disintegrant and optimization of concentration of super disintegrates. The main criteria for fast dissolving tablets are to disintegrate or dissolve rapidly in oral cavity in 15-60 seconds, without, need of water. All the ingredients were co- ground in a pestle and motor and then talc and magnesium stearate were added and mixed for 10 minutes. The mixed blend of drug – excipient was compressed to produce tablets of strength 350mg [11].

Table 3: Formulation (in mg)

Formulation Code	Drug	Crosspovidone	Ispaghula powder	Microcrystalline cellulose	Lactose	Magnesium stearate
F1	100	7	-	100	136	7
F2	100	14	-	100	129	7
F3	100	21	-	100	122	7
F4	100	-	7	100	136	7
F5	100	-	14	100	129	7
F6	100	-	21	100	122	7

***In-Vitro* Evaluation Tests:**

1. Weight variation test:

The weight variation test was performed as per USP. Twenty tablets were randomly selected from each formulation and individually weighed. The average weight and the weight variation were calculated as described in IP

%Weight variation= [Individual weight-Average weight)/Average weight] × 100

2. Drug content:

Randomly 5 tablets were collected crushed and weighed the amount equivalent to 100mg of drug. Transformed to 100ml volumetric flask, dissolved in small volume of methanol and volume make up to mark with 0.1NHCLbuffer.Appropriate dilution was done and the sample was analyzed for drug content at 275nm spectrophotometrically [12].

3. Hardness:

The hardness of formulated fast dissolving tablets was assessed using a Monsanto hardness tester and the mean hardness of three tablets was determined.

4. Friability:

The Roche friability test apparatus was used to determine the friability of the tablets.20 tablets were weighed and placed in the apparatus, and allowed to operate for 100 revolutions at a rate 25 rpm. The tablets were collected, dedusted and reweighed. The percentage of the friability was calculated.

Percentage friability= [(Initial weight-final weight)/initial weight] ×100

5. Disintegration test:

The disintegration test as carried out using disintegration test apparatus as specified in the Indian pharmacopoeia which consists of basket rock holding 6 plastic tubes, opened at the top and covered at the bottom by a 10 mesh screen. Tablets were placed in the tubes of basket rack assembly and were immersed in 900 ml of water kept in 1 liter beaker held at 35ºC.The apparatus was operated at a rate of 30±2 oscillations per minute and the time taken by the tablets to disintegrate was noted [13].

***In–vitro* dissolution studies:**

The in-vitro drug release profiles of aceclofenac from directly compressed fast dissolving tablets were obtained using a dissolution rate test apparatus USP type-2

Dissolution apparatus: Electro lab ETC 11L
Dissolution medium: 900ml of 0.1NHCL buffer
Apparatus type: paddle
Speed: 50rpm
Temperature: 37±2ºC

The dissolution study of tablets was carried out in 900 ml of 0.1NHCL buffer as the dissolution medium maintained at 37±2ºC and 50 rpm. Then 5 ml samples were collected upto 60 min at intervals of 5,10,15,20,30,40,50and 60 min.

Comparative dissolution studies were done for prepared fast dissolving tablet formulations (F1-F3) using crosspovidone and formulations (F4-F6) using Ispaghula powder [14].

Compatibility studies:

Compatibility studies were conducted by using Fourier transforms infrared spectroscopy (FTIR). FTIR spectra of Aceclofenac, Ispaghula husk, Mixture of Aceclofenac and Ispaghula husk were shown in Fig 6 – 8. No significant alternations in the FTIR peak in mixture of Aceclofenac and Ispaghula husk (Fig 8) were detected. Thus there were no chemical interactions. The minor shift associated with the drug indicates some sought of solid state interactions between the drug and the excipients.

RESULTS:

Table 4: Calibration curve of Aceclofenac

S.No.	Concentration(µg/ml)	Absorbance at 275 nm
1	0.0	0.0
2	2.0	0.048
3	4.0	0.100
4	6.0	0.152
5	8.0	0.210
6	10	0.260

Table 5: Test results of Pre-compression study.

Formulation Code	Angle of repose	Hausner's ratio	Carr's Index	Bulk density	Tapped density
F1	17.21±0.05	1.17	16.26	0.40±0.10	0.46±0.01
F2	14.27± 0.04	1.12	11.45	0.38±0.10	0.41±0.03
F3	19.03±0.03	1.15	13.22	0.39±0.07	0.44±0.12
F4	23.90±0.07	1.18	14.59	0.41±0.11	0.46±0.08
F5	25.18±0.06	1.16	11.27	0.36±0.09	0.58±0.11
F6	27.11±0.01	1.11	12.85	0.41±0.05	0.46±0.06

Table 6: Post-compressions evaluation tests of fast dissolving tablets.

Formulation Code	Weight variation	Hardness (kg/cm^2)	Friability (%)	Disintegration Time (Sec)
F1	349±1.07	3.4±1.2	0.53±0.02	36
F2	348±1.13	3.3±1.1	0.21±0.08	45
F3	351±0.98	3.3±0.6	0.28±0.03	39
F4	348±1.01	3.1±1.4	0.19±0.04	43
F5	351±0.81	3.0±0.8	0.20±0.03	49
F6	349±0.79	3.4±0.5	0.23±0.08	44

Table 7: Absorbance samples from F1-F6.

Time (min)	F1	F2	F3	F4	F5	F6
0	0	0	0	0	0	0
5	0.101	0.135	0.28	0.12	0.151	0.302
10	0.164	0.249	0.401	0.181	0.286	0.438
15	0.211	0.407	0.675	0.236	0.399	0.699
20	0.364	0.644	0.873	0.395	0.655	0.098
25	0.498	0.836	0.104	0.532	0.85	0.138
30	0.518	0.118	0.166	0.576	0.131	0.191
40	0.709	0.152	0.194	0.769	0.173	0.226
50	0.855	0.196	0.219	0.101	0.22	0.271
60	0.114	0.224	0.259	0.123	0.239	0.277

Table 8: Dissolution profile of Formulations (% drug release v/s time)

Time (min)	F1	F2	F3	F4	F5	F6
0	0	0	0	0	0	0
5	3.64	4.86	10.08	4.32	5.44	10.87
10	5.90	8.96	14.44	6.52	10.30	15.77
15	7.60	14.65	24.30	8.50	14.36	25.16
20	13.10	23.18	31.43	14.22	23.58	35.28
25	17.93	30.10	37.44	19.15	30.60	49.68
30	18.65	42.48	59.76	20.74	47.16	68.76
40	25.52	54.72	69.84	27.68	62.28	81.36
50	30.78	70.56	78.84	36.36	79.20	97.56
60	41.04	80.65	93.24	44.28	86.04	99.72

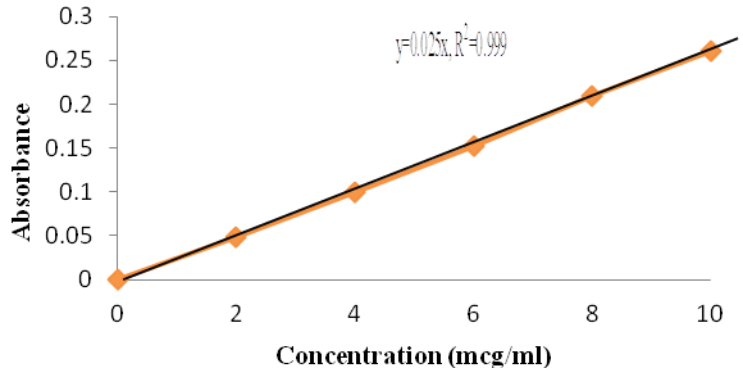

Fig. 1: Calibration Curve of Aceclofenac in 0.01 N HCL

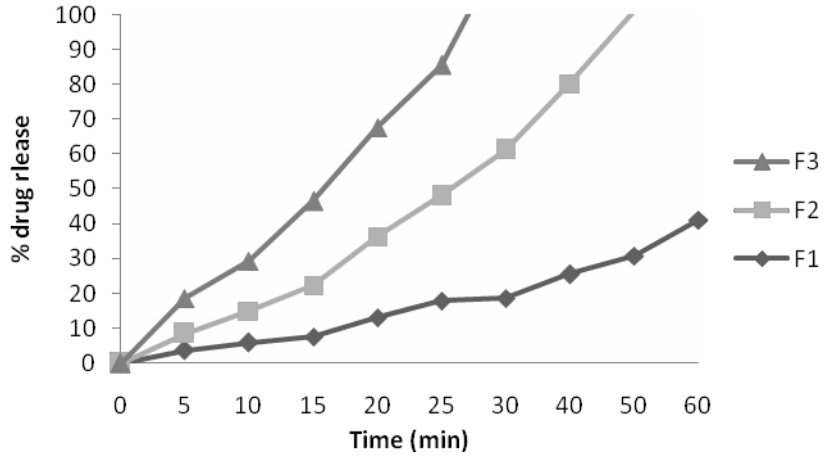

Fig. 2: Dissolution profiles of Aceclofenac formulations (F1, F2, and F3) prepared with cross povidone

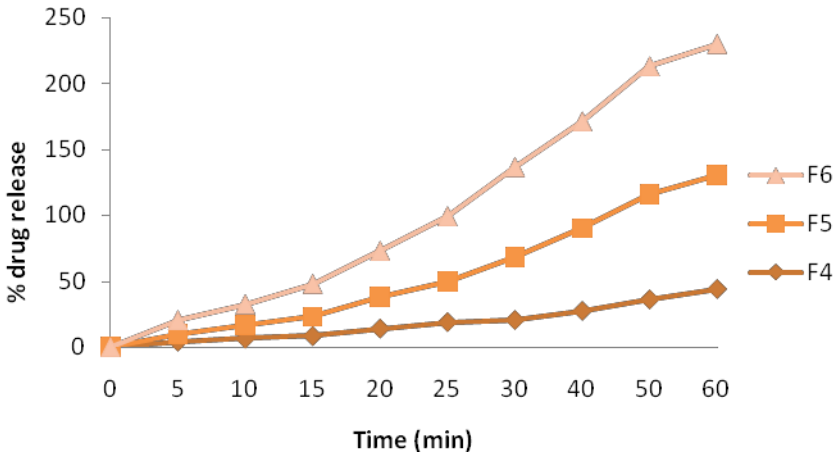

Fig. 3: Dissolution profiles of Aceclofenac formulations (F4, F5, and F6) prepared with Ispaghula Husk

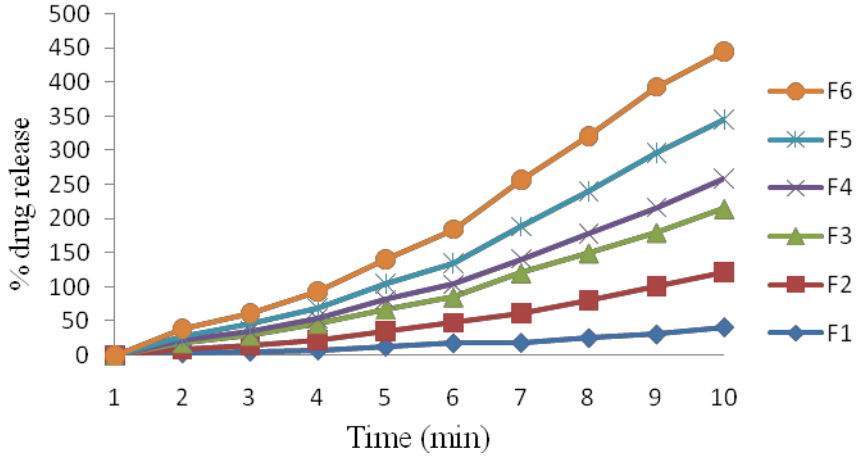

Fig. 4: Comparative Dissolution Profiles of Aceclofenac Formulations- F1 to F6

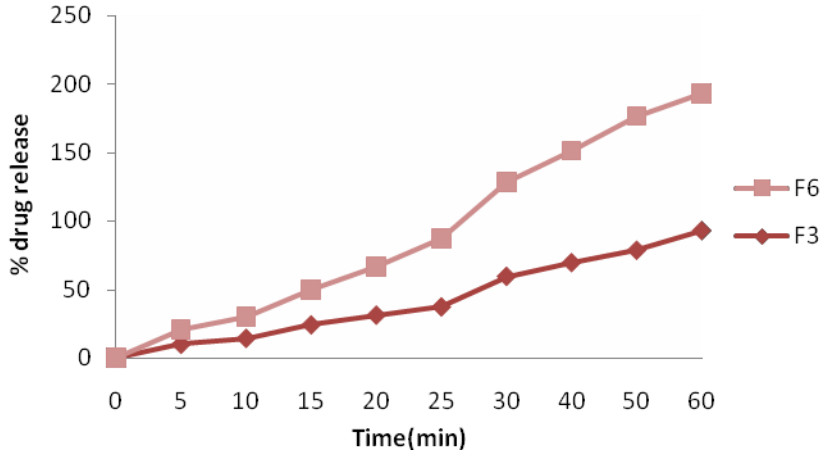

Fig. 5: Comparative Dissolution Profiles of Aceclofenac best Formulations, F3 and F6

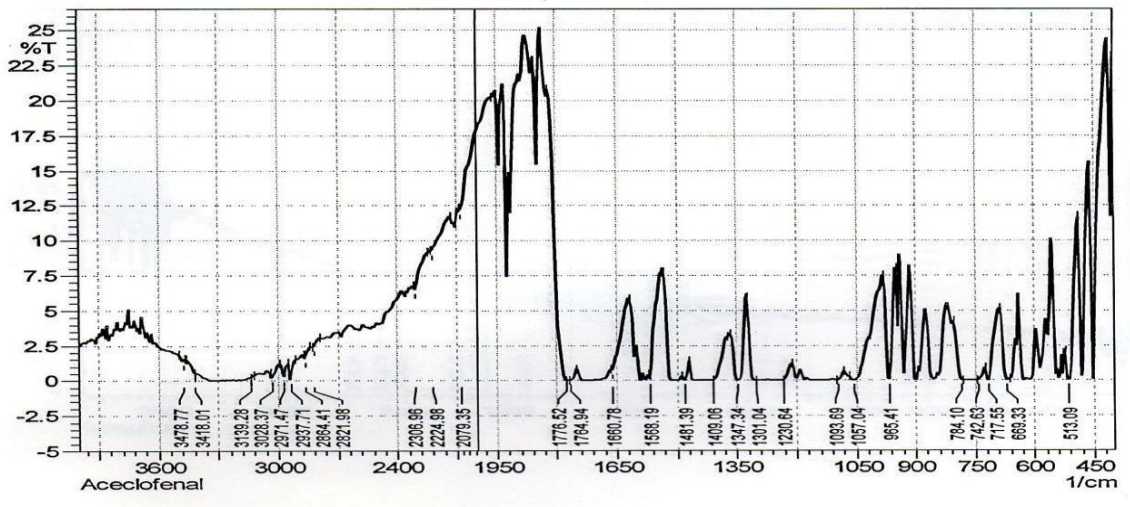

Fig. 6: FTIR spectra of Aceclofenac

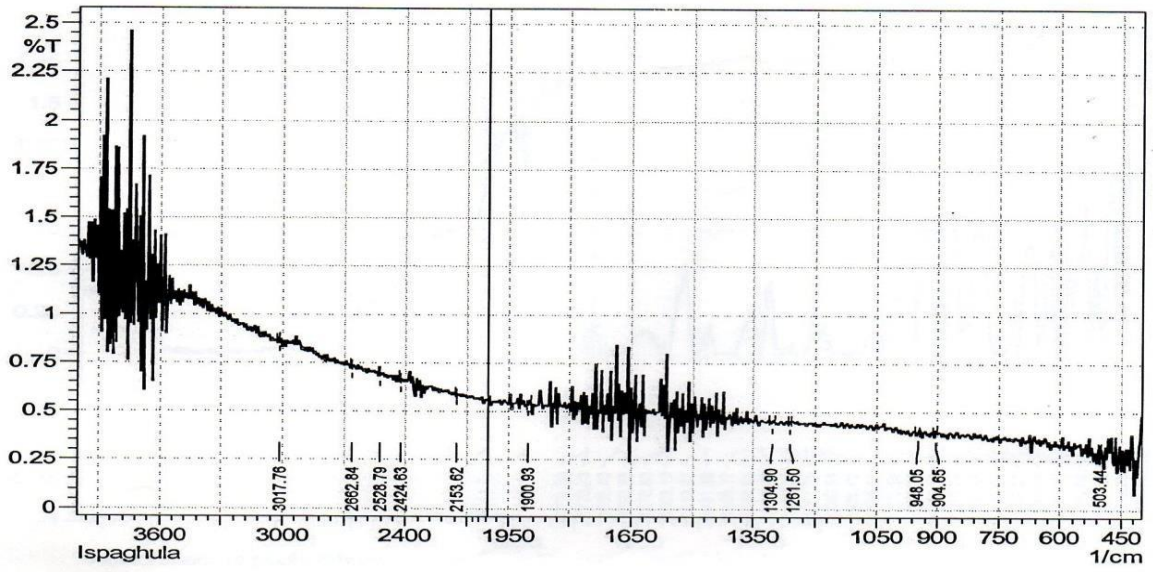

Fig .7: FTIR spectra of Ispaghula

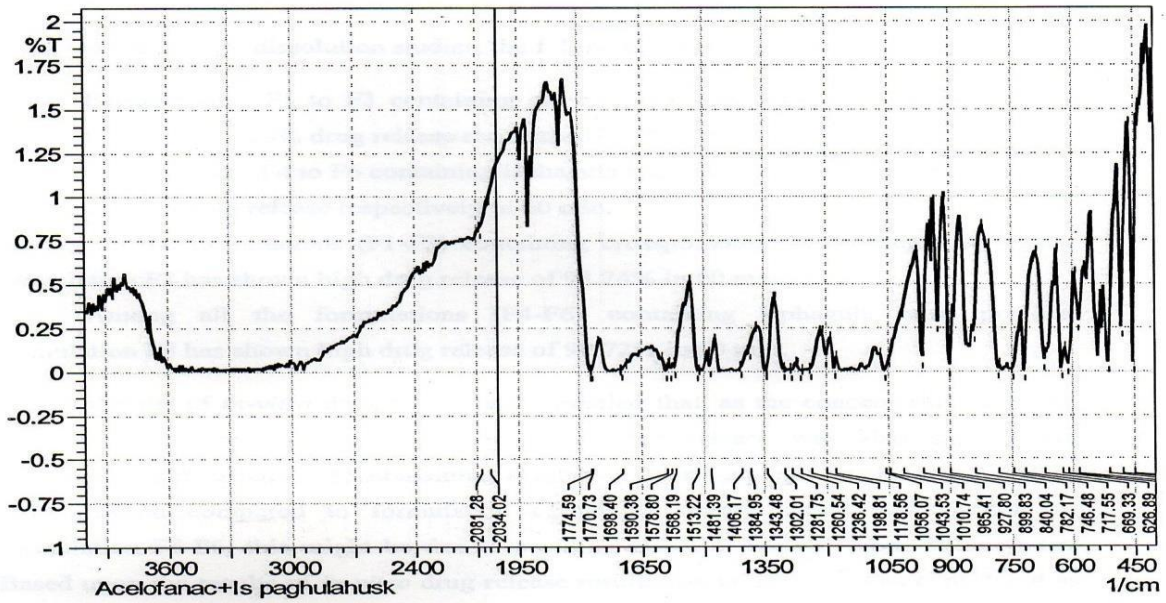

Fig. 8: FTIR spectra of mixture of Aceclofenac and Ispaghula husk powder

DISCUSSION:

All the formulations have shown pre-formulation test results within the limits showing angle of repose in the range of 14.27-27.11 indicating good flow, Carr's index and Hausner's ratio were found to be in the range of 11.27-16.26 and 1.11 to 1.18 respectively indicating good flow properties.

Formulations have also passed the post-compression parameters with weight variation ranging within the limits i.e., 349-351, Hardness with 3.0-3.4, friability with the range of 0.19-0.53 and disintegration was found to be rapid with a range of 36-46 sec.

FTIR studies revealed that there was no incompatibility among the ingredients used in formulation.

Based on the *in-vitro* dissolution studies, the following interpretation was done:

- Formulations F1 to F3 containing crosspovidone as disintegrant shown 41.04, 80.64 and 93.24% drug release respectively in 60 min among which formulation F3 has shown high drug release.
- Formulations F4 to F6 containing Ispaghula husk powder shown 44.28, 86.04 and 99.72% drug release respectively in 60 min among which formulation F6 has shown high drug release.

It was also revealed, that when the concentration of super disintegrates increases, cumulative percent of drug release was also significantly increases. Formulations F1-F3 containing synthetic super disintegrates showed less drug release when compared to formulations containing natural super disintegrates i.e., formulations F4-F6, this might me due to swelling effect of natural super disintegrates. Based on this, Formulation F6 was considered as optimized formulation.

CONCLUSION:

Fast dissolving tablets of Aceclofenac with Ispaghula powder could be considered as safe and useful oral delivery system to increase the drug bioavailability and to improve patient compliance. From this study we conclude that natural super disintegrants could be applied effectively in preparation of FDT's with better water absorption, disintegration and drug released properties. Thus natural super disintegrants exhibits faster drug dissolution and improved bio-availability thereby helping in effective therapy and improved patient compliance.

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REFERENCES:

1. Ved Parkash, Saurabh Maan, Deepika, Shiv Kumar Yadav, Hemlata, Vikas Jogpal· Fast disintegrating tablets: opportunity in drug delivery systems. J Adv Pharm Technol Res., 2011; 2(4): 223–235.
2. Zade PS, Kawtikwar PS, Sakarkar DM. Formulations, evaluation and optimization of fast dissolving tablet containing tizanidine hydrochloride. Inter J Pharm Tech Res., 2009; 1:34-42.
3. Ishikawa T, Watanabe Y, Utoquchi N, Matsumoto M. Preparation and evaluation of tablets rapidly disintegrating in saliva containing better taste masked granules by the compression method. Chem Pharm Bull.,1999;47:1451-1454.
4. Omaima SA, Mohammed HA, Nagia MA, Ahmed SZ. Formulation and optimization of mouth dissolve tablets containing rofecoxib solid dispersion. AAPS Pharm Sci Tech., 2006; 7:1-9.
5. Simone S, Peter CS. Fast dispersible ibuprofen tablets. Eur J Pharm Sci., 2002; 15:295-305.
6. http://en.wikipedia.org/wiki/fosinopril
7. www.cims.com
8. Kuchekar, B.S, Badhan A.C, Mahahjan H.S. Mouth dissolving tablets: A Novel Drug Delivery System. Pharma Times, 2003; 35:7-9.
9. Lachman L, Lieberman H.A, Kanig J.L, Banker G.S, Anderson N.R. The Theory and practice of Industrail Pharmacy. Mumbai, Varghese Publishing House, 3rd edition: 296-302.
10. Agarwal V, Bhavesh H, Kothari, Derek V. Moe R K, Khankari. Drug delivery: Fast dissolving systems. In: James Swarbrick. Encyclopedia of pharmaceutical technology. Information health care, 2007; 1104-1105.
11. Nangude T.D, Chatap V.K, Bhse K.S, Sharma D.K. Mouth dissolving tablets:Geriatics and pediatrics friendly drug delivery system. Indian Drugs, 2007; 44(6):471-473.
12. Induwade N.H, Rajyaguru T.H, Nakhat P.D.Novel approach-Fast dissolving tablets. Indian Drugs, 2002; 39(8):405-408.
13. Lachman L, Lieberman H.A, Kanig J.L, Banker G.S, Anderson N.R. The Theory and practice of Industrail Pharmacy. Mumbai, Varghese Publishing House. 3rd edition, 1991; 297-301.
14. Vijaya K.S, Mishra D.N. Rapidly Disintegrating oral tablets of meloxicam. Indian Drugs, 2006; 43(2):117-121.