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RESEARCH ARTICLE

Formulation and Evaluation of Aceclofenac Fast Dissolving Tablets by Using Natural and Synthetic Superdisintegrants

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ABSTRACT

On contact with saliva, FDTs (Fast dissolving tablets) which are designed to disintegrate rapidly, enables tremendous oral administration without contact with water. Also chewing these formulations produces an increased convenience and ease of administration with a significant potential efficacy to improve the patient compliance, predominantly in certain populations who were facing difficulties for swallowing the conventional solid oral dosage forms. In our present study, the effect of a natural superdisintegrant namely, Fenugreek and some synthetic superdisintegrants such as SSG (Sodium Starch Glycolate), MCC (Micro Crystalline Cellulose), CP (Cross Povidone) and CCS (Cross Carmaellose sodium) were employed for this study to produce the formulations of FDTs. By direct compression method, FDTs of Aceclofenac were prepared and evaluated as per IP standards. From our study it was confirmed that Fenugreek showed excellent swelling index than the synthetic superdisintegrants. Hence the present study reveals that this natural superdisintegrants showed significant disintegration.

KEYWORDS

Aceclofenac, Fenugreek seed, SSG, MCC, Cross Povidone, Cross Carmellose sodium, Fast Dissolving Tablets

INTRODUCTION

The drug delivery technology has certainly infused new interest incitingly, traditional of old drugs by providing them new life specially through their therapeutic targets[1].Recent developments in the technology have presented viable dosage alternatives from oral route for paediatrics, geriatrics, bedridden, nauseous or non-compliance patients[2]. A fast dissolving drug delivery system in most cases, is a tablet that dissolves or disintegrants in the oral cavity without the need of water or chewing[3-4].

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The basic approach used in development of fast dissolving tablet by the use of synthetic superdisintegrants like Cross carmellose, sodium starch glycollate, poly vinyl pyrollidone, etc.[5-8] Number of natural, semi synthetic and synthetic polymer material are used in the various drug delivery system. Recent trend towards the use of vegwetable and non- toxic products demands the replacement of synthetic additives with natural one[9]. Aceclofenac is a potent inhibitor of the enzyme cyclo-oxygenase, which is involved in the production of prostaglandins. Aceclofenac can be administered twice daily as 100mg orally in the treatment of rheumatoid arthritis. Geriatric patients may have difficulty in swallowing and

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chewing the tablets resulting in patient non compliance and ineffective theraphy[10-12]. Objective of my study to formulate and evaluate Aceclofenac fast dissolving tablets by direct compression method and to increase the drug release profile in short duration of time. Evaluation of formulated tablets was done using various quality parameters like hardness, friability, wetting time, DT, in vitro dissolution study.

An annual plant, namely *Trigonellum foenum* - graecum, (Fam:-Fabaceae) which is commonly called as Fenugreek. in tamil – vendhayam. The plant has small round leaves, cultivated in worldwide as semi-acrid crop[13]. It has been used since ancient times both as food and medicine by the people living on the shores of Mediterranean and across Asia.The seeds are brownish yellow and have peculiar odor[14].

MATERIALS AND METHODS

Aceclofenac, Sodium Starch Glucollate, cross carmellose sodium, cross povidone, Microcrystalline cellulose was obtained as gift nsamples from Microlabs, Hosur. Fenugreek seeds was purchased in the local market. Magnesium stearate was obtained as gift sample from central drug House pvt.Ltd. Talc, Dextrose was purchased from Spectrum reagents and chemicals pvt, Ltd.

Method of Preparation

Fast dissolving tablets containing 300mg of Aceclofenac were prepared by direct compression method, each tablet containing 100mg of Aceclofenac was prepared by using direct compression as per formula given in the superdisintegrants SSG, MCC, Cross povidone, Cross Carmellose Sodium (5%, 10%, 15%) and Fenugreek (5%, 10%, 15%) were used in different combination. All the ingredients were passed through sieve #60 and kept in hot air oven at 60º C to make anhydrous and accurately weighed. The drug, superdisintegrants, MCC, dextrose, were mixed to improve drug distribution and content uniformity and triturated well in a mortor. Then magnesium stearate, and talc was passed through sieve #80 mixed and blended well with initial mixture. The mixed blend of drug and excipients was compressed using single punching machine to produce tablet weighing 300mg having diameter 4.5mm, following the procedure six batches of MDT of Aceclofenac sodium in different ratio of superdisintegrants were prepared.

Evaluation of Powder Blends

Bulk Density[15]

Bulk density (ρb) to a measure used to describe a packing of particles. It is (gm/ml) and was determine using a balance and measuring cylinder. Initially the weight of the measuring cylinder was taken. Then, 4 gm pre sieved (40#) bulk drug were poured into the measuring cylinder using a funnel and weighed (M). Then volume of the powder (Vb) was taken. Bulk density of the granules was calculated using following formula.

Bulk density = Weight of powder/ Volume of powder

or

$$\rho b = M / Vb$$

Tapped Density[16, 17]

The granular powder mixture was tapped for a fixed (500) number of taps. The minimum volume (Vt) occupied in the cylinder and the weight (M) of the blend was measured. The tapped density (Electro Lab ETD 1020) (ρt) was calculated using following formula.

Bulk density = Weight of powder/ Volume of powder

or

$$\rho b = M / Vt$$

Carr's Index (Ci)[18]

Tapped and bulk density measurements can be used to estimate the carr's index of a material. Carr's index was determined by,

Carr' index = ((Tapped density – bulk density) / Tapped density) %

Angle of Repose

Angle of repose (α) was determined by funnel

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method. The blend was poured through a funnel that can be raised vertically until a maximum cone height (h) was obtained. The radius of the heap (r) was measured and angle of repose was calculated. It is used to determine the flow property of powder

$$\alpha = \tan^{-1} (h/r)$$

Hausner's Ratio

Hausner's ratio is a guide of ease of powder flow; it is calculated by following formula.

Hausner ratio = Tapped density/ Bulk density

or

Hausner ratio = ρt/ ρb

Evaluation of Fast Dissolving Tablets

Quality Control tests for FDTs of all formulations were performed, and the average values were calculated. All the tablets were evaluated for different parameters as appearance, weight variation, hardness, thickness, friability, wetting time, water absorption ratio, disintegration time, and *In vitro* dissolution study

Appearance

Tablets from each formulation were randomly selected and organoleptic properties such as colour, odour, taste, and shape were evaluated.

Weight Variation

Twenty tablets were selected randomly from each batch weighed individually on electronic balance (Shimadzu). The individual weighed is then compared with average weight for the weight variations.

Hardness[19]

For each formulation, the hardness of tablets was determined using the Monsanto hardness tester.

Wetting time[20]

A piece of tissue paper (10.75×12 mm) folded twice was placed in a culture dish (d=6.5cm) containing 6ml of water. A tablet was put on the paper and the time for complete wetting was measured.

Water Absorption Ratio[20]

The test was done with the same procedure as that of wetting time.in this test initial weight of the tablet was taken before placing on petridish. After complete wetting the wetted tablet was taken and then weighed. Water absorption ratio, R was determined using the equation

R=100(Wb-Wa) / Wa

Where Wa is the weight of tablet before water absorption

Wb is the weight of tablet after absorption

Disintegration Time

It was determined by USP tablet disintegration test apparatus (electrolab USP ED-2AL) using 900 ml of distilled water without disk at room temperature. Test was performed on 6 tablets. Limit for the disintegration time of FDTs: Not more than 30 seconds according to USP.

***In Vitro* Drug Release[21, 22]**

In vitro drug release of aceclofenac from fast dissolving tablets was determined using USP Dissolution Apparatus II (Paddle type) (Electrolab TDT- 08l U.S.P). The dissolution test was performed using 900 ml of phosphate buffer (pH 7.4) at 37 ± 0.5 ^{0} C. The speed of rotation of paddle was set at 50 rpm. At a predetermined time interval (5 min); 5 ml samples were withdrawn, filtered through whatman filter paper. Absorption of solution was checked by UV spectrophotometer at 276 nm and drug release was determined from standard curve.

Determination of Drug Content[23, 24]

Amount of drug present in each tablet was determined by taking 20 tablets, and then it was crushed in a mortar. Then the powder equivalent to 100mg of drug was transferred to 100ml standard flask. The powder was dissolved in 5ml of methanol and made upto volume with phosphate buffer pH 6.8. The sample was mixed thoroughly and filtered the solution was diluted suitably and analyzed for drug content by UV spectrophotometer at 274nm using phosphate buffer pH 6.8 as blank.

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Table 1: Different Types of Formulation F1-F6

S.NO.	Ingredients	F1	F2	F3	F4	F5	F6
1.	Aceclofenac	100	100	100	100	100	100
2.	Fenugreek seeds powder	10	20	30	-	-	-
3.	Soduim Starch Glycollate	-	-	-	10	20	30
4.	Cross Povidone	-	-	-	-	-	-
5.	Cross Carmellose Sodium	-	-	-	-	-	-
6.	Microcrystalline Cellulose	130	120	110	130	120	110
7.	Dextrose	50	50	50	50	50	50
8.	Magnesium stearate	5	5	5	5	5	5
9.	Talc	5	5	5	5	5	5
10	Total Weight	300	300	300	300	300	300

Table 2: Different Types of Formulation F7-F12

S.NO.	Ingredients	F7	F8	F9	F10	F11	F12
1.	Aceclofenac	100	100	100	100	100	100
2.	Fenugreek seed powder	-	-	-	-	-	-
3.	Soduim Starch Glycollate	-	-	-	-	-	-
4.	Cross Povidone	10	20	30	-	-	-
5.	Cross Carmellose Sodium	-	-	-	10	20	30
6.	Microcrystalline Cellulose	130	120	110	130	120	110
7.	Dextrose	50	50	50	50	50	50
8.	Magnesium Stearate	5	5	5	5	5	5
9.	Talc	5	5	5	5	5	5
10	Total Weight	300	300	300	300	300	300

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RESULTS AND DISCUSSION

Fast Dissolving tablets were designed to disintegrate rapidly on contact with saliva and enables oral administration without water or chewing, these formulations offer increased convenience and ease of administration. The tablets were prepared by Direct Compression method by using natural and synthetic superdisintegrants such as Fenugreek seed powder, Sodium starch glycollate, Cross povidone, Cross carmellose sodium etc to optimize the disintegration, *in-vitro* dissolution, drug content.

The preformulation studies are the first step in the development of any formulation. The goal of this study is to establish physical characteristics. The absorption maxima shows the λ max at 285nm.

The weight variation for the Aceclofenac fast dissolving tablets passes the I.P limit.

The hardness of the tablet shows 3-4kg/cm found to be optimum and also the tablets were showed around then only.

The friability test showed for all the formulations i.e from F1-F12 should not more than 1%.

Disintegration time for tablets prepared with Fenugreek was greater to that prepared with sodium starch glycollate, cross povidone, cross carmellose sodium indicating that Fenugreek had good disintegrating property. This rapid disintegration of the fast dissolving tablets was due to the penetration of saliva into the pores of the tablet which lead to the swelling of superdisintegrants to create enough hydrodynamic pressure for quick and complete disintegration of the tablet. Fenugreek was effective at concentration i.e 30%.

Fenugreek was effective at concentration at 30%. *In –vitro* dissolution study reveals that F3 was an optimized formulation that releases more than 90% of drug within 5minutes as compared with other formulations.

Table 3: Derived Properties of Formulations F1-F6

S.NO	Properties	F1	F2	F3	F4	F5	F6
1.	Angle Of Repose	$28^0$40’ ± 0.769	$26^0$60’ ± 0.317	$28^0$50’± 0.057	$28^0$90’± 0.692	$24^0$94’± 0.577	$26^0$11’± 0.080
2.	Bulk Density	0.56 ± 0.0065	0.57 ± 0.040	0.58 ± 0.004	0.62 ± 0.007	0.64 ± 0.008	0.65 ± 0.008
3.	Tapped Density	0.64 ± 0.008	0.64 ± 0.008	0.65 ± 0.008	0.73 ± 0.001	0.75 ± 0.0.017	0.76 ± 0.0.017
4.	Carr’s Index	11.56 ± 0.152	11.23 ± 0.635	11.30 ± 0.70	15.03 ± 0.251	15.06 ± 0.850	14.05 ± 0.360
5.	Hausners Ratio	0.88 ± 0.001	0.89 ± 0.006	0.89 ± 0.007	0.84 ± 0.002	0.84 ± 0.008	0.85 ± 0.009

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Table 4: Derived Properties of Formulations F7-F12

S. No.	Properties	F7	F8	F9	F10	F11	F12
1.	Angle Of Repose	$27^0$27' ± 0.300	$26^0$04'± 0.753	$27^0$38'± 0.344	$27^0$38'± 0.835	$28^0$03'± 0.837	$28^0$30'± 0.663
2.	Bulk Density	0.58 ± 0.007	0.59 ± 0.003	0.60 ± 0.004	0.58 ± 0.007	0.57 ± 0.006	0.57 ± 0.010
3.	Tapped Density	0.64 ± 0.0127	0.64 ± 0.0080	0.65 ± 0.0085	0.64 ± 0.0126	65.00 ± 0.0215	0.63 ± 0.0080
4.	Carr's Index	10.01 ± 0.781	09.06 ± 0.665	08.08 ± 0.529	09.73 ± 0.757	11.06 ± 0.776	08.53 ± 0.585
5.	Hausners\ Ratio	0.89 ± 0.007	0.90 ± 0.006	0.91 ± 0.007	0.90 ± 0.007	0.88 ± 0.035	0.91 ± 0.005

Table 5: Evaluation of Various Parameters from F1-F6

S. No.	Properties	F1	F2	F3	F4	F5	F6
1	Hardness	3.41 ± 0.0601	3.54 ± 0.3234	3.79 ± 0.2516	3.55 ± 0.0763	3.58 ± 0.0907	3.57 ± 0.1331
2	Friability	0.48 ± 0.0288	0.45 ± 0.050	0.33 ± 0.0288	0.23 ± 0.0288	0.25 ± 0.05	0.28 ± 0.0288
3	Weight Variation	0.302 ± 0.002	0.305 ± 0.004	0.313 ± 0.011	0.306 ± 0.002	0.304 ± 0.001	0.303 ± 0.001
4	Disintegration Time	0.59 ± 0.01	0.42 ± 0.023	0.33 ± 0.032	0.79 ± 0.017	0.75 ± 0.011	0.67 ± 0.005
5.	Wetting Time (s)	45	43	40	90	80	70
6.	Water Absorption Ratio(%)	81 ± 0.23	85 ± 0.71	89 ± 0.81	60 ± 0.42	70 ± 0.41	75 ± 0.31

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Table 6: Evaluation of Various Parameters from F7-F12

S. No.	Properties	F7	F8	F9	F10	F11	F12
1.	Hardness (kg/cm^3)	3.30 ± 0.076	3.69 ± 0.236	3.84 ± 0.153	3.81±0.136	3.66±0.176	3.76±0.332
2.	Friability (%)	0.36 ± 0.057	0.43 ± 0.057	0.43 ± 0.057	0.46±0.057	0.35±0.050	0.33±0.057
3.	Weight Variation	0.3017 ± 0.0002	0.3045 ± 0.0045	0.3043 ± 0.0036	0.3028± 0.0157	0.3083±0.082	0.3033±0.016
4.	Disintegration Time (minutes)	0.89 ± 0.01	0.82 ± 0.020	0.63 ± 0.015	0.72±0.026	0.65±0.023	0.48±0.015
5.	Wetting Time (seconds)	95	82	73	100	92	85
6.	Water absorption ratio(%)	65 ± 0.32	69 ± 0.51	77 ± 0.25	80±0.36	76±0.85	67±0.68

Table 7: *In-Vitro* Dissolution Study of F1-F6

S. No	Time (min.)	F1	F2	F3	F4	F5	F6
1.	0	0	0	0	0	0	0
2.	1	2.8846	3.6923	5.1923	17.5384	21.3461	25.615385
3.	2	30.9294	31.3928	32.2038	24.6158	33.3935	34.0953
4.	3	35.8443	37.1164	37.6984	32.6320	42.9292	40.1710
5.	4	37.0776	38.1217	48.2820	36.3966	46.7166	50.0676
6.	5	74.3135	87.2446	98.5812	54.7079	59.3969	61.14

Table 8: *In-Vitro* Dissolution Study of F7-F12

S. No	Time (min.)	F7	F8	F9	F10	F11	F12
1	0	0	0	0	0	0	0
2	1	16.5	17.0769	6.8076	7.7307	8.3076	9.92307
3	2	17.2289	21.1533	24.5920	18.1325	19.2876	21.8297
4	3	19.3441	21.6617	30.5312	25.2112	25.6766	26.9551
5	4	20.7715	25.05589	40.4066	27.9210	29.6566	31.6302
6	5	37.7789	44.84205	50.8807	31.2135	35.03	41.1617

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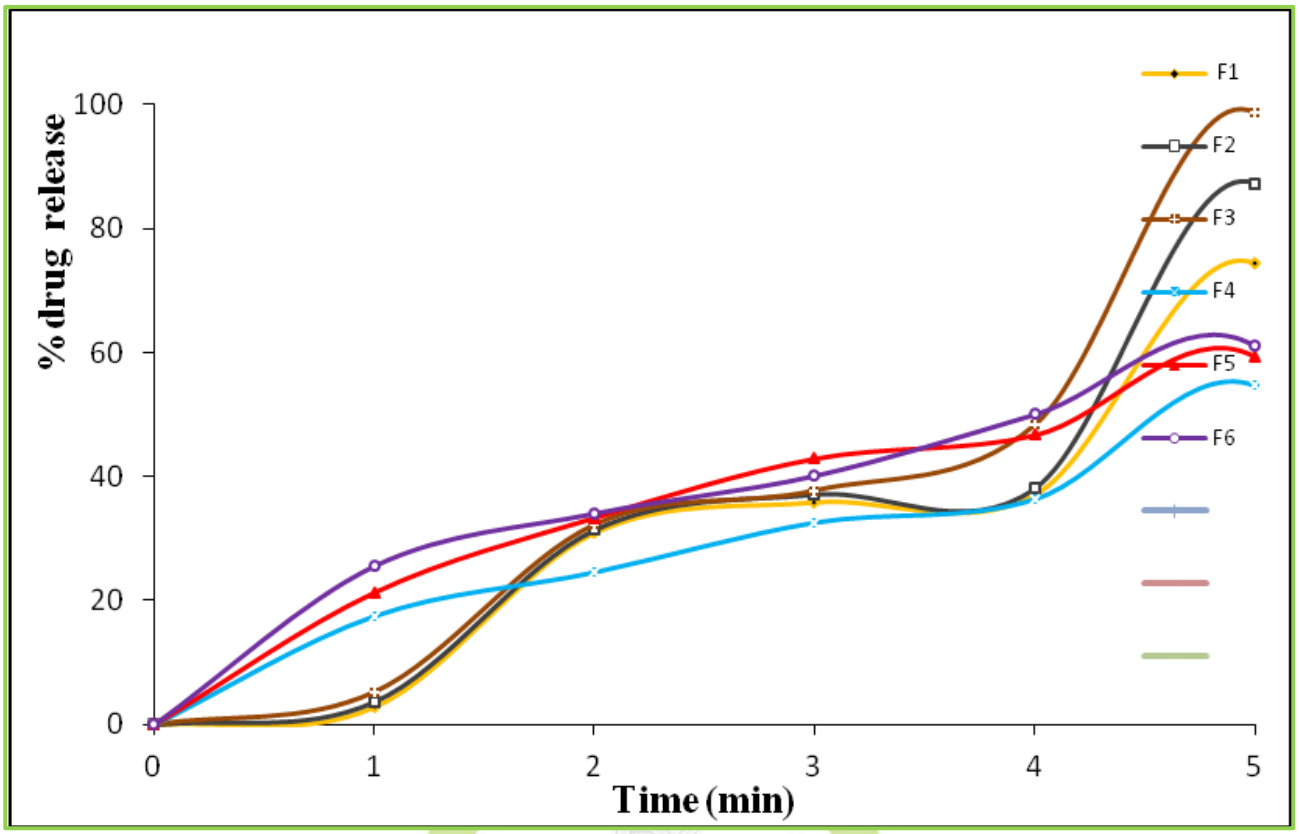

Figure 1: *In-Vitro* Dissolution Study of F1-F6

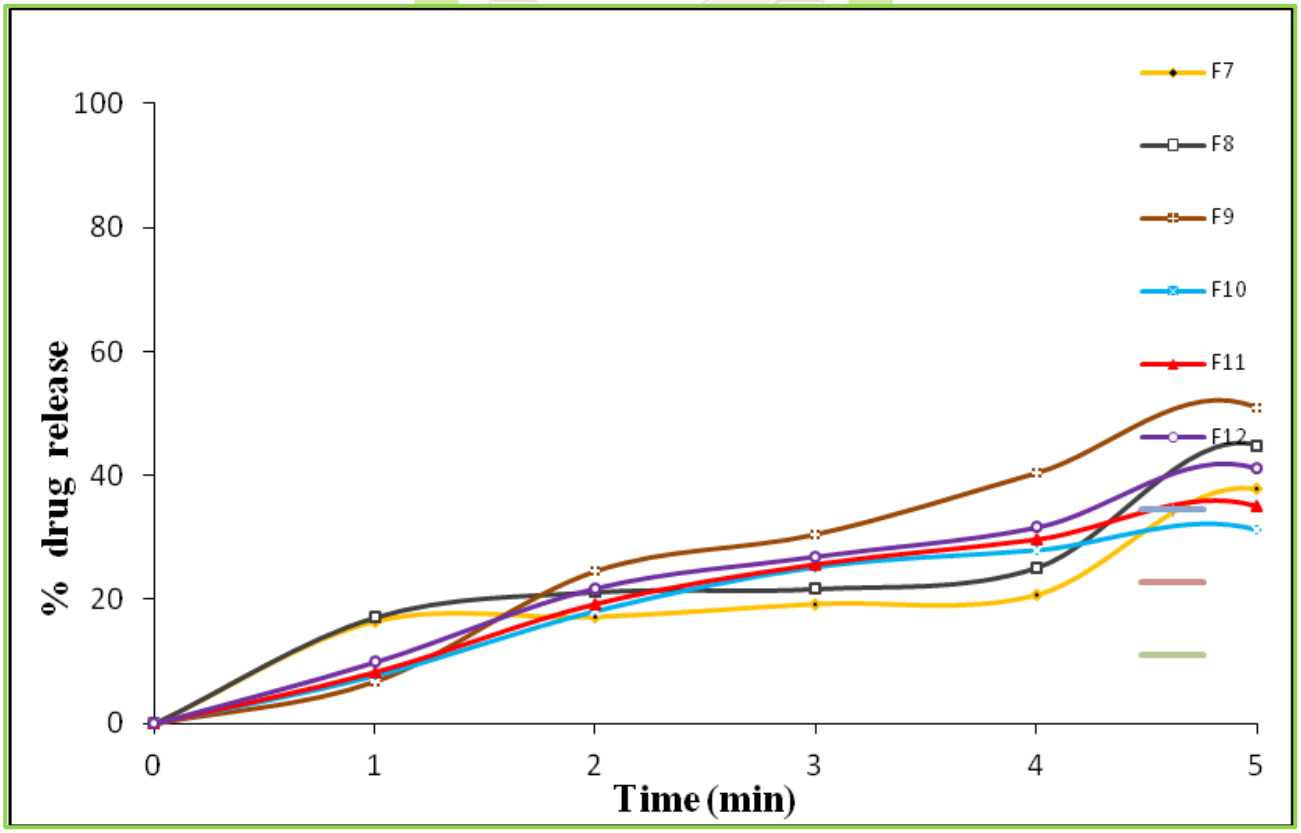

Figure 2: *In-Vitro* Dissolution Study of F7-F12

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CONCLUSION

Our study showed a significant and enthusiastic report by achieving a Aceclofenac formulations which is rendering a fast dissolving aptitude as tablets by direct compression method by enhancing an excellent bioavailability. Apart from that the formulations of aceclofenac showed better drug releasing tendency which was obtained only by the natural superdisintegrants, Fenugreek than other synthetic formulations. This may owing to the penetration of saliva fluid into the pores of the accessed tablet which increases the swelling ability of superdisintegrants to create enough hydrodynamic pressure for quick and complete disintegration. Finally from our reports it was confirmed that the natural superdisintegrants have amicable caliber in fast dissolving nature of Aceclofenac and still the future work on this natural superdisintegrants is under process.

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REFERENCES

1. Vyas, S. P., & Khar, R. K. (2004). Targeted & controlled drug delivery: Novel carrier systems. CBS publishers & distributors, New delhi, 38-46.
2. Malke, S., Shidhaye, S., & Kadam, V. J. (2007). Formulation and evaluation of oxcarbazepine fast dissolve tablets. *Indian journal of Pharmaceutical sciences*, *69*(2), 211. https://doi.org/10.4103/0250-474X.33145
3. Kuchekar, B. S., Atul, B. C., Mahajan, H. S. (2003). Mouth dissolving tablets: A novel drug delivery system. Pharma Times, 35, 7-9.
4. Allen Jr, L. V., & Wang, B. (1997). *U.S. Patent No. 5,595,761*. Washington, DC: U.S. Patent and Trademark Office.
5. Sharma, S., Gupta, G. D., Bharadwaj, S., & Hans, V. (2008). New generation of tablet: Fast dissolving tablet. *Pharmainfonet*, *6*(1), 111-119.
6. Habib, W., Khankari, R., & Hontz, J. (2000). Fast-dissolve drug delivery systems. *Critical Reviews™ in Therapeutic Drug Carrier Systems*, *17*(1), 61-72.
7. Chang, R. K., Guo, X., Burnside, B. A., & Couch, R. A. (2000). Fast-dissolving tablets. *Pharmaceutical technology*, *24*(6), 52-52.
8. Dobetti, L. (2001). Fast-melting tablets: Developments and technologies. *Pharmaceutical technology*, 44-50.
9. Chein, Y. W. (2005). Novel Drug Delivery system, 2nd ed, Marcel Dekker, New York, 249 – 267.
10. Kuchekar, B. S., Bhise, S. B., & Arumugam, V. (2001). Design of fast dissolving tablets. *Indian journal of pharmaceutical education*, 35(4), 150-152.
11. Indurwade, N. H., Rajyaguru, T. H., & Nakhat, P. D. (2002). Novel approach: Fast dissolvi ng tablets. *Indian drugs*, 39(8), 405-409.
12. Chang, R. K., Guo, X., Burnside, B. A., & Couch, R. A. (2000). Fast-dissolving tablets. *Pharmaceutical technology*, 24(6), 52-58.
13. Zohary, D., Hopf, M., & Weiss, E. (2012). *Domestication of Plants in the Old World: The origin and spread of domesticated plants in Southwest Asia, Europe, and the Mediterranean Basin*. Oxford University Press on Demand. https://doi.org/10.1093/acprof:osobl/9780199549061.001.0001
14. Kulkarni, U., Borgaonkar, P. A., Patil, B. S., & Korwar, P. G. (2011). Formulation and development of fast disintegrating tablet containing Fenugreek seed powder. *Asian Journal of Pharmaceutical and Clinical Research*, *4*(1), 87.
15. Sekulovi, C. D., Tufegdz, C. N., Birmanc, C. M. (1986). The investigation of influence

of Explotab on disintegration of tablets. Pharmazie, 41, 153-154.

16. Sharma, S., & Gupta, G. D. (2014). Formulation and characterization of fast-dissolving tablet of promethazine theoclate. *Asian Journal of Pharmaceutics (AJP): Free full text articles from Asian J Pharm*, *2*(1), 70-72. https://doi.org/10.4103/0973-8398.41571
17. Ansel, H. C., Popovich, N. G., & Allen, L. V. (1995). *Pharmaceutical dosage forms and drug delivery systems* (Vol. 6). Baltimore: Williams & Wilkins.
18. Indian Pharmacopoeia. Vol-2. New Delhi: Controller of Publication; 1986.
19. Banker, G. S., Anderson, N. R. tablets. In; Lachman L, Lieberman H.A, Kanig J.L. The Theory and Practice of Industrial Pharmacy. III Edition. Varghese Publishing House. Mumbai. 1987, 296-306.
20. British Pharmacopoeia. Vol-2. London: her Majestry Stationary office; 1988.
21. Sunada, H., & Bi, Y. (2002). Preparation, evaluation and optimization of rapidly disintegrating tablets. *Powder technology*, *122*(2-3), 188-198. https://doi.org/10.1016/S0032-5910(01)00415-6
22. Kuchekar, B., Atul, C., Badhan Mahajan, H. Mouth dissolving tablets: a novel drug delivery system. Pharma Times 2003, 35: 7–9.
23. Kumar, R., Patil, S. R., Patil, M. B., Paschapur, M. S., & Rathnanand, M. (2010). Design and characterization of aceclofenac mouth dissolving tablets by effervescent formulation approach. *Der pharmacia lettre*, *2*(1), 220-236.
24. Chakraborty, S., Khandai, M., Singh, S. P., & Patra, N. C. (2008). Comparative study on effect of natural and synthetic superdisintegrants in the formulation of fast dissolving tablets. *International Journal of Green Pharmacy (IJGP)*, 2(1), 22-2. https://doi.org/10.4103/0973-8258.39158

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