EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 9
Issue: 9
196-203
Year: 2022

FORMULATION AND EVALUATION OF FAST DISSOLVING TABLET OF CYCLODEXTRIN INCLUSION COMPLXED WATER INSOLUBLE DRUG: ACECLOFENAC

A. Bhargav, F. R. Sheeba, B. V. Vinutha*, Dr. Shivanand K. Mutta and H. S. Keerthy

Mallige College of Pharmacy, 71 Silvepura, Chikkabanavara post, Bangalore-560090.

***Corresponding Author: B. V. Vinutha**
Mallige College of Pharmacy, 71 Silvepura, Chikkabanavara post, Bangalore-560090.

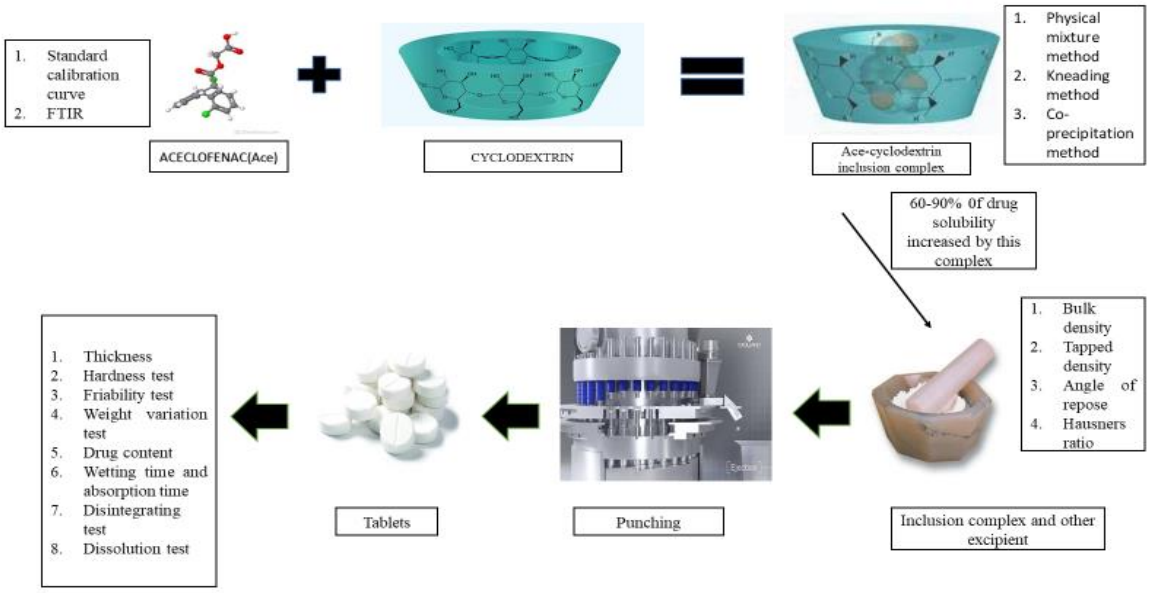
Article Received on 25/06/2022 **Article Revised on 15/07/2022** **Article Accepted on 05/08/2022**

ABSTRACT

The enhancement of solubility of poorly water-soluble drugs is one of the challenging aspects of drug development. Therefore, formulation approaches are being explored to enhance solubility of poorly water-soluble drugs. The aim of the present study was formulation and evaluation of a fast-dissolving tablet of cyclodextrin inclusion complex with water insoluble drug aceclofenac. Complexation is an extensively used technique in the pharmaceutical field to improve solubility of several pharmaceutical ingredients and poorly water-soluble drugs. The inclusion complex of aceclofenac with β-cyclodextrin was prepared in 1:0.5, 1:1, 1:1.5 and 1:2 ratios in various methods such as physical mixture method, kneading method, and co-precipitation method. Among all the inclusion complex formulations, the aceclofenac and β-cyclodextrin 1:2 ratio in the physical mixture method showed an increase in solubility than pure drug. The best inclusion complex was prepared as a mouth dissolving tablet by using various types of super disintegrants such as sodium croscarmellose, polyvinylpyrrolidone and starch maize. The granules were evaluated for angle of repose, bulk density, tapped density and Carr's index. Tablets are prepared by direct compression method and evaluated for weight variation, hardness, friability, wetting time, water absorption ratio, disintegration time and *in-vitro* drug release. The F3 formulation containing sodium croscarmellose was best among all the formulations. It disintegrates within 48sec, wetting time was 30 sec and 94% of drug release in 30 minutes.

KEYWORDS: Aceclofenac, cyclodextrin, inclusion complexes, solubility enhancement, fast dissolving tablets.

Graphical abstract



INTRODUCTION

Drug release is a pivotal and limiting step for oral drug bioavailability, particularly for drug with low gastrointestinal solubility and high permeability. By enhancing the drug release profile of these drugs, it is possible to enhance their bioavailability and reduce their side effect. Solid dispersion is one of the most successful strategies to ameliorate the drug release of poorly soluble drugs.[1] Presenting the compound as the molecular dispersion combining the benefits of original increase in the solubility (with in the solid solution) and maximizing the surface area of the compound that come in contact with the dissolution medium as the carrier dissolves.[2] The large surface area of the resulting suspension should result in an enhanced dissolution rate and thereby bettere bioavailability.[3] The possibility of combining several carriers to produce an optimized product further extended the range of possibilities for formulation.[4]

Many patients especially children and elderly have difficulty in swallowing tablets and capsules so resulting in non-compliance and ineffective therapy.[5] Recent advances in novel drug delivery systems (NDDS) enhance safety and efficacy of drug molecules by formulating a convenient dosage form for administration and to achieve better patient compliance and convenience. One such approach led to development of fast dissolving tablets.[6-8] Advantage of this drug delivery system include administration without water, convenience of administration and accurate dosing as compare to liquids, easy portability, ability to provide advantage of liquid medication in the form of solid preparation, ideal for paediatric and geriatric patients and rapid dissolution /absorption of the drug, which may produce rapid onset of action. Some drugs are absorbed from mouth, pharynx and oesophagus as the saliva passes down in to stomach and in similar cases bioavailability of drug is increased, pre-gastric absorption also improved.[9.10]

Aceclofenac (ACF) is chemically [[[2-[(2,6-dichlorophenyl) amino] phenyl] acetyl] oxy] acetic acid. It is a potent nonsteroidal anti-inflammatory drug (NSAID), therapeutically used in inflammatory and painful conditions of rheumatic and nonrheumatic origin. It is an acid compound (pKa 4.30 at 25˚C) with a very low aqueous solubility (0.058µg/ml at 25˚C) in the unionized form. Another problem associated with this active principle aceclofenac lies in its very great bitterness. In general, aceclofenac required in acute painful conditions where prompt, quick action and relief required. However, aceclofenac results in poor bioavailability when administered in the form of conventional tablets because of its high hydrophobicity and poor aqueous solubility. In this work, it was investigated whether the low water solubility problem and bitterness could be overcome by the arrangement of ACF–HPbCD binary systems.[11]

Cyclodextrins are cyclic oligosaccharides, containing six, seven or eight glucopyranose units (α, β or gamma respectively) obtained by the enzymatic degradation of starch.[12] These are torus shaped molecules with a hydrophilic outer surface and lipophilic central cavity, which can accommodate a variety of lipophilic drugs. Cyclodextrins are suitable to form inclusion complexes with poorly water-soluble drugs and have been shown to improve pharmaceutical properties like solubility, dissolution rate, bioavaibility, stability and even palatability without affecting their intrinsic lipophilicity or pharmacological properties.[13] Among of the three parent cyclodextrins, β-cyclodextrin (β-CD) appears most useful as a pharmaceutical complexing agent because of its complexing ability, low cost and other properties.[12,14] The capability of cyclodextrin to form inclusion complexes may also be enhanced by substitution on the hydroxyl group.

The objective of present study is to prepare inclusion complexes of aceclofenac with cyclodextrin in different molar ratios by different methods such as physical, kneading and co-precipitation methods. The inclusion complexes were further formulated into fast disintegration tablets by direct compression technique using super disintegrates in order to increase the solubility of aceclofenac for enhancement of dissolution rate and bioavailability of the drug in the prepared tablet formulations.

MATERIALS AND METHODS

MATERIALS

Aceclofenac procured from Koushik pharmaceutical, Chennai and all other excipients such as poly vinyl pyrrolidone from Shashikant pharmaceuticals, Chennai, cross carmellose from Pushkar pharma, Mumbai and Starch maize from Abuja exports ltd, Gujarat and β-cyclodextrin from Himedia laboratories, Mumbai.

METHODS

Preparation of inclusion complex

Physical Mixture Method (P): Aceclofenac and beta-cyclodextrin in different ratios (1:0.5, 1:1, 1:1.5, 1:2) were mixed in a mortar for about one hour with constant trituration and passed through the 80number sieve. The collected product was stored in the desiccator.

Kneading method (K): Beta cyclodextrin (1:0.5, 1:1, 1:1.5, 1:2) were triturated in a mortar with a small volume of water. The drug was slowly added to it. The thick slurry formed was kneaded in a glass mortar for 30 mins and then completely dried in hot air oven at 60°C. The dried mass was sieved at 80 number mesh and the obtained product was stored in a glass jar.[14]

Co-precipitation method (C): In this method the active drug and beta cyclodextrin are mixed with different molar ratios (1:0.5, 1:1, 1:1.5, 1:2). Then solvent methanol and distilled water was added. The mixture is stirred for one hour at room temperature and the solvent

will be evaporated. The precipitate obtained as a crystalline powder is pulverized and sieve through sieve #80 and stored in desiccators.[15]

Table 1: Formulation of aceclofenac-cyclodextrin inclusion complex.

Methode	Code for formulation	Drug to carrier complex	Drug to carrier ratio
Physical mixture method	P1	Aceclofenac:Beta-cyclodextrin	1:0.5
	P2	Aceclofenac:Beta-cyclodextrin	1:1
	P3	Aceclofenac:Beta-cyclodextrin	1:1.5
	P4	Aceclofenac:Beta-cyclodextrin	1:2
Kneading method	K1	Aceclofenac:Beta-cyclodextrin	1:0.5
	K2	Aceclofenac:Beta-cyclodextrin	1:1
	K3	Aceclofenac:Beta-cyclodextrin	1:1.5
	K4	Aceclofenac:Beta-cyclodextrin	1:2
CO-precipitation method	C1	Aceclofenac:Beta-cyclodextrin	1:0.5
	C2	Aceclofenac:Beta-cyclodextrin	1:1
	C3	Aceclofenac:Beta-cyclodextrin	1:1.5
	C4	Aceclofenac:Beta-cyclodextrin	1:2

Note: Among all this formulation K1, K2 and P4 was found to be best formulation because solubility of the pure drug was maximum. Hence, these formulation are selected for preparation of fast dissolving tablets.

Preparation of aceclofenac-cyclodextrin inclusion complex of fast dissolving tablet

The composition of aceclofenac FDT is shown in Table 1 and all excipients used for aceclofenac FDT were within limits as per CDER IIG guideline. Aceclofenac–CD complex and the excipients except lubricants were sieved through #24 mesh and #40 mesh respectively. Aceclofenac–CD complex granules containing amount equivalent to 100 mg of aceclofenac, were mixed with the other excipients, sweetener, flavour, and the whole mixture was blended with the mixer for 15 min. Then lubricant magnesium stearate was passed through #60 mesh and added to the above blend and mixed for 2 min. The above blend was compressed into tablet weight of 600 mg using 12.5 mm flat bevelled edge tooling on a 16-station single rotary compression machine.[16]

Table 2: Formulation of aceclofenac-cyclodextrin inclusion complex of fast dissolving tablet.

Ingredients	F1	F2	F3	F4	F5	F6	F7	F8	F9
Inclusion complex K1 (Equivalent to 100mg of aceclofenac)	150mg	-	-	150mg	-	-	150mg	-	-
Inclusion complex K2 (Equivalent to 100mg of aceclofenac)	-	200mg	-	-	200mg	-	-	200mg	-
Inclusion complex P4 (Equivalent to 100mg of aceclofenac)	-	-	300mg	-	-	300mg	-	-	300mg
Cross-carmellose	12mg	12mg	12mg		-	-	-	-	-
Poly vinyl pyrrolidone	-	-	-	12mg	12mg	12mg			-
Starch maize	-	-	-	-	-	-	12mg	12mg	12mg
Magnesium stearate	10mg	10mg	10mg	10mg	10mg	10mg	10mg	10mg	10mg
Mannitol	20mg	20mg	20mg	20mg	20mg	20mg	20mg	20mg	20mg
Micro crystallinecellouse	158mg	108mg	8mg	158mg	108mg	8mg	158mg	108mg	8mg
Total	350mg	350mg	350mg	350mg	350mg	350mg	350mg	350mg	350mg

EVALUATION

Pre-formulation studies

Calibration curve for Aceclofenac: An accurately weighed quantity of aceclofenac (100mg) was dissolved in small quantity of phosphate buffer pH 6.8 and make up the volume up to 100 ml. Primary stock solution was further diluted up to 100ml to produce a secondary stock solution having concentration of 50ug/ml. Working Standard solution having concentration 5 to 40 µg/ml was prepared by appropriately diluting the stock solution.

FTIR: FTIR spectral analysis was carried out by KBr pellet method by using Shimadzu FTIR spectrometer. Potassium bromide was mixed with drug in 9:1ratio and the spectra were taken. The IR spectra of physical matrix were compared with that of aceclofenac to check for any possible drug- excipients interaction.[16]

Phase solubility studies: Phase solubility measurements were performed according to the method reported by Higuchi and Connors. An excess amount of drug was added to 10 mL β-CD aqueous solutions in volumetric flasks and shaken on rotary flask shaker at constant temperature of 37 ± 0.5 C for 72 h in order to reach equilibrium. After shaking the solution was filtered through membrane filter and analysed by UV-spectroscopy at 273nm.[11]

Pre-compression studies

Angle of Repose: Fixed funnel method was used. A funnel was fixed with its tip at a given height(h) above a flat horizontal surface on which a graph paper was placed. Powder was firmly poured through a funnel till the apex of the conical pile just touches the tip of funnel. The angle of repose was then calculated by using the formula.

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

Where,

θ - angle of repose

h - height of the pile

r - radius of the base of the pile

Bulk Density: The bulk density depends on particle size distribution, shape and cohesiveness. Accurately weighed quantity of powder was carefully poured into the graduated measuring cylinder through large funnel.

$Db = M/V_0$.

Where,

Db -Bulk density(g/cc)

M - Mass of the powder

V_0 - Bulk volume of powder

Tapped Density: Weighed quantity of powder was introduced into a clean dry 100 ml measuring cylinder. The cylinder was tapped in to 100 times from a constant height and the tapped volumes were read.It is expressed in g/cc.

$D_t = M/V_t$

Where,

D_t - Tapped Density (g/cc)

M - Mass of the powder (g)

V_t - Tapped volume of the powder

Hauser's ratio and Compressibility index: The Hausner's ratio and compressibility index was calculated using measured values of bulk density and tapped density as follow,

Hausner's Ratio = $Tapped\ density\ /Bulk\ density$

Compressibility index = $Tapped\ density - Bulk\ density / Tapped\ density \times 100$.[17]

Post-compression studies

Thickness: The tablets thickness is important for uniformity of tablet size. Thickness was measured using Vernier Calliper. The average of three tablets was taken. The tablet thickness should be controlled within ± 5 variations of a standard value.

Hardness test: It is measured by using Monsanto hardness tester. It is expressed in kg/cm^2. The average of three tablets was taken according to USP guidelines from each formulation. The mean and standard deviation were also calculated.

Friability test: Weighed 20 tablets and initial weight was recorded and place in Roche friabilator and rotates at 25 rpm for 4 minutes. The tablets were removed and again weighed and final weight was recorded. It is calculated by using the equation.

% Friability = $initial\ weigh\ t\ of\ tablet - final\ weigh\ t\ of\ tablet\ /initial\ weigh\ t\ of\ tablet \times 100$

% Friability of the tablets less than 1% is considered acceptable.

Weight variation test: According USP twenty tablets were selected randomly from each batch and weighed individually by using analytical weighing balance. The average and standard deviation were calculated.

Disintegrating test: Disintegration test was performed was test apparatus. Fill the beaker with 6.8 pH phosphate buffer on the apparatus and put tablet into the beaker and record the time taken to the tablet to disintegrate.[14]

Drug content: Three tablets from each formulation of aceclofenac were taken in separate 100ml volumetric flask. 100 ml of pH 6.8 phosphate buffer was added to volumetric flask and kept for 24 hours under constant stirring. The solution was filtered, suitably and analysed at 273nm by UV spectrophotometer. The average of three tablets was taken as the content of drug in one tablet unit.[16]

percentage drug content = $Absorbance/\ slope \times 1/\ 1000 \times Dilution\ factor/\ Dose \times 100\%$

Wetting time and water absorption ratio: A piece of tissue paper folded twice was placed in a small petri dish containing 6ml of saliva or 6.8 pH phosphate buffer a tablet was put on the paper and the time of complete wetting time was measured. The wetted tablets were reweighted and the water absorption ratio was determined according to the following equation.

R= (Wa-Wa)/Wb (100)

Where,

Wa and Wb were the weights of the tablets before and after test.

Dissolution Studies: The drug release studies from aceclofenac tablet were performed using USP II dissolution test apparatus (paddle type). Originally tablets were placed in 900ml of pH 7.4 phosphate buffer and maintained the temperature at 37±0.5°C for 30 minutes. The paddle was rotated at 75 rpm. 5ml of sample was collected and replaced 5ml buffer manually after every 2 mins till 12 mins maintain the sink condition and assayed for drug content after suitable dilution with respective medium, using a UV-Visible Spectrophotometer at 273 nm.[17]

Zero Order Kinetics: It describes the system in which the release rate is independent of its concentration.
$Q_t = Q_0 + K_0t$
Where,
Q_t - amount of drug dissolved in time t
Q_0 - initial amount of drug in the solution
K_0 - zero order release constant
If the zero-order drug release kinetic is obeyed, a plot of Q_t versus t will give straight line with a slope of K_0 and an intercept at Q_0.

First Order Kinetic: It describes the drug release from the system in which the release rate is concentration dependant.
$\text{Log } Q_t = \log Q_0 + K1t/2.303$
Where,
Q_t - amount of drug dissolved in time
Q_0 - initial amount of drug in the solution
K1 - first order release constant.
If the release pattern of drug follows first order kinetics, then a plot of log (Q_0 - Q_t) versus t will be straight line with a slope of K1/2.303 and an intercept at t = 0 of log Q_0

Higuchi Model: It describes the fraction of drug release from a matrix is proportional to square root of time.
$M_t/M_\infty = K_H \boldsymbol{t_{1/2}}$
Where,
M_t and M_∞ - cumulative amount of drug release at time t and infinite time
K_H - Higuchi dissolution constant reflection formulation characteristics.
If the Higuchi model of drug release is obeyed, then a plot of M_t/M_∞ versus $t_{1/2}$ will be straight line with slope of K_H.

Korsmeyers- Peppas Model: The power law describes the fractional drug release is exponentially related to the release time and adequately describes the release of drug from slabs, cylinders and spheres, as expressed in following equation.
$Mt / M_\infty = K\ t\ n$
$\text{Log } (M_t / M_\infty) = \log K + n \log t$

Stability Studies: Stability studies are done to understand how to design a product and its packaging such that product has appropriate physical, chemical and microbiological properties during a defined shelf life when stored and used. Short-term stability studies were performed at room temperature over a period of 3 months. 5 tablets were packed in amber coloured screw capped bottle and kept in stability chamber maintained at room temperature. At the end of 3 months period, hardness and drug content and dissolution test was performed to determine the drug release profile.[18]

RESULTS

Calibration curve of Aceclofenac

The λmax of aceclofenac in 7.4 pH phosphate buffer was found to be 273 nm. The absorbance values are tabulated in the table 3. Aceclofenac obeyed Beer Lamberts law in the concentration range of 1-10 µg/ml with regression co-efficient 0.999.

Table 3: Data for calibration curve of aceclofenac.

Sl.no	Concentration (µg/ml)	Absorbance
1	0	0
2	2	O.059
3	4	0.123
4	6	0.183
5	8	0.254
6	10	0.312

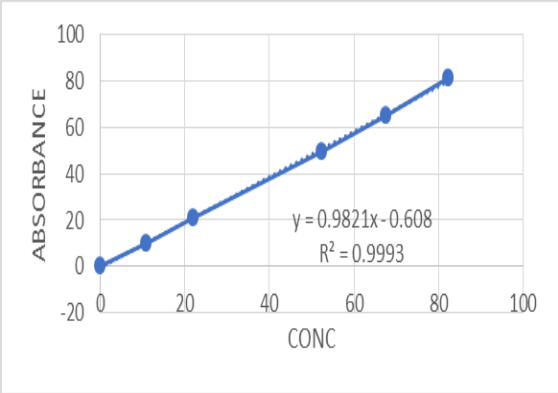


Fig 1: Calibration plot of aceclofenac.

FTIR studies: The compatibility between the drug and excipients was studied by FTIR spectroscopy. The results indicates that there was no chemical incompatibility between drug and excipient used in formulation.

Phase solubility studies: The result of the solubility studies showed that β-cyclodextrin were efficient carriers for solubility enhancement of poorly soluble drugs. Aceclofenac inclusion complex showed 2-8 fold increase in the solubility than pure drug. K1, K2 and P4 was found to be best formulation of inclusion complex because solubility of the pure drug was maximum.

Table 4: Data for solubility study of inclusion complex.

Sl.no	Formulation code	Solubility (µg/ml)	Solubility enhancement ratio
1	Pure drug	0.0462	----------
2	P1	0.149	2
3	P2	0.25	5
4	P3	0.27	5
5	P4	0.324	7
6	K1	0.313	6
7	K2	0.387	8
8	K3	0.276	5
9	K4	0.285	6
10	C1	0.118	2
11	C2	0.15	3
12	C3	0.166	3
13	C4	0.168	3

Pre-compression studies

Pre compression parameter of all formulation F1 to F9 are satisfactory. Bulk density, tapped density, angle of repose and Hausner's ratio are within the limit.

Bulk density ranges from 0.68 ± 0.78 and Tapped density ranges from 0.87±0.97.

Compressibility index ranges from 15.7 ± 17.5.

Hausner's ratio ranges from 1.1 ± 1.36.

Angle of repose from28.4 °± 26.54°. Results are shown in table 5.

Table 5: Data for pre-compression parameters.

Sl.no	Formulation code	Angle of repose(θ)	Bulk density(g/ml)	Tapped density	Compressibility index (%)	Hausner's ratio
1	F1	28.25°	0.78	0.975	17.5	1.01
2	F2	29.05°	0.77	0.96	15.7	1.37
3	F3	26.24°	0.77	0.89	16.54	1.2
4	F4	28.25°	0.75	0.92	16.2	1.28
5	F5	29.05°	0.72	0.94	17.5	1.24
6	F6	28.25°	0.76	0.89	17.2	1.08
7	F7	28.25°	0.73	0.92	15.2	1.36
8	F8	27.50°	0.71	0.96	17.4	1.20
9	F9	29.50°	0.68	0.93	16.8	1.05

Post compression evaluation

Pre compression parameter of all formulation F1 to F9 was found to be satisfactory and all were within the pharmacopeia limit.

Tablet hardness of all batches tablet was found to be in range of 3 Kg/cm^2.

Thickness between 3.15 ± to 2.98 mm.

Friability between 0.529±0.532%.

Drug content between 98.85%.

Tablet weight in the range of 347.15 to 351.85mg.

Wetting time 30 sec to 170 sec and water absorption ratio 8.6 to 22.

Disintegrating time 48 sec to 167 sec. Thus, all the physical parameters of the manually compressed tablets were within limits. The results shown in table 6.

Table 6: Data for post-compression parameters.

Formulation code	Thickness (mm)	Weight variation (mg)	Hardness (Kg/cm^2)	Friability (%w/w)	Drug content (%)	Wetting time (sec)	Water absorption ratio	Disintegration time (sec)
F1	2.98	347.15±1.143	3	0.531	99.10	82	18	120
F2	3.12	348.85±1.12	3	0.543	99.14	75	19	102
F3	3.11	347.85±1.5	3	0.531	99.12	30	22	48
F4	3.15	348.50±1.29	3	0.552	99.20	170	8.6	155
F5	3.09	349.5±1.47	3	0.545	99.16	155	8.9	147
F6	3.13	349.35±1.05	3	0.535	99.32	135	8.6	167
F7	3.12	351.2±1.37	3	0.540	99.28	131	19	112
F8	3.12	350.55±1.72	3	0.529	99.36	68	18	107
F9	3.12	351.85±1.65	3	0.532	99.40	55	22	90

In-vitro drug release study of aceclofenac fast dissolving tablet

All the formulated fast dissolving aceclofenac tablets were evaluated to determine *in-vitro* drug release according to the procedure described in methodology. Formulation F3 shows 94.04% of drug release, so F3 selected as best formulation for preparation of fast dissolving tablet.

Table 7: Data for *In-vitro* drug release study of aceclofenac fast dissolving tablet.

Time in mins	% of drug release								
	F1	F2	F3	F4	F5	F6	F7	F8	F9
5	9	10	10.96	6.9	7.30	8.04	9.13	7.3	10.05
10	18.4	21.3	22.05	14.7	15.6	18.69	20.26	19.3	20.99
15	34.98	46.7	52.4	28.26	32.34	35.05	24.05	26.7	46.32
20	46.20	61.5	67.46	35.18	40.11	46.95	40.75	48.98	64.87
25	63.90	77.3	82.34	52.83	63.91	65.1	63.90	70.15	77.3
30	75.39	85.8	94.04	64.15	67.93	73.42	68.85	81.79	91.3

Kinetic of *in- vitro* drug release

The data obtained from *in-vitro* dissolution studies were fitted in different models viz. zero order, first order, Higuchi and Korsmeyer- Peppas equation, the result were shown in table 8. It was observed that the highest correlation of best formulation F3 was found for Peppas model (R2 =0.9203), which indicates the drug release would be by diffusion process.

Table 8: Data for kinetic drug release study of aceclofenac fast dissolving tablets.

Formulation code	Kinetic models				N value	Best fit model
	Zero order	First order	Higuchi model	Peppas model		
F1	0.920	0.972	0.994	0.992	1.212	Peppas model
F2	0.981	0.981	0.975	0.985	1.254	Peppas model
F3	0.928	0.978	0.973	0.979	1.267	Peppas model
F4	0.987	0.946	0.979	0.991	1.261	Peppas model
F5	0.975	0.944	0.987	0.954	1.297	Higuchi model
F6	0.972	0.993	0.976	0.995	2.731	Peppas model
F7	0.974	0.953	0.953	0.980	1.141	Peppas model
F8	0.771	0.977	0.938	0.917	1.824	Peppas model
F9	0.986	0.930	0.986	0.987	1.856	Peppas model

Stability Studies

From the stability studies, it was clear that the formulation was physically and chemically stable for 30 days and there was no significant change in the physical parameters, drug content and *in vitro* dissolution profiles as shown in the table 9.

Table 9: Data for stability study of Formulation F3 at Room Temperature.

Parameters	Results
Hardness	3.12 kg/cm2
Thickness	3.11mm
Wetting time	30sec
Disintegration time	48sec
Drug content	98.85%
Rate of dissolution (at the end of 30 minutes)	94.04%

CONCLUSION

In this study, fast dissolving tablet of cyclodextrin aceclofenac complex was prepared by direct compression method using various super disintegrates such as sodium croscarmellose, polyvinyl pyrrolidone and starch maize in different ratio. The FT-IR studies revealed that there was no chemical interaction of aceclofenac with β-cyclodextrin and super disintegrates hence they are compatible. All the inclusion complex showed increase in solubility than pure drug of aceclofenac. Formulation of inclusion complex K1, K2 and P4 showed that more solubility enhancement ratio than other formulation. Hence, this inclusion complex is used to prepare mouth dissolving tablets. The pre-compression and post- compression evaluation indicate that the entire formulated tablets were within the acceptable limit. The formulation F3 containing sodium cross carmellose showed the wetting time of 30sec, water absorption ratio of 22, disintegration time of 48 sec and 94% of drug release within 30 mins, so it is considered as best formulation. It was found to be stable and retained their original properties under storage conditions. It can be concluded that the inclusion complexation method is an effective approach for the enhancement of water insoluble drugs like aceclofenac and the prepared fast dissolving tablets is providing quick onset of action without need of water for swallowing.

AKNOWLEDGEMENT

The authors would like to thank management and principal of Mallige College of Pharmacy, Bangalore for providing the facilities to carry out the research work.

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