



Formulation and Evaluation of fast-dissolving tablets of Aceclofenac using Solid Dispersion methods

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Abstract:

Aceclofenac is a novel non-steroidal anti-inflammatory medication that functions by preventing prostaglandin formation by inhibiting the activity of the cyclooxygenase 2 (COX-2) enzyme. Compared to COX-1, it is more selective for COX-2. Aceclofenac reaches its peak blood level 1.25 to 3 hours after oral dosing and is essentially insoluble in water. It is essentially insoluble in water-based solutions. The rate-limiting phase in the medication absorption process is dissolution in the case of medicines that are poorly soluble in water. Several studies have successfully used the solid dispersion technique to increase the solubility and dissolution rates of medications that are poorly soluble in water, which in turn increases the drugs' bioavailability. Aceclofenac's dissolution can be enhanced by optimizing the solid dispersion in a fast-dissolving tablet formulation and by employing melt solvent technologies to formulate solid dispersions using water-soluble carriers such as mannitol. Within 30 minutes, the prepared tablets demonstrated efficient and quick drug dissolution in vitro. Using solid drug dispersion to formulate fast-dissolving tablets would increase medication solubility and, in turn, bioavailability while also enhancing patient compliance and convenience. Various weight ratios between the medicine and carrier were measured, including 1:1, 1:2, 1:3, 1:4, and 1:5. The drug's solubility was assessed in formulations with SD and physical mixtures. The optimized SD formulation of the medication and carrier, along with superdisintegrants such as sodium starch glycolate, croscarmellose sodium, and crospovidone, was used to create fast-dissolving ACE tablets. It was determined by IR and DSC experiments that the medication changed from its crystalline form to an amorphous state during the creation of SD. The quickest in vitro drug release (92.2%) and fastest disintegration (39s). We demonstrated by fast-dissolving tablets containing 20% crospovidone as super-disintegrants. We conclude that a promising method for producing effective, quickly dissolving Aceclofenac tablets is the combination of solid dispersion with superdisintegrants.

Keywords: Aceclofenac; Mannitol; Fast-dissolving Tablet; Solid dispersion

1. INTRODUCTION

A novel non-steroidal anti-inflammatory medication that works by preventing prostaglandin formation by inhibiting the activity of the enzyme cyclooxygenase 2 (COX-2). Compared to COX-1, it is more selective for COX-2. Since traditional NSAIDs, can cause major gastrointestinal problems such as ulcers, severe bleeding, and perforations, which can lead to hospitalization and even death, aceclofenac is suggested. It is mostly used to treat dysmenorrhea, rheumatoid arthritis, and osteoarthritis. The medication is offered as tablets and is not yet listed as official in any pharmacopoeia other than B.P. Aceclofenac reaches its peak blood level between 1.25 and 3 hours after oral treatment and is essentially insoluble in water. It is essentially insoluble in water-based solutions. The rate and degree of medication absorption are determined by the drug's dissolving rate and extent from any solid dosage form. The rate-

limiting phase in the medication absorption process is dissolution in the case of medicines that are poorly soluble in water. Because of the irregular absorption from the gastrointestinal tract (GIT), medicines that are very hydrophobic (aqueous solubility less than 0.1 mg/ml and 37°C) may pose bioavailability issues. To increase solubility, dissolution rates, and bioavailability of medications that are poorly soluble in water, the solid dispersion method has been extensively and effectively applied. When made into solid dispersions, a number of drugs have demonstrated improved dissolving properties. Reports on the development of these systems have surfaced. Aceclofenac may cause absorption issues due to dissolution because of its low solubility in water. Given these guiding principles, there is a compelling need to create a solid unit dosage form that quickly dissolves in the GI tract, delivering Aceclofenac and shortening the time it takes for a pharmacological impact to manifest. Therefore, the current study aims to enhance the dissolution of Aceclofenac by optimizing the solid dispersion using water-soluble carriers such as mannitol, as well as by using melt solvent and solvent evaporation techniques. The optimized solid dispersion will then be transformed into a fast-dissolving tablet formulation.

Fast dissolving drug delivery system

A dosage form intended for oral administration that quickly dissolves in the mouth and becomes liquid when swallowed is known as a fast-dissolving drug delivery system, or FDDDS. The pharmaceutical industry prefers conventional dosage forms for their low manufacturing costs and ease of delivery. However, because they are easier to swallow, fast-dissolving pills are recommended for pediatric and geriatric patients.

The advantages of a fast-dissolving drug delivery system

- ❖ include ease of administration for pediatrics, geriatrics, the mentally ill, and the uncooperative.
- ❖ They require no water intake.
- ❖ It shows quick disintegration and dissolution of the dosage form.
- ❖ It overcomes unacceptable taste of the drugs.
- ❖ It can be designed to leave minimal or no residue in the mouth after administration, and also provide a pleasant mouth feel.

Introduction to Solid dispersion system:

It is described as a solid dispersion of one or more active substances made by the melting, solvent, or melting-solvent process in an inert carrier or matrix. Another name for the solid dispersion is a solid-state dispersion. Melts are the term used to describe dispersions that are obtained by the fusion process, and co-precipitates or co-evaporates are the terms used to describe dispersions that are obtained by the solvent method. The fusion and co-solvent processes are the two fundamental steps in the preparation of solid dispersion. These techniques have also been modified, and they have been combined.

2. Method of solid dispersion preparation:

Various techniques can be employed to prepare solid dispersion, depending on the drug's and the carriers' physical and thermal stability.

Melting or fusion method:

A physical combination of an active agent and a water-soluble carrier is heated until the mixture melts. When the melt is vigorously agitated in an ice bath, it soon solidifies. Subsequently, the combined material is crushed and screened. Since fast solidification traps solute molecules in the solvent matrix, quick congelation is preferred since it makes the medicine supersaturated. Solidification can occur on stainless steel plates that are connected to a cooling system that facilitates rapid heat dissipation. Using a modified spray dryer, it has also been used to spray congelation onto a cold metal surface. The product generated from spray solidification can be pelletized, removing the requirement for a grinding step that might modify the crystalline structure.

Solvent Method:

Two solid components are physically combined and dissolved in a common solvent. The solvent is then typically extracted by evaporating the combination at different temperatures and pressures. The quality of the dispersions is highly dependent on the solvent selected and the rate at which it is removed. Solvents in combination may also be employed. Spray drying and freeze-drying are further methods for removing solvents. Co-precipitation is another term for this technique. In order to increase the bioavailability of weakly water-soluble medications such as nifedipine, spironolactone, and ketoprofen, co-precipitation is a recognized method.

The melting-solvent method

has revealed that adding 5-10% w/w of a liquid compound to PEG 6000 can be done without noticeably affecting the product's solid characteristics. As a result, solid dispersion can be made by dissolving the medication in an appropriate solvent first and then adding the solution directly into the PEG melt (70°C) without draining the liquid solvent.

3. MATERIALS AND METHODS

Determination of UV absorption maxima

Phosphate buffer pH 6.8 was used to prepare and dilute the aceclofenac solution appropriately. A UV/Vis double beam spectrophotometer, the Shimadzu UV-1601, was used to record the solution's UV spectrum. Figure 1 illustrates the solution's UV maximum at 275.0 nm.

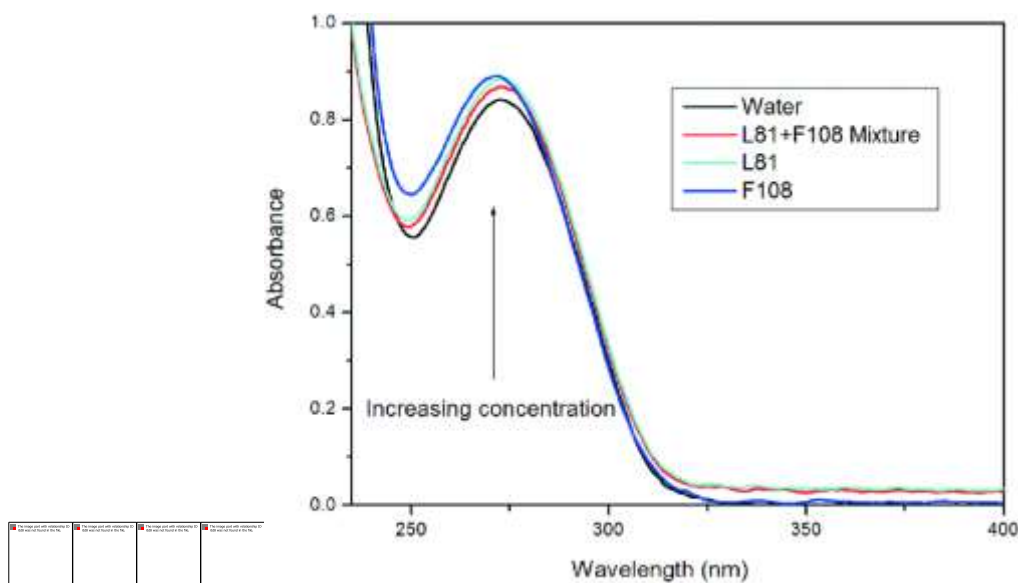


Figure 1: UV spectrum of aceclofenac

Preparation of the calibration curve

Ten milligrams of aceclofenac, precisely weighed, were added to a 100-milliliter volumetric flask and dissolved in sixty milliliters of phosphate buffer (pH 6.8). Phosphate buffer pH 6.8 was used to adjust the volume to the mark and create a stock solution (0.1 mg/ml). Volumetric flasks with a capacity of 10 ml were filled with aliquots of the Aceclofenac working solution (0.5 – 3 ml, 100 µg/ml), and the volume was adjusted with phosphate buffer pH 6.8. Using a Shimadzu UV/Vis double beam spectrophotometer, the absorbance of the resultant solutions was measured at 275.0 nm against a reagent blank solution made in a similar manner but without medication. Plotting concentration vs absorbance led to the creation of the calibration curve. The linearity, accuracy, and precision of the procedure were verified. The technique complies with Beer-Lambert's law between 5 and 30 µg/mL of concentration. Table 1 and Figure 2 display the standard curve preparation findings.

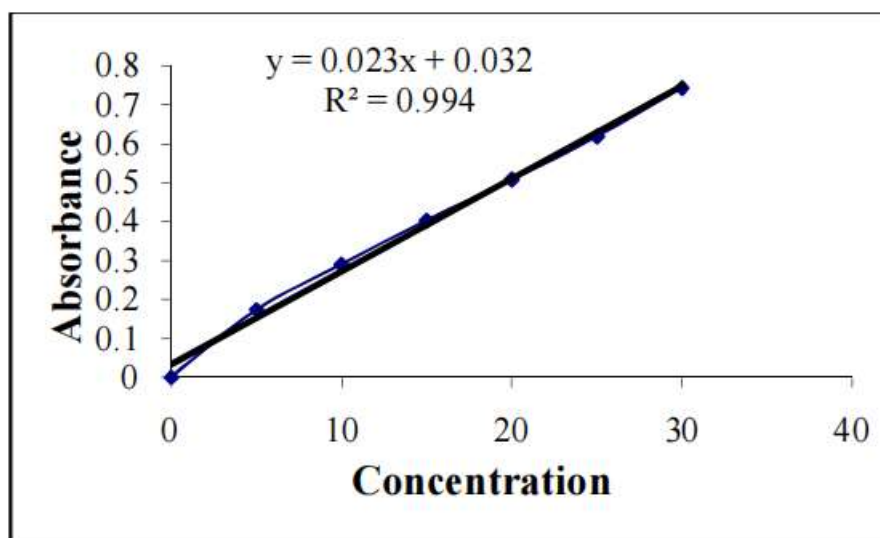


Figure 2: Calibration curve of aceclofenac in phosphate buffer at pH 6.8 in phosphate buffer pH 6.8

Preparation of a solid dispersion of aceclofenac with carriers.

Solid dispersions containing aceclofenac and carriers in ratios of 1:1, 1:2, 1:3, and 1:4 were produced using the melt solvent technique. Furthermore, mannitol was utilized in the same manner to produce a solid dispersion of the drug. The method was to dissolve aceclofenac in acetone, then mix the liquid into the 165°C mannitol melt. It was then submerged in an ice bath to cool it down quickly. The majority was kept in desiccators to allow it to dry completely. After the mass solidified, it was pulverized, scraped, and crushed after being run through an 80 μ screen. All of the solid dispersion was kept in hermetically sealed glass jars until it was needed.

Infrared absorption spectroscopy.

The infrared absorption spectra (IR spectra) of mannitol, aceclofenac, and their solid dispersion are presented in this work. The infrared absorption spectroscopy (IR) of aceclofenac shows a unique band at 3319, 3278, and 1770 cm^{-1} , which correspond to the OH, NH, and C=O stretching vibration bands. Solid dispersion (SD) prepared at a 1:3 ratio using the solvent evaporation method shows a shift to a higher wave number and a decrease in intensity for 3319 and 3270 cm^{-1} . This finding suggests that SD might not have the drug's molecular interaction with mannitol. The solid dispersion of aceclofenac-mannitol tablets is listed in Table 1, and the cumulative proportion of aceclofenac released from mannitol-manufactured tablets is listed in Table 3. The in vitro release profile of tablets prepared with mannitol is displayed in Figure 3. Tablet formulations were made using the aceclofenac-mannitol solid dispersion (1:4), which has shown the highest in vitro dissolving rate. Between 1:1:4 and 1:3 solid dispersions, there are differences in the rate of dissolution. The dissolving agent used was sodium croscarmellose. Sodium lauryl sulfate (1%) and magnesium stearate (1%) were used as glidants and lubricants. The average weight of the pill was reduced to 500 mg with the equal mixing lactose and hydroxypropyl cellulose (HPC) equally. After the ingredients were well combined, the mixture was compressed into 500 mg tablets using a rotating tablet machine. The manufactured tablets were inspected for several characteristics and kept in a tightly closed glass container.

Table 1: Formulations of Aceclofenac-mannitol tablets by solid dispersion

<i>Ingredients</i>	Quantity (mg)								
	R1	R2	R3	R4	R5	R6	R7	R8	R9
Aceclofenac	100	100	100	100	100	100	100	100	100
Crospovidone	44	55	66	44	55	66	44	55	66
Mannitol	247.5	247.5	247.5	275	275	275	302.5	302.5	302.5
Microcrystal- line cellulose	50	50	50	50	50	50	50	50	50
Talc	11	11	11	11	11	11	11	11	11
Magnesium stearate	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Sodium lauryl sulphate	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lactose monohydrate	86.5	75.5	64.5	59	48	37	31.5	20.5	9.5
Total	550	550	550	550	550	550	550	550	550

Evaluation of solid dispersion tablets

The concentration, friability, hardness, and disintegration of compressed tablets were assessed. Hardness was measured using the Monsanto type hardness tester. Each tube of the disintegration apparatus (model ED, Electrolab) was filled with one tablet and kept at $37 \pm 2^\circ\text{C}$. By ingesting twenty tablets, the friabilator was able to determine friability. Twenty tablets were precisely weighed and finely powdered for the drug content investigation. A 100 ml volumetric flask containing the powder equal to 100 mg of aceclofenac was filled with phosphate buffer pH 6.8 and allowed to dissolve. A pH 6.8-phosphate buffer was used to dilute 5 milliliters of the filtrate to 100 milliliters and assayed for drug content at 275.0 nm using a double beam UV / Vis.Shimadzu spectrophotometer (model 2201). The

tablets that were identified tablets had an average drug content of $102 \pm 0.2\%$. The assessment of aceclofenac tablets is displayed in Table 4.

Table 4 displays the outcomes of Batch S4's formulation for aceclofenac tablets.

In vitro dissolution study of aceclofenac tablets

Using USP dissolution apparatus II (model TDT-06T, Electrolab) at 50 rpm and phosphate buffer at pH 6.8 as a dissolution medium, an in vitro dissolution investigation of tablets was carried out while maintaining a temperature of 37 ± 0.50 C. Samples were taken out in 5 ml increments up to 30 minutes. Later, they were diluted, filtered via filter paper, and then examined at 275 NM using a UV/Vis double-beam spectrometer.

Comparison of the prepared aceclofenac tablet with marketed tablets

The in vitro drug release profile and percentage dissolving efficiency of the new tablet formulation were compared with those of a regular market tablet. For comparison, the drug's percentage dissolved in 30 minutes (Q30) and its dissolving efficiency after 30 minutes (DE30) were taken into account. Table 5 presents the findings. The in vitro release profile was examined for similarity factor (f_2) and dissimilarity factor (f_1) with a typical market tablet (CMT). Table 6 displays the information.

4. RESULT AND DISCUSSIONS:

As shown in Figure 1, the analytical method's results for the aceclofenac solution revealed a UV peak at 275 nm. The linearity, accuracy, and precision were confirmed. In the concentration range of 5 – 30 μM , the approach complies with Beer-Lambert's law, as indicated by a correlation coefficient of 0.9947 (Table 2), which suggests good linearity in this range. The suggested approach is simple, sensitive, accurate, and precise, and it can be used to estimate the amount of aceclofenac in tablets and bulk medication as a quality control measure.

Table 2: Data for the calibration curve of aceclofenac in phosphate buffer at pH 6.8 at 275 nm

S.NO	Concentration ($\mu\text{g/ml}$)	Absorbance 1	Absorbance 2	Absorbance 3	Average
1	0	0	0	0	0
2	5	0.162	0.164	0.163	0.163
3	10	0.279	0.278	0.28	0.279
4	15	0.389	0.391	0.39	0.39
5	20	0.518	0.519	0.517	0.518
6	25	0.615	0.614	0.615	0.615
7	30	0.724	0.723	0.722	0.723

Results of in vitro dissolution study of the prepared tablets.

The cumulative percentage of aceclofenac released from formulations is displayed in Table 3. It is evident that the solubility of aceclofenac solubility has significantly improved. Agglomeration of particles or poor wettability may be the cause of the pure drug's poor dissolution. The in vitro release profile of aceclofenac from mannitol using various

weight ratios - 1, 2, 3:1, and 4:1:4 - for a single part of aceclofenac and pure medication is displayed in Figure 3. The release profile demonstrates that as the drug:mannitol ratio rises to 1:3, aceclofenac dissolves more readily. It is possible that the carrier's increased wettability is the cause of the disintegration rate rise. At larger ratios (1:4), no discernible variations in dissolution are seen. This might be the result of a molecular dispersion structure distortion that leaves an insoluble base particle and increases carrier molecule accumulation in the bulk, which leads to saturation and delays aceclofenac's further solubility. This formulation with mannitol is utilized to conduct additional assessment.

Table 3: Cumulative percentage of Aceclofenac release from formulated tablets with Mannitol

S.NO	Time (min)	S1	S2	S3	S4	S5
1	0	0	0	0	0	0
2	5	8.7	14.86	31.99	53.73	55.43
3	10	14.96	25.43	40.66	64.92	67.58
4	15	22.76	36.97	51.13	75.65	74.94
5	20	29.1	46.45	62.66	84.23	85.03
6	25	38.87	55.85	66.55	91	92
7	30	49.31	61.18	77.48	94.82	96.58
8	60	61	76.96	85.87	97.91	98.74

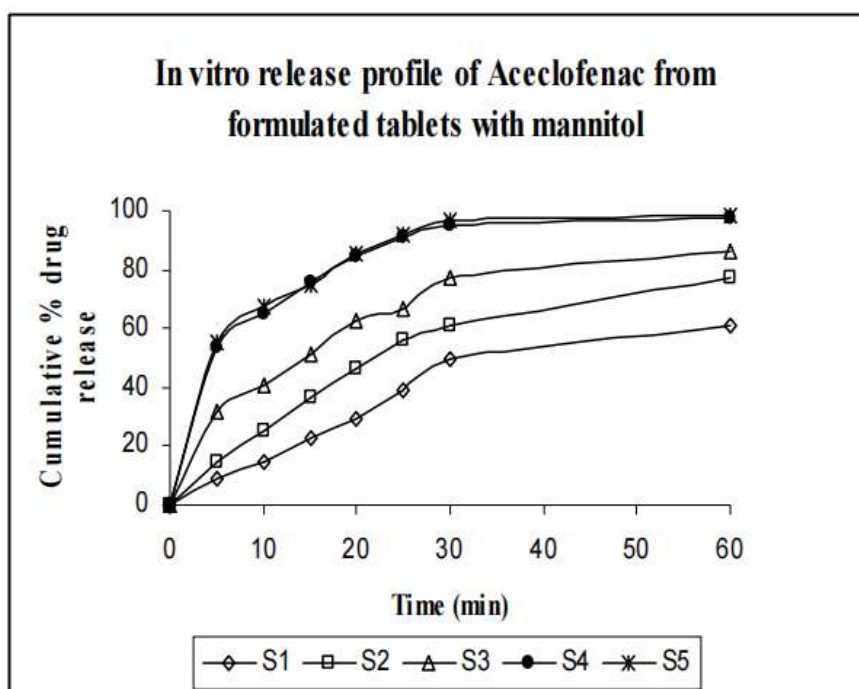


Figure 3: In vitro release profile of aceclofenac from formulated tablets with mannitol.

Results of the evaluation of formulated tablets:

The hardness, disintegration, friability, and drug content of compressed tablets were assessed (Table 4). The average hardness and average disintegration time were determined to be 3 kg/cm² and 15 seconds, respectively. The results showed that the percentages of friability and assay were within acceptable bounds, at 0.42 and 102.8 ± 0.2, respectively.

Table 4: Results of formulated Aceclofenac tablet batch S4

S.NO	EVALUATION PARAMETERS	RESULTS
1	Mean hardness (Kg / cm ²),	3
2	Mean disintegration time (sec)	15
3	Friability %	0.42
4	Assay %)	102 ± 0.2

The results of the comparison between prepared aceclofenac tablets and marketed tablets

The tablet formulation created (formulation S4) was assessed for its in vitro drug release profile (Q30) and percentage dissolving efficiency (DE30) against standard market tablets (CMT A), (CMT B), and (CMT C). The Q30 values for formulation S4 and conventionally sold tablets (CMT A, B, and C) were 70.47, 80.46, 81.46, and 95.32, respectively (Table 5, Figure 4), illustrating the advantage of formulation S4. The DE30 readings were 23.17, 53.13, 62.26, 59.50, and 69.79. (Table 5, Figure 4) demonstrates how much better Formulation S4 is. For similarity factor (f2) and dissimilarity factor (f1), the in vitro release profile of Formulation S4 was compared with those of standard market tablets (CMT A), (CMT B), and (CMT C). Table 6 shows that there is no resemblance in the in vitro dissolution of Formulation S4 with (CMT A), (CMT B), and (CMT C). The values for f1 for (CMT A), (CMT B), and (CMT C) are 21.94, 11.33, and 13.07, respectively, while f2 for (CMT A), (CMT B), and (CMT C) are 36.33, 49.77, and 47.09. As a result, Formulation S4 was thought to be more rapidly and more cost-effectively dissolved in vitro.

Table 5: Comparison of formulation S4 with marketed aceclofenac tablets

Product	% Drug release after 30 min (Q ₃₀)	% Dissolution efficiency after 30 min (DE30)
Pure Drug	4.31	19.49
Market Product (CMT) A	70.47	53.13
Market Product (CMT) B	80.46	62.26

Market Product (CMT) C	81.42	59.50
Formulation R8	94.82	65.89

DE₃₀: Dissolution efficiency after 30 min.
Q₃₀: % Dissolution efficiency after 30 min.
CMT A: A conventional market tablet from Intas pharmaceutical Ltd.
CMT B: A conventional market tablet from Medley pharmaceutical Ltd.
CMT C: A conventional market tablet from IPCA pharmaceutical Ltd

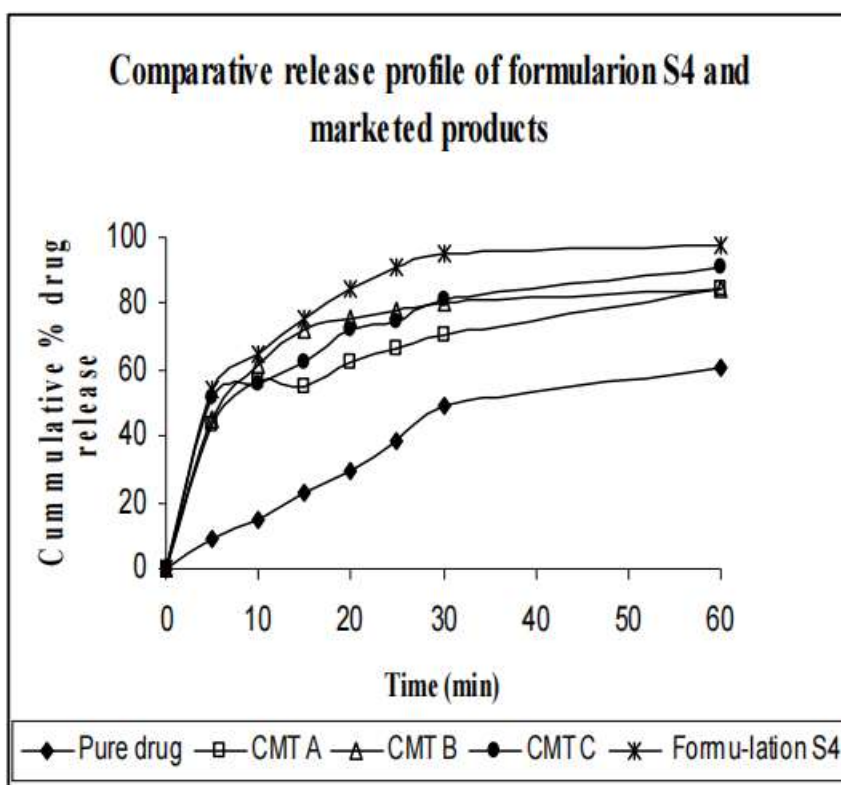


Figure 4: In vitro release profile of aceclofenac from Formulation S4 and the marketed product.

Table 6: Cumulative % drug release of batch (S4) and the marketed product.

Table 6: Results of stability study of batch R8.		
Time (Min)	Cumulative % drug release (Initial)	Cumulative % drug release (After storage at 40°C for 3 months)

0	0	0
5	48.25	45.16
10	62.21	57.28
15	73.67	68.47
20	81.09	76.09
25	85.75	80.41
30	88.75	83.64
60	92.53	87.36
Similarity factor (f_2) = 65.05 Dissimilarity factor (f_1) = 12.14		

5. CONCLUSION

Using mannitol as a carrier, the study shows how to manufacture fast-dissolving aceclofenac tablets with its solid dispersion. The drug's in vitro dissolution from the solid dispersion was significantly influenced by the polymer concentration and type utilized in the dispersion. Within 30 minutes, the prepared tablets demonstrated efficient and quick drug dissolution in vitro. The medication can be produced using the designed tablets at a fair price and with a quick onset of action.

References

1. H. Friedrich, A. Nada, Roland Bodmeier Drug Development and Industrial Pharmacy Volume 31, Number 8 / 2005, 719-728
2. Chengsheng Liu, Kashappa Goud H. Desai, Chenguang Liu Drug Development and Industrial Pharmacy Volume 31, Number 1 / 2005, 1-10
3. A. Cutrignelli, A. Latrofa, M. Franco, M. Serra, M. G. Pisu, G. Biggio, G. Liso Drug Development and Industrial Pharmacy Volume 30, Number 1 / 2004, 53-64
4. Dae-Duk Kim, H. Won Jun, Bong-Kyu Yoo, Chul-Soon Yong Drug Development and Industrial Pharmacy Volume 31, Number 7 / 2005, 697-707
5. Leticia S. Koester, Paulo Mayorga, Valquiria L. Bassani Drug Development and Industrial Pharmacy Volume 29, Number 2 / 2003, 139-144
6. M. Serpil Kislalioglu, Wantanee Phuapradit, A. Waseem Malick, Navnit H. Shah Drug Development and Industrial Pharmacy Volume 28, Number 3 / 2002, 275-284
7. Palmieri, Franco Cantalamessa, Piera Di Martino, Cinzia Nasuti, Sante Martelli Drug Development and Industrial Pharmacy Volume 28, Number 10 / 2002, 1241-1250
8. Ormod, D., Wellington, K. and Wagstaff, A.J., Drugs, 2002, 62,2059
9. Fricker, J., Varkalis, J., Zwillich, S., Adler, R., Forester, E.,Recker, D.P. and Verburg, K."M., Amer. J. Ther., 2002,9,89.
10. Hadi Valizadeh, Ali Nokhodchi, Nahid Qarakhani, Parvin Zakeri-Milani, Shirzad Azarmi, Davood Hassanzadeh, Raimar Löbenberg Drug Development and Industrial Pharmacy Volume 30, Number 3 / 2004, 303-317

11. Letícia S. Koester, Paulo Mayorga, Valquiria L. Bassani Drug Development and Industrial Pharmacy Volume 29, Number 2 / 2003, 139-144
12. Baker, D.E., Rev. Gastroenterol. Disord. 2002, 2, 16
13. Camu, F., Beecher, T., Recker, D.P. and Verburg, K.M., Amer. J. Ther., 2002, 9, 43
14. Higuchi, T. and Mishra, J., J. Pharm. Sci., 1962, 51, 685
15. Goldberg, A.H., Gibaldi, M. and Kanig, J.L., J. Pharma.Sci. 1966, 55, 482.
16. Hilton, J.E. and Summers, M.P., Int. J. Pharm., 1986, 31, 157.
17. Najib, M.M., Suleiman, M. and Malakh, A.N., Int. J. Pharm., 1986, 32, 229
18. Rani, G., Venkataramana, D., Suryakumar, J. and Krishna, D.R., Indian. J. Pharm. Sci., 1993, 55, 61
19. Maria Rosaria Lauro, Maria Luisa Torre, Lauretta Maggi, Francesco De Simone, Ubaldo Conte, Rita Patrizia Aquino Drug Development and Industrial Pharmacy Volume 28, Number 4 / 2002, 371-379
20. Giovanni Filippo Palmieri, Franco Cantalamessa, Piera Di Martino, Cinzia Nasuti, Sante Martelli Drug Development and Industrial Pharmacy Volume 28, Number 10 / 2002, 1241-1250
21. Han-Gon Choi, Dae-Duk Kim, H. Won Jun, Bong-Kyu Yoo, Chul-Soon Yong Drug Development and Industrial Pharmacy Volume 31, Number 7 / 2005, 697-707
22. Evangelos Karavas, Georgios Ktistis, Aristotelis Xenakis, Emmanouel Georgarakis Drug Development and Industrial Pharmacy" Volume 31, Number 6 / 2005, 473-490
23. Chen Liu, Junhua Wu, Bin Shi, Yuanxing Zhang, Tiankun Gao, and Yuanying Pei. Drug Development and Industrial Pharmacy Volume 32, Number 1 / 2006, pp. 115 – 123
24. Mooter, G.V., Wuyts, M., Blaton, N., Busson, R., Grobrt, P., Augustijns, P., and Kinget, R., Eur. J. Pharm. Sci., 2001, 12, 261
25. Okonogi, S., Oguchi, Y., Yonemochi, E., Puttipipatkachorn, S. and Yamamoto, K., Int. J. Pharm., 1997, 156, 175.
26. Rani G, Venkataramana D, Suryakumar J and Krishna DR. Indian J Pharm Sci. 1993;55:61.
27. Patel DM, Shah RR and Jogani PD. Indian J Pharm Sci. 2003;65:264
28. Patel DM, Shah RR and Jogani PD. Indian J Pharm Sci. 2004;66:49.
29. Madusudan B, Rambhau D, Gudsoorkar VR, Shete JS and Apte SS. Indian J Pharm. Sci. 2002;64:233
30. Lachman L and Lieberman HA. In; Pharmaceutical Dosage Forms, Tablets, Marcel Dekker, Inc., New York; Vol. 2
31. Indian Pharmacopoeia, Controller of Publications, India, New Delhi; 2nd Edn 1966:740
32. Indian Pharmacopoeia, Controller of Publications, India, New Delhi; 4th Edn. 1966:A-80.
33. Indian Pharmacopoeia, Controller of Publications, India, New Delhi; 4th Edn. 1966:A-82.