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RESEARCH ON ENHANCEMENT OF FORMULATION EFFICACY FOR MCC PELLETS USING ACECLOFENAC AND ACETAMINOPHEN API

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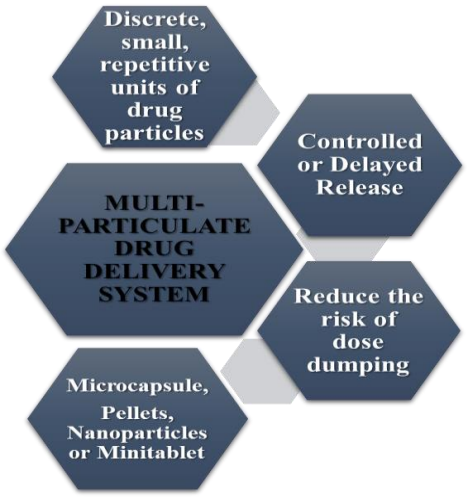
ABSTRACT

MDDS consists of two layers of drug differentiated by a layer of extended-release polymer. The system consists of water-insoluble pellets on which the drug is coated and to control the release rate of that drug the extended-release polymer such as ethylcellulose is coated. To control the rate of drug release a pore-forming agent like HPMC is incorporated along with ethylcellulose and another drug was coated over the layer of extended-release coating for the immediate release. As the system comprises of two different drugs and an extended-release polymer this system brings the advantage of formulation of incompatible drug that may be intended to be given at the same time along with that due to extended-release coating this may also help to control the release rates of drugs for the treatment of Analgesic and Antipyretic activity multilayer pellets were coated using polymers such as Ethylcellulose, and Hpmc.

KEYWORDS: Pelletization, Sustained release formulation, Greater patient compliance.

INTRODUCTION

Pelletization is the process of converting a medication and excipient mixture into tiny, free-flowing spheres for oral drug administration. Uniform, spherical pellets provide several benefits over powders, granules, and single-unit dose forms, making them popular in the pharmaceutical sector.[1,7] Sized between 100 and 2000 micrograms. Pellets have a lower surface area to volume ratio than powders, resulting in improved flow and mixing qualities and, ultimately, more reliable dosing.[8,11]



With a need for more targeted dosage forms, their ability to be adjusted and optimized in order to properly regulate the release of medication from the dosage system is becoming increasingly important. Pellets provide superior plasma profiles and reduce the danger of dosage dumping compared to modified-release single-unit systems. Previous investigations have reported on the compression and compaction behavior of pellets made of microcrystalline cellulose. MCC was selected as a filler in pharmaceutical aggregates. Pellets exhibited minimal fragmentation. Another significant feature of the MCC pellets was their porosity, which was linked to the tensile strength generated by unlubricated pellets and influenced the degree of densification and deformation the pellets experienced during compression.[12,26]

Need of Multilayer

• To manage the administration of dual-release fixed dosage combinations containing several active pharmaceutical ingredients (APIs).

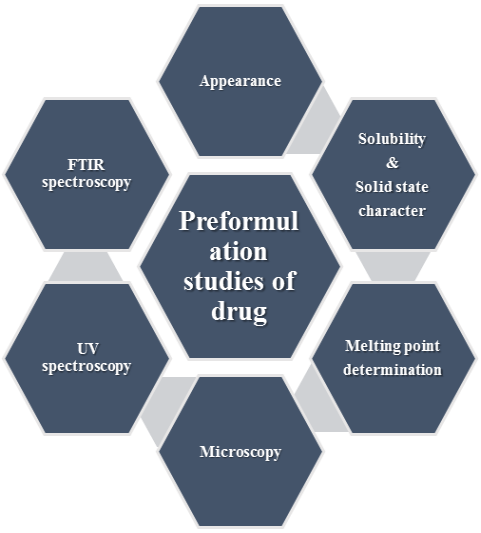
• To create novel medication delivery methods, such as floating tablets for gastroretentive drug administration.[27,31]

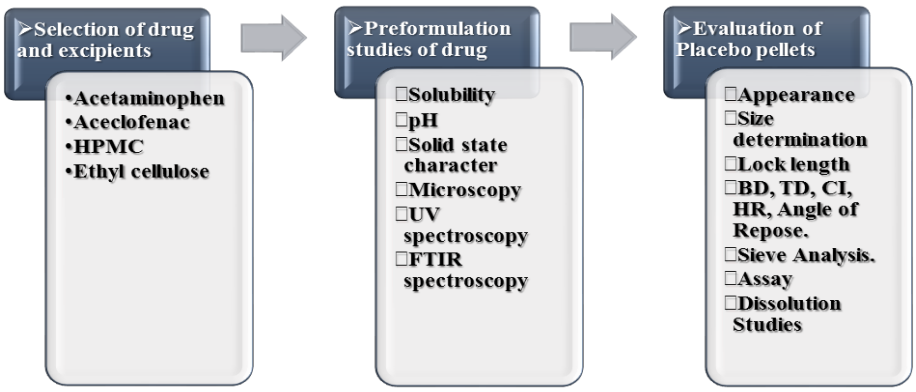
2. MATERIALS AND METHODS

2.1 Materials

Sr. No.	Name of Material	Mfg/Supplied by	Batch no/ Lot No	Expiry Date	Function
1.	Pellets	MB sugars & Pvt. Ltd Pharmaceuticals Malegaon M.H	MB-23/MCP-07/10	Sept 2025	Vehicle
2.	Aceclofenac	Dhamtec pharma & consultants Mumbai M.H	DH/ ACFC A001	May 2025	API
3.	Acetaminophen	Dhamtec pharma & consultants Mumbai M.H	DH/ PCM A09/745	June 2025	API
4.	Ethanol	Variety traders Amravati M.H	2022020	-	Solvent
5.	Ethylcellulose	CDH	200621	June 2024	Coating Agent
6.	Hydroxypropyl methyl Cellulose	CDH	190280	Feb 2025	Film former
7.	Polyethylene glycol	CDH	101222	Dec 2024	Binder
8.	Disodium hydrogen phosphate	CDH	430622	May 2027	Emulsifier

3. Preformulation Studies

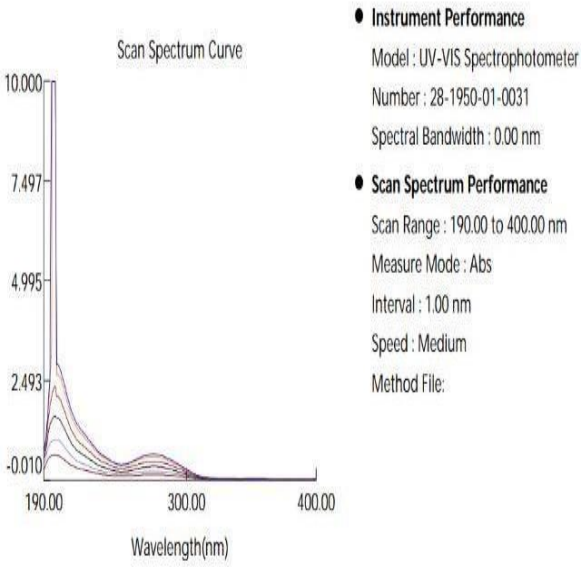




4. Evaluation Parameters

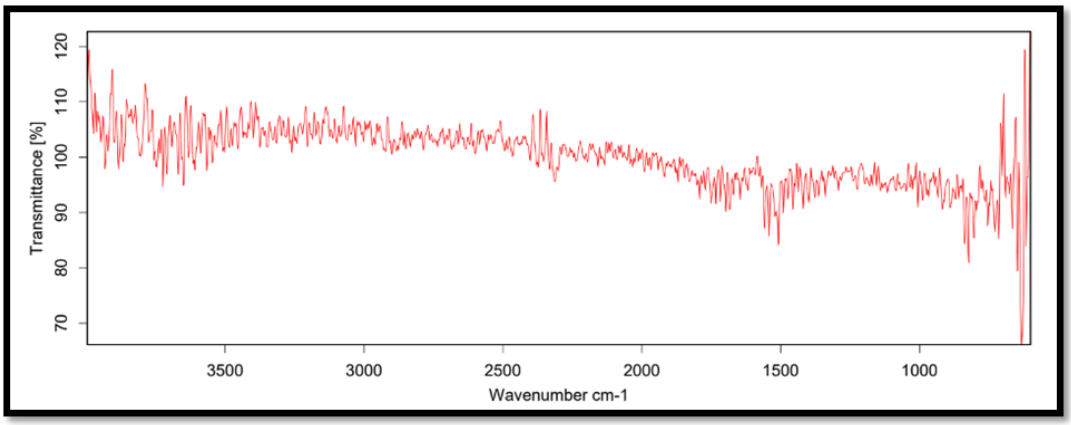
➢ Aceclofenac

- Appearance The drug (API) was tested for appearance by visual observation. this method describes the visual assessment as Powdery texture. 0.1 g of the drug was placed on a slide and tested for appearance.
- Solubility: It is a very vital parameter to understand the solubility of drug in different organic and inorganic solvents.
- Melting point determination: The melting point of the aceclofenac was determined by the Thieles tube method.
- Aceclofenac has a melting point of between 149 and 150°C.
- Microscopy: Microscopy of Aceclofenac drug(API) was performed under a compound microscope and solid crystal-like appearance was observed under the microscope.
- UV spectroscopy: LabIndia [UV 3092]
- Evaluation of pure drug (API) was performed under Uv.visible spectroscopy and Lamda max of pure drug was found to be 276nm



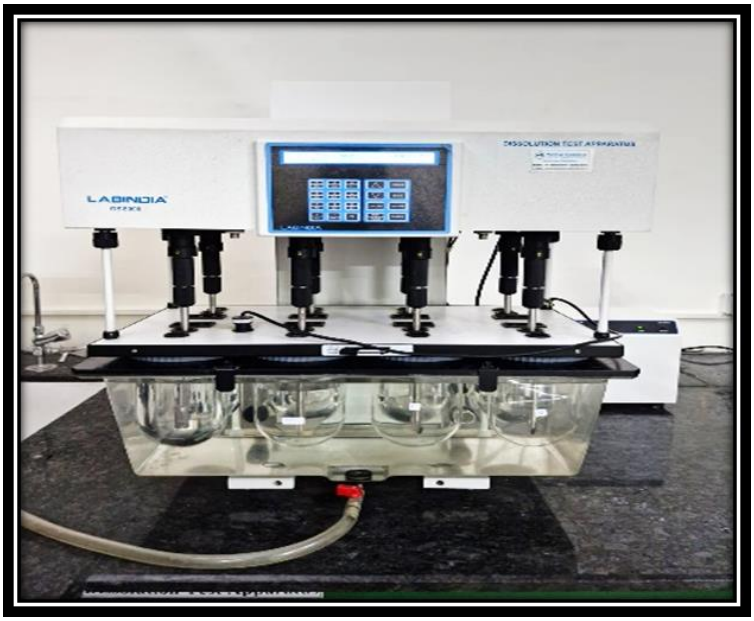
Fourier Transform Infrared Spectra of Aceclofenac

FTIR spectroscopy:- The FTIR spectrum was recorded over the range of 4000 to 400cm^{-1} using a Fourier Transform infrared spectrophotometer (Bruker Alpha II).



Dissolution studies:- Lab India [98000]

- The USP paddle type II was used for the in vitro dissolution studies.
- Apparatus: USP Type –II (paddle)
- Volume of medium: 900 ml
- Temperature: 37 ± 0.5^{0}C
- Paddles Speed: 100 rpm
- Dissolution medium used: 6.8 pH Buffer



Evaluation of pellets:
Carr's Index: TD - BD / TD
The Carr's Index was in the range of 13.51% This indicates good flow properties of granules.

- Hausner's ratio: TD/BD

The Hausner's ratios were found in the range of 1.15. So it indicates good flow properties.

- Angle of repose: θ = tan -1 (h/r)

measured according to the fixed funnel standing method.

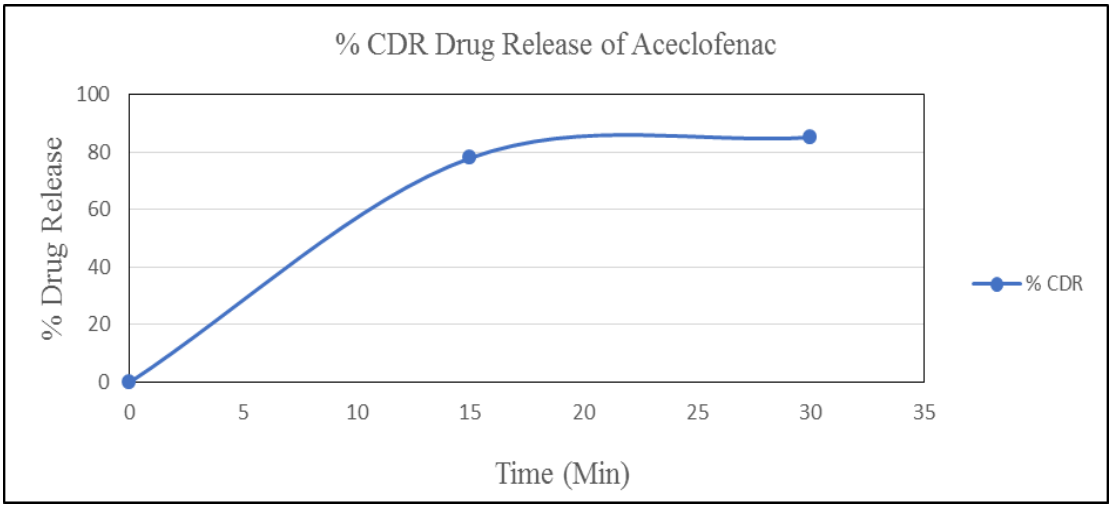
The angle of repose is 30.96. The flow properties of pellets in all formulations exhibit good flow.

4. RESULTS AND DISCUSSION

Invitro dissolution profile of Aceclofenac Immediate-release Pellets

Table: Invitro dissolution profile of Aceclofenac Immediate-release Pellets.

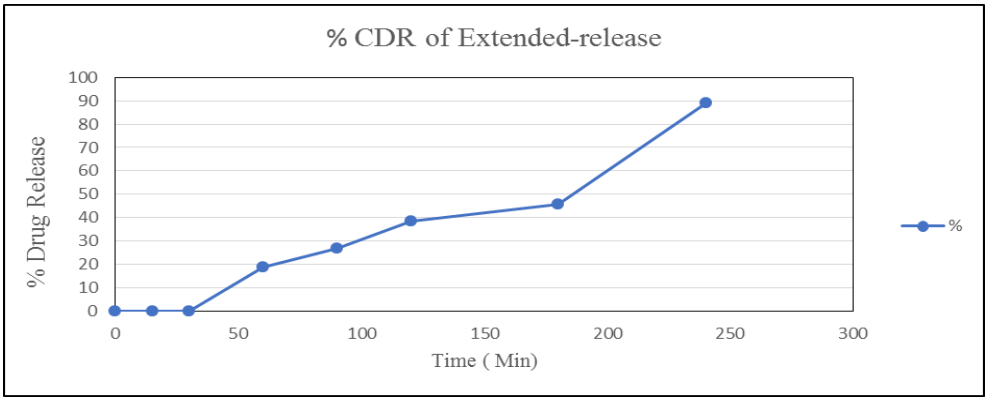
Time (min)	Absorbance	Concentration (ug/ml)	Dilution Factor (10)	CDR	% CDR
00	0.000	0.00	00.0	00.00	00.00
15	0.171	8.65	86.5	77.85	77.85
30	0.182	9.45	94.5	85.05	85.05



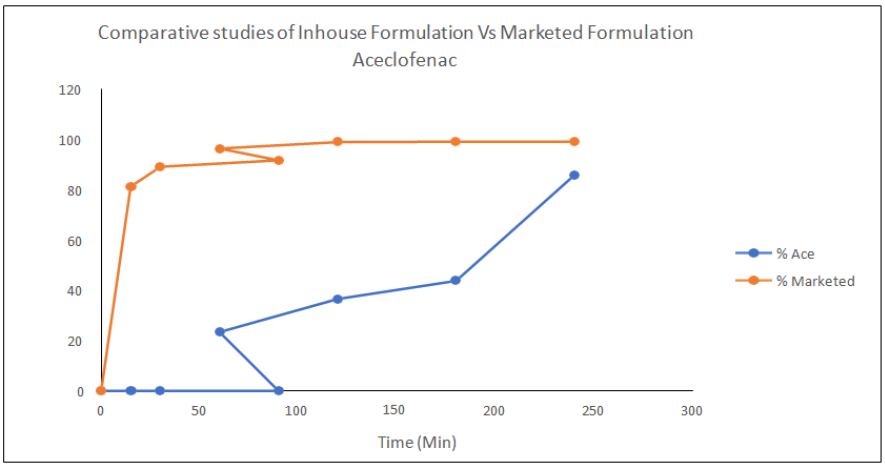
2. Invitro dissolution profile of Extended-release Pellets

Table: Invitro dissolution profile of Extended-release Pellets.

Time (min)	Absorbance	Concentration (µg/ml)	Dilution Factor (10)	CDR	% CDR
00	0.000	0.000	00.00	00.00	00.00
15	0.014	0.000	00.00	00.00	00.00
30	0.032	0.000	00.00	00.00	00.00
60	0.069	1.211	12.11	18.89	18.89
90	0.093	2.963	29.63	26.66	26.66
120	0.111	4.277	42.77	38.49	38.49
180	0.122	5.080	50.80	45.72	45.72
240	0.188	9.89	98.9	89.01	89.01



Comparative studies: Inhouse Formulation vs. Marketed Formulation



5. SUMMARY AND CONCLUSION

- In the final formulation, the release profile that have been achieved was with the help of water-insoluble polymer and pore forming agent for one particular drug specificity
- The Results for the formulations were as follows
- 00 % release at 30 min using polymer coating of EC and HPMC.
- 40% of Drug releases after 2hrs.
- 90% of Drug releases after 4hrs.
- Also, the same formulation consists of an immediate release mechanism for another drug with the help of water-soluble polymer HPMC.
- Specifically, the releases obtained are as follows
- 72% drug release at 5 min.
- 83% drug releases at 10 min.
- 95% of drug release at 15 min.
- 99.85% of drug releases at 30 min.
- This formulation is compared with the marketed formulation for the drug release profile of both drugs and it shows that as compared to marketed formulation the In-house formulation shows extended drug release.
- This formulation can further be modified for three or more incompatible drugs and can also be further developed for the Extended-release up to 12 to 24hrs.

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