IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Comparative Assessment Of Formulated Curcumin Tablets Versus Marketed Curcumin Tablets

Varsha Ravindra Waghmare, Dr. Utkarsha S. Shivsharan

M. Pharmacy Pharmaceutical Quality Assurance.

D.S.T.S Mandal's College of Pharmacy, Solapur

Abstract

Background:

notable anti-inflammatory, antioxidant, and therapeutic effects. Nevertheless, its limited solubility in water and low bioavailability pose significant challenges in the development of formulations.

Objective: Curcumin, the primary bioactive component of turmeric (*Curcuma longa*), possesses

This study aimed to create curcumin tablets and assess their pharmaceutical characteristics in comparison to a commercially available curcumin tablet.

Methods:

Curcumin tablets were produced utilizing suitable tablet manufacturing methods such as direct compression or wet granulation. Both the formulated and marketed tablets underwent evaluation for various quality control parameters, including weight variation, hardness, thickness, friability, disintegration time, drug content, and in vitro dissolution studies. The results obtained were analyzed and compared.

Keywords:

Curcumin, Tablet Formulation, Comparative Analysis, Dissolution Study, Drug Content, Marketed Tablet, Quality Assessment

Introduction:

Curcumin, is the major bioactive constituent of *Curcuma longa*[1,2], is well known for its antioxidant, anti-inflammatory, and anticancer properties[1,2,6]. It has been explored for use in conditions such as diabetes, cough, and Alzheimer's disease. Despite its therapeutic potential, its clinical effectiveness is restricted due to poor aqueous solubility and limited oral bioavailability[2,7].

The present work focuses on developing a tablet formulation of curcumin using plant-derived excipients to promote an environmentally sustainable approach. Piperine was incorporated as a bioavailability enhancer[6,7]. Natural polymers were selected to replace synthetic excipients commonly used in tablet formulations. Banana peel pectin was employed as a binder which is a natural polymer and was incorporated to regulate drug release. Tablets were prepared by the wet granulation technique showed extended release.

In recent times, there has been growing worry about the safety, environmental effects, and regulatory approval of synthetic excipients. utilized in drug compositions. This has resulted to an increasing interest in sustainable pharmacy methods, which highlight the application of natural, biodegradable, safe for health, and eco-friendly materials in pharmaceutical product development.

Tablets are the most commonly used oral dosage forms because they provide accurate dosing, good stability, ease of administration, cost-effective manufacturing, convenient packaging, and improved patient compliance. These advantages make tablets a preferred choice for delivering therapeutic agents such as curcumin.

A comparative analysis is necessary to assess if the developed curcumin tablet exhibits quality, safety, and performance attributes that are on par with those of an established marketed product. Variations in formulation components, manufacturing techniques, and processing conditions can significantly affect critical tablet characteristics such as hardness, friability, disintegration time, drug content, and dissolution behavior.

By evaluating the formulated tablet against a marketed counterpart, researchers can gauge the efficacy of the new formulation and ascertain its compliance with recognized pharmaceutical standards. Such investigations are instrumental in pinpointing the advantages and drawbacks of the new formulation, thereby providing substantiation for its potential application as an alternative to existing commercial products.

Aim of Study:

To formulate and evaluate Curcumin tablet by using natural polymers and compare with marketed curcumin tablet.

Objective of study

- To prepare curcumin tablets.
- To evaluate pre-compression parameters.
- To evaluate post-compression parameters.
- To compare the formulated and marketed tablets.
- To perform dissolution and drug content studies.

Methodology:

Materials: Curcumin and piperine powder were purchased from Amazon.com.

Banana peels were obtained from fresh bananas of Musa paradisiaca and were extracted. The sample was authenticated at D.B.F Dayanand Institute of Arts and Science from the Botany Department.

Extraction of Banana Peel Pectin: Fresh bananas were bought and washed with distilled water to remove dirt and debris.

The peel was separated from the banana and cut into small pieces for quick and efficient drying. The peels were dried at room temperature for 8–10 days. The dried peels were ground into a powder and then sieved. The powder was heated with water and 0.5% citric acid to extract pectin, which was then cooled and evaporated to obtain a dry powder of pectin[24].

Raw Banana Peels

Pectin

Table no 1 : Formulation table

Sr. no	Ingredient	Quantity
1	Curcumin + Piperine	100mg
2	Pectin	37mg
3	Starch	60mg
4	Talc	3mg
5	D.W	Q.S

Method of preparation

The ingredients were accurately weighed and thoroughly mixed by blending the API with the excipients in dry form. A sufficient amount of distilled water was added to produce a cohesive wet mass, which was sieved through sieve no. 16 to form granules. The wet granules were dried and then passed through sieve no. 22 to achieve uniform particle size. Lubricants and glidants were subsequently added and blended gently for 2–5 minutes. Finally, the prepared granules were compressed into tablets using a tablet punching machine, and the tablets were assessed for both pre-compression and post-compression parameters.

Evaluation of Tablet

Physical parameters[3,4,12]:

1. Appearance

Appearance is the first most required quality for the acceptance of tablet. General elegance and its identity play a major role for the consumer acceptance. Acceptance of the appearance of batches of the tablet has been done based on the measurement of the following factors like size, color, shape, presence or absence of odor, taste etc.

2. Size and shape

Size and shape of a tablet has been determined by its thickness. Size and shape of table plays an important role in its patient compliance as the size of the tablet increases it is not much easier for its administration. Micrometer is the devise which is used to determine the thickness of a tablet. It can be acceptable if the batch falls within the ±5% of standard deviation.

3. Organoleptic properties

Color should be distributed uniformly without appearance of any signs of mottling. Color of the tablet should be compared with the standard color for comparison.

Pre- compression characterization of granules[11,12]:

1. Bulk Density:

A precise amount (m) of granules was carefully added to the measuring cylinder. The granules were read to the closest graded unit to determine the unsettled apparent volume (V) after being leveled without compacting if required. The bulk density was determined using the formula m/V and represented as grams per ml.

2. Tapped Density:

A predetermined amount of granules was placed in a measuring cylinder and tapped for five minutes using a mechanical tapping device. Both the first and last volumes were mentioned.

3. Angle of Repose:

The angle of repose measures the frictional forces in loose powder or granules. The angle between the surface of a pile of granules or powder and the horizontal plane is as large as it can be. The funnel method is used for this[11]. The following formula is used to determine the angle of repose value:

Where, Θ =Angle of repose, h =Height of the pile, r =Radius of the pile

1. Compressibility Index

Compressibility index is used as an important parameter to determine the flow property of the powder. It is indirectly related to the relative flow property rate, cohesiveness and particle size. It is simple, fast and popular method for predicting flow characteristics. Carr's index can be represented by Equation Hausner's ratio

2. Hausner ratio:

A powder's tendency to consolidate is measured by its compressibility index (CI), which is a measure of the relative significance of inter-particulate interactions.

A measure of a material's flowability that accounts for the resistance a bed of particles encounters as a result of their interactions is called the Hausner ratio (HR). Compressibility index and Hausner ratio were calculated by using the formula:

1. compressibility Index (%)=Tapped Density−Bulk Density/Tapped Density×100

2. Hausner Ratio=Tapped Density/Bulk Density

Post compression parameters:

1. Hardness Test:

A tablet's hardness is an indicator of its strength and capacity to withstand mechanical shocks during processing and handling. Using a Monsanto hardness tester, the tablets' hardness was assessed for each formulation. kg/cm-2 is the unit of measurement, it was measured by using Monsanto Hardness tester.

2. Friability Test:

Friability tests are used to evaluate the impact of shocks and friction, which frequently result in tablets breaking, chipping, or capping. Roche Friabilator was employed to assess the tablets' friability.

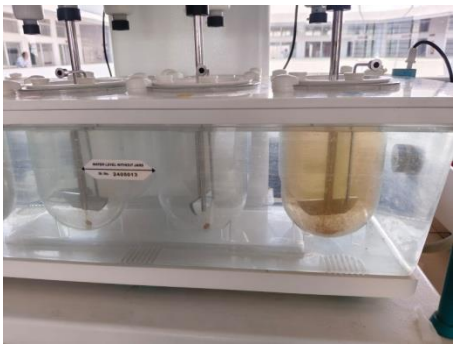
3. Drug Content

Ten tablets were chosen at random from each batch for this test, and they were ground up in a mortar. The powder was dissolved in 10 ml phosphate buffer pH 7.4 by sonication for 15 min and filtered through Whatman filter paper[3]. Suitable dilutions were made, and the drug content was spectrophotometrically analysed at 425 nm using a UV-VIS spectrophotometer (Systronics 2022).

4. Weight variation test

Random selection of 10 tablets from each batch should be done and note down the weight of the tablet individually and check for any variation in its weight. According to US Pharmacopeias small variations in the weight is negligible and can be accepted. Below is the acceptable limit of percentage deviation in weight variation.

5. Dissolution Test:



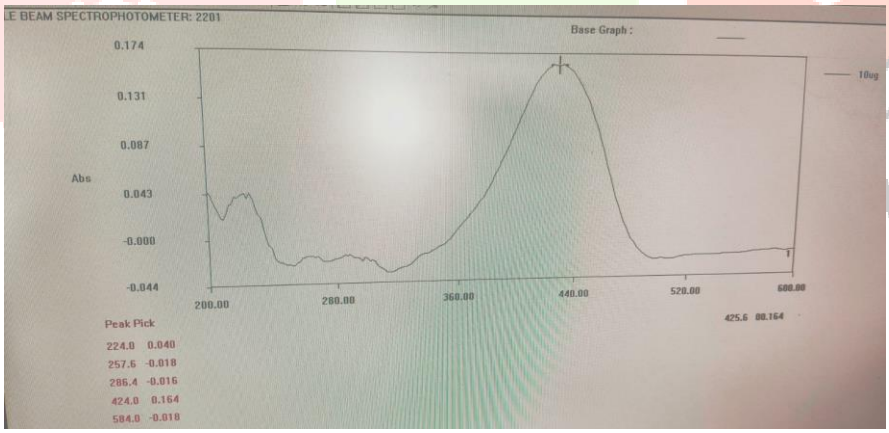
In vitro dissolution study of tablets were conducted using USP dissolution apparatus II at 75 rpm, using phosphate buffer pH 7.4 as a dissolution media maintaining at 37 ± 0.5°[4,10].

Results:

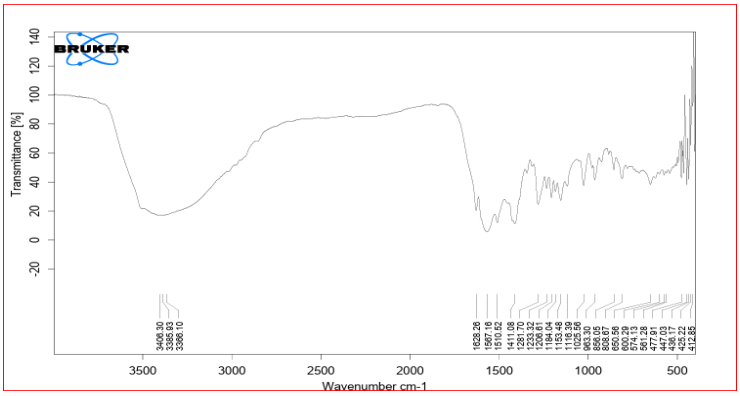
1. Quantification of Curcumin by UV Spectroscopy

It was found that curcumin's λmax was 425.6 nm in 7.4N

Phosphate buffer solution, It was used to study drug release to look at the wavelength of curcumin in different dissolving mediums.



2. FTIR spectroscopy was performed to evaluate the compatibility between curcumin and the selected natural excipients.



Observed Peak (cm^{-1})	**Functional Group**	**Assignment**	**Inference**
3468–3363	O–H	O–H stretching	Hydroxyl groups of curcumin and pectin
1678	C=O	Carbonyl stretching	β-Diketone group of curcumin
1567	C=C	Aromatic C=C stretching	Aromatic ring of curcumin
1507	Aromatic ring	Skeletal vibration	Aromatic structure
1430	C–H	CH_2/CH_3 bending	Aliphatic bending vibration
1281	C–O	Phenolic C–O stretching	Curcumin functional group
1242	C–O	Ether/phenolic C–O stretching	Phenolic group
1183	C–O–C	Ether stretching	Pectin/polysaccharide
1103	C–O–C	Glycosidic bond stretching	Pectin structure
1015	C–O	Alcohol/C–O stretching	Polysaccharide backbone
954–853	=C–H	Out-of-plane bending	Aromatic/alkene vibration
650–412	Fingerprint region	Skeletal vibrations	Confirms formulation structure

FTIR analysis confirmed the presence of characteristic functional groups of curcumin and natural polymeric excipients. The absence of significant peak shifts or new peaks indicates compatibility between the drug and excipients, suggesting no chemical interaction during formulation.

This indicates the absence of any chemical interaction between curcumin and the natural excipients, confirming the compatibility of the formulation components and the stability of the active ingredient during tablet preparation.

Evaluation Parameters:

The formulated tablets exhibited acceptable pharmaceutical properties and met pharmacopeial standards for all assessed parameters. The drug content was determined to be within the acceptable limits, and the dissolution profile indicated satisfactory drug release. Comparative analysis revealed that the formulated tablets demonstrated performance on par with the marketed product.

Parameter	**Formulated tablet**	**Marketed tablet**	**Pharmacopeial limit**
Weight variation	Pass	Pass	±7.5% (for tablets 130–324 mg) or ±5% (for >324 mg
Hardness	7.4kg/cm^2	7.1kg/cm^2	4–8 kg/cm² (acceptable range)
Friability	0.16%	0.11%	NMT 1.0%
Thickness	3.5	4.4	-
Drug content	102%	109%	90-110% of label claim

In-vitro Dissolution study:

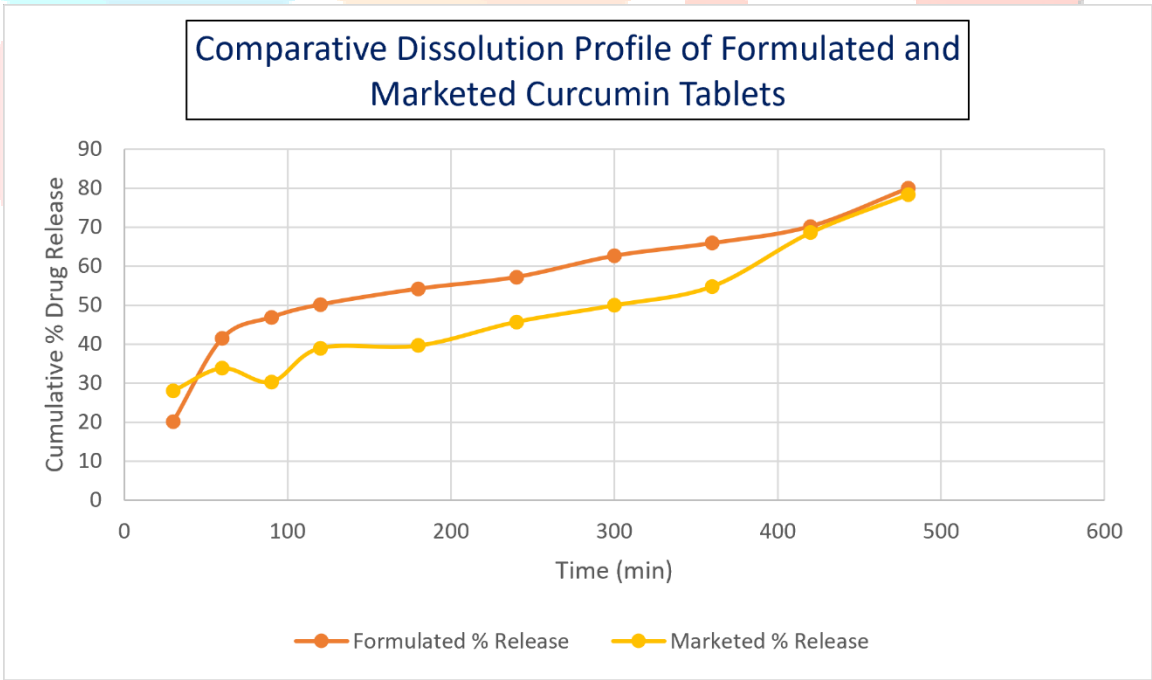


Figure illustrates the comparative dissolution profiles of the formulated and marketed curcumin tablets. The formulated tablet exhibited a gradual and controlled release of curcumin throughout the dissolution study. An initial burst release was observed during the first 60 minutes, followed by a sustained release pattern up to 480 minutes. The marketed tablet also showed a gradual increase in drug release but exhibited a comparatively slower release during the initial stages.

The formulated tablet achieved approximately 85% cumulative drug release at 480 minutes, while the marketed tablet exhibited approximately 84% cumulative drug release at the same time point. The dissolution profiles of both formulations were comparable, indicating that the developed formulation provided drug release similar to the marketed product.

The sustained release behavior of the formulated tablet may be attributed to the incorporation of natural polymers, which effectively controlled the diffusion of curcumin from the tablet matrix. Overall, the formulated tablet demonstrated satisfactory dissolution characteristics and can be considered a promising, eco-friendly alternative to the marketed curcumin tablet.

Conclusion:

The comparative dissolution study confirmed that the formulated curcumin tablet exhibited a controlled and sustained drug release profile comparable to the marketed formulation, demonstrating its potential as an effective and stable oral dosage form.

Conclusion:

The formulated curcumin tablets exhibited satisfactory quality attributes and showed performance comparable to that of the marketed tablets. This study indicates that the developed formulation may serve as a viable alternative to commercially available curcumin tablet products.

References:

1. Hewlings, S. J., & Kalman, D. S. (2017). *Curcumin: A review of its effects on human health*. Foods, 6(10), 92.
2. Nelson, K. M., Dahlin, J. L., Bisson, J., Graham, J., Pauli, G. F., & Walters, M. A. (2017). *The essential medicinal chemistry of curcumin*. Journal of Medicinal Chemistry, 60(5), 1620–1637.
3. Indian Pharmacopoeia. Government of India, Ministry of Health and Family Welfare, Ghaziabad.
4. United States Pharmacopeia. USP–NF 2024. Rockville, MD.
5. International Council for Harmonisation. Pharmaceutical Development Guideline.
6. Aggarwal, B. B., et al. (2013). *Curcumin: The Indian solid gold*. Advances in Experimental Medicine and Biology.
7. Prasad, S., Gupta, S. C., Tyagi, A. K., & Aggarwal, B. B. (2014). *Curcumin, a component of turmeric*. Herbal Medicine: Biomolecular and Clinical Aspects.
8. Yallapu, M. M., Jaggi, M., & Chauhan, S. C. (2012). *Curcumin nanoformulations: A future nanomedicine*. Drug Discovery Today.
9. Patel, S., et al. (2020). *Natural polymers in pharmaceutical drug delivery systems*. Journal of Drug Delivery Science and Technology.
10. Dash, S., Murthy, P. N., Nath, L., & Chowdhury, P. (2010). *Kinetic modeling on drug release from controlled drug delivery systems*. Acta Poloniae Pharmaceutica.
11. Aulton, M. E., & Taylor, K. M. G. (2021). *Aulton's Pharmaceutics: The Design and Manufacture of Medicines* (6th ed.).
12. Lachman, L., Lieberman, H. A., & Kanig, J. L. *The Theory and Practice of Industrial Pharmacy*.
13. Banker, G. S., & Rhodes, C. T. *Modern Pharmaceutics* (4th ed.).