

# FORMULATION AND EVALUATION OF SUGAR FREE CHEWABLE TABLETS OF MONTELUKAST SODIUM

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## Abstract:

The present study was undertaken to formulate sugar free Montelukast sodium chewable tablets by direct compression method using various disintegrants and superdisintegrants. The substance used as disintegrants and superdisintegrants are maize starch, pregelatinized starch, sodium starch glycolate, croscarmellose sodium and crospovidone. A total of five formulations (F-I to F-V) of sugar free Montelukast sodium chewable tablets were prepared by direct compression method. All the formulations were evaluated for both pre compression and post compression parameters as per the requirements of standards. Preformulation study of API such as organoleptic properties, solubility, compatibility study and FT- IR drug - excipients interaction study were carried out. The prepared blends were also evaluated for precompression parameters such as angle of repose, bulk density, tapped density, compressibility index and hausner's ratio. The prepared tablets were evaluated for post compression parameters such as thickness, hardness, weight variation, friability, disintegration, wetting time, water absorption ratio, taste evaluation, assay and in vitro drug release study. Comparative dissolution study of optimized formulation (F-V) and marketed product was carried out and the drug release of optimized formulation (F-V) was rapid (97.29%) compared to the marketed product (88.01%) at the end of 30 minutes. From the results it was concluded that the formulation F-V showed rapid drug release compared to the marketed product. The stability results of optimized formulation (F-V) indicated that there were no significant changes found in physical appearance, thickness, hardness, average weight, friability, disintegration, assay and in vitro drug release even after stored at  $25\pm 2^{\circ}\text{C}/60\%\pm 5\%\text{RH}$  and  $40\pm 2^{\circ}\text{C}/75\%\pm 5\%\text{RH}$  for 3 months. The results showed that the optimized formulation F-V was stable even after stored at  $25\pm 2^{\circ}\text{C}/60\%\pm 5\%\text{RH}$  and  $40\pm 2^{\circ}\text{C}/75\%\pm 5\%\text{RH}$  for a period of three months.

**Key words:** Formulation, Evaluation, Sugar Free Chewable Tablets, Montelukast Sodium.

## INTRODUCTION

Chewable tablets are solid oral dosage forms that are designed to be chewed and disintegrated in the oral cavity before swallowing. They provide an easy and palatable method of drug administration, especially for pediatric, geriatric, and dysphagic patients who may have difficulty swallowing conventional tablets or capsules (Reddy et al., 2018). The formulation of chewable tablets is aimed at enhancing patient compliance and ensuring that the active pharmaceutical ingredient (API) is adequately absorbed after oral ingestion.

### Purpose

Chewable tablets are primarily developed to:

- **Improve patient compliance:** Particularly for children, the elderly, and those with swallowing difficulties (Shah et al., 2020).
- **Ensure faster onset of action:** Chewable tablets facilitate quicker absorption by initiating partial dissolution in the oral cavity, leading to faster therapeutic effects.
- **Offer a palatable alternative:** The incorporation of sweeteners, flavoring agents, and taste-masking techniques ensures a pleasant taste, thereby enhancing the acceptability of the dosage form.

### Key Characteristics

1. **Taste Masking:** Since many APIs have a bitter taste, effective taste-masking techniques, such as the use of sweeteners, flavors, and polymer coatings, are necessary to improve palatability (Sastry et al., 2018).
2. **Texture and Mouthfeel:** The texture should be smooth without grittiness or unpleasant residue, providing a comfortable chewing experience.
3. **Disintegration Properties:** Designed to disintegrate quickly in the oral cavity, chewable tablets should facilitate easy breakdown and swallowing without causing discomfort (Jain et al., 2017).
4. **Physical Stability:** Chewable tablets should maintain mechanical strength during handling and transportation while remaining easy to chew.

### Advantages

- **Ease of Administration:** Chewable tablets eliminate the need to swallow whole tablets, making them suitable for patients with dysphagia or swallowing difficulties (Pinto et al., 2019).
- **Improved Compliance:** Pleasant taste and convenience increase adherence, particularly among pediatric and geriatric populations.
- **Faster Onset of Action:** Partial absorption of certain APIs in the oral cavity can lead to quicker therapeutic effects (Allen et al., 2017).
- **Reduced Risk of Choking:** Safe and easy administration reduces the likelihood of choking, making them safer than traditional tablets for at-risk populations.

### Disadvantages

- **Taste Masking Challenges:** APIs with strong or bitter tastes may require sophisticated taste-masking techniques to ensure patient acceptability.
- **Risk of Dental Caries:** Sugar-based sweeteners in chewable tablets can lead to dental problems with prolonged or frequent use (Shah et al., 2020).
- **Fragility and Storage Issues:** Chewable tablets tend to be more friable and may be prone to breakage during handling and packaging.
- **Limited API Load:** Chewable tablets are typically suitable for low-dose APIs, as high doses may lead to large tablet sizes, making them difficult to chew and swallow.

### Common Applications

- **Antacids:** Chewable formulations of calcium carbonate and magnesium hydroxide for rapid relief of acid indigestion (Jain et al., 2017).
- **Vitamins and Dietary Supplements:** Multivitamins and mineral supplements designed for children and elderly patients.
- **Analgesics:** Non-steroidal anti-inflammatory drugs (NSAIDs), such as ibuprofen, formulated as chewable tablets for quick pain relief (Sastry et al., 2018).
- **Antibiotics:** Pediatric formulations, such as chewable amoxicillin tablets, for better compliance and improved therapeutic outcomes.

The aim of present study is to formulate sugar free Montelukast sodium chewable tablets using various disintegrants and superdisintegrants by direct compression method and to evaluate the formulations for various pharmaceutical parameters and compare with marketed product of Montelukast sodium chewable tablets.

Montelukast sodium is used for chronic treatment of asthma and allergic rhinitis. Paediatric, geriatric and bedridden patients show inconvenience in swallowing conventional tablets of Montelukast sodium with lesser amounts of water. Montelukast sodium is basically a tasteless drug. So some patient's does not like to consume the drug orally. Moreover, marketed preparation of Montelukast sodium currently available is not completely devoid of tasteless problem. So the objective of the study is to produce a drug delivery system with better pharmaceutical and therapeutic properties and making the formulation suitable for diabetic and non diabetic patients and minimizing the drawbacks of commercially available conventional Montelukast sodium tablets by formulating sugar free Montelukast sodium chewable tablets thereby improving the patient compliance, convenience in administration and better mouth feel. Also the effectiveness of Montelukast sodium will be improved by the reduction in size that occurs during mastication of drug before swallowing.

**MATERIALS AND METHODS****LIST OF MATERIALS USED AND MANUFACTURERS****Table 1: List of Materials used and Manufacturers**

S. No.	MATERIALS	MANUFACTURERS
1	Montelukast sodium	MetroChem API Pvt. Ltd., Hyderabad, Telangana.
2	Mannitol anhydrous	Shandong Tunali Pharma, China.
3	Maize starch	Universal Starch Chemical Allied, Ltd., Mumbai, Maharashtra.
4	Pregelatinized starch	DFE Pharma, Cuddalore, Tamilnadu.
5	Sodium starch glycolate	Prachin Chemical Pvt. Ltd., Ahmedabad, Gujarat.
6	Croscarmellose sodium	Prachin Chemical Pvt. Ltd., Ahmedabad, Gujarat.

**METHODOLOGY****FORMULATION OF MONTELUKAST SODIUM CHEWABLE TABLETS BY DIRECT COMPRESSION METHOD<sup>77</sup>**

Chewable tablets of Montelukast sodium were prepared by direct compression method as per the composition shown in Table 8. Five formulations (F-I to F-V) were prepared by direct compression method.

**DIRECT COMPRESSION METHOD****Sieving**

The active ingredient was passed through the sieve # 40. The other ingredients given in the formulation table were passed separately through the same sieve.

**Dry mixing**

All the materials (including the active ingredient) were weighed and taken in a poly bag and mixed for 10 minutes.

**Lubrication**

The magnesium stearate was passed through the sieve # 60 and mixed together with the powder mixture in a polybag for 5 minutes to get a uniform blend.

**Compression**

Finally, the powder mixture was compressed into tablets using rotary tablet compression machine of punch size 7.14mm to prepare tablets each weighing 150mg.

**Packing**

The prepared tablets were packed by PVC- Alu Blister packing.

**Table: 2 Composition of Montelukast sodium Chewable Tablets**

Ingredients	Quantity per Tablet (mg)				
	Formulation Code				
	F-I	F-II	F-III	F-IV	F-V
Montelukast sodium	5.00	5.00	5.00	5.00	5.00
Mannitol anhydrous	124.20	124.20	124.20	124.20	124.20
Maize starch	15.00	-	-	-	-
Pregelatinized starch	-	15.00	-	-	-
Sodium starch glycolate	-	-	15.00	-	-
Croscarmellose sodium	-	-	-	15.00	-

Crospovidone	-	-	-	-	15.00
Neo sucralose	1.50	1.50	1.50	1.50	1.50
Strawberry powder flavor	0.80	0.80	0.80	0.80	0.80
Iron oxide red	0.20	0.20	0.20	0.20	0.20
Methylparaben	1.50	1.50	1.50	1.50	1.50
Propylparaben	0.30	0.30	0.30	0.30	0.30
Magnesium stearate	1.50	1.50	1.50	1.50	1.50

## RESULTS AND DISCUSSION

The present study was undertaken to formulate sugar free Montelukast sodium chewable tablets by direct compression method using various disintegrants and superdisintegrants. The substance used as disintegrants and superdisintegrants are maize starch, pregelatinized starch, sodium starch glycolate, croscarmellose sodium and crospovidone. A total of five formulations (F-I to F-V) were prepared using various disintegrants and superdisintegrants.

The prepared blend of different formulations were evaluated for precompression parameters such as I.R spectral studies, angle of repose, bulk density, tapped density, compressibility index and hausner's ratio. The prepared tablets were evaluated for various post compression parameters like appearance, thickness, hardness, weight variation, friability, disintegration test, wetting time, water absorption ratio, drug content, taste evaluation and *in vitro* dissolution studies. The optimized formulation was subjected for stability studies. The results were presented as follows in appropriate tables and figures.

## PREFORMULATION STUDIES ORGANOLEPTIC PROPERTIES

The organoleptic properties of Montelukast sodium was presented in Table. 3

**Table.3 Organoleptic Properties of Montelukast sodium (API)**

Tests	Specification as per I.P	Observation
Color	Off white to pale yellow color	Off white to pale yellow color
Odor	Odorless	Odorless
Taste	Tasteless	Tasteless

### Discussion:

The organoleptic properties like color, odor and taste of the API were evaluated. The color of Montelukast sodium was found to be off white to pale yellow, no characteristic odor and no characteristic taste was observed in the study. Montelukast sodium showed similar color, odor and taste as per I.P specification.

**SOLUBILITY TEST**

The solubility profile of Montelukast sodium was presented in Table. 4

**Table.4 Solubility Analysis of Montelukast sodium (API)**

Raw Material ( API )	Solubility
Montelukast sodium	Soluble in water
	Freely soluble in ethanol, methanol
	Practically insoluble in acetonitrile

**Discussion:**

The solubility analysis of drug indicates that Montelukast sodium is soluble in water, freely soluble in ethanol and methanol and practically insoluble in organic solvents.

**DRUG - EXCIPIENTS COMPATIBILITY STUDIES**

Compatibility studies were performed by preparing blend of different excipients with drug and stored at room temperature for one month. The blends were evaluated for every 15 days for changes like caking, liquefaction, discoloration and odor formation. The drug excipients compatibility profiles were shown in

**Table. 5 Drug - Excipients Compatibility Studies**

S. No.	Composition	Initial Period	After 15 days	After 30 days
1	Montelukast sodium	Off white to pale yellow color powder with no characteristic odor	*NCC	NCC
2	Montelukast sodium + Mannitol anhydrous		NCC	NCC
3	Montelukast sodium + Maize starch		NCC	NCC
4	Montelukast sodium + Pregelatinized starch		NCC	NCC
5	Montelukast sodium + Sodium starch glycolate		NCC	NCC
6	Montelukast sodium + Croscarmellose sodium		NCC	NCC
7	Montelukast sodium + Crospovidone		NCC	NCC
8	Montelukast sodium + Neo sucralose		NCC	NCC
9	Montelukast sodium + Magnesium stearate		NCC	NCC
10	Montelukast sodium + Methylparaben		NCC	NCC
11	Montelukast sodium + Propylparaben		NCC	NCC
12	Montelukast sodium + Iron oxide red	Brick red color powder	NCC	NCC
13	Montelukast sodium + Strawberry flavor	White color with strawberry odor	NCC	NCC

**\* NCC: No Characteristic Change Discussion:**

From the above drug excipients compatibility study, it was observed that there was no characteristic change found between the drug and excipients. Thus it was concluded that the excipients selected for the formulation were compatible with Montelukast and suitable for formulation development.

**FT- IR SPECTRAL STUDIES**

FT- IR studies of the pure Montelukast sodium, disintegrant, superdisintegrant and combination of drug and superdisintegrants containing highest proportion were carried out to found any interaction between drug and

excipients used in the formulation. FT- IR study was performed using IR spectroscopy (SHIMADZU). The I.R. Spectra of drug, disintegrants and superdisintegrant were shown in fig: 3 to 13 and in table 13 to 23 respectively. The comparison of FT- IR spectral data of drug with superdisintegrants was given in table 6.

**Table. 6 Comparative FT- IR Spectral Data of Drug, Disintegrants and Super disintegrants**

Compounds	Functional Groups (cm <sup>-1</sup> )				
	OH	C-H	C=C	C-N	C-Cl
Drug (Montelukast sodium)	3356	3062	1573	1141	756
Drug+ Maize starch	3394	2931	1597	1411	763
Drug + Pregelatinized starch	3371	2924	1597	1149	756
Drug+Sodium starch glycolate	3387	2931	1597	1149	763
Drug+Croscarmellose sodium	3394	2916	1627	1126	756
Drug+Crospovidone	3441	2931	1597	1165	756

#### Discussion:

FT- IR spectral studies indicated that the drug is compatible with all the excipients. The FT- IR spectrum of physical mixture showed all the characteristic peaks of Montelukast sodium, thus conforming that no interaction of drug occurred with the components of formulation.

#### EVALUATION OF PRECOMPRESSION PARAMETERS MICROMERITIC PROPERTIES

The powder blends were evaluated for the following parameters such as angle of repose, bulk density, tapped density, compressibility index and hausner' ratio. The results were given below in Table. 7

**Table. 7 Precompression Parameters**

Formulation Code	Angle of Repose (Θ)	Bulk Density (g/cm <sup>3</sup> )	Tapped Density (g/cm <sup>3</sup> )	Compressibility Index (%)	Hausner's Ratio
F-I	29.3±0.1	0.305±0.2	0.361±0.2	16.2±0.2	1.18±0.2
F-II	27.1±0.4	0.309±0.6	0.357±0.3	16.0±0.9	1.18±0.7
F-III	27.0±0.1	0.303±0.5	0.354±0.1	15.5±0.4	1.19±0.5
F-IV	26.5±0.9	0.292±0.7	0.367±0.8	16.3±0.7	1.17±0.2
F-V	25.6±0.8	0.304±0.4	0.342±0.5	15.4±0.2	1.17±0.3

All the values are expressed as mean ± SD, n=3

#### Discussion:

The angle of repose of all formulations were found between 25<sup>o</sup>.60' to 29<sup>o</sup>.30' that is well within the specification limit of 25<sup>o</sup>- 29<sup>o</sup> which indicates the flow type of powder blend was excellent. Formulation F-V showed better flow property.

The bulk density was found between 0.292 to 0.309 g/cm<sup>3</sup>, tapped density was found between 0.342 to 0.367 g/cm<sup>3</sup>. Compressibility index was found in the range of 15.4 to 16.3% which indicates the flow

type of powder blend was fair. Hausner's ratio ranges between 1.17 to 1.19. The above results in terms of micromeritic properties revealed that the flow property of all formulation was excellent and within the acceptable limit.

## EVALUATION OF MONTELUKAST SODIUM CHEWABLE TABLETS

### POST COMPRESSION PARAMETERS

#### GENERAL APPEARANCE

The general appearance of all formulations (F-I to F-V) were examined and found as follows,

**Color** - Brick red color **Shape** - Round **Surface** - Smooth

**Cracks, depressions, pinholes** – Absent

The prepared tablets were evaluated for various post compression parameters. The results are presented in

**Table. 8 Post Compression Parameters**

Formulation code	Thickness (mm)	Hardness (kg /cm <sup>2</sup> )	Weight Variation (mg)	Friability (%)
F-I	3.22±0.018	6.05±0.21	153.60±1.82	0.011±0.006
F-II	3.20±0.032	6.42±0.14	149.20±1.59	0.012±0.008
F-III	3.21±0.027	6.20±0.56	155.10±1.42	0.012±0.004
F-IV	3.20±0.041	6.65±0.17	151.90±1.78	0.014±0.009
F-V	3.22±0.032	6.15±0.56	150.80±1.29	0.013±0.012
Marketed Sample	2.81±0.16	7.00±0.1	153.01±2.32	0.012±0.05

All the values are expressed as mean± SD, n=3

#### Discussion:

##### Thickness and Hardness

The thickness of tablets was measured and were found in the range between 3.20±0.032 mm to 3.22±0.032 mm. All the formulation possessed uniform thickness. The hardness of the tablets was measured and the values were found in the range between 6.05±0.21 kg/cm<sup>2</sup> to 6.65±0.17 kg/cm<sup>2</sup>. The prepared tablets possessed good mechanical strength with sufficient hardness. The thickness and hardness of marketed sample was found to be 2.81±0.16 mm and 7.00±0.1 kg/cm<sup>2</sup> respectively.

##### Weight Variation and Friability Test

All formulations of Montelukast sodium chewable tablets passed the weight variation test since the values are within the acceptable variation limit (±7.5%) of the tablet. Similarly percentage friability values of the prepared Montelukast sodium chewable tablets showed less than 1% weight loss that is highly within the acceptable limit. Hence all the tablets passed the friability test. Montelukast sodium chewable tablets were evaluated for various parameters and the results are given in Table.9.

**Table. 9 Evaluation of Montelukast sodium Chewable Tablets**

Formulation Code	Disintegration Test (min)	Wetting Time (Sec)	Water Absorption Ratio (%)	Taste
F-I	5.21±0.015	73±0.57	70.18±0.57	Sweet
F-II	5.07±0.064	70±0.57	86.88±0.56	Sweet
F-III	4.39±0.005	65±0.41	90.80±0.59	Sweet
F-IV	3.23±0.057	49±.53	93.2±0.57	Sweet
F-V	1.10±0.01	30±0.54	96.80±0.58	Sweet
Marketed Sample	2.42±0.025	39±0.43	92.14±0.57	Sweet

All the values are expressed as mean± SD, n=3 Discussion:

**Disintegration Time**

Disintegration time of Montelukast sodium chewable tablets were found between 1.10±0.01 to 5.21±0.015 minutes. Specification limit of disintegration time for uncoated tablet from I.P is NMT 15 minutes. Disintegration time of all formulations were found within the time as specified in the I.P and passed the disintegration test. The disintegration time of formulation- V containing crospovidone showed rapid disintegration (1.10±0.01 min) compared with other formulations.

**Wetting Time and Water Absorption Ratio**

Wetting time of all formulations were found between 30 to 73 seconds. Formulation V showed least wetting time (30 sec). Formulation V containing superdisintegrant such as crospovidone will quickly absorb water. Water absorption ratio of all formulations were found between 70% to 96%. The wetting time profiles of Montelukast sodium chewable tablets were shown in Fig. 14

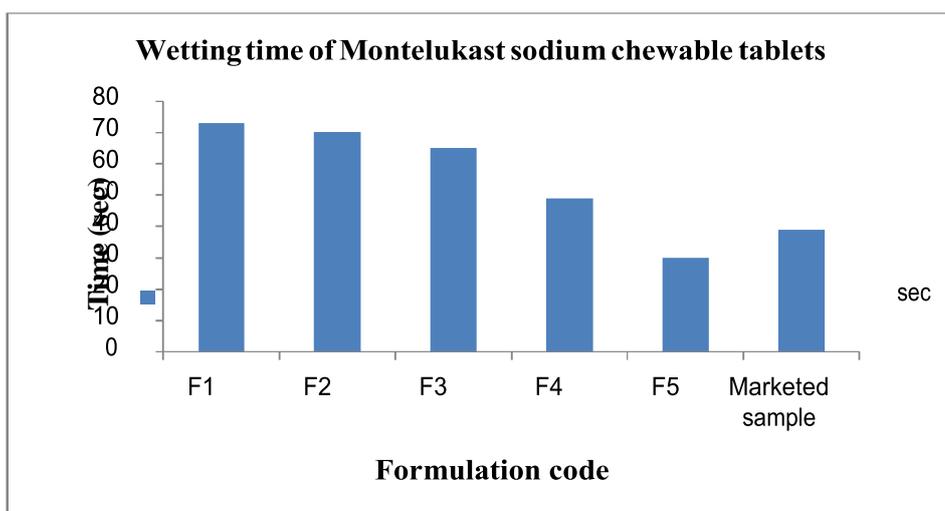


Fig. 1 Wetting Time Profiles of Montelukast Chewable Tablets

**Taste (Sensory Evaluation)**

Tasteless of the drug was changed in all formulations by using sugar free sweetening agent. All the formulations possessed sweet taste.

Table.10 Assay of Montelukast sodium Chewable Tablets

Formulation Code	Limit(%)	Assay(%)
F-I	90-110%	100.70±1.50
F-II		100.53±1.45
F-III		100.89±2.86
F-IV		101.52±1.24
F-V		102.08±1.45
Marketed sample		100.70±1.50

**Discussion:**

The content of Montelukast sodium in the chewable tablets were found in the range between 100.53 to 102.08%. The acceptable limit of Montelukast content as per I.P is 90 to 110%. The results revealed that the content of Montelukast sodium was within the acceptable limits in all the formulations.

**CALIBRATION CURVE OF MONTELUKAST SODIUM**

**Preparation of 0.5% of Sodium lauryl sulphate Solution**

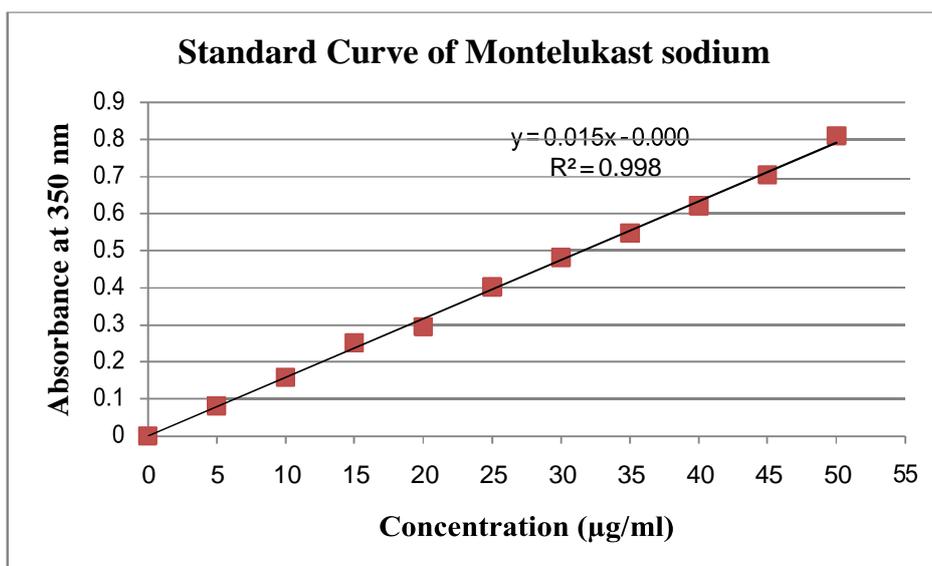
Place 0.5 gm of sodium lauryl sulphate into a 100 ml volumetric flask and the volume was made up with de-mineralized water.

**Calibration Curve of Montelukast sodium**

0.025 gm of Montelukast sodium was accurately weighed and dissolved first in methanol and the volume was made upto 50 ml with de-mineralized water. From this 10ml was pipetted out and transferred into a 50 ml volumetric flask and make upto required volume using 0.5% SLS solution. This is secondary stock solution and from this various concentration of drug (5-50 µg/ml) were pipetted out separately into 10 ml standard flask and make upto required volume using 0.5% SLS solution and the absorbance of the resulting solutions were measured by using UV spectrophotometer at 350 nm. Standard curve of Montelukast sodium was given in the table.11 and fig.2

**Table.11 Calibration Curve Data of Montelukast sodium**

S. No.	Concentration (µg/ml)	Absorbance (350 nm)
1	5	0.0812
2	10	0.158
3	15	0.251
4	20	0.294
5	25	0.401
6	30	0.481
7	35	0.548
8	40	0.621
9	45	0.705
10	50	0.81



**Fig. 2 Standard Curve of Montelukast sodium**

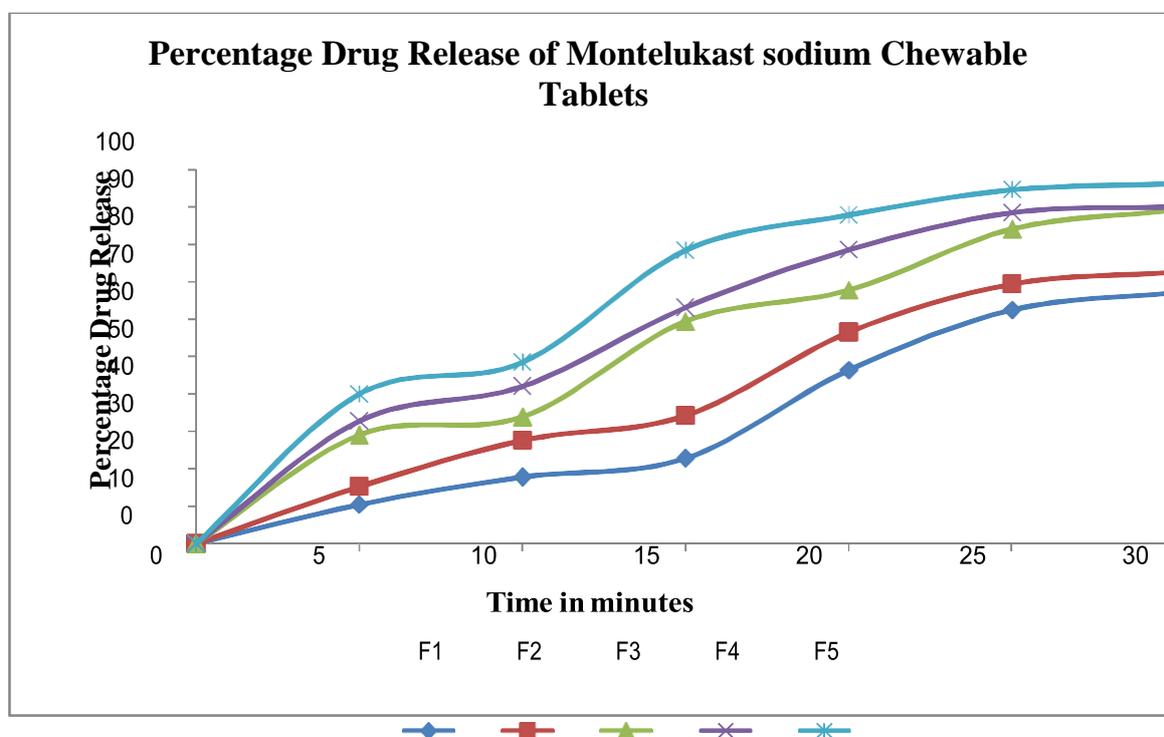
**IN VITRO DISSOLUTION STUDIES**

The *in vitro* drug release studies of Montelukast sodium chewable tablets were given Table. 12 and fig:3 respectively.

**Table. 12 In Vitro Drug Release Data of Montelukast sodium Chewable Tablets**

Time (min.)	Percentage Drug Release (%)				
	F – I	F – II	F - III	F – IV	F – V
5	10.44±0.46	15.23±1.0	29.11±0.10	32.78±1.14	39.99±0.56
10	17.78±0.30	27.67±0.58	33.97±0.45	42.11±0.57	48.55±0.59
15	22.77±0.54	34.23±0.59	59.45±0.01	63.12±0.05	78.45±0.64
20	46.46±0.80	56.56±1.00	67.84±0.58	78.55±1.07	87.92±0.88
25	62.51±1.51	69.45±1.40	84.09±0.59	88.57±0.57	94.65±1.00
30	67.07±0.45	72.66±0.98	89.15±0.01	90.13±0.99	97.29±0.99

All the values are expressed as mean± SD, n=3



**Fig. 3 In Vitro Drug Release Profiles of Montelukast sodium Chewable Tablets**

**Discussion:**

Montelukast sodium chewable tablets was prepared by direct compression method using disintegrants like maize starch, pregelatinized starch and superdisintegrants like sodium starch glycolate, croscarmellose sodium and crospovidone. The dissolution study results are shown in table.30.

Montelukast sodium release was studied in 0.5% SLS solution for upto 30 minutes. The drug release of formulation F-I, F-II was found to be 67.07±0.45% and 72.66±0.98% at 30 minutes. The drug release of formulation F-III, F-IV and F-V was found to be 89.15±0.01%, 90.13±0.99% and 97.29±0.99% respectively. The acceptable *in vitro* dissolution limit for Montelukast sodium as per IP is NLT 80% of drug release at 30 minutes. Formulations F-III, F-IV and F-V passed the *in vitro* drug release studies.

Among the three formulations, formulation F-V containing crospovidone as superdisintegrant showed highest dissolution rates at the end of 30 minutes. They may be due to easy swelling ability and wicking capacity of crospovidone when compared to other disintegrants. The order of enhancement of the dissolution rate with

various disintegrants and superdisintegrants was found to be croscopovidone > croscarmellose sodium > sodium starch glycolate > pregelatinized starch > maize starch. Formulation F-V was taken as optimized formulation based on rapid disintegration time (1.10 minute), wetting time (30 sec) and *in vitro* dissolution profiles (97.29 %).

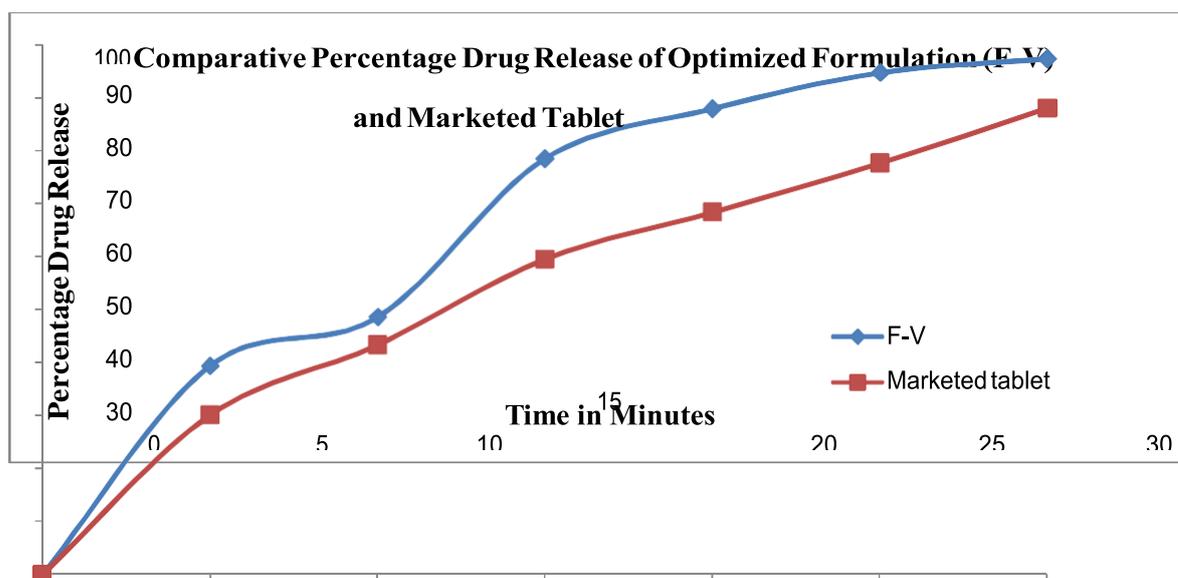
**COMPARATIVE DISSOLUTION STUDY OF MARKETED FORMULATION AND OPTIMIZED FORMULATION (F-V)**

The dissolution profile of optimized formulation (F-V) was compared with marketed Montelukast sodium chewable tablet. The comparative drug release profiles are shown in Table. 13 and fig.4.

**Table. 13 Comparative *In Vitro* Release Data of Montelukast sodium Marketed Tablet and Optimized Formulation (F-V)**

Time (min.)	Percentage Drug Release	
	Formulation F-V	Marketed tablet
5	39.99±0.56	30.09±0.11
10	48.55±0.59	43.30±0.55
15	78.45±0.64	59.47±0.90
20	87.92±0.88	68.33±1.01
25	94.65±1.00	77.57±0.62
30	97.29±0.99	88.01±0.83

All the values are expressed as mean± SD, n=3



**Fig.4 Comparative *In Vitro* Drug Release Profiles of Montelukast sodium Marketed Tablet and Optimized Formulation (F-V)**

**Discussion:**

The percentage drug release of Marketed sample and optimized formulation (F-V) was found to be 88.01±0.83 % and 97.29 ±0.99 % at 30 minutes. The drug release of optimized formulation of Montelukast sodium chewable tablets was found to be greater than that of marketed product.

**STABILITY STUDIES**

The optimized formulation (F-V) was selected for the stability study and stored at 25±2°C/60%±5%RH and 40±2°C/75%±5%RH for a period of three months. The tablets were evaluated for various parameters like physical appearance, weight variation, thickness, hardness, friability, disintegration time, drug content and *in vitro* drug release at every month interval. The results are presented in Table 14

**Table. 14 Stability Data of Optimized Formulation (F-V) Stored at 25±2°C/60%±5%RH**

S. No.	Storage Conditions: 25±2°C/60%±5%RH				
	Parameters	Initial Period	1 <sup>st</sup> Month	2 <sup>nd</sup> Month	3 <sup>rd</sup> Month
1	Physical appearance	Brick red, round shaped tablets	Complies	Complies	Complies
2	Weight variation test (mg)	150.8	150.74	150.63	150.21
3	Thickness (mm)	3.22	3.22	3.2	3.2
4	Hardness (Kg/cm <sup>2</sup> )	6.15	6.15	6.15	6.1
5	Friability (%)	0.12	0.16	0.26	0.31
6	Disintegration time (min.)	1.10	1.21	1.45	1.47
7	Drug content Limit (90-110%)	102.08	102.06	102.06	102.04
8	<i>In vitro</i> drug release at the end of 30 min. (%)	97.29	97.25	97.21	97.2

**Table. 15 Stability Data of Optimized Formulation (F-V) Stored at 40±2°C/75%±5%RH**

S. No.	Storage Conditions: 40±2°C/75%±5%RH				
	Parameters	Initial Period	1 <sup>st</sup> Month	2 <sup>nd</sup> Month	3 <sup>rd</sup> Month
1	Physical appearance	Brick red, round shaped tablets	Complies	Complies	Complies
2	Weight variation test (mg)	150.8	150.99	150.87	150.21
3	Thickness (mm)	3.22	3.19	3.22	3.21
4	Hardness (Kg/cm <sup>2</sup> )	6.15	6.15	6.17	6.17
5	Friability (%)	0.12	0.2	0.24	0.3
6	Disintegration time (min.)	1.10	1.21	1.45	1.00
7	Drug content Limit (90-110%)	102.08	102.05	102.05	102
8	<i>In vitro</i> drug release at the end of 30 min. (%)	97.29	97.22	97.18	97.11

**Discussion:**

Stability results revealed that there were no significant changes found in physical appearance, weight, thickness, hardness, friability, disintegration time, drug content and *in vitro* drug release during the period of 3 months even after stored at 25±2°C/60%±5%RH and 40±2°C/75%±5%RH. The results revealed that the drug was stable even after stored at 25±2°C/60%±5%RH and 40±2°C/75%±5%RH for three months.

**SUMMARY**

The present study was undertaken to formulate sugar free Montelukast sodium chewable tablets by direct compression method using various disintegrants and superdisintegrants. The substance used as disintegrants

and superdisintegrants are maize starch, pregelatinized starch, sodium starch glycolate, croscarmellose sodium and crospovidone.

A total of five formulations (F-I to F-V) of sugar free Montelukast sodium chewable tablets were prepared by direct compression method. All the formulations were evaluated for both pre compression and post compression parameters as per the requirements of standards. Preformulation study of API such as organoleptic properties, solubility, compatibility study and FT- IR drug - excipients interaction study were carried out. The prepared blends were also evaluated for precompression parameters such as angle of repose, bulk density, tapped density, compressibility index and hausner's ratio. The prepared tablets were evaluated for post compression parameters such as thickness, hardness, weight variation, friability, disintegration, wetting time, water absorption ratio, taste evaluation, assay and *in vitro* drug release study.

From the experimental results the following points can be summarized,

- ✓ In the preformulation study Montelukast sodium showed similar color, taste and odor as per the I.P specification. The results of drug excipients compatibility study showed that the excipients selected for the formulation were compatible with the API and suitable for formulation development.
- ✓ FT- IR spectral studies of pure drug and drug with excipients showed that there was no interaction between the drug and excipients used in the formulation.
- ✓ The results of micromeritic properties indicate that the flow property of formulation F-V showed better flow property compared with other formulations.
- ✓ All formulations possessed uniform thickness. The prepared tablets also possessed good mechanical strength with sufficient hardness.
- ✓ All formulations of Montelukast sodium chewable tablets passed the weight variation test since the values are within the acceptable variation limit ( $\pm 7.5$ ) of the tablet. All formulations of Montelukast sodium chewable tablets showed less than 1% weight loss and passed the friability test.
- ✓ Disintegration time of Montelukast sodium chewable tablets were found between  $1.10 \pm 0.01$  to  $5.21 \pm 0.015$  minutes. Formulation F- V showed least disintegration time ( $1.10 \pm 0.01$  min) compared with all other formulations.
- ✓ Wetting time and water absorption ratio of Montelukast sodium chewable tablets were found to be in the range between 30 to 73 seconds and 70% to 96% respectively. Formulation F-V prepared using crospovidone as superdisintegrant showed least wetting time ( $30 \pm 0.54$  sec) and high water absorption ratio ( $96.80 \pm 0.58\%$ ) among all formulation. All formulations showed good taste and better mouth feel.
- ✓ The content of Montelukast sodium in chewable tablets were found within the acceptable limits. (90-110%).
- ✓ In the *in vitro* drug release study, formulation F-V prepared using crospovidone as superdisintegrant showed maximum drug release (97.29%) at the end of 30 minutes.
- ✓ The obtained data suggested that formulation (F-V) containing crospovidone as super disintegrant showed better disintegration time ( $1.10 \pm 0.01$  min), wetting time ( $30 \pm 0.54$ sec) and *in vitro* drug release (97.29%) and hence formulation F-V was considered as the optimized formulation based on rapid disintegration time ,wetting time and *in vitro* drug release.
- ✓ Comparative dissolution study of optimized formulation (F-V) and marketed product was carried out and the drug release of optimized formulation (F-V) was rapid (97.29%) compared to the marketed product (88.01%) at the end of 30 minutes. From the results it was concluded that the formulation F-V showed rapid drug release compared to the marketed product.
- ✓ The stability results of optimized formulation (F-V) indicated that there were no significant changes found in physical appearance, thickness, hardness, average weight, friability, disintegration, assay and *in vitro* drug release even after stored at  $25 \pm 2^\circ\text{C}/60\% \pm 5\% \text{RH}$  and  $40 \pm 2^\circ\text{C}/75\% \pm 5\% \text{RH}$  for 3 months. The results showed that the optimized formulation F-V was stable even after stored at  $25 \pm 2^\circ\text{C}/60\% \pm 5\% \text{RH}$  and  $40 \pm 2^\circ\text{C}/75\% \pm 5\% \text{RH}$  for a period of three months.

## CONCLUSION

From this study, the overall results revealed that the formulation F-V containing crospovidone as superdisintegrant was found to be better one which satisfied all the criteria for chewable tablets. The work

concludes that Montelukast sodium chewable tablets could be successfully formulated by direct compression method using crospovidone as superdisintegrant which may improve the patient compliance, convenience in administration, therapeutic efficiency, better mouth feel making the formulation suitable for geriatric, bed ridden, diabetic and non diabetic patients.

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