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Design and *In-vitro* Characterization of Loperamide Chewable Tablets

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A B S T R A C T

In the present work Maize starch, Mannitol and Cross carmellose sodium were employed as super disintegrating agents to enhance the solubility and dissolution rate. All the formulations were prepared by direct compression method. The blend of all the formulations showed good flow properties such as angle of repose, bulk density, tapped density. The prepared tablets were shown good post compression parameters and they passed all the quality control evaluation parameters as per I.P limits. Among all the formulations F7 formulation showed maximum % drug release i.e., 97.11 % in 45 min hence it is considered as optimized formulation. The F7 formulation contains Crosscarmellose sodiumas super disintegrate in the concentration of 2 mg.

Keywords: Loperamide, Maize starch, Mannitol, Cross carmellose sodium

A R T I C L E I N F O

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1. Introduction

Chewable tablets which are required to be broken and chewed in between the teeth before ingestion. These tablets are given to the children who have difficulty in swallowing and to the adults who dislike swallowing. These tablets are intended to disintegrate smoothly in mouth at a moderate rate either with or without actual chewing, characteristically chewable tablets have a smooth texture upon disintegration, are pleasant tasting and leave no bitter or unpleasant taste. Successful tablet formulation development involves the careful selection of ingredients in order to manufacture a

robust solid dosage form. Choosing the appropriate excipient to perform a specific function in a tablet formulation such as disintegration or lubrication can be critical to achieving acceptable manufacturing performance. Sweeteners, both naturally occurring and synthetic are one type of functional excipient commonly used in chewable tablet formulations to mask the unpleasant tastes and facilitate pediatric dosing. Ideally upon chewing, they are broken down in the mouth and release their ingredients in the process and therefore, do not have much lag time as required for the disintegration of tablets before absorption from stomach. Chewable tablet are often employed when the active ingredient is intended to act in a localized manner rather than systemically. Chewable tablet is one that is palatable and may be chewed and ingested with little or no water.

Loperamide, sold under the brand name Imodium among others, is a medication used to decrease the frequency of diarrhea. It is often used for this purpose in gastroenteritis, inflammatory bowel disease, and short bowel syndrome.

2. Materials and Methods

Loperamide, Maize starch**,** Mannitol, Croscarmellose sodium, Magnesium stearate, Talc, Microcrystalline cellulose all the chemicals used were lab grade.

Formulation of Loperamide chewable tablets:

Composition of preliminary trials for Loperamide chewable tablets by direct compression. All the ingredients were weighed. Required quantity of drug and excipient mixed thoroughly in a polybag. The blend is compressed using rotary tablet machine-8 station with 6mm flat punch, B tooling. Each tablet contains 2 mg Loperamide and other pharmaceutical ingredients.

Evaluation of chewable tablets:

Pre-Compression Parameters:

Angle of repose: In order to determine the flow property, the angle of repose was determined using the standard procedure. It is the maximum angle that can be obtained between the free standing surface of the powder heap and the horizontal plane.tan θ = h/r

Determination of bulk density and tapped density: A quantity of 5gm of the powder (W) from each formula was introduced into a 25 ml measuring cylinder. After the initial volume was observed, the cylinder was allowed to fall under its own weight onto a hard surface from the height of 2.5 cm at 2 sec intervals.The tapping was continued until no further change in volume was noted. The bulk density, and tapped density were calculated using the following formulae.

Bulk density = W / V_o

Tapped density = W / V_f

Where, W = weight of the powder,

Vo = Initial volume,

V_f = Final volume

Compressibility index (Carr's index): It was identified using the formula, $C.I = 100 (V_0 – V_f) / V$

Hauser's Ratio: It indicates the flow properties of the powder and is measured by the ratio of tapped density to the bulk density.

Hauser's Ratio = $(W / V_f) / (W / V_0)$

Where,

W / V_f= Tapped density, W / V_0 =Bulk density

Post compression parameters:

Shape of Tablets:

The Compressed tablets were examined under the magnifying lens for the shape of the tablet.

Hardness:

Hardness indicates the ability of a tablet to withstand mechanical shocks while handling. The hardness of the tablet was determined using Monsanto hardness tester. It is expressed in kg/cm2**.** Five tablets were randomly Picked and hardness of the tablet was determined.

Friability Test:

The friability of tablets was determined using Roche friabilator. It is expressed in percentage (%). Twenty tablets were initially weighed (w_0 initial) and transferred into friabilator was operated at 25rpm for 4 mins or run up to 100 revolutions. The tablets were weighed (w).

The friability was then calculated by Friability = 100 (1-w/w0)

Weight variation test:

Twenty tablets were selected at random and the average weight was determined.

% Maximum positive deviation = (WH –A/ A) x 100

***In-vitro* Dissolution studies:**

In-vitro dissolution studies were carried out by using 500ml of phosphate buffer pH 7.4 in USP dissolution apparatus by using paddle method. The dissolution studies were carried out for about 60 min.

FT-IR:

Drug-Excipients compatibility studies were performed by FTIR spectroscopy. KBr disc method was used for the preparation of samples and those discs were scanned from 4000 to 400 cm-1. The obtained spectrum of the pure drug was compared with the spectrum of its physical mixture for identifying changes in the position of the characteristic peaks.

3. Results and Discussion

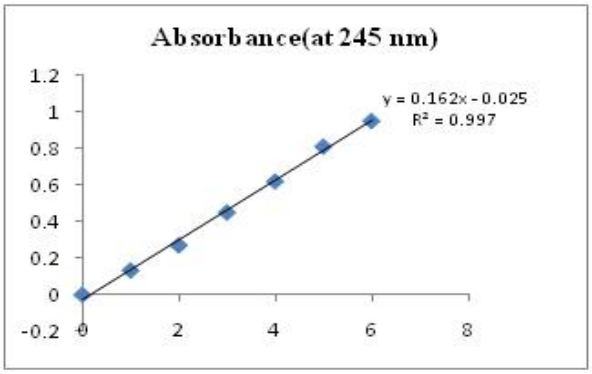

Fig 1: Stdgraph of Loperamide inphosphate buffer (pH 6.8)

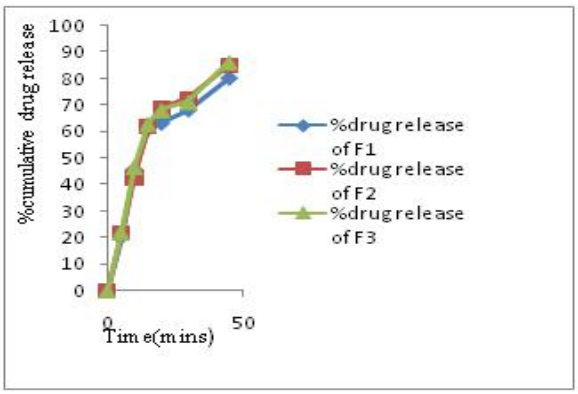

Fig. 2: % drug release of the formulation F1-F3

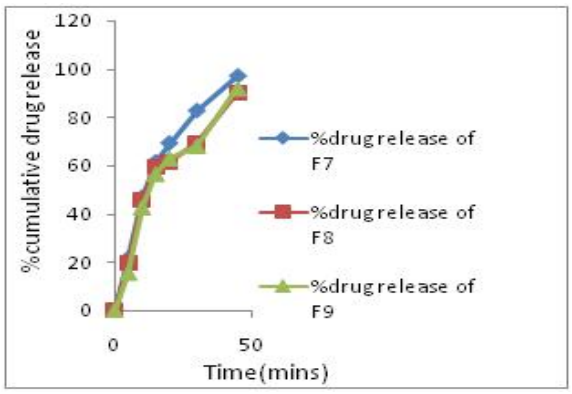

Figure 4: % drug release of the formulation F7-F9

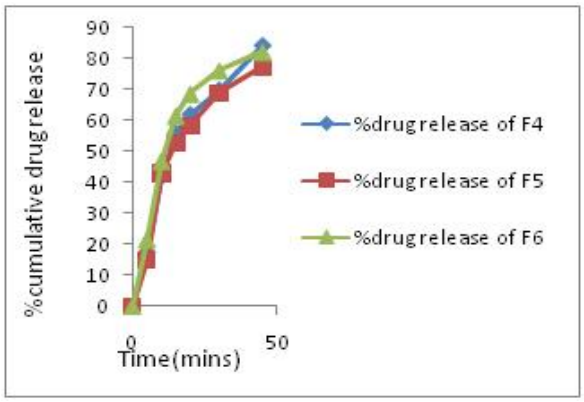

Figure 3: % drug release of the formulation F4-F6

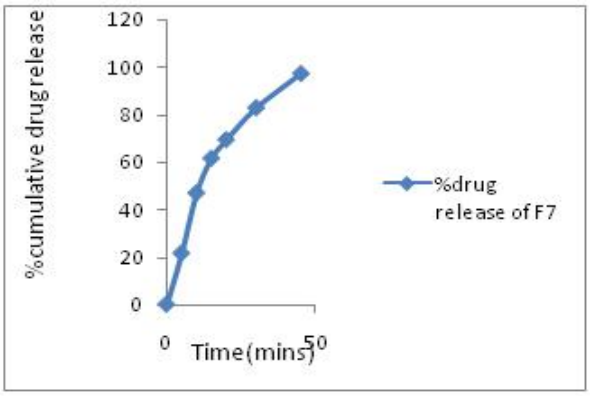

Figure 5: % drug release of the formulation F7 (Optimized formulation)

Table 1: Formulation of Loperamide chewables

Ingredient	F_1	F_2	F_3	F_4	F_5	F_6	F_7	F_8	F_9
Loperamide (mg)	2	2	2	2	2	2	2	2	2
Mannitol (mg)	2	4	6	-	-	-	-	-	-
Maize starch(mg)	-	-	-	2	4	6	-	-	-
Croscarmellose sodium(mg)	-	-	-	-	-	-	2	4	6
Talc(mg)	2	2	2	2	2	2	2	2	2
Mg. Stearate(mg)	2	2	2	2	2	2	2	2	2
MCC(mg)	52	50	48	52	50	48	52	50	48
TOTAL(mg)	60	60	60	60	60	60	60	60	60

Table 2: Concentration and absorbance for calibration curve of Loperamide in phosphate buffer (pH 6.8**)**

S. No.	Conc.(µg/ml)	Absorbance*(at 245nm)
1	1	0.134
2	2	0.271
3	3	0.451
4	4	0.621
5	5	0.812
6	6	0.952

Table 3: Pre-compression parameters

Formulations	Bulk Density (gm/cm^2)	Tapped Density (gm/cm^2)	Carr's Index (%)	Hausner ratio	Angle of Repose(Θ)
F_1	0.42	0.50	16.19	1.11	23.91
F_2	0.51	0.54	14.55	1.12	28.24
F_3	0.53	0.55	12.80	1.14	27.31
F_4	0.47	0.57	18.37	1.18	25.72

F_5	0.43	0.56	14.80	1.19	27.31
F_6	0.49	0.54	13.46	1.16	24.22
F_7	0.48	0.52	15.29	1.17	25.14
F_8	0.52	0.51	14.55	1.15	24.15
F_9	0.53	0.59	16.34	1.14	27.16

Table 4: Post-compression parameters

Formulations	Weight variation (mg)	Hardness (kg/cm^2)	Thickness (mm)	Friability (%)	Assay (%)
F_1	60	2.6	3.41	0.45	97.21
F_2	60	2.4	3.43	0.32	96.16
F_3	62	2.4	3.45	0.41	97.13
F_4	69	2.5	3.46	0.42	98.25
F_5	64	2.2	3.47	0.43	97.24
F_6	61	2.6	3.46	0.44	97.26
F_7	63	2.7	3.44	0.41	97.12
F_8	62	2.5	3.48	0.44	97.59
F_9	61	2.4	3.45	0.42	96.11

Table 5: The dissolution data for all the formulations

Time (Min)	F_1	F_2	F_3	F_4	F_5	F_6	F7	F8	F9
5	20.15	21.8	22.15	17.5	15	21.55	21.55	19.47	15.44
10	45.68	42.87	46.77	41.97	42.97	46.87	46.87	45.71	42.64
15	60.97	62.14	62.94	55.94	52.74	61.47	61.47	59.44	56.52
20	63.17	68.82	68.14	61.87	58.44	68.55	69.31	61.47	62.99
30	68.14	72.64	71.24	69.77	68.77	76.11	82.74	69.14	68.14
45	80.15	85.11	86.21	84.11	77.15	82.14	97.11	90.14	92.11

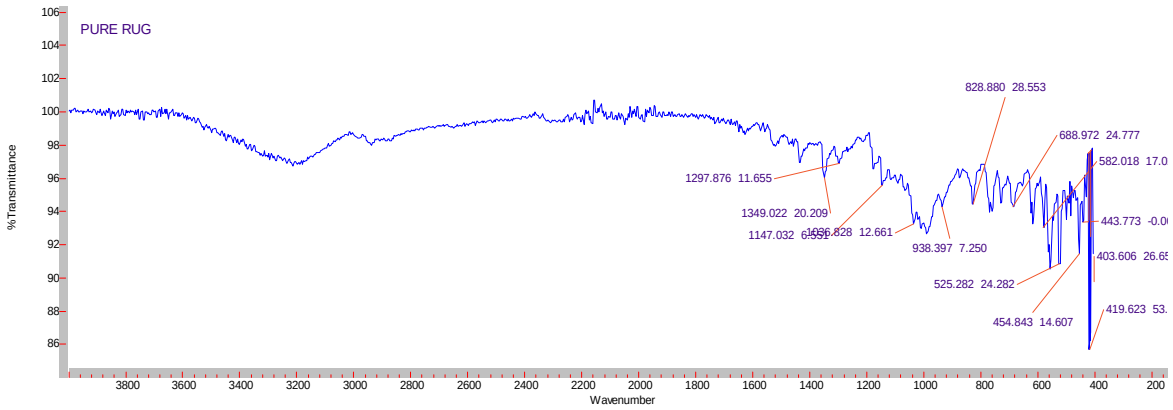

Figure 6: FTIR Spectrum of Loperamide pure drug.

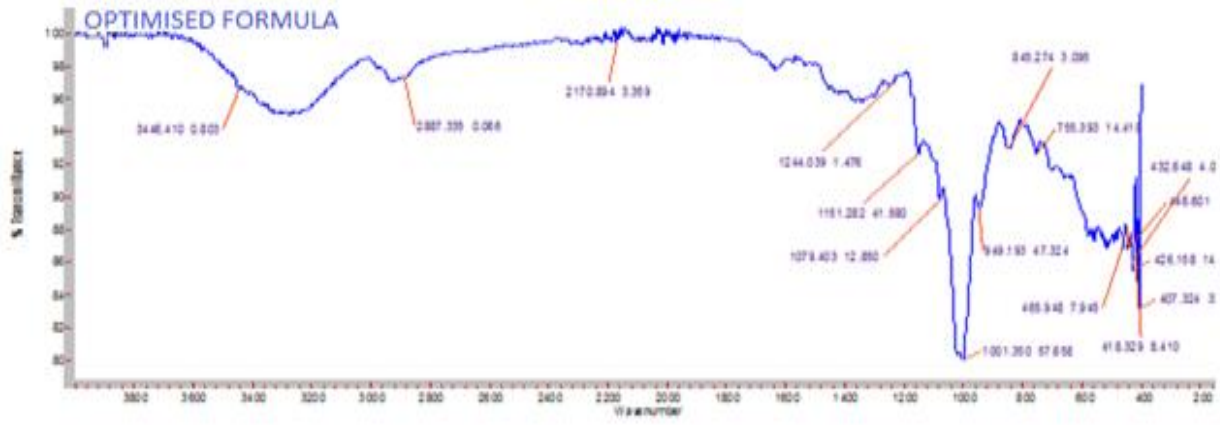

Figure 7: FTIR Spectrum of Optimized Formulation

4. Conclusion

Chewable tablets are designed for use by the children and such persons who may have difficulty in swallowing the tablets. These are intended to be chewed in the mouth prior to swallowing and are not intended to be swallowed intact. Additionally, chewable tablets facilitate more rapid release and hence more rapid absorption of active ingredients and provide quick onset of action. Literature review was carried out regarding chewable tablets, from that Loperamide was selected as model drug and ethyl cellulose, maize starch, cross carmellose sodium and mannitol were selected as polymers. Loperamide, sold under the brand name Imodium among others, is a medication used to decrease the frequency of diarrhea. It is often used for this purpose in gastroenteritis, inflammatory bowel disease, and short bowel syndrome. Analytical profile of drug molecule was established in 6.8 pH phosphate buffer and standard calibration curve was plotted by taking different concentrations. The drug and excipient compatability studies were carried out by using FTIR spectroscopy. From the studies it was evident that the drug and excipients are compatable with each other. Tablets were formulated with varying concentrations of maize starch, croscarmellose sodium and mannitol. The formulated chewable tablets were evaluated for various physical parameters. The *in-vitro* dissolution study demonstrated that chewable tablets of Loperamide prepared with 2mg croscarmellose sodium shown maximum drug release. Based on the results of evaluation tests formulation coded F7 was concluded as best formulation.

5. References

[1] Sabina Akhtar, Pulak Dev Formulation and Evaluation of Chewable Multivitamin Tablet International Journal of Current Pharmaceutical Research, 9(4). 2017.

[2] Rahul Gupta, Gulshan Chhabra, Dr. Kamla Pathak, Harish Kr Bishnoi and Anil KumarTo formulate and evaluate taste masked chewable tablet of Levocetirizinedihydrochloride and Montelukast sodium using ion exchange resin as a drug carrier. The Pharma Innovation Journal 2017; 6(7): 27-32

[3] Bolton S. Pharmaceutical statistics- Practical and clinical applications. 3nd Ed. Marcel Dekker Inc. New York; 1997.

[4] Kathiresan K, Vijin P, Moorthi C, Manavalan R. formulation and evaluation of loratadinechewable tablets. Res J Pharm Bio CheSci 2010, 1(4): 763-74.

[5] Two level full factorial tutorials. Design expert Software, Version 8.0.4.1, user's guide. Inc., New York.

[6] Meyer SB, Jacques LF, Donald E. Canadian guidelines for the management of acute exacerbation of chronic bronchitis. Can Repir J. 2008 Aug; 10(5): 248-58.

[7] Simone S, Peter CS. Fast dispersible ibuprofen tablets. Eur J PharmaceutSci. 2002 Feb 1; 15: 295–305.

[8] Surya Prakash Gautam , Janki Prasad Rai , Uma Billshaiya , Nilesh Jain, Pradeep Vikram, Deepak Kumar Jain Formulation And Evaluation Of Mouth Dissolving Tablet Of LoperamideIJPSR, 2013; Vol. 4(5): 1782-1788.

[9] BagmarUjwala R., Redasani V. K., Kothawade Sachin. N. Preparation And In-Vitro Evaluation of Loperamide Hydrochloride Spherical Crystals By Emulsion Solvent Diffusion Technique International Journal of Pharmacy and Pharmaceutical Sciences ISSN- 0975-1491 Vol 5, Issue 2, 2013

[10] Venkatalakshmi R, Sasikala C, SP Silambarasan Formulation and Evaluation of Loperamide Hydrochloride Mouth Dissolving Tablet by Using Super Disintegrants, 2010; Page 530-534.