CODEN [USA]: IAJPBB ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

SJIF Impact Factor: 7.187
https://doi.org/10.5281/zenodo.10018923

https://www.iajps.com/volumes/volume10-august-2023/36-issue-08-august-23

Available online at: http://www.iajps.com ***Research Article***

FORMULATION AND EVALUATION OF COLON TARGETED DRUG DELIVERY SYSTEM OF PREDNISOLONE

Sappidi Supriya[1], Thadakapally Ramchander[2]

[1,2] Mother Teresa College of Pharmacy, N.F.C Nagar, Ghatkesar, Medchal, Telangana

Abstract:

This study's goal was to develop compression-coated Prednisolone tablets employing pectin, xanthan gum, and HPMC as carriers for an efficient and secure treatment of ulcerative colitis and inflammatory bowel disease. HPMC coated pellets provide more defense against early medicine issue in the upper GI tract than pectin by itself. Tablets were then prepared and evaluated for their physical properties like weight variation, hardness, friability and content uniformity. Based on the amount of medicine released in the colon, crushed covered tablets with a pectin blend were more effective in producing a medicine that targets the colon while releasing the least amount of medication in the other portions of the gastro intestinal tract. The r^2 value in the zero order plots is 0.947, while the first order gave 0.909, indicating the link between drug concentration and drug release rate.

Keywords: *Prednisolone, Pectin, Xanthan gum, HPMC, invitro release, Kinetics, drug release.*

Corresponding author:

Thadakapally Ramchander,

Mother Teresa College of Pharmacy,
N.F.C Nagar, Ghatkesar, Medchal, Telangana

QR code

Please cite this article in press Sappidi Supriya et al, ***Formulation And Evaluation Of Colon Targeted Drug Delivery System Of Prednisolone****, Indo Am. J. P. Sci, 2023; 10 (08).*

INTRODUCTION:

Colon specific drug delivery has gained increasing importance for the delivery of drugs in the treatment associated with the colon and also acts as the potential site for the systemic delivery of the therapeutic peptides and proteins [1]. Colonic delivery refers to targeted delivery of drugs into the lower GI tract which occurs primarily in the large intestine [2, 3]. Colon specific delivery systems prevent the release of the drug in the upper part of the GIT and require a triggering mechanism to release the drug on reaching the colon [4]. Due to the lack of digestive enzymes and the long transit time colon is considered as suitable site for the absorption of various drugs [5].

Colon specific drug delivery mainly shows topical action in case of inflammatory bowel disease by using drugs like hydrocortisone, budenoside, mesalazine. They exert local action in treatment of chronic pancreatitis. They also show systemic action for oral delivery of peptides and vaccines using the drugs like 5 fluorouracil, NSAIDS.

Prednisolone is a glucocorticoid. Soluble in ethanol (95 %) and in methanol, sparingly soluble in acetone, slightly soluble in CHCl3, very slightly soluble in water. It is a synthetic adrenocortical steroid drug with predominantly gluco-corticoid properties. Some of these properties reproduce the physiological actions of endogenous gluco corticoids [6-8]. Prednisolone mainly promotes gluconeogenesis, increased deposition of glycogen in liver, inhibition of utilization of glucose, anti-insulin activity, increased catabolism of protein [9-10]. Prednisolone is mainly used for topical treatment of Inflammatory Bowel Disease like Ulcerative colitis, Crohn's disease. It can also be used as an immunosuppressive drug for organ transplants and in cases of adrenal insufficiency, Asthma, Uveitis, Rheumatoid arthritis, Ulcerative colitis, temporal arthritis [11]. Pectin is a high-molecular-weight, carbohydrate-like plant constituent consisting primarily of chains of galacturonic acid units linked as 1,4-a-glucosides, with a molecular weight of 30 000–100 000. Pectin has been used as an adsorbent and bulk-forming agent, and is present in multi-ingredient preparations for the management of diarrhea, constipation, and obesity; it has also been used as an emulsion stabilizer. Experimentally, pectin has been used in gel formulations for the oral sustained delivery of ambroxol. Pectin gel beads have been shown to be an effective medium for controlling the release of a drug within the gastrointestinal (GI) tract [12]. It has also been used in a colon-biodegradable pectin matrix with a pH-sensitive polymeric coating, which retards the onset of drug release, overcoming the problems of pectin solubility in the upper GI tract.

The objective of the study is to design and evaluate matrix tablets of Prednisolone using polymers such as Chitosan and Pectin. And to carry out the Pre and post compressional parameters for the powder blend of matrix tablets as well as final finished dosage form[13].

MATERIALS AND METHODS:

Materials

Prednisolone was purchased from Sri Krishna Drugs Limited,Hyderabad. Microcrystalline cellulose, Pectin, Hydroxy propyl methyl cellulose (HPMC K100), Xanthan gum purchased from S.D. fine chemicals.

Methods

Preparation of coated core Tablets

Prednisolone's core tablets were made utilizing the direct compression method Using rotary tablet press, predinisolone was dry mixed with MCC and talc before being compacted into a tablet. Then, various granular coat formulations were compression coated onto the core tablet in various ratios. Pellets of the coat formulation were created by combining the ingredients and soaking them in alcohol. The damp mass was subsequently put finished sieve No. 22 and dried for two hours at 50 °C in a hot air oven [14]. Granular material representing around 45% of the coat mass was initial added to the die hollow for compression coating. The remaining 55% of the coat gritty solid was then added to the core tablet after it had been manually placed in the center. The covering was then tightly compacted round the tablet's center using flat, round punches.

Table 1: Preparation of medication Compression Coated Tablets

S.No.	Constituents (mg)	Quantity per tablet (mg)					
		F1	F2	F3	F4	F5	F6
1. 1	Prednisolone	20	20	20	20	20	20
2.	Microcrystalline cellulose	8	8	8	8	8	8
3.	Mg. stearate	2	2	2	2	2	2
4.	Talc	5	5	5	5	5	5
5.	Xanthan gum	45	25	20	20	45	25
6.	HPMC K100	25	20	45	25	20	45
7.	Pectin	20	45	25	45	25	20

POST COMPRESSION STUDIES

General appearance

Each batch of the formulation's tablets was inspected for general appearance. Shape and colour were appraised visually as the general appearance criteria [15].

Uniformity of Mass

Twenty tablets were designated at arbitrary, and each was balanced separately. Additionally measured was average weight. Calculating the percentage deviation of the tablets and comparing it to the required requirements [16].

Thickness and Diameter

Using a Vernier calliper, the tablets' diameter and thickness were measured [17].

Hardness

The Monsanto Tester was cast-off to regulate the hardness of the manufactured formulations [18]. It was stated as kg/cm2.

Friability

A sample of tablets that had been pre-weighed was put in the device, which remained turned on for 100 rotations before the tablets were de-dusted and reweighed.

$$\%\text{Friability} = \frac{\text{(Initial weight of tablet - final weight of the tablet)}}{\text{Primary mass of tablet}} \times 100$$

***In-vitro* drug release study**

Core tablets were studied for in-vitro medicine release utilising a USP Type-II (Paddle) Dissolution device with 900 ml of pH of 6.8 were used. Temperature was upheld at 37°C± 0.5°C difference while stirring at 75 RPM. At dissimilar intermissions, the samples were taken out of the dissolution medium, and the exact same volume of new media was added for each sampling. The samples were then examined using UV-Visible Spectrophotometer at 234 nm [19].

RELEASE RATE KINETICS

Zero order equation

It was perfect for the preparation to take release outline of zero order to attain extended achievement [20].

$C = K_0 t$

Where, K_0 = Zero order constant

First order equation

The display was designed as log % cumulative medicine residual vs period in hours.

$$\text{Log } C = \log C_0 - Kt/2.303$$

C_0 = Preliminary concentration of medicine
K = First order
t = Time in hours

Higuchi kinetics

The chart was designed with % cumulative medicine release vs. square root of time

$$Q = Kt^{½}$$

K = constant indicating design flexible system (differential rate constant)

\Korsmeyer – Peppas equation

To assess the mechanism of medication release, it was additional designed in Peppas equation as log cumulative % of medicine released (vs) log time.

$$\mathbf{Mt/M\alpha = Ktn}$$

$Mt/M\alpha$= Portion of medicine released at time t
t = Release time
K = Kinetics constant
n = Diffusional exponent revealing of the mechanism of medicine release.

Hixson and Crowell equation

$$\mathbf{Qo^{⅓} - Qt^{⅓} = KHCt}$$

Q_t = Quantity of medicine released at time t
Q_o = Initial sum of medicine
K_{HC} = Rate constant for Hixson Crowell equation

RESULTS AND DISCUSSION:

Table 2: POST COMPRESSION READINGS

S.No.	Formulation	Uniformity weight (mg)	Thickness (mm)	Hardness (kg/cm^2)	Friability (%)	% Drug content
1.	F1	125.5	2.4	5.1	0.159	97.80
2.	F2	125.7	2.6	5.8	0.024	98.40
3.	F3	125.2	2.5	5.4	0.130	97.10
4.	F4	125.5	2.6	5.7	0.240	98.20
5.	F5	125.1	2.4	5.4	0.170	98.10
6.	F6	125.4	2.6	5.6	0.022	95.30

IN VITRODRUG RELEASE STUDY CORE TABLET

Table 3: Drug release study of formulated core tablet

Formulationcode	% Drug release
0	0.00
30	12.30
60	29.10
90	36.7
120	45.80
150	58.48
180	72.23

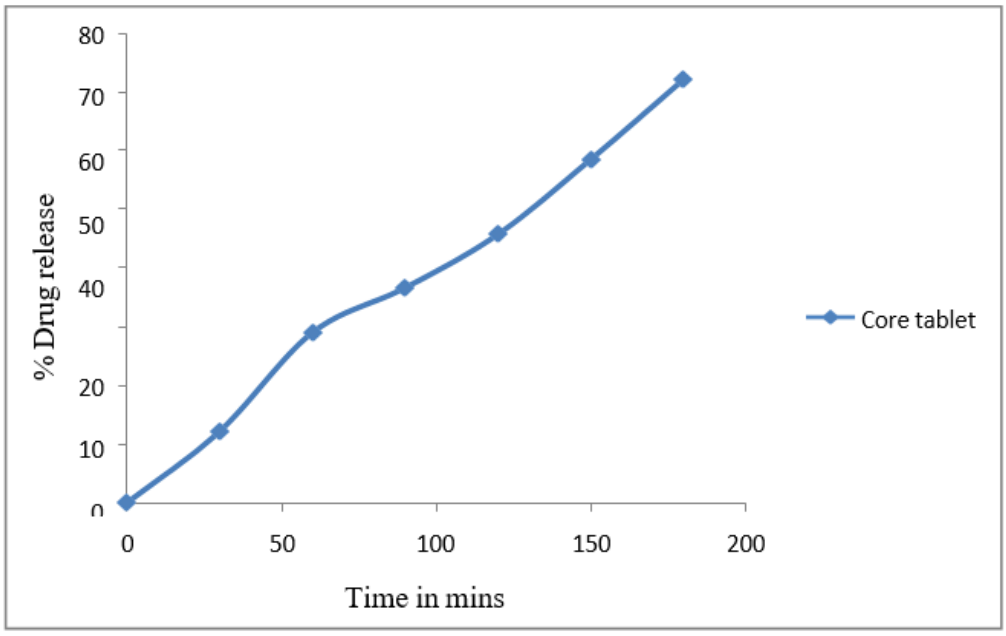

Fig 1: In vitro data of core tablet

Table 4: Drug release of formulated tablet

Time (Hrs)	Drug release (%)					
	F1	F2	F3	F4	F5	F6
0	0.00	0.00	0.00	0.00	0.00	0.00
1	39.28	41.66	31.30	34.22	48.56	46.20
2	56.70	49.54	56.34	59.36	54.64	58.88
3	65.48	58.42	68.58	71.48	60.78	62.18
4	71.58	65.28	72.52	78.72	72.22	75.72
5	82.40	78.60	85.16	84.72	84.18	81.50
6	93.30	84.78	92.40	90.58	91.78	88.22

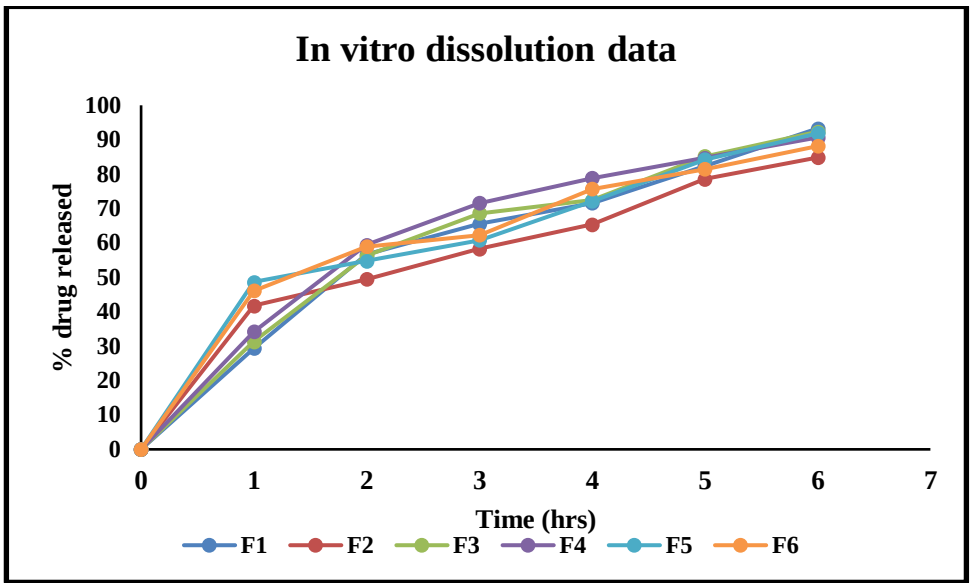

Fig 2: In vitro Medicine release of formulated tablets

Table 5: Release kinetics

Formulation code	Zeroorder (R^2)	Firstorder(R^2)	Higuchi(R^2)	Hixon-crowell (R^2)	Korsmeyer-Peppas	
					(R^2)	N
F4	0.947	0.909	0.972	0.785	0.965	0.520

RELEASE KINETICS

The r2 value in the zero order plots is 0.947, while the first order gave 0.909, indicating the link between drug concentration and drug release rate.

CONCLUSION:

This study's goal was to develop compression-coated Prednisolone tablets employing pectin, xanthan gum, and HPMC as carriers for an efficient and secure treatment of ulcerative colitis and inflammatory bowel disease. HPMC coated pellets provide more defense against early medicine issue in the upper GI tract than pectin by itself. Based on the amount of medicine released in the colon, crushed covered

tablets with a pectin blend were more effective in producing a medicine that targets the colon while releasing the least amount of medication in the other portions of the gastro intestinal tract.

REFERENCES

1. Jain A, Yashwant G, Sanjay KJ. Perspectives of biodegradable natural polysaccharides for site-Specific drug delivery to the Colon. J Pharm Pharmaceut Sci 2007 April 18; 0(1):86-128.
2. Bagyalakshmi J, Arun Raj R, Ravi TK. Fomulation, physical charecterisation and In-vitro release studies of prednisolone alginate beads for colon targeting by ionotropic gelation. International journal of Comprehensive Pharmacy. 2011, 3(4): 1-4.
3. Sumathi S, Alok RR. Release behaviour of drugs from Tamarind Seed polysaccharide tablets. J Pharm Pharmaceut Sci 2002 Mar 7; 5(1):12-18.
4. Hadkar, U.B., 2008. Handbook of practical physical pharmacy and physical pharmaceutics. Nirali Prakashan, pp: 85(88): 92-93.
5. Jubril, J. Muazu and G. T. Mohammed. Effects of Phosphate Modified and Pregelatinized Sweet Potato Starches on Disintegrant Property of Paracetamol Tablet Formulations. Journal of Applied Pharmaceutical Science 02 (02); 2012: 32-36.
6. Lachman, H.A. Lieberman and J.L Kanig, 1990. The Theory and Practice of Industrial Pharmacy, Third edition Lea and febiger, Philadelphia; 296-303: 336-342.
7. The Indian Pharmacopoeia. Volume I, the controller of publication, Ministry of Health and Family Welfare, Government of Indian, 2007 175-184.
8. Allen, L.V., N.G. Popovich and H.C. Ansel. Pharmaceutical dosage forms and drug delivery systems. Eighth edition, Wolters Kluwers Lippincott Williams & Wilkins Philadelphia, 2008: 148-50: 227-259.
9. Dhara B.Patel, Madhabhai M.Patel. Natural excipient in controlled Drug Delivery Systems. J. Pharmacy Res., 2009, 2(5); 900-907.
10. Anil k. Philip, Betty K.P. Colon Targeted Drug Delivery System: A Review on primary and Novel Approaches. Oman. Medical Journal. 2010; 25:70-78.
11. Amal H, Kamel EL, Alaaa A and Abdel M. Oral colon targeted delivery systems for treatment of inflammatory bowel diseases: synthesis in-vitro and in-vivo as assessment. International Journal of Pharmaceutics. 2008, 358: 248 – 255.
12. Chambin G, Duplis D, Chambion A Voilley Y and Poorcelot. Colon –Specific drug delivery. Influence of solution reticulation properties upon pectin beads performance. International Journal pharmaceutics. 2006. 321: 86-93.
13. Hetal K, Amrita Nagie and Murthy RSR. Characterization of calcium alginate beads of 5-fluorauracil for colon delivery. Asian Journal of Pharmaceutics. 2008. 2: 241-245.
14. Choorasia MK and Jain SK. Pharmaceutical approaches to colon targeted drug delivery systems. Journal of Pharmaceutical science. 2003. 6: 33-66.
15. Vyas SP. and Khar R. Targeted and controlled drug delivery –concepts and advances. 2002. First edition, p 218-253.
16. Surender Verma, Singh S k. and Vipin R. Colon diseases and approaches- An overview. International journal of pharmacy and technology. 2011. 3(3): 1197-1213
17. Jain SK, Choorasia MK. Arn Dengre R. Azopolymers for colon targeted drug delivery. Indian Journal of pharmaceutical sciences. 2005. 67: 43 – 50.
18. Indian Pharmacopoeia, 2007, Vol-I, 3rd edition, Gov. of India, Ministry of Health and Family Welfare, Controller of publications, New Delhi; A-479
19. Mohanad Naji Sahib, Shaymaa A A. Design and invitro evaluation of prednisolone tablets. Asian journal of pharmaceutical and clinical research. 2009. 2(4); 84-93.
20. 20.Pandey AK, Choudhary N, Rai VK, Dwivedi H, Kymonil KM, Saraf SA. Fabrication and evaluation of Tinidazole microbeads for colon targeting. Asian Pacific Journal of Topical Disease.