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Original Research Paper

DESIGN AND DEVELOPMENT OF AYURVEDIC ANTHELMINTIC COLON TARGETING TABLET OF ISOPELLETIERINE

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ABSTRACT

Small intestine is mostly the site for drug absorption but in same case the drugs need to be targeted to colon due to some factors like local colonic disease degradation related conditions, delayed release of drugs, systemic delivery of protein and peptide drugs etc. Colon targeted drug delivery is important and relatively new concept for the absorption of drugs because it offers almost neutral pH and long residence time. For the successful targeting of drugs to colon the dosage form should be designed such that it prevents the drug delivery in upper GIT and release it in colonic region. Plants had been used for medicinal purposes long before recorded history. In the last few decades there has been an exponential growth in the field of herbal medicine. It is getting popularized in developing and developed countries owing to its natural origin and lesser side effects. Researchers are being carried out now days on a large scale to discover the herbal alternatives for various allopathic medicines. Anthelmintic drugs are one such example for which herbal alternatives are being searched. In this research we confirmed the anthelmintic activity of Pomegranate (*Punica granatum*). Like pomegranate, other drugs, mainly garlic, quassia, barberry are also studied upon for their anthelmintic activity.

Keywords: Colon targeting, Isopelletierine, Pomegranate, Ayurvedic, Anthelmintic, Worms.

INTRODUCTION

Plants had been used for medicinal purposes long before recorded history. In the last few decades there has been an exponential growth in the field of herbal medicine. It is getting popularized in developing and developed countries owing to its natural origin and lesser side effects. Researchers are being carried out now days on a large scale to discover the herbal alternatives for various allopathic medicines. Anthelmintic drugs are one such example for which herbal alternatives are being searched. In this research we confirmed the anthelmintic activity of Pomegranate (Punica granatum). Like pomegranate, other drugs, mainly garlic, quassia, barberry are also studied upon for their anthelmintic activity. Ancient man derived more than 90 percent of medicinal agents from higher plants. Even today, traditional system of medicine is practiced in many countries possessing ancient cultures, and major portion of their therapeutic needs are obtained from plant drugs. India with its wide eco geographical and climatic diversity possesses a rich medicinal plant wealth and has a very rich heritage of knowledge in the use of herbal drugs. A large part of population depends even at present time on the indigenous systems of medicine, *Ayurveda, Unani, and Sidha***.** Anthelmintics or antihelmintics are drugs that expel parasitic worms (helminths) from the body, by either stunning or killing them. They may also be called Vermifuges (stunning) or vermicides (killing). There is vast variety of herbal drugs used as Anthelmintics in Ayurveda. Punica Granatum is one of the widely used herbal anthelmintic drugs used in Ayurveda. Pomegranate (*Punica Granatum* L.), a species of Punicaceae, has recently become of great interest to the scientist who engage themselves in pharmaceutical, nutriological and pharmacological research and new drug development, due to its distinctive multiple

officinal parts and multiple bioactivities such as hypolipidemic, antioxidant, antiviral, anti-neoplastic, antibacterial, anti-diabetic, anti-diarrheal and helmithic effects. It also has potential for prevention and treatment of inflammation and cancer.

Colon

Colon was considered as Black Box as most of the drugs were absorbed from upper part of GI tract. It has also been suggested that colonic delivery of orally administered protein and peptide drugs might be possible, because enzyme activity is low in the colon. Besides these low hostile environment , the colonic transit time is long (20-30 hours) and the colonic tissue is highly responsive to the action of absorbtion enhancers Analgesic peptides, oral vaccines, growth hormone and insulin are candidates for use of the colon as a site for absorption. Various diseases that exhibit diurnal rhythms might also be treatable using colon-specific formulations.

Anatomy of Colon

It is a 6-foot long muscular tube that connects the small intestine to the rectum. The large intestine is made up of the ceacum, the ascending (right) colon, the transverse (across) colon, the descending (left) colon, and the sigmoid colon, which connects to the rectum. It is about 1.5 m long, the transverse colon being the largest and most mobile part, and has an average diameter of about 6.5 cm, although it varies in diameter from approximately 9 cm in the ceacum to 2 cm in the sigmoid colon. The appendix is a small tube attached to the ceacum. The large intestine is a highly specialized organ that is responsible for processing waste so that emptying the bowels is easy and convenient.The colon is composed of a number of different layers of tissue:

- The mucosa, the innermost layer, includes a single layer of epithelial cells, a layer of connective tissue, and a thin muscle layer. It is lined with goblet cells, glands that secrete mucous to help the passage of material through the colon.
- The submucosa is a layer of connective tissue beneath the mucosa.
- Muscularis externa.
- The circular muscle is a band of muscle that wraps around the entire colon and helps move waste material through it.
- The serosa is the outermost layer of the colon.
- Subserose called as pericolic fat.

Functions

- Expulsion of the contents of the colon at an appropriate time.
- Colon works as the organ for storing waste products, reabsorbing water from wastes and maintaining water balance in the body.
- Creation of suitable environment for the growth of colonic microorganisms.
- Intestinal bacteria synthesize vitamin K, important in blood clot formation.
- Absorption of sodium and water from the lumen, secretion and excretion of potassium and bicarbonate.

Helmintics Infection

Helmintics are the parasitic agents that cause infection to lower region of stomach depending upon their shape these agents are of fallowing type:

- Cestode (Tape worm)
- Nematodes (Round worms)
- Trematode (Flukes)

Infection with parasitic worms is most common disease in many tropical and subtropical countries. These parasitic worms firmly hold the intestinal mucosa and continue their reproduction by egg

production.Anthelmintics is the agents which are used to destroy or eliminate these parasitic worms from the gastrointestinal tract. They act by killing or paralyzing the worms so that such worms could be easily expelled out of gut. Some Anthelmintic agents also impair the egg production process in the worms. Depending upon their mechanism of action Anthelmintic agents are categories in to Vermifuges and Vermicides.[1,4,6,7,8,9]

MATERIAL AND METHODS

Isopelletierine (API) was extracted from pomegranate seeds using methanol as solvent at institute's laboratory. Ethyl cellulose was procured from S.D. fine chemicals Mumbai, HPMC K-15M was procured from colorcon Asia Pvt. Ltd. Mumbai, Lactose and Isopropyl alcohol was procured from Qualigens fine chemical Mumbai, PVP (K30) from Ozone internationals Mumbai, magnesium stearate from LOBA chemicals, Mumbai, Potassium chloride, potassium dihydrogen phosphate, sodium hydroxide, and hydrochloric acid was procured from Nulife pharmaceuticals Pvt. Ltd. Pune.

Method

Phytochemical investigation of Isopelletierine (alkaloid): to check the presence of Isopelletierine following tests was performed. To perform the test evaporates the methanolic extract and add 0.1N dil. HCl shake well and filter, with filtrate perform fallowing tests.

Phytochemical investigation of Isopelletierine (alkaloid)

Sr. No	Test	Observation	Inference
1	Dragendroff's Test	Orange Brown ppt	Alkaloid Present
2	Wagner's Test	Reddish Brown ppt	Alkaloid Present
3	Mayer's Test	Yellow ppt	Alkaloid Present
4	Tannic Acid Test	Yellow pp	Alkaloid Present

Preparation of Test Reagents

Dragendroff's Reagent

Boil 14 gm of sodium iodide with 5.2 gm bismuth carbonate in 5 ml glacial acetic acid allow standing overnight. Filter & to the filtrate add 160 ml sodium acetate and 1 ml water preserve in amber colored bottle when needed take 20ml glacial acetic acid, to 10 ml of this stock solution then make up the volume up to 100 ml with distilled water.

Wagner's Reagent

Dissolve 1.27 gm of iodine and 2 gm of potassium iodide in 5 ml water and make up the volume to 100 ml with distilled water.

Mayer's Reagent

Dissolve 1.36 gm of mercuric chloride in 100 ml distilled water then add 5 gm of potassium iodide in 20 ml distilled water and finally make up the volume 100 ml with distilled water.

Tannic acid Reagent

Dissolve 5 gm of tannic acid in 20 ml of water and make up the volume 100 ml with distilled water.[6]

Anthelmintic Activity of Pomegranate Seed Extract

Pure drug extract was studied for its anthelmintic activity on earth worms (*Pheretima posthuma*) due to their anatomical and physiological similarity with intestinal round worms.[7]

Preformulation Studies of Drug Extract

Organoleptic Characteristics

Drug extract was studied for the organoleptic characteristics such as color, odor and taste.

Standardization of Drug

Melting Point

The melting point of the drug was measured using capillary melting method.[11]

Development of UV Spectroscopy Method for Drug Extract

UV spectrophotometry is widely employed for routine drug analysis. Therefore the objective of the present study was to develop an UV spectrophotometric method for analysis of drug extract. Calibration curve for drug extract was generated in methanol.

Calibration Curve of Drug Extract

About 10 mg drug extract was accurately weighed and dissolved in 100 ml of methanol. The UV spectrum was recorded in the range of 200-800 nm, to determine λ_{max} value. The absorption maxima were found to be 284 nm. A series of dilution were made from the above stock solution to get the solutions of concentrations ranging 2-10 µg/ml. The scanning was recorded at 284 nm.

Fourier Transform Infra Red Spectroscopy

The infrared spectrum of pure drug extract and drug extract, ethyl cellulose (sample1) and drug extract, HPMC-K15M was recorded by using FTIR spectrophotometer and the spectrum analysis was done.[2]

Differential Scanning Colorimetry Studies

DSC studies were carried out for the pure drug extract and its physical mixtures with ethyl cellulose, HPMC-K15M respectively in the ratio 1:1. The heating rate of 10°C/min between temperatures ranges 30°C-300°C was maintained.[2]

Formulation Development

Trial Batches Formulation

From the literature review it is known that ethyl cellulose and HPMC-K15M are the best for the colon targeting formulations. The trial batches were prepared by using different concentrations of ethyl cellulose, HPMC-K15M and Lactose as shown in fallowing table.

Formulation of Isopelletierine tablets by using different Concentrations of ethyl cellulose, HPMC-K15M and Lactose

Formulation	F1	F2	F3	F4	F5	F6	F7	F8	F9
Isopelletierine	100	100	100	100	100	100	100	100	100
Ethyl cellulose	10	20	30	40	50	60	70	80	90
HPMC-K15M	20	40	60	80	100	120	140	160	160
Lactose	235	205	175	145	115	85	55	25	15
PVP(K30)	25	25	25	25	25	25	25	25	25
Mg.Stearate	10	10	10	10	10	10	10	10	10
IPA	Q.S.	Q.S.	Q.S.	Q.S.	Q.S.	Q.S.	Q.S.	Q.S.	Q.S.
Total Wt.	400	400	400	400	400	400	400	400	400

Note: All quantities are given in mg.

Preparation of Isopelletierine Matrix Tablet

The tablets were prepared by wet granulation method as follows: Drug and the excipients were sieved through sieve no. 85# Kneading of all ingredients were done then the wet mass were prepared by using Pvp k30 paste in isopropyl alcohol as a binder & dough mass was prepared. These passed through sieve no.08 #, then it was dried in oven at 50 ^{0}C for 15 min. then these dried granules were passed through sieve no.16 # after this these granules were lubricated by magnesium Stearate to increase the flow properties of granules. Then Matrix Tablets were compressed with the (Lab Press) 8 station compression machine using 11.6 mm flat punch to form a flat beveled table. The machine was set to yield tablets with mean thickness of 4.45 mm, diameter of 10.0 mm, weight 400 mg and hardness up to 6 kg/cm^2.

The prepared formulations were evaluated for parameters like appearance, hardness, thickness and diameter, weight variation test, friability, *in vitro* dissolution study, drug content, swelling index and matrix integrity study.

Evaluation of Granules-Trial Batches

Powder characteristics

Bulk Density and Tapped Density

The bulk density was measured by using bulk density apparatus. The apparent bulk density was determined by pouring pre sieved bulk drug granules into a graduated cylinder via a funnel and measuring the volume and weight. Tapped density was determined by placing a graduated cylinder containing a known mass of drug on a mechanical tapper apparatus which was operated at fixed number of taps until the powder bed volume had reached to minimum.

The unit of tapped density and untapped density is reported in g/ml.

Bulk density = mass / bulk volume

Tapped density = mass / tapped volume

Carr's index: A simple test has been developed to evaluate the flow ability of a powder by comparing the poured density and tapped density of a powder and the rate at which it packed down. Useful empirical guide is given by Carr's compressibility index.

This is the simple index that can be determined on small quantities of powder and may be interpreted as in Table 6. The Carr's compressibility index can be calculated by using formula:

$$\text{Carr's index in (\%)} = \frac{\text{Tapped density} - \text{Poured density}}{\text{Tapped density}} \times 100$$

Hausner's ratio: Hausner's ratio was determined for characterization of flow of powder blend. A Hausner's ratio greater than 1.25 is considered to be an indication of poor flow ability. Formula used was as follows:

Bulk density / Tapped density

Angle of repose: A static heap of granule**,** with only gravity acting upon it, will tend to form a conical mount. The angle to the horizontal cannot exceed a certain value; this is known as angle of repose (θ). The angle of repose was measured by using the funnel method. The measured quantity of granules was filled in the funnel and powder was allowed to flow on the paper. The area and height of powder covered on paper was measured. The angle of repose was calculated by using formula;

$$\tan \theta = \frac{h}{r}$$

Wherever, θ = Angle of repose

h = Height of heap

r = Radius of surface covered

Relationship between angle of reposes and flow property

Sr. No.	Angle of repose (Degree)	Type of flow
1	< 25	Excellent
2	25-30	Good
3	30-40	Passable
4	>40	Very Poor

Evaluation of Tablets-Trial Batches

Appearance: Matrix tablets were checked for their size, shape and organoleptic characteristics.

Thickness and Diameter: Thickness and diameter of tablets were important for uniformity of tablet size. Thickness and diameter was measured using vernier caliper.

Hardness: The resistance of tablet to shipping or breakage under conditions of storage, transportation and handling.The weight variation test was performed according to the method prescribed in USP. Twenty tablets were randomly selected and individually weighed. The average weight of twenty tablets was calculated.

Allowable Limit for Weight Variation

Sr. No.	Average weight of tablet (X mg)	% Deviation
1	X≤ 80 mg	10
2	80< to <250 mg	7.5
3	X≥250 mg	5

Uniformity of Content

Twenty tablets were crushed and powder equivalent to weight of tablet dissolved in methanol. Then suitable dilutions were made and absorbance at 284 nm was taken by using a UV spectrophotometer. Drug content was calculated and the results obtained were compared with USP standards.

In Vitro Dissolution Studies

In vitro dissolution studies of Isopelletierine matrix tablets were carried out using USP 23 (TDT-08L, Electro lab) dissolution testing apparatus paddle method.[3]

In Vitro Drug Release Study by Enzyme-Triggered System

This dissolution study of optimized batch of isopelletierine tablet was carried out by dissolution apparatus 2^{nd} (DA 6D veego,TDT 08L Electrolab) at rotation speed 100 rpm in a 933.3 ml medium at 37^0c in order to stimulate enzyme in GIT pepsin 0.32%W/V was added in the dissolution medium.The tablet was transfered to dissolution medium and sample were taken at selected time intervals, filtered through whatmans filter paper no.41 and analyzed by U.V spectrophotometer (V-630Jasco) at 284 nm for both acidic and basic medium. The continuous dissolution method USP XXIII was used by stimulating conditions of the GIT. In this study tablet was added in 700ml of 0.1N HCl P^H (1.2) for 2h.at the end of 2h 233.3ml of tribasic sodium phosphate was added to all the dissolution vessels and the P^H was adjusted to 6.5 (1h), 6.8 (2h) and 7.2 (till end of test).by using 2M NaoH or 2M HCl. To evaluate enzyme-triggered drug release of isopelletierine tablet at the end of 3hours pancreatic, a rich product of colonic micro flora in a concentration of 0.1% W/W was added in to P^H 6.5 phosphate buffer to stimulate the degradation of polysaccharide by micro flora in the colon. Matrix integrity Matrix integrity was observed while performing *in vitro* dissolution studies and the swollen mass of the tablets remain intact or not was checked.[10]

Swelling Index Studies

Tablets were weighed individually (W_1) and placed separately in petridish containing phosphate buffer pH 6.8 solution. The petridish was kept in incubator at temperature 37 ± 0.5°C throughout the study. At regular intervals (0.5, 1, 2, 3... 12 h), tablets were removed from the petridish and excess water was removed carefully by using filter paper. The swollen tablets were reweighed (W_2). The swelling index of each system was calculated using the following formula:

Swelling Index = $(W_2- W_1) \times 100/W_1$

Anthelmintic Activity of Formulation (Isopelletierine Matrix Tablet)

Prepared isopelletierine matrix tablet was also studied for its anthelmintic activity on earth worms (pheretima posthuma) to check whether there was any interaction between drug and excipients and results were compared with pure drug extracts result.[10]

Result

Table: Phytochemical investigation of isopelletierine (alkaloid)

Sr. No.	Test	Observation	Inference
1	Dragendroff's Test	Orange Brown ppt	Alkaloid confirmed
2	Wagner's Test	Reddish Brown ppt	Alkaloid confirmed
3	Mayer's Test	Yellow ppt	Alkaloid confirmed
4	Tannic Acid Test	Yellow ppt	Alkaloid confirmed

Discussion

From all the above tests we can conclude that the pomegranate seed extract contains the isopelletierine because isopelletierine is an alkaloid in nature and it was confirmed from the above tests.

Table: Anthelmintic activity of pomegranate seed extract

Sr. No.	Test	Paralysis Time (min)	Death Time (min)
1	Control	-	-
2	Reference	25	38
3	Drug Extract	08	13

Preformulation Studies of Drug Extract

Organoleptic characteristics

Pomegranate seeds extract was dark brown semisolid gel, having pleasant odour and a sweetish taste.

Solubility of drug

The solubility of drug extract was studied in solvents like water, 0.1N NaOH, ethanol, methanol, 0.1N HCL, pH 6.8 phosphate buffers and pH 7.4 phosphate buffer. A required quantity of drug was taken and solubilized in solvents separately and the solubility was observed. Then a suitable medium was selected depending upon the solubility results.It was found very soluble in methanol, water and soluble in ethanol.

Standardization of Drug

Melting point

The melting point was found to be in the range of 192 °C. The reported melting point is about191-193 °C. This confirmed the purity of sample.

Development of UV spectroscopy method for drug extract

The calibration curve for drug extract was generated by using PCP disso V3 software. The graph of absorbance against concentration for drug extract was found to be linear in the concentration range of 2-10 µg/ml at 284 nm. The r^2 of the calibration curve was found to be 0.980. The calibration curve for drug extract in methanol is shown in Figure.

Fourier transform infra red spectroscopy

The infrared spectrum is highly specific for each chemical structure, with small structural differences resulting in significant spectral changes. After running a spectrum, significant peaks relating to major functional groups were identified and a spectrum of sample of drug extract was compared with the standard spectrum from the literature. No spectral changes in comparison to spectrum of pure drug extract. The interpretation of FTIR frequencies is standard were observed. Hence, FTIR spectrum confirmed the structure of the drug.

Differential scanning colorimetry studies

This method is more accurate than the other methods. An additional advantage is that the sample required is only 2-5 mg. When no physical or chemical changes occur within sample then there is neither a temperature change nor input energy to maintain an isotherm. However, when phase changes occur then

latent heat suppresses a temperature change and isothermal energy required registers as an electrical signal generated by thermocouples. Crystalline transitions, fusion, evaporation and sublimation are obvious changes in state which can be quantified.

Granule Characteristics

Bulk density and Tapped density

Table: Evaluation data for Isopelletierine granules

Batch	Bulk Density (gm/cc)	Tapped Density (gm/cc)	Carr's Index (%)	Hausner Ratio	Angle Of Repose (Degree)
F1	0.48±0.26	0.61±0.21	8.19±0.9	1.08±0.3	19.26±1.8
F2	0.51±0.28	0.60±0.24	9.48±0.7	1.10±0.4	24.18±6.7
F3	0.48±0.27	0.56±0.31	11.52±0.4	1.13±0.7	18.16±7.5
F4	0.50±0.29	0.59±0.32	8.47±0.7	1.09±0.4	19.14±6.2
F5	**0.52±0.31**	**0.60±0.34**	**13.12±0.11**	**1.15±0.8**	**21.14±4.5**
F6	0.54±0.33	0.58±0.26	13.60±0.9	1.16±0.9	20.40±3.5
F7	0.49±0.31	0.52±0.34	7.22±0.5	1.08±0.3	18.21±2.7
F8	0.54±0.33	0.57±0.27	10.80±0.7	1.12±0.6	24.14±3.2
F9	0.56±0.34	0.52±0.32	7.22±0.5	1.08±0.4	21.14±2.4

Angle of repose

The angle of repose for the drug was found to be 19.14°. It showed that the drug isopelletierine has good flow characteristic.

Table: Evaluation parameters for trial batches of isopelletierine tablet

Batch	Thickness (mm)	Hardness Kg/cm^2	Friability (%)	Weight Variation (mg)	Batch
F1	4.3±0.3	5.3±1.2	0.52±0.3	399.3±1.7	F1
F2	4.1±0.5	5.8±0.5	0.58±0.4	401.5±1.2	F2
F3	4.4±0.7	6.3±1.3	0.62±0.1	400.7±1.6	F3
F4	4.2±0.6	5.3±0.6	0.55±0.5	398.4±1.8	F4
F5	**4.3±0.9**	**5.9±0.8**	**0.64±0.7**	**399.7±1.9**	**F5**
F6	4.1±0.4	5.5±0.4	0.59±0.6	401.4±1.5	F6
F7	4.2±0.5	5.8±0.6	0.67±0.4	402.1±1.9	F7
F8	4.2±0.8	6.1±0.8	0.70±0.2	398.9±1.0	F8
F9	4.1±0.2	5.0±0.9	0.66±0.5	400.1±1.4	F9

Matrix integrity

Matrices of tablets were found to have good integrity beyond 12 h till the end of dissolution study for all formulations

In vitro dissolution study

In vitro studies were performed to study about the drug release from the dosage form in the physiological condition and kinetics of drug release was studied. Depending upon the *in vitro* release from the dosage form, we can predict the *in vivo* drug release from the same dosage form. The *in vitro* drug release profiles of formulation F1-F9.

Table: In vitro dissolution study (% release)

Time (Hrs)	F1	F2	F3	F4	F5	F6	F7	F8	F9
0	0	0	0	0	**0**	0	0	0	0
1	29.33	28.11	7.08	22.95	**6.78**	7.75	7.39	23.34	24.82
2	32.67	31.07	13.75	30.92	**14.26**	12.05	13.58	29.16	29.76
3	38.08	36.19	20.57	41.95	**19.75**	13.97	19.68	32.86	32.46
4	41.31	40.77	28.25	46.29	**27.35**	20.95	25.52	45.79	44.10
5	46.52	46.54	31.79	48.08	**35.17**	33.42	30.78	49.73	48.35
6	51.75	50.05	38.09	57.96	**51.80**	49.21	38.58	59.79	54.20
7	57.88	61.56	43.47	65.47	**60.73**	56.28	42.05	65.80	58.10
8	64.68	63.83	50.04	70.29	**69.74**	62.74	49.42	72.05	63.78
9	80.10	70.63	59.56	74.46	**77.14**	70.40	56.84	75.69	69.16
10	74.78	73.77	65.67	77.86	**87.84**	82.50	63.08	78.69	75.53
11	79.89	79.77	71.98	81.30	**92.20**	90.36	70.36	82.26	81.17
12	83.25	84.10	74.55	84.07	**98.21**	95.32	76.49	85.75	86.03
13	87.72	88.07	76.05	87.99	**99.11**	97.45	78.20	89.69	86.89

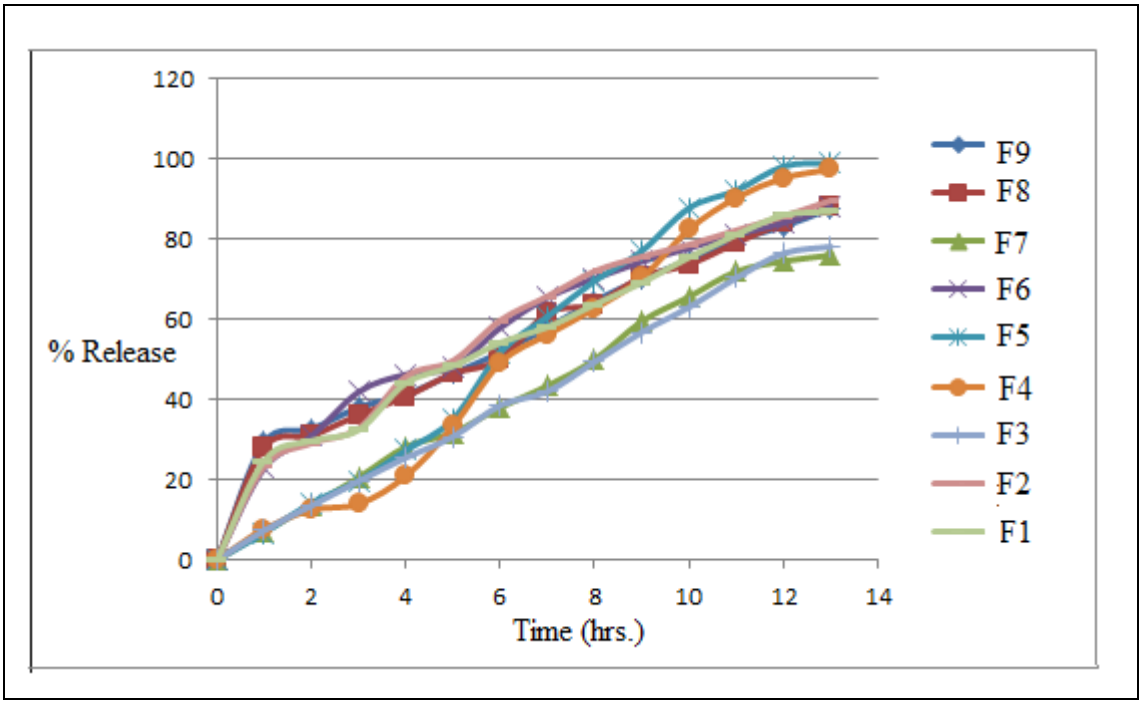

Figure: Dissolution data of all trial batches (% release)

Discussion

In the present study multiparticulate system for colonic drug delivery was developed and tested in *vitro* with enzyme stimulating the GI conditions without the use of fecal matter and scarification of animals as previously done in some studies. The multiparticulate (combination of drug and ph resistant polymer) shows release of drug specifically at the target site after suitable lag time and may contribute in effective treatment of colonic diseases which can be further proven by in *vivo* studies. Diffusion and swelling are the most important rate-controlling mechanisms of colon targeting drug delivery. Hydrophilic materials such as ethyl cellulose, HPMC K15M and lactose were used to control the drug release of highly water soluble isopelletierine. Among all the 9 formulations, formulation F3, F5 and F8 showed good results. The

formulation F5 was selected as optimized formulation as it shows 99.11 % drug release and time required for 50% drug release is 5.69 h.

Swelling index study

Swelling behavior of all 9 formulations was studied. The study showed that swelling increased up to 7-9 h for all formulations and further the tablet starts to erode. In first few hours' water was absorbed by the hydrophilic polymers and weight gain by the tablet was observed. When there is water ingress from outer side to the tablet core, the outer gel layer starts to erode. This erosion of polymer dominates over water sorption after 8 h, due to this the weight of the tablet gets decreased and tends to eroded more quickly and the tablet volume decreases progressively. Optimized formulation F5 shows 294.10 ± 4.58% of swelling index at the end of 8th h. Hydrophilic gums contribute for the swelling behavior of the tablet and also help to maintain the matrix integrity of the tablet. Swelling behavior of all 9 formulations.

Table: Swelling index data

Batch	Swelling index (%)	Batch	Swelling index (%)
F1	291.10 ± 10.20	F7	290.00 ± 9.27
F2	283.33 ± 5.92	F8	292.10 ± 7.46
F3	290.40 ± 8.54	F9	284.15 ± 10.58
F4	283.90 ± 5.71	F6	292.11 ± 12.37
F5	**294.10 ± 4.58**		

Table: Anthelmintic activity of isopelletierine tablet (formulation)

Sr. No	Test	Paralysis Time (min)	Death Time (min)
1	Control	-	-
2	Reference	25	38
3	Formulation	10	15

DISCUSSION

Anthelmintic activity of formulation was carried along with reference of Piperazine citrate & control solution of distilled water. Based on histopathological study report and photographs of samples following conclusion has been made formulation shows more potent activity then reference sample. There was not much difference in paralysing & death time between drug extract &formulation. Hence the selected polymers were concluded compatible with the anthelmintic activity of formulation.

AUTHOR'S CONTRIBUTION

KN was just guided VB how to perform all the activities of research while SD contributed for the Preformulation studies and VB was done all the work from beginning to end.

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REFERENCES

1. CK, Kokate; AP, Purohit and SB, Gokhale (2009), "***Book of Pharmacognosy***", 43th Edition, Nirali Prakashan, Dehli.
2. Gurudeep, R; Chatwal, Sham and K, Anand (2008), "***Instrumental Methods of Chemical Analysis***", 5th Revised and Enlarged reprinted edition. Himalaya publishing house.

3. Brahmankar, DM and Jaiswal, SB (1995), "***Biopharmaceutics and Pharmacokinetics A Treties***",1st Edition, Vllabh Prakashan, New Delhi, 335-57.
4. SS, Kadam; KR, Mahadik and KG, Bothra (2007), "Principles of medicinal chemistry", Vol.1 Nirali prakashan, Dehli.
5. Lachman, L; Lieberman, HA and Kanig, JL(1991), "***The Theory and Practice of Industrial Pharmacy***", 3rd Edition, Varghese publishing house, Hind Rajasthan building Bombay, 293.
6. KR, Khandelwal (2008), "***Practical Pharmacognosy Techniques & Experiments***", 10th Edition, Nirali Prakashan, Pune.
7. Shilpa, Subhedar; Pushpendra, Goswami; Nikita, Rana; Abhishek, Gupta and Pawandeep, Shukla (2001),"***International Journal of Drug Discovery and Herbal Research (IJDDHR***) 1(3), 150-152.
8. Asija, Rajesh; Chaudhari, Bharat and Asija, Sangeeta (2011), "Oral Colon Targeted Drug Delivery System Review On Current And Novel Prespectives", ***Journal of Pharmaceutical and Scientific Innovation***,
9. VR, Sinha; BR, Mittal; KK, Bhutani; Rachana, Kumaria (2012), "Colonic Drug Delivery of 5-flurouracil: An **In vitro** Evaluation", ***International Journal of Pharmaceutics***.
10. MK, Chourasia and SK, Jain (2012), "Approaches to colon targeted drug delivery system", ***J. Pharm. Pharmaceutical Science***.
11. JP, Wibaut and U, Hollstein (1957), "***Archives of Biochemistry and Biophysics***", 69, The Laboratory for Organic Chemistry, Municipal University of Amsterdam Holland, 27-32 .

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