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STUDIES ON MICROBIALLY TRIGGERED ENTERIC COATED TABLETS FOR COLON TARGETED DELIVERY OF MESALAMINE

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Keywords:

Mesalamine, Guar gum, Matrix tablet, Enteric coating, Colon targeting

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ABSTRACT: Objective: This study aims to develop an enteric coated (coated with Eudragit S-100) matrix tablet of Mesalamine to improve the bioavailability by targeting the drug to the colon for the treatment of ulcerative colitis. **Materials and Methods:** Matrix tablets were prepared by wet granulation technique by applying 3^2 full factorial designs for optimization. The independent variables used were the amount of guar gum, and amount of starch paste, each at three different levels and dependent variables was hardness, percent cumulative drug release (% CDR) study at 5^{th} hr. and time required for 90% of drug release ($t_{90\%}$). The prepared matrix tablets were coated with Eudragit S-100. **Result and Discussion:** The prepared tablets were characterized for physical parameters, *in-vitro* drug release (with and without 2% rat ceacal contents) and stability on storage. The optimized formulation was subjected to *in-vivo* roentgen graphic studies to analyze the *in-vivo* behavior of the prepared tablet. The optimized formulation consisting of guar gum (20% w/w) and starch paste (15% w/w) released a negligible amount of drug at pH 1.2 and pH 7.4 whereas the maximum amount of drug release was observed at pH 6.8 in the presence of 2% rat caecal contents. The *in-vitro* drug release of marketed formulation (Mesacol) also studied, the results show that formulation was unable to target drug in the colonic region when compared with the optimized formulation. **Conclusion:** The enteric coated guar gum based matrix tablets of Mesalamine is a potential system to target the drug release in the colon for better treatment of ulcerative colitis.

INTRODUCTION: Colon-specific diseases are often inefficiently managed by oral therapy because most orally administered drugs are absorbed before arriving in the colon. Therefore, colon-specific drug delivery systems, which can deliver drugs to the lower gastrointestinal tract without releasing them in the upper GI-tract, can be expected to increase the quality of life for patients suffering from colon specific diseases.

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Treatment might be more effective if the drug substances were targeted directly on the site of action in the colon. Lower doses might be adequate and, if so, systemic side effects might be reduced.

Several serious diseases of the colon like Inflammatory Bowel Disease (IBD), including Ulcerative Colitis and Crohn's disease, Irritable Bowel Syndromes (IBS), Constipation and Colorectal Carcinoma might be capable of being treated more effectively if drugs were targeted on the colon. Therefore, it appears that targeted drug delivery with an appropriate release pattern could be crucial in providing effective therapy for these chronic diseases. In addition to providing more effective therapy of colon related diseases, colon-specific delivery has the potential to address

important unmet therapeutic needs, including oral delivery of macromolecular drugs.

Various systems have been developed for colon-specific drug delivery. These include covalent linkage of a drug with a carrier, coating with pH-sensitive polymer, time-dependent release system, and enzymatically controlled delivery systems. Enteric coated systems are the most commonly used for colonic drug delivery, but the disadvantage of this system is that the pH difference between small intestine and colon is not very pronounced. These delivery systems do not allow reproducible drug release. The time-dependent release system has the limitation that it is unable to sense any variation in the upper gastrointestinal tract transit time, any variation in the gastric emptying time may lead to drug release in the small intestine before arrival in the colon. Thus applying a single approach for colon-specific drug delivery was unable to target the drug to colon. Therefore in this work, the use of more than one approach, i.e. pH sensitive and enzymatically controlled delivery system, both are selected.

Mesalamine, 5- aminosalicylic acid is very effective in the treatment of inflammatory bowel diseases. However, the systemic circulation of the drug may be associated with acute pancreatitis and nephrotoxicity. This may be optimized with a control drug delivery system, which maximizes topical exposure of the drug to the diseased tissue and minimizes systemic absorption of the drug. Guar gum is a naturally occurring galactomannan polysaccharide; consists of chiefly high molecular weight hydrocolloidal polysaccharide, composed of galactan and mannan units combined through glycosidic linkages and shows degradation in the large intestine due to the presence of microbial enzymes.

In this work, we have used guar gum as a polysaccharide to form a matrix tablet with drug Mesalamine, which was coated with Eudragit S-100 polymer. The Eudragit S-100 is pH sensitive polymers which protect the release of drug in upper GIT and start to dissolve when arriving in the small intestine. In the small intestine, guar gum starts to swell, and when it comes in the colon is degraded by colonic bacteria where the drug is released. In vitro, drug release studies were carried out on Eudragit S-100 coated matrix tablet of Mesalamine in simulated gastrointestinal fluids in presence and absence of rat caecal contents [1-4].

MATERIALS AND METHODS:

Materials: Mesalamine was obtained as a gift sample from Sun Pharmaceuticals Ltd. Mumbai. Eudragit S-100 was obtained as a gift sample from Evonik Roehm Pharma Polymers. Guar gum, starch, and magnesium Stearate were obtained from Research Fine lab, Mumbai. Microcrystalline cellulose (MCC) was obtained from Yarrow Chem Products, Mumbai. Talc was obtained from Loba Chemie private Ltd. All other reagents and solvents used for the study were of pharmacopoeial and analytical grade.

Methods:

Compatibility of Mesalamine with Excipient: A physical mixture of Mesalamine with the polymers like Guar gum, Eudragit S-100 were prepared by mixing in 1:1 w/w ratio using glass mortar. The prepared mixture was examined visually and evaluated for the possible interactions using Differential Scanning Calorimetry (DSC) and Fourier-transform Infrared (FT-IR) spectroscopy.[14]

Visual Examination: Sample of Mesalamine mixture with polymers was subjected to visual examination. Samples were tested for any changes in appearance, such as discoloration, caking, liquefaction, or formation of clumps.

Fourier-Transform Infrared Spectroscopy: FT-IR spectra of drug, polymers and their mixtures were determined using Jasco FTIR -4100, Japan; instrument. The wavelength ranged from 400 to 4000 cm^{-1}.

Differential Scanning Calorimetry: Differential scanning calorimetry (DSC) analysis was performed for pure drug, guar gum, Eudragit S-100, physical mixture using a DSC, Shimadzu TA 60WS, instrument. Each sample was accurately weighed (~1-3 mg) in an aluminum pan, crimped, and hermetically sealed, while an empty pan of the same type was used as a reference. The system was calibrated with a high purity sample of indium. The samples were scanned at the heating rate of 20 ºC/min over a temperature range of 100 to 300 ºC under the nitrogen atmosphere.

Experimental Design: The experiment was designed using 3^2 full factorials for optimization of desired formulation [13]. The independent variables were the amount of guar gum (X_1) and the amount of starch paste (X_2), each at three different levels (-1,0,+1). The dependent variables were hardness (Y_1), % cumulative drug release at 5th h (Y_2), and time required for 90% of drug release ($t_{90\%}$) in pH 6.8 phosphate buffer. A total of nine formulations were prepared, and composition of matrix tablet based on experimental design is shown in **Table 1.**

TABLE 1: COMPOSITION OF GUAR GUM BASED MATRIX TABLET OF MESALAMINE

Formulation code	Mesalamine (mg)	Guar gum (mg)	Starch paste (10% w/v) (mg)	Magnesium Stearate (mg)	Talc (mg)	Microcrystalline cellulose (mg)
F1	400	97.5	34	6.8	6.8	134.9
F2	400	97.5	68	6.8	6.8	100.9
F3	400	97.5	102	6.8	6.8	66.9
F4	400	130	34	6.8	6.8	102.9
F5	400	130	68	6.8	6.8	68.4
F6	400	130	102	6.8	6.8	34.4
F7	400	162.5	34	6.8	6.8	69.9
F8	400	162.5	68	6.8	6.8	35.9
F9	400	162.5	102	6.8	6.8	1.9

Preparation of Matrix Tablet Mesalamine with Guar Gum: The guar gum based colon targeted matrix tablets of Mesalamine were prepared by wet granulation technique using 10% (w/v) starch paste as a binder. Microcrystalline cellulose was used as diluents and a mixture of talc with magnesium Stearate at 1:1 (w/w) ratio was used as a lubricant. Mesalamine and all the excipients previously passed through sieve no. #60. Then, Mesalamine was mixed with the excipients like MCC and guar gum except for the binding agent and lubricant. The blend was mixed for 10 min in a polybag, and later the mixer was granulated with starch paste. The resulting wet mass was passed through a sieve no. #16 and the granules were dried at 50^0C for 15 min to get a loss on drying (LOD) value between 1% and 1.2%, after which they were passed through sieve no #25. Dried granules were blended with magnesium stearate and talc (1:1, w/w). The lubricated granules were then compressed using 13 mm punch [11, 16].

Coating of Matrix Tablet of Mesalamine: During the optimization of coating level, tablets were coated with 4% (w/v) Eudragit S-100 solution to obtain different % weight gain of tablet-like 4%, 5% and 6% and were investigated. Coating level was optimized on the basis of the weight of coated tablet and efficiency of the coat in sealing the drug release in the gastric environment. The prepared matrix tablets were finally coated with 4% (w/v) solution of Eudragit S-100 in 50 ml (1:3) mixture of ethanol 95% (v/v) and isopropyl alcohol to obtained 6% weight gain of the tablets. Dibutyl phthalate (10%, v/v) was added as the plasticizer and talc was added to reduce the tackiness of the tablets. Tablets were coated using conventional pharma R & D coater (Ideal Cures Pvt. Ltd, India). The pan was rotated at the speed of 18 rpm; the coating solution was sprayed at a rate of approximately 1-2 ml/min. The pressure of the atomizer was adjusted to 1-2 kg/cm^2, and the inlet and outlet temperatures were varied from 35 °C to 55 °C. The process was continued until tablets obtained 6% w/w weight gain. The coated tablets were rotated for a further 15 min under blower [7, 8, 10].

Swelling Index: The core tablets were subjected to swelling studies. One tablet from each formulation was randomly selected, weighed (W_1), and placed in a Petri dish containing 10 ml of pH 7.4 phosphate buffer. At regular time interval (20, 40, 60, 80, 100, 120, 140, 160 and 180 min) the tablet was carefully removed from Petri dish and excess of water was removed using filter paper. The swollen tablets were reweighed (W_2), and swelling index of each tablet was calculated using the equation. The analysis was performed in triplicate [10].

$$\text{Swelling Index} = W_2 - W_1 \times 100 / W_1$$

Preparation of Rat Caecal Content Medium: Six rats weighing (150-250g) and maintained on a normal diet were used. To induce enzyme acting specifically on guar gum in the ceacum, 2 ml of 1%

w/v guar gum aqueous dispersion was directly administered to the rats daily for 7 days. Forty-five minutes before the drug release experiment, the rats were sacrificed by cervical dislocation. The abdomen was opened, the caecum was traced, ligated at both the ends, dissected and immediately transferred into pH 6.8 phosphate buffer, previously bubbled with CO_2 to maintain anaerobic conditions. The caecal bags were opened; their contents were weighed and suspended in phosphate buffer to give a final ceacal concentration of 2% w/v [9].

***In-vitro* Drug Release Studies:** The enteric coated tablets of mesalamine with guar gum were evaluated for their integrity in the physiological environment of the stomach and small intestine under conditions mimicking mouth to colon transit. These studies were carried out using a USP XXII / XXIII dissolution rate test apparatus (Apparatus 1, 100 rpm, 37 ºC). The tablets were tested for the drug release for2 hr in 0.1N HCl (900 ml), as the average gastric emptying time is about 2 h. Then the dissolution medium was replaced with pH 7.4 phosphate buffer (900 ml) and tested for 3 h, as the average small intestine transit time is about 3 h. At the end of the periods, samples were taken and analyzed for Mesalamine content using UV spectrophotometer. The susceptibility of guar gum coats to the enzymatic action of colonic bacteria was assessed by continuing the drug release studies in 100 ml of pH 6.8 phosphate buffered saline (PBS) containing 2% w/v of rat caecal contents. The drug release studies were carried out in USP dissolution rate test apparatus (apparatus 1, 100 rpm, 37 ºC) with slight modification. A beaker (capacity 150 ml, internal diameter 55 mm) containing 100 ml of dissolution medium was immersed in 1000 ml vessel containing water, which was in turn in the water bath of the apparatus. The coated tablets were placed in the baskets of the apparatus and immersed in the dissolution medium containing rat caecal contents. The experiments were carried out with continuous CO_2 supply into the beakers to simulate the anaerobic environment of the caecum. The drug release studies were carried out for 21 h (usual colonic transit time is 20-30 h), and 1 ml samples were taken at different time intervals and replaced with 1 ml of fresh PBS bubbled with CO_2. The volume was made up to 10 ml with PBS, centrifuged, and the supernatant liquid was filtered through a bacteria proof filter and analyzed. The above study was carried out for all the Mesalamine coated tablets without rat caecal content in pH-6.8 PBS (control) [5].

Statistical Analysis: Statistical tools such as descriptive statistics, one way ANOVA by Stat-Ease Design expert software were used. A value of $p<0.05$ was considered to be statically significant.

***In-vivo* Studies Roentgenography (X-ray Study):** The protocol for *in-vivo* roentgenographic study was approved by the Institutional Animal Ethics Committee at Y. B. Chavan College of Pharmacy, Aurangabad, India. As per the protocol number CPCSEA/IAEC/Pharmaceutics- 09/2011-12/46, one albino rabbit was used for the study. In this study, the healthy rabbit fasted overnight. The enteric coated tablet of mesalamine containing radio-opaque material such as barium sulfate (20%) was given to fasted rabbit with a glass of water. After administration of tablet, X-ray images were taken at a different time interval to trace movement, location, and integrity of tablet in different parts of GIT [10].

Stability Studies: The best formulation was kept for stability studies in a stability chamber (Thermolab) for three months at temperature 40^0C ± 2 ºC and RH 75 ± 5%, as per ICH Q1A R2 guidelines. The changes in physical appearance, drug content, and *in-vitro* drug release with and without caecal content was observed after intervals of one month.

RESULTS AND DISCUSSION: The FT-IR spectra were used to characterize the possibility of interactions between drug and polymers in the solid state. **Fig. 1** shows the FT-IR spectra of pure drug, polymers, and their physical mixture. The characteristic IR band of Mesalamine was obtained at 3810 cm^{-1} owing to OH stretching mode. The peak at 1619 cm^{-1} corresponds to C=C Stretch of the aromatic group and N-H bond scissoring. The peak 1355 cm^{-1} assigns OH deformation of –OH group. Guar gum shows the characteristic band at 2362 cm^{-1} and Eudragit polymer at 1730 cm^{-1} showing ester vibration [11]. The presence of all characteristic peaks in the spectra of mesalamine mixture with the polymers shows the absence of interaction.

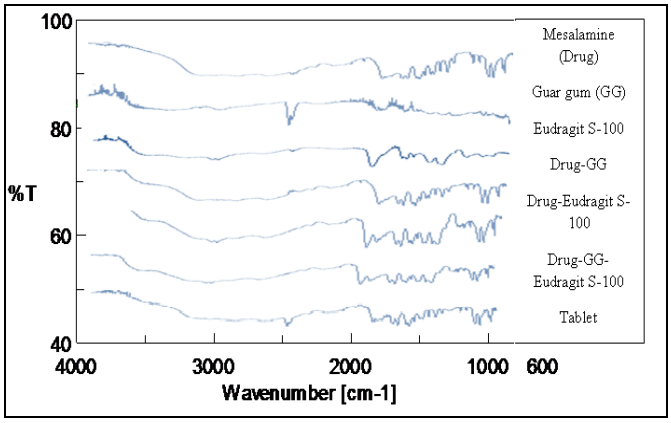

FIG. 1: FT-IR SPECTRA OF DRUG, POLYMERS AND THEIR 1:1 w/w PHYSICAL MIXTURE

The DSC thermogram of Mesalamine, polymers and their mixtures were shown in the **Fig. 2.** The mesalamine shows a sharp endothermic peak at 295.63 ºC, which indicate its pure crystalline form, followed by the decomposition process at a higher temperature after melting. DSC thermogram of guar gum and Eudragit S-100 showed a peak at 100 ºC and 255.46 ºC respectively. The thermogram of the physical mixture showed an endotherm at 289.12 ºC corresponding to mesalamine.

The difference in thermal peaks between the pure components and physical mixture blend may be attributed to sampling geometry effects and the reduction of individual purity in the presence of another component.

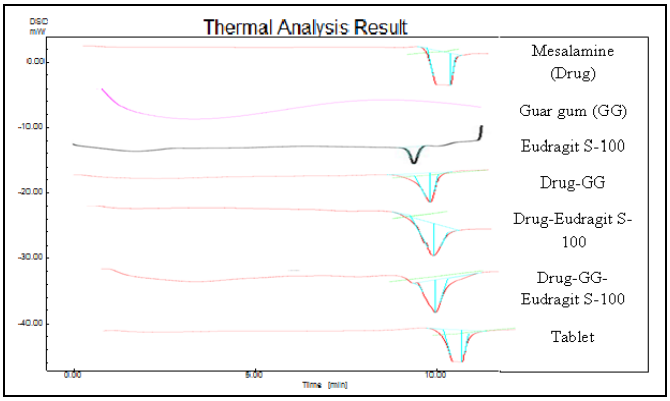

FIG. 2: DSC THERMOGRAM OF DRUG, POLYMERS AND THEIR 1:1 W/W PHYSICAL MIXTURES.

Based on the factorial design, tablets were prepared and evaluated for weight variation, thickness, hardness, drug content, friability, and swelling index. The results of this study are shown in **Table 2.**

TABLE 2: EVALUATION OF PREPARED MATRIX TABLET

Formulation code	Weight (mg)	Thickness (mm)	Hardness (Kg/cm^2)	Friability (%)	Drug content (%)	Swelling index (%)
F1	681.3±2.3	6.3 ± 0.06	4.2±0.29	0.69± 0.05	99.29±0.54	19.49±1.03
F2	676.0±3.6	5.3 ± 0.05	4.5±0.00	0.61 ± 0.06	99.88±0.28	17.61±1.65
F3	676.3±4.04	6.6 ± 0.05	4.7±0.28	0.53 ± 0.05	100.52±0.5	15.67±0.73
F4	679.0±1.15	6.0 ± 0.00	4.0±0.50	0.63 ± 0.08	98.91±0.35	26.91±1.43
F5	683.0±2.3	5.3 ± 0.06	4.33±0.29	0.47 ± 0.06	99.62±0.51	23.9±0.96
F6	675.6±2.0	6.3 ± 0.06	4.83±0.29	0.57 ± 0.04	100.21±0.36	17.99±0.48
F7	672.6±2.51	6.3 ± 0.05	4.16±0.76	0.71 ± 0.07	99.39±0.54	31.85±2.64
F8	682.3±2.5	6.6 ± 0.06	4.66±0.28	0.53 ± 0.05	100.78±0.32	28.36±0.47
F9	258.0±2.06	7.3 ± 0.06	5.33±0.29	0.13 ± 0.50	99.04±0.42	24.87±0.92

*All values are means ± SD, n=3

***In-vitro* Drug Release Studies:** In initial studies, dissolution of the marketed tablet (Mesacol) was studied to determined effectiveness of coat in sealing the drug release in the small intestine, shown in the **Fig. 3C** (which follow only single approach). During the study it was found that tablet unable to seal the drug release in the upper GIT; the tablet was completely dissolved within 4 hrs.

According to factorial design, tablets were prepared and coated with 4% (w/v) Eudragit S-100 solution to obtain different % weight gain of tablet-like 4%, 5%, and 6%. But during the evaluation, it was found that tablets with 4% and 5% weight gain were not effective in sealing the drug release in the gastric environment. Thus 6% weight gain of 4% (w/v) coating level was selected since it exhibited satisfactory sealing of drug release in the gastric environment.

On the evaluation of % CDR at 5th h (mean ± S.D) of formulation F1-F9 in pH 7.4 phosphate buffer for 3 h., it was found that formulation F1, F2, and F3 show % CDR 8.4 ± 0.87%, 7.8 ± 1.12% and 7.2 ± 0.87% respectively which contain 15% of guar gum. As the level of starch paste increased from 5% (w/w) in F1 to 15% (w/w) in F3, the % CDR at 5th h decreased. This could be due to the reason that increased levels of starch paste in the tablets increased their ability to resist disintegration in the

intestinal fluid. As the amount of guar gum was increased from 15% (w/w) to 20% (w/w) in formulations F4–F6, the % CDR at 5th h decreased to 4.8 ± 1.04%, 4.3 ± 1.17% and 3.7 ± 0.99% for F4, F5, and F6 respectively. This shows that as the concentration of guar gum increases % CDR at 5th hr. decreases. On further increased in guar gum concentration, *i.e.* 20% in formulation F7, F8, and F9, which shows drug release 3.3 ± 0.76%, 2.8 ± 0.79%, and 2.4 ± 1.70% respectively. The reduction in the amount of % CDR at 5th h with an increase in the amount of guar gum can be explained based on the fact that guar gum tends to swell and form a gel at higher pH which might be contributing towards the decrease in the release profile owing to the formation of a diffusion control layer. The % CDR at 5th h for F9 formulation was found to be only 2.4 ± 1.70% which contained a higher amount of (15% w/w) of starch paste.

Finally, the drug release behavior of all formulation tablets was determined in pH 6.8 phosphate buffer containing 2% (w/v) of rat caecal contents (colonic environment). Amongst all formulations, F1 was found to exhibit the maximum amount of drug release, *i.e.* 96.55 ± 0.60% in the colonic environment. This could be due to the presence of the lowest amount of guar gum in F1 formulation.

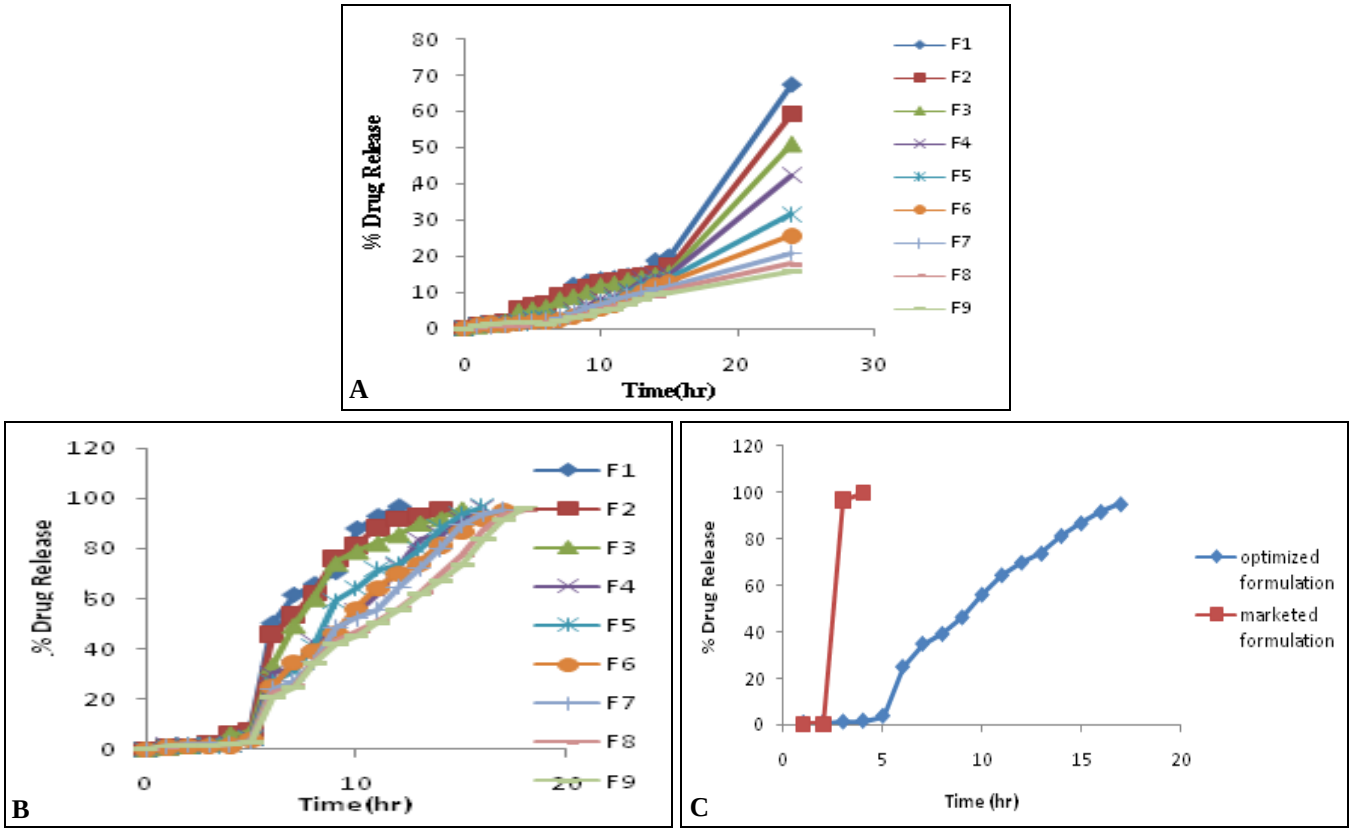

FIG. 3: DISSOLUTION PROFILES OF MESALAMINE TABLETS

A. Dissolution profiles of Mesalamine tablets in dissolution media without ceacal contents.
B. Dissolution profiles of Mesalamine tablets in dissolution media with ceacal contents.
C. Dissolution profiles of optimized formulation (F6) and marketed formulation Mesacol tablet.

After evaluating the experimental formulations for all the above parameters, their release behavior in the colonic environment was further analyzed using response surface methodology. For optimized formulation it was desirable that it should exhibit minimum drug release in stomach and small intestine whereas maximum drug release in the colon; whereas time is taken to release the majority of the drug in the colon should be minimum. To determine the levels of factors (X1 and X2), which yielded optimum drug release responses, mathematical relationships were generated between the dependent and independent variables (responses) using Design expert software. Multiple regression analysis for 3^2 factorial designs, as shown in the **Table 3.**

TABLE 3: MULTIPLE REGRESSION ANALYSIS OF 3^2 FACTORIAL BATCHES FOR (HARDNESS, % CDR AT 5th h & $T_{90\%}$)

Source	Degree of freedom	Sum square	Mean square	F-value	Prob>F
		Y_1= Hardness			
Model	2	1.05	0.53	8.38	0.0183
X_1	1	0.010	0.010	0.17	0.6978
X_2	1	1.04	1.04	16.60	0.0065
	R^2=0.7365	AdjR^2=0.648	PredR^2=0.2957	SD=0.25	CV=5.61
Equation		Y_1=4.47+0.042X_1+0.42 X_2			
		Y_2=% Cumulative Drug Release(%CDR) at 5thhr			
Model	5	47.21	9.44	156.36	0.0008
X_1	1	42.45	42.45	703.09	0.0001
X_2	1	1.88	1.88	31.16	0.0114
X_1X_2	1	9.000E-004	9.000E-004	0.015	0.9105
X_1^2	1	2.85	2.85	47.17	0.0063
X_2^2	1	0.023	0.023	0.38	0.5827
	R^2=0.9962	Adj R^2=0.989	Pred R^2=0.956	SD=0.25	CV=4.53
Equation		Y_2= 4.70-2.66X_1-0.56X_2 +0.015X_1 X_2 +1.19X_1^2-0.11 X_2^2			
		Y_3=Time required for 90% drug release ($t_{90\%}$)			
Model	2	33.21	16.60	23.83	0.0014
X_1	1	28.17	28.17	40.43	0.0007
X_2	1	5.04	5.04	7.04	0.0361
	R^2=0.8882	Adj R^2=0.850	Pred R^2=0.739	SD=0.83	CV=5.80
Equation		Y_3=14.39+2.17X_1+0.92 X_2			

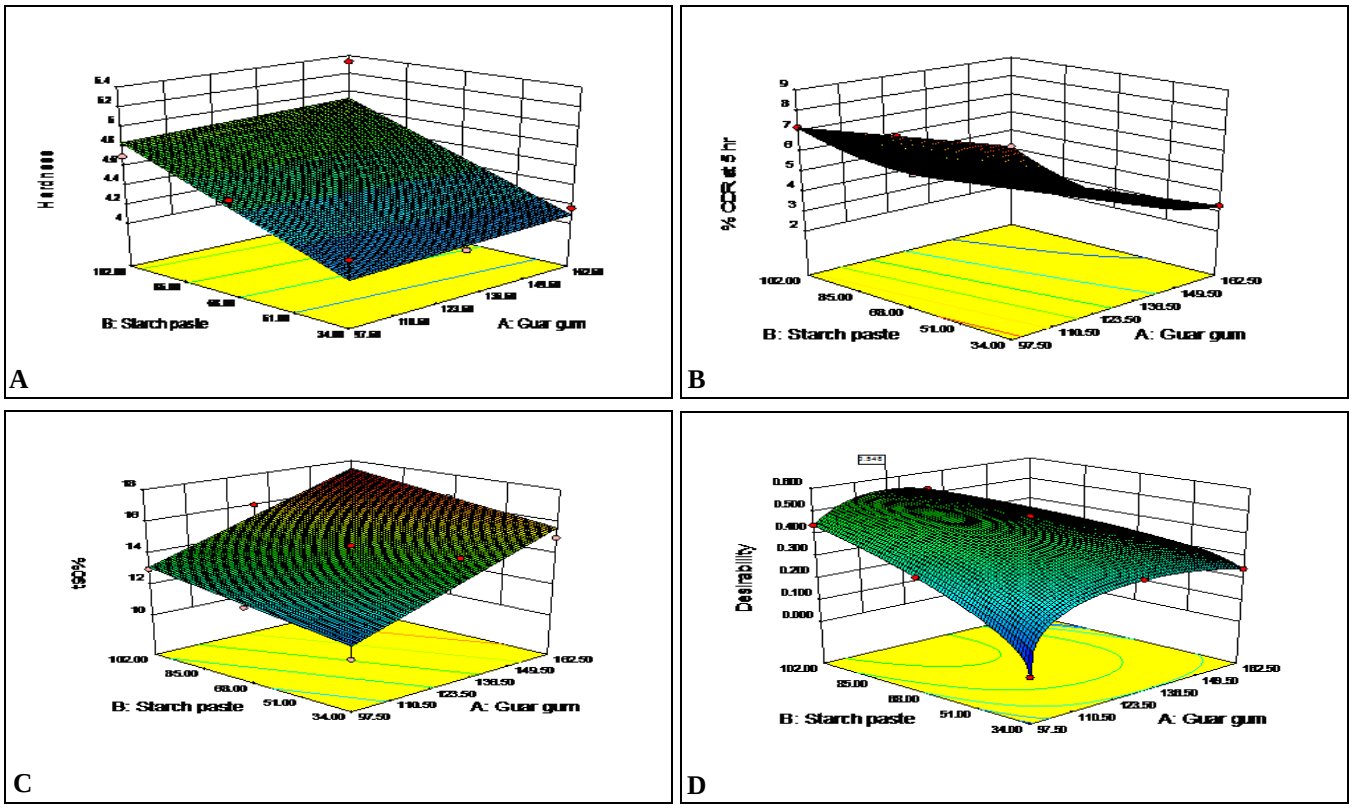

FIG. 4: RESPONSE SURFACE PLOTS SHOWING EFFECT OF GUAR GUM AND STARCH PASTE ON (A) HARDNESS, (B) % CDR AT 5th h, (C) $T_{90\%}$ AND (D) DESIRABILITY OF OPTIMIZED FORMULATION

Selection of Optimized Formulation: The formulation F6 was selected as the best formulation according to the design expert software with the desirability factor 0.548. The optimized formulation exhibited a hardness of 4.83 Kg/cm^2, 3.7% of CDR after 5th h, and $t_{90\%}$ at 16 h.

***In-vivo* Roentgenographic Study:** In an *in-vivo* study, tablet of optimized formulation (F6) containing barium sulfate was prepared, and overnight fasted rabbits were made to swallow the tablet, at specified interval X-ray images were taken **Fig. 5**.

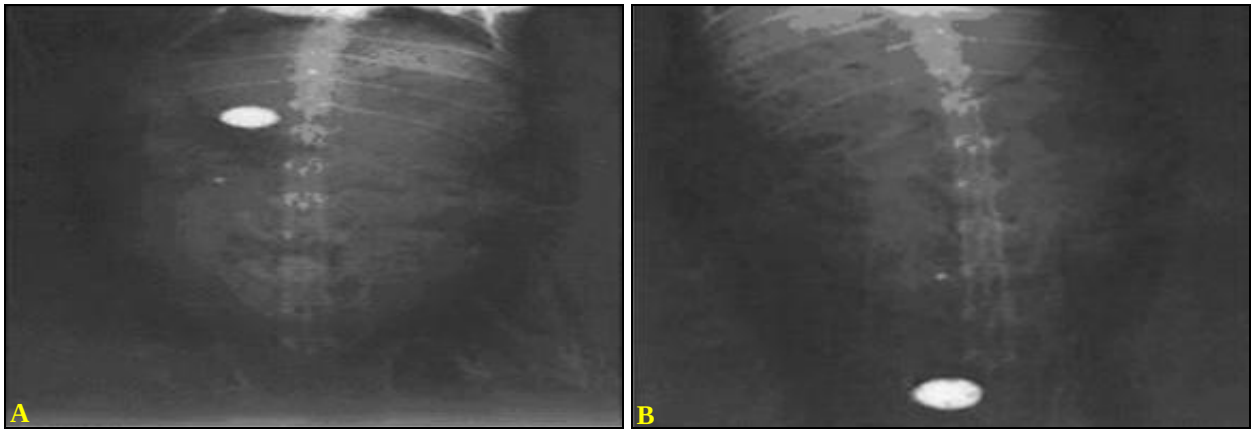

FIG. 5: X-RAY IMAGE SHOWING THE LOCATION OF TABLET IN DIFFERENT PARTS OF GIT, IN RABBIT
(A): After the first hour of administration in the stomach.
(B): After the seventh hour of administration in the colon.

From X-ray images, it is observed that the enteric coated tablet remained intact in the upper part of GIT and then swelled in the colon.

Stability Studies: The optimized formulation was subjected to stability studies for three months (40 ºC ± 2 ºC and 75% ± 5% RH). The physical appearance and drug content were found to be within limits during the storage period. The *in-vitro* drug release in presence & absence rat caecal content was also taken; it can be seen that a slight decrease in release of drug and kinetic model showed Peppas model with R values corresponding to 0.99.

CONCLUSION: The enteric coated, guar gum based matrix tablet of mesalamine for colonic delivery was successfully optimized using 3^2 factorial design. Single approach (pH sensitive method) is unable to target the drug Mesalamine in the colon for the treatment of ulcerative colitis. FTIR and DSC data also confirm that there is no chemical interaction of the drug with the other components used in the formulation. A 6% weight gain of 4% (w/v) coating level of Eudragit S-100 was found to be capable of preventing the drug release in the gastric environment. The optimized tablets contained 20% (w/w) of guar gum as matrix former and 15% (w/w) of 10% (w/v) starch paste as a binder. The optimized formulation was the best formulation having hardness 4.83 Kg/cm^2, 3.7% CDR after 5 h and $t_{90\%}$ at 16 h; this was determined using Design Expert Software. *In-vivo* studies in albino rabbits revealed intactness of the tablet in the stomach, small intestine and it swollen tablet core in the colon.

Accelerated stability studies established the physical integrity of the formulation & chemical stability of the drug. Hence, the present study concludes that microbially triggered guar gum based colon targeted enteric coated (coated with Eudragit S-100) matrix tablets of Mesalamine are a potential system to target the drug release in the colon for better treatment of ulcerative colitis.

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CONFLICT OF INTEREST: Nil

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