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Formulation and Evaluation of Sustained Release Tablets of Esomeprazole Using Natural and Synthetic Polymers

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Abstract: ***The main objective of the present study is to prepare and evaluate in vitro sustained release tablets to improve the bioavailability, reduce the number of doses and to increase patient compliance for the treatment of Zollinger Ellison syndrome and peptic ulcer disease. The tablets were prepared by direct compression method using carbopol 934 and xanthan gums, hydroxyl propyl methyl cellulose as polymers. The tablets were evaluated for their micromeritic properties and in vitro release as well as by Fourier transform infrared (FTIR). The data showed FTIR and DSC results indicate that the drug was compatible with the polymers used. Among all formulations F2 showed the most suitable sustained release properties with 99.65% of drug release at the end of 12 h. The results indicated that a decrease in release kinetics of the drugwas observed by increasing the polymer concentration. The release data was fitted to various mathematical models such as, Higuchi, Korsmeyer- Peppas, First-order, and Zero order to evaluate the kinetics and mechanism of the drug release. From this studies it sis concluded that the Tablets prepared with xanthan gum were revealed that increase in the concentration retards the drug release and can be used as a sustained release delivery system for Esmoprazole.***

Keywords: Esomeprazole, HPMC K 15M, Xanthan Gum, Carbopol 934, Sustained release

1. Introduction

Oral route is the most preferred route for administration of drugs. Tablets are the most popular oral formulation available in the market and preferred by the patients and physician alike. In long-term therapy for the treatment of chronic disease conditions. Conventional formulations are required to be administered multiple doses and therefore have several disadvantages [1]. The primary benefit of a sustained release dosage form, compared to a conventional dosage form, is the uniform drug plasma concentration and therefore uniform therapeutic effect. Over the past two decades, sustained release dosage forms have made significant progress in terms of clinical efficacy and patient compliance. Matrix devices, due to their chemical inertness, drug embedding ability and drug release character, have gained steady popularity for sustaining the release of a drug [2].

Zollinger-Ellison syndrome is a condition in which the patient suffers from ulcers in the upper digestive tract (that do not respond to medications), excessive gastric acid secretion and diarrhea. The increased acid secretion results in inflammation and ulcers in the stomach and lower food pipe, and diarrhea [3]. Esomeprazole is chemically bis(5-methoxy-2- [(S)-[(4-methoxy-3,5-dimethyl-2 pyridinyl) methyl] sulfinyl]-1-H-benzimidazole-1-yl), a compound that inhibits gastric acid secretion. Esomeprazole is inactive at neutral pH, but at pH < 5 rearranges to two charged cationic forms (a sulphenic acid and a sulphenamide configurations) that react covalently with SH groups of the H+K+ATPase enzyme and inactivate it irreversibly, especially when two molecules of omeprazole react with one molecule of the enzyme. Its bioavailability is 89% and has a plasma elimination half life of 1.5 h [4]. Esomeprazole reduces the production of digestive acids, thus minimizing their effect on the esophagus [6]. The main aim of the present study is to develop and evaluate the novel sustained release tablets of esmoprazole using natural and synthetic polymers on the release rate and *in vitro* evaluation.

2. Materials and Methods

2.1 Chemicals

Esomeprazole magnesium was procured as a gift sample from Dr. Reddy's Laboratories Ltd, Hyderabad, India, HPMC, Xanthangum, and Magnesium stearate were provided by Pharma Train, Hyderabad. Microcrystalline cellulose was purchased from Signet chemicals, Mumbai. Magnesium stearate, Talc and Potassium hydrogen phthalate were purchased from S.D Fine chemicals Ltd, Mumbai. All other chemicals used in our work were of analytical grade.

2.2 Methods

Preformulation studies: Drug-excipient compatability studies

Fourier Transform Infrared spectroscopic studies

A Fourier Transform – Infra Red spectrophotometer was used to study the non-thermal analysis of drug-excipient (binary mixture of drug:excipient 1:1 ratio) compatibility. The spectrum of each sample was recorded over the 450-4000 cm-1. Pure drug of Esomeprazole with physical mixture (excipients) compatibility studies were performed.

2.3 Standard graphs

Standard graph of Esomeprazole in Phosphate buffer pH 6.8:

100 mg of Esomeprazole was dissolved in small amount of phosphate buffer and make the volume up to 100mL with phosphate buffer pH 6.8, from this primary stock (1mg/mL), 10 mL solution was transferred to another volumetric flask made up to 100 mL with Phosphate buffer pH 6.8. From this secondary stock 0.1, 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, mL was

taken separately and made up to 10 mL with phosphate buffer pH 6.8 to produce 1, 2, 4, 6, 8, 10, 12 µg/mL respectively. The absorbance was measured at 302 nm using a UV spectrophotometer.

Standard graph of Esomeprazole in phosphate buffer pH 0.1N HCL:

100 mg of Esomeprazole was dissolved in small amount of phosphate buffer and make the volume up to 100mL with phosphate buffer pH 0.1N HCL, from this primary stock (1mg/mL), 10 mL solution was transferred to another volumetric flask made up to 100 mL with phosphate buffer 0.1N HCL. From this secondary stock 0.1, 0.2, 0.4, 0.6, 0.8, 1.0,1.2 mL was taken separately and made up to 10 mL with phosphate buffer pH 0.1N HCL, to produce 1, 2, 4, 6, 8, 10.µg/mL respectively. The absorbance was measured at 302 nm using a UV spectrophotometer.

Extended release tablets were prepared by direct compression method. All ingredients were weighed and passed through 40# sieve, blended except lubricant. These above granules were lubricated with Magnesium stearate, which was previous, passed through 60# Sieve. The lubricated granules were for compressed 100 mg tablet using 6mm die and punches, with hardness between 5-6 kg/cm2

2.4 Solubility Studies

The solubility of Esomeprazole in phosphate buffer solution pH 6.8, pH 0.1N HCL and water was determined by phase equilibrium method. An excess amount of drug was taken into 20 ml vials containing 10 mL of phosphate buffers (pH 6.8, and pH 0.1N HCL). Vials were closed with rubber caps and constantly agitated at room temperature for 24hrs using rotary shaker. After 24hrs, the solution was filtered through 0.2µm Whatman's filter paper. The amount of drug solubilized was then estimated by measuring the absorbance at 302 nm using a UV spectrophotometer. The standard curves for Esomeprazole were established in phosphate buffers (pH 6.8 and 0.1) and from the slope of the straight line the solubility of esomeprazole was calculated. The studies were repeated in triplicate (n = 3) and mean was calculated.

2.5 Formulation and preparation of tablets

Sustained release tablets were prepared by a direct compression method, before going to direct compression all the ingredients were screened through sieve no.100. Esomeprazole was mixed manually with different ratios of HPMC K 15M, PVA and Xanthan gum, carbopol 934 as polymers and MCCP101 as diluent for 10 min. The blend was mixed with Magnesium stearate for 3-5 min and then compressed into tablets by the direct compression method using 6mm flat faced punches. The tablets were compressed using a sixteen station SISCO rotary tablet-punching machine. The mass of the tablets was determined using a digital balance (SHIMADZU) and thickness with digital screw gauge. The composition of different formulas of esomeprazole sustain release matrix tablets is shown in table1.

Table 1: Formulation composition for tablets

Formulation No.	Esomeprazole	Xanthan gum	HPMC K 15	Carbopol 934	PVA	Mg. Stearate	Talc	MCC pH 102
F1	20	10	-	-	10	4	4	QS
F2	20	20	-	-	10	4	4	QS
F3	20	30	-	-	10	4	4	QS
F4	20	-	10	-	10	4	4	QS
F5	20	-	20	-	10	4	4	QS
F6	20	-	30	-	10	4	4	QS
F7	20	-	-	10	10	4	4	QS
F8	20	-	-	20	10	4	4	QS
F9	20	-	-	30	10	4	4	QS

All the quantities were in mg

Evaluation of blend

Angle of repose

The angle of repose of granules was determined by the funnel method. The granules were allowed to flow through the funnel freely onto the surface. The diameter of the powder cone was measured and angle of repose was calculated using the following equation.

$$\text{Tan } \theta = h/r$$

Where h and r are the height and radius of the powder cone respectively.

Bulk Density Both loose bulk density (LBD) and tapped bulk density (TBD) were determined and calculated by using the following formulas.

LBD=weight of the powder/volume of the packing

TBD=weight of the powder/tapped volume of the packing

Compressibility index: The compressibility index of the granules was determined by Carr's compressibility index.

Carr's index (%) = [TBD-LBD] /TBD X 100

Esomeprazole evaluated for post compression parameters like hardness, weight variation, friability, drug content uniformity etc. The data was presented in Table 2.

Average weight

Weight variation was studied by taking 20 tablets of each formulation, they were weighed on an electronic balance (Shimadzu, AUX 220, Japan), and the test was carried according to the Indian Pharmacopoeia.

Hardness and Friability

Hardness indicates the ability of a tablet to withstand mechanical shocks while handling. The hardness of the

tablets was determined using Pfizer hardness tester (Table 5).

Friability test:
Weighed amount of 20 dedusted tablets were subjected to rotating drum of friability test apparatus. The drum was rotated at a speed of 25 rpm for 4 minutes and reweighed the tablets.
% friability was calculated by the following formula.
% friability = {(Initial weight – final weight) / Initial weight} X 100 %

Friability of tablets less than 1% of their weight are considered acceptable.

Determination of drug content The drug content was carried out by weighing 10 tablets from each batch and calculated the average weight. Then the tablets were triturated to get a fine powder. From the resulting triturate, powder was weighed accurately which was equivalent to 5 mg Esomeprazole and dissolved in 100 ml volumetric flask containing 50 ml of 0.1N HCL and volume was made to 100 ml with solvent. The volumetric flask was shaken using sonicator for 1 hr and after suitable dilution with 0.1N HCL, the drug content was determined using UV-Visible Spectrophotometer at 302 nm.

***In- Vitro* dissolution studies of Esomeprazole extended released tablets**
The dissolution test for Esomeprazole control release tablets was done by using 0.1N HCL for 2hrs after which the dissolution medium was changed to 4.5 pH acetate buffer for 2hrs and finally to 6.8 phosphate buffer period using USP type II (paddle). Dissolution Testing Apparatus (Electrolab) 900ml of the medium was used as dissolution medium agitated at 50 RPM, at temperature of 37 ^{OC} ± 0.5^{OC}. 5 ml samples were withdrawn from 1-20 hrs. An equal volume of fresh medium was immediately replaced to maintain the dissolution volume. The amount of Esomeprazole dissolved was determined by taking reading of absorbance at the wavelength of maximum absorbance of about 302 nm of filtered portion of samples withdrawn. Dissolution studies were performed two times for each tablet formulation and the mean values were taken. The studies were carried out in triplicate, and the release data obtained were fitted into various release models, namely, zero order (Eq 1), first order (Eq 2), Higuchi (Eq 3) and Korsmeyer-Peppas (Eq 4).

$$Qt = Kot \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$
$$\ln Qt = \ln Qo - K1t \quad \ldots\ldots (2)$$
$$Qt = Kh\, t^{1/2} \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$
$$Mt/Mo = Kp\, tn \quad \ldots\ldots\ldots\ldots\ldots (4)$$

Where K is constant, Qt is the amount of drug released at time, 0 or t, Mt is also the amount of drug diffused at tome, 0 or t. To determine release mechanism, the parameters n and k in the Korsmeyer Peppas equation were computed[7]. The data was presented in (Table 9), the mechanism of drug release was shown in (Fig.8-11).

3. Results and Discussion

Esomeprazole is used to treat dyspepsia, peptic ulcer disease (PUD), gastroesophageal reflux disease (GORD/GERD) and Zollinger-Ellison syndrome. Esomeprazole has the very low biological half life of about 1.5 hr. Therefore formulating tablets is going to extend the release upto 6-12 hrs and also going to avoid the acidic environment in which the is unstable. Esomeprazole tablets were prepared by direct compression technique, using natural polymers like guargum, hydrophilic polymers like HPMC K 15M, Carbopol 934 P.

Determination of absorption maximum values
The UV-Visible Spectrum of Esomeprazole (10µg/ml) in 6.8 pH phosphate buffer was shown in fig. 1. The maximum absorbance was observed at 302 nm.

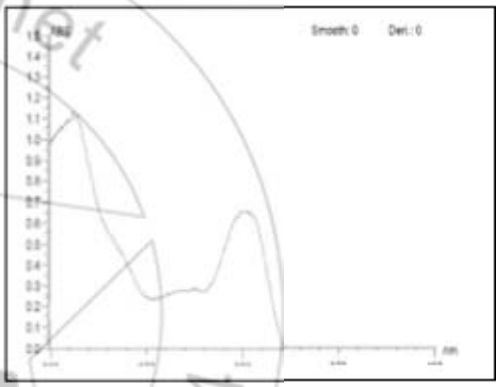

Figure 1: UV absorption spectrum of Esomeprazole in 6.8 pH phosphate buffer

Preformulation study

Preformulation studies are primarily done to investigate the physicochemical properties of drug and to establish its compatibility with other excipients.

FTIR Compatibility Studies
In the FTIR spectra of pure drug and formulation with other ingredients (different polymers) it is observed that the peaks of major functional groups of Esomeprazole, which are present in spectrum of pure drug, are observed. It means that there are no interactions between drug and other ingredients in a physical mixture and drug is compatible with other ingredients.

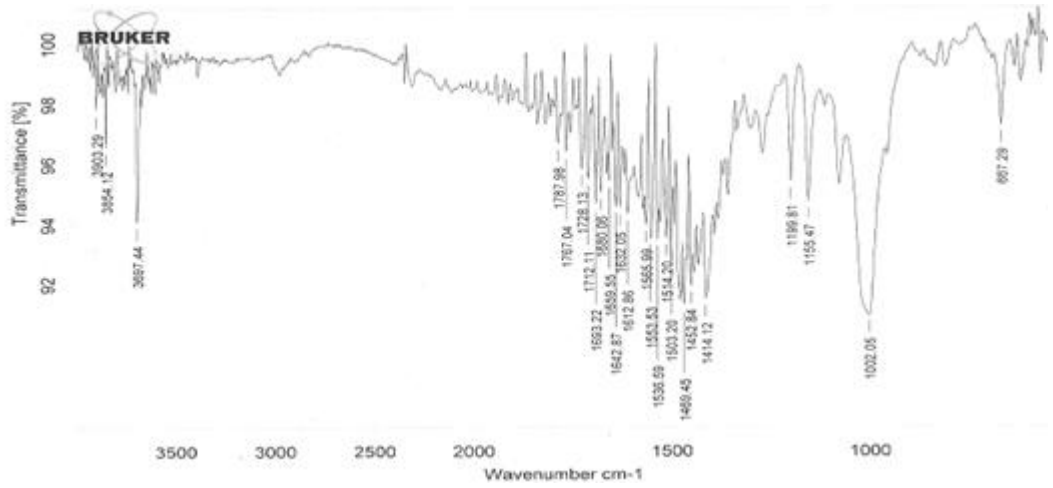

Figure 2: FT-IR Spectrum of Esomeprazole pure drug

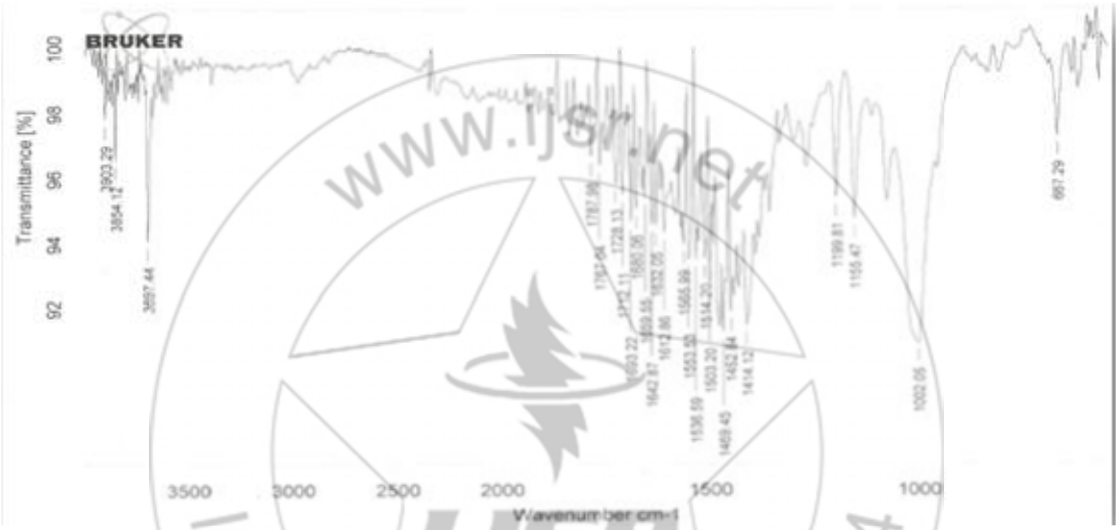

Figure 3: FT-IR Spectrum of Optimised Formulation

Standard graph in phosphate buffer pH 6.8 (λ max 302nm)

Standard graph of Esomeprazole was plotted as per the procedure in experimental method and its linearity is shown in table 2 and fig.4**.** The standard graph of Esomeprazole showed good linearity with R^2 of 0.999, which indicates that it obeys "Beer- Lamberts" law.

Table 2: Observations for graph of Esomeprazole in p H 6.8 phosphate buffer (302nm)

Concentration [µg/ml]	*Absorbance*
0	0
5	0.181
10	0.362
15	0.543
20	0.712
25	0.867

It was found that the estimation of Esomeprazole by UV spectrophotometric method at λ_{max}304 nm in pH 6.8 Phosphate buffer. had good reproducibility and this method was used in the study. The correlation coefficient for the standard curve was found to be closer to 1, at the concentration range, 5-25µg/ml. The regression equation generated was y = 0.035x + 0.007.

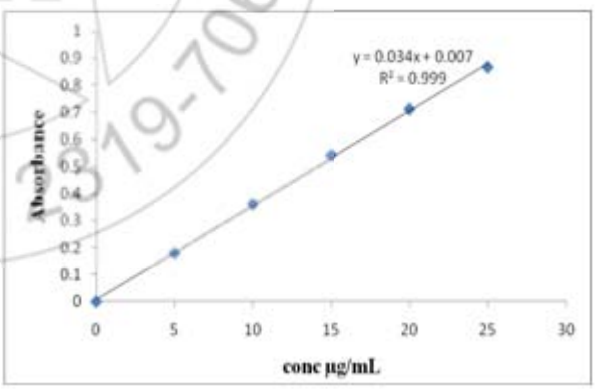

Figure 4: Standard graph of Esomeprazole pH 6.8 phosphate buffer (302nm)

Standard graph in phosphate buffer pH 0.1 N HCL (λ max 302nm)

Standard graph of Esomeprazole was plotted as per the procedure in experimental method and its linearity is shown in Table 3 and Fig. 6. The standard graph of Esomeprazole showed good linearity with R2 of 0.9972, which indicates that it obeys "Beer- Lamberts" law. It was found that the estimation of Esomeprazole by UV spectrophotometric method at λ_{max} 302 nm in 0.1N Hydrochloric acid had good reproducibility and this method was used in the study. The correlation coefficient for the standard curve was found to

be closer to 1, at the concentration range, 5-25µg/ml. The regression equation generated was y = 0.024x+0.001.

Table 3: Observations for graph of Esomeprazole in p H 0.1 N HCL phosphate buffer (302nm)

Concentration [µg/ml]	*Absorbance*
0	0
5	0.12
10	0.248
15	0.361
20	0.482
25	0.61

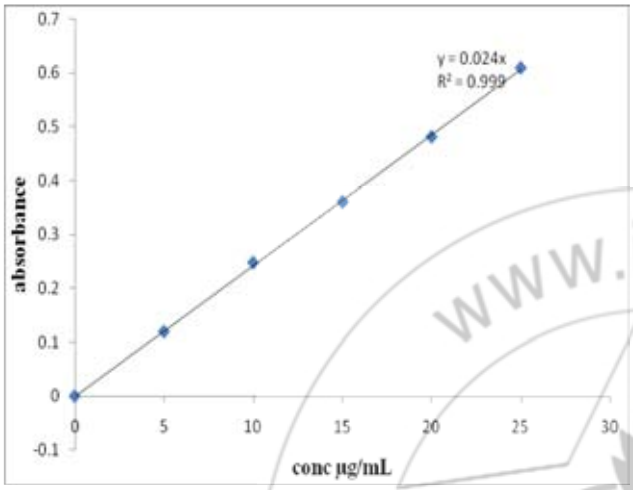

Figure 5: Standard graph of Esomeprazole in 0.1N HCl

Tablet powder blend was subjected to various pre-formulation parameters. The angle of repose values indicates that the powder blend has good flow properties. The bulk density of all the formulations was found to be in the range of 0.49±0.05 to 0.54±0.02 (gm/cm3) showing that the powder has good flow properties. The tapped density of all the formulations was found to be in the range of 0.57±0.06 to 0.65±0.04 showing the powder has good flow properties. The compressibility index of all the formulations was found to be ranging from 14.03 to 18.75 (Carr's index). Which shows that the powder has good flow properties. All the formulations has shown the hausner's ratio ranging between 1.16±0.02 to 1.21±0.07 indicating the powder has good flow properties.

Table 4: Preformulation parameters of powder blend

Form-ulation Code	Angle of Repose	Bulk density (gm/ml)	Tapped density (gm/ml)	Carr's index (%)	Hausner's Ratio
F1	25.01±0.21	0.49±0.05	0.57±0.06	14.03±0.01	1.16±0.02
F2	26.8±0.35	0.56±0.04	0.67±0.08	16.41±0.00	1.19±0.05
F3	27.7±0.42	0.52±0.09	0.64±0.02	18.75±0.09	1.23±0.06
F4	25.33±0.48	0.54±0.05	0.64±0.04	15.62±0.05	1.18±0.08
F5	25.24±0.52	0.53±0.02	0.65±0.05	18.46±0.09	1.22±0.07
F6	28.12±0.35	0.56±0.03	0.66±0.02	15.15±0.02	1.17±0.05
F7	27.08±0.47	0.58±0.01	0.69±0.05	15.94±0.01	1.18±0.04
F8	25.12±0.51	0.48±0.09	0.57±0.05	15.78±0.05	1.18±0.06
F9	26.45±0.65	0.54±0.02	0.65±0.04	16.92±0.04	1.2±0.07

Quality Control Parameters For tablets:

Tablet quality control tests such as weight variation, hardness, and friability, thickness, and drug release studies in different media were performed on the compression tablet. This indicates the powder blends are good for direct compression. It was observed from (Table 4) that the prepared tablets were evaluated for Weight variation, Hardness, Friability, Thickness, Drug content. Thickness was found to be in the range of 3.8 to 3.6 mm. Hardness of the tablets was in the range of 4.2 ± 0.2 to 4.6 ± 0.2 kg/cm2 which was sufficient for the handling of tablets throughout the shelf life. Percentage % friability was between 0.50 – 0.55 % and complies with pharmacopoeial limit of less than 1%. Average weight is between 399.5 – 400 mg which is a pharmacopoeial limit. Drug content of Esmoprazole found to be in the range of 99.8 to 99.4, was within the limits as per I.P and ICH guidelines

Table 5: *In vitro* quality control parameters for tablets

Formulation codes	*Average Weight (mg)*	*Hardness (kg/cm2)*	*Friability (%loss)*	*Thickness (mm)*	*Drug content (%)*
F1	399.5	4.5	0.50	3.8	99.8
F2	401.2	4.5	0.51	3.9	99.1
F3	399.5	4.4	0.51	3.9	99.8
F4	400.6	4.5	0.55	3.9	99.7
F5	401	4.4	0.56	3.7	99.3
F6	400	4.5	0.45	3.7	99.5
F7	399.5	4.1	0.51	3.4	99.8
F8	399.5	4.3	0.49	3.7	99.8
F9	400	4.5	0.55	3.6	99.4

All the parameters such as weight variation, friability, hardness, thickness and drug content were found to be within limits.

***In Vitro* Drug Release Studies**

In vitro drug release studies were conducted in phosphate buffer pH 6.8 and the studies revealed that the release of Esomeprazole from different formulations varies with characteristics and composition of matrix forming polymers as shown in graphs. The release profile of formulations made of Xanthn Gum (F1-F3) were given in fig.11 more than 90% (t90%) of the drug released in 6 hrs for F1, 11hrs for F2, & 12hrs for F3 formulation. F1 and F2 were unable to sustain the drug release for desired period of time. Drug: polymer ratio for F3 is 1:1.5, this F3 formulation was considered as an optimized formulation among all these formulations because it released maximum amount of drug.

Table 6: Dissolution Data of Esomeprazole Tablets Prepared With Xanthan gum Different Concentrations

Time (hr)	Cumulative percent drug dissolved		
	f1	f2	f3
0	0	0	0
0.5	28.18	23.93	18.4
1	34.47	31.68	22.3
2	50.38	39.77	29.5
3	79.33	44.51	32.3
4	84.38	52.97	41.3
5	89.45	59.84	52.6
6	93.4	65.81	59.4
7	96.8	70.91	65.2
8	99.2	78.29	72.3

9		83.94	79.5
10		89.88	82.5
11		93.82	89.1
12		99.65	91.2

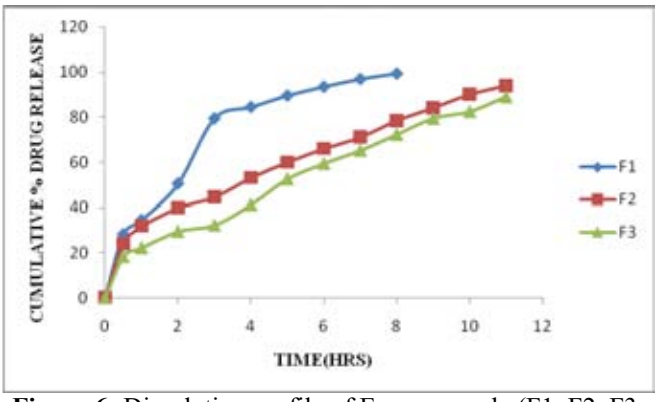

Figure 6: Dissolution profile of Esomeprazole (F1, F2, F3 formulations).

The release profile of formulations made of HPMC K 15 (F4-F6) were given in fig.8 more than 90% (t90%) of the drug released in 4 hrs for F4, 6 hrs for F5, & less than 90% in 6hrs for formulation F6. F4 was unable to sustain the drug release for desired period of time. Drug: polymer ratio for F5 is 1:1, this F5 formulation was considered as an optimized formulation among all these formulations because it released maximum amount of drug in desired period of 6hrs and showed good swelling index properties with increase in polymer ratio the *invitro* drug release was decreased such a case is seen in F6 formulation.

Table 7: Dissolution Data of Esomeprazole Tablets Prepared With HPMC K 15 in Different Concentrations

TIME (hr)	CUMULATIVE percent drug dissolved		
	f4	f5	f6
0	0	0	0
0.5	37.25	34.24	30.62
1	48.26	43.37	34.86
2	54.16	48.63	40.35
3	71.01	65.04	48.45
4	88.26	70.25	54.8
5	99.1	87.33	59.25
6		94.41	65.24
7		98.56	70.73
8			78.34
9			85.52
10			99.17

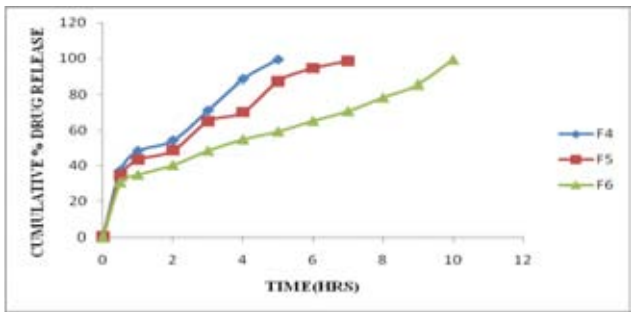

Figure 7: Dissolution profile of Esomeprazole (F4, F5, F6 formulations)

Table 8: Dissolution Data of Esomeprazole Tablets Prepared With carbopol 934 in Different Concentrations

Time (hr)	Cumulative percent drug dissolved		
	f7	f8	f9
0	0	0	0
0.5	8.2	3.2	1.9
1	13.2	8.9	2.2
2	16.3	12.3	8.3
3	22.4	17.4	12.3
4	26.3	19.3	17.4
5	29.5	22.4	19.3
6	32.8	25.6	22.4
7	38.4	32.3	25.6
8	42.5	37.6	32.9
9	48.15	42.8	37.5
10	56.36	52.6	42.7
11	73.46	62.3	52.3
12	85.51	72.3	62.8

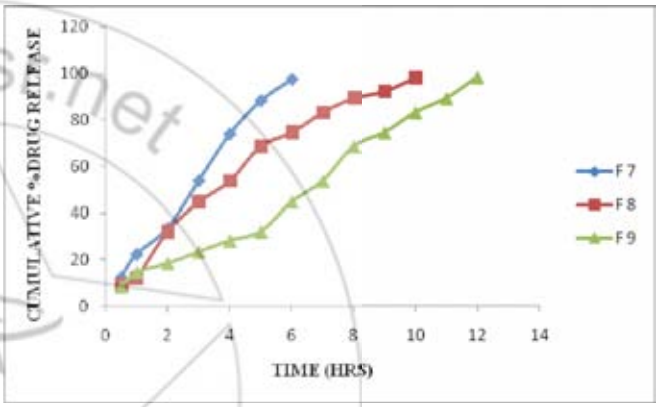

Figure 8: Dissolution profile of Esomeprazole (F7, F8, F9 formulations)

The release profile of formulations made of Carbopol 934 (F7-F9) were given in fig.8 more than 90% (t90%) of the drug released in 12 hrs for F7, 12 hrs for F8 & F9. F8 & F9 was unable to sustain the drug release for desired period of time. Shows that with increase in polymer ratio the in vitro drug release was decreased such a case is seen in F9 formulation. Formulations prepared with Carbopol 934 retard the drug release more than 12hrs. These formulations also did not take into consideration. Formulations prepared with xanthan gum were revealed that increase in the concentration retards the drug release. Among all formulations F2 formulation was considered as optimised formulation because it released maximum amount of drug in desired period of time. It was shown 99.65% drug release at 12hrs.

Determination of the Release Kinetics

The release of amoxicillin and Esomeprazole from the optimized formula was determined by finding the best fitting of the dissolution data to the mathematical models like zero order, first order, Higuchi's model, and the results are shown in table 9. From the graphs it was evident that the formulation F2 was followed Higuchi release kinetics.

Table 9: Release kinetics data for optimised formulation

Cumulative (%) Release Q	Time (T)	Root (T)	Log (%) Release	Log (T)	Log (%) Remain	Release Rate (Cumulative % Release / T)	1/Cum% Release	Peppas Log Q/100	% Drug Remaining
0	0	0			2				100
23.93	0.5	0.707	1.379	-0.301	1.881	47.86	0.0418	-0.621	76.07
31.68	1	1	1.501	0	1.835	31.68	0.0316	-0.499	68.32
39.77	2	1.414	1.6	0.301	1.78	19.885	0.0251	-0.4	60.23
44.51	3	1.732	1.648	0.477	1.744	14.837	0.0225	-0.352	55.49
52.97	4	2	1.724	0.602	1.672	13.243	0.0189	-0.276	47.03
59.84	5	2.236	1.777	0.699	1.604	11.968	0.0167	-0.223	40.16
65.81	6	2.449	1.818	0.778	1.534	10.968	0.0152	-0.182	34.19
70.91	7	2.646	1.851	0.845	1.464	10.13	0.0141	-0.149	29.09
78.29	8	2.828	1.894	0.903	1.337	9.786	0.0128	-0.106	21.71
83.94	9	3	1.924	0.954	1.206	9.327	0.0119	-0.076	16.06
89.88	10	3.162	1.954	1	1.005	8.988	0.0111	-0.046	10.12
93.82	11	3.317	1.972	1.041	0.791	8.529	0.0107	-0.028	6.18
99.65	12	3.464	1.998	1.079	-0.456	8.304	0.01	-0.002	0.35

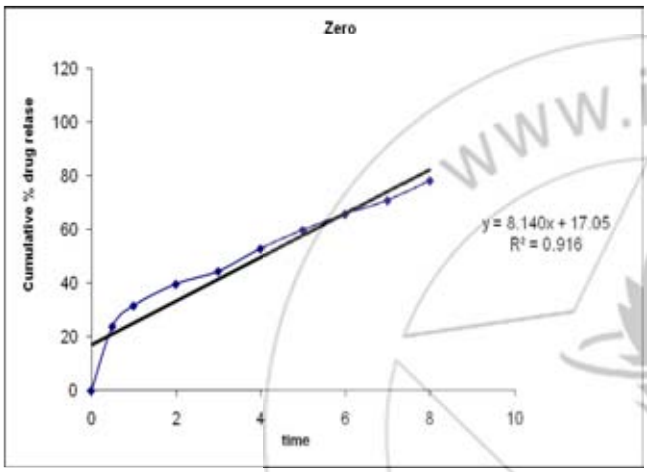

Figure 9: Zero order release kinetics graph

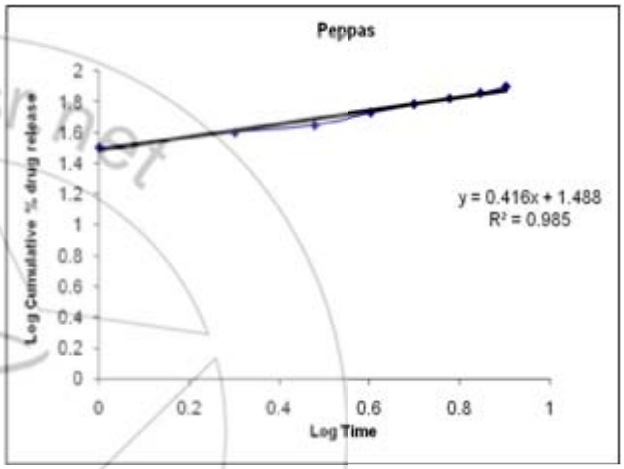

Figure 11: Karsmayer peppas graph

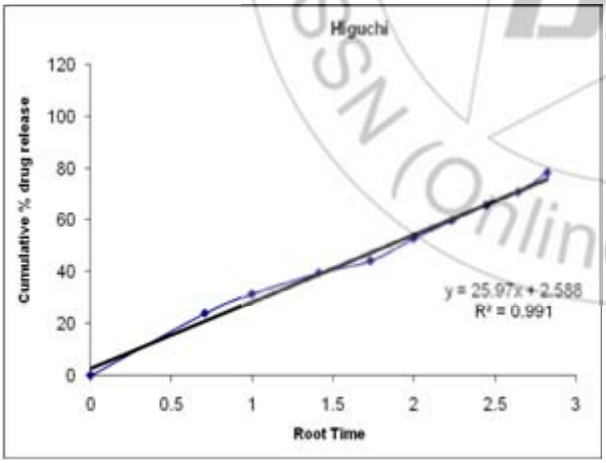

Figure 10: Higuchi release kinetics graph

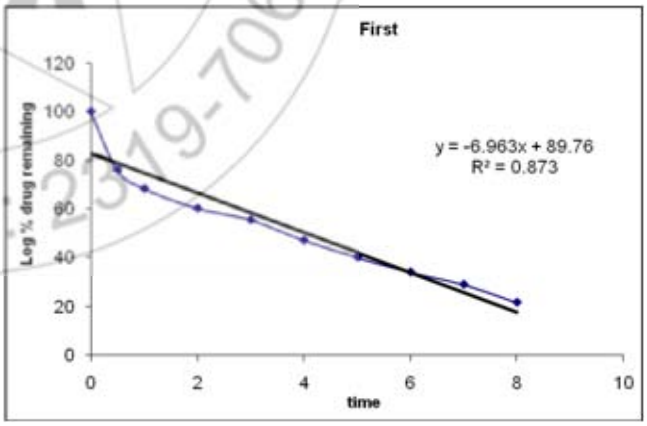

Figure 12: First order release kinetics graph

4. Conclusion

The results of this investigation enabled us to fabricate extended release matix tablets containing Esomeprazole. It is also demonstrated that the release of Esomeprazole from directly compressed matrix tablets can be modified by changing the type and amount of polymer in the matrix tablets. The aim of the study was to study the effect of various hydrophilic and hydrophobic polymers on *in-vitro* release rate from sustained release tablets of Esomeprazole. The formulation was developed by using various polymers

such as HPMC K 15 M and Xanthan gum, Carbopol 934. The formulation blend was subjected to various preformulation studies, flow properties and all the formulations were found to be good indicating that the powder blend has good flow properties. Among all the formulations prepared by using HPMC K 15 M were unable retard drug release up to 12 hours. Hence those formulations did not take into consideration. Formulations prepared with Carbopol 934 retard the drug release more than 12hrs. These formulations also did not take into consideration. Formulations prepared with xanthan gum were revealed that increase in the concentration retards the drug release. Among all formulations F2 formulation was considered as optimised formulation. It was shown 99.65% drug release at 12hrs. The optimised formulation dissolution data was subjected to release kinetics, from the release kinetics data it was evident that the formulation followed Higuchi mechanism of drug release.

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References

[1] P.R. Ravi, S. Ganga, R.N. Saha, American Association of Pharmaceutical Scientists Pharm Sci Tech., 2007; 8(4): 1-9.
[2] S.C. Basak, K.S. Kumar, M. Ramalingam, Brazilian Journal of Pharmaceutical Sciences., 2008; 44(3): 477-482.
[3] What is Zollinger – Ellison syndrome? What causes Zollinger Ellision syndrome? Medical news today: [cited 2011 Sep 16].
[4] Scott LJ, Dunn CJ, Mallarkey G, Sharpe M. Esomeprazole: a review of its use in themanagement of acid-related disorders. Drugs 2002; 62(10): 1503-1538.
[5] Locust bean gum powder [homepage on internet] Glyconutrition for life [cited 2011 July 29]http://www.glyconutritionforlife.org/Science_of_Gly c onutrients/Locust_Bean_Gum_ Powder.php
[6] Peppas NA. Analysis of Fickian and non-Fickian drug release from polymers. Pharm. Acta Helv 1985; 60:110-111.
[7] Altaf AS, Friend DR, MASRx and COSRx. Sustained-Release Technology in Rathbone MJ, Hadgraft J, Robert MS, Modified Release Drug Delivery Technology, Marcell Dekker Inc., New York, 2003; 1: 102-117.
[8] Reddy KR., Mutalik S, Reddy S. AAPS Pharm. Sci. Tech.2003; 4: 19. 121-125.
[9] Mohammed AD et al. Release of propranolol hydrochloride from matrix tablets containing sodium carboxymethylcellulose and Hydroxypropyl methyl cellulose. Pharm Dev Tech.1999; 4: 313-324.
[10] Salsa T, Veiga F. Drug Develop. Ind Pharm. 1997; 23: 931.
[11] Jantzen GM, Robinson JR, Sustained and controlled-release drug delivery systems, inBanker GS, Rhodes CT (Eds.) Modern Pharmaceutics, 3rd Ed, Revised andExpanded, Drugs and the Pharmaceutical Sciences., Marcel Dekker, Inc. NewYork. 1995; 72: 575-609.
[12] Jantzen GM, Robinson JR. Sustained and Controlled-Release Drug Delivery systems Modern Pharmaceutics, 4thed; 2003; 121: 501-502.
[13] Lee BJ, Ryu SG, Cui JH, Drug Dev. Ind.Pharm.1999; 25: 493-501.
[14] N.Aruna,Formulation And Evaluation Of Sustained Release Matrix Tablets Containing Metformin Hcl And *Syzygium cumin* International Journal of Pharmaceutical & Biological Archives 2011; 2: 112-115.
[15] Sameer shafi,formulation and evaluation of sintered matrix tablets of diltiazem hydrochloride ,international journal of pharmaceuticeuts 2011; 3: 67-73.
[16] Kamlesh J.Formulation of Sustained Release Metformin Hydrochloride Matrix Tablets: Influence of Hydrophilic Polymers on the Release Rate And *In Vitro* Evaluation, International Journal of Research in Controlled Release, 2011; 9-16: 43-49.
[17] G.N.K.GaneshPreparation and Evaluation of Sustained Release Matrix Tablet of Diclofenac Sodium using Natural Polymer journal of pharmaceutical research.2010; 2 6: 103-107.
[18] 3.Leon Lachman, Herbert A. Lieberman & Joseph L.Kanig. "The theory and practice of industrial pharmacy" 3rd edition. Page no: 331-332 & 364-368, Varghese – Bombay.
[19] Raymond C. Rowe, Paul J Sheskey, and Paul J Weller. "Hand book of pharmaceutical excipients. Fourth edition 2003 page no: 373.568.297.454.641.566. & AAPS pharmscitech 2007, Royal Pharmaceutical society of Great Britain (London).
[20] J.G.Hardy, J.N.C.Healey"evaluation of an enteric-coated delayed-release 5-aminosalicylic acid tablet in patients with inflammatory bowl disease" *Aliment .pharmacol .therpy*.(1987).