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Formulation and *in vitro* Characterization of Propranolol Hydrochloride Extended Release Matrix Tablets

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Abstract
Extended release dosage forms cover a wide range of prolonged action preparations that provide continuous release of their active ingredients for a specified period of time. Propranolol hydrochloride is an anti-hypertensive agent which is used in the treatment of hypertension. The present investigation describes the preparation and evaluation of extended release matrix tablets of highly water soluble propranolol hydrochloride using different synthetic (HPMC K4M, HPMC K100M) and natural (sodium alginate, xanthan gum) polymers in which the matrix tablets were prepared by direct compression method in various drug: polymer concentration. Physical observation at room conditions (temp, RH) and Fourier transform infrared spectroscopy (FTIR) study concluded that no chemical interaction between drug and excipients used. The prepared blends were evaluated for tests angle of repose, bulk density, tapped density, compressibity index and hausner's ratio. The tablets were analysed to determine the hardness, friability and *in vitro* release study was carried out. Dissolution studies were carried out in pH 1.2 HCl media and followed by pH 6.8 phosphate buffer media up to 24 hrs. In this investigation it is confirmed that the release rate from the matrix tablets which are prepared by xanthan gum were shown better release than other. The results of formulations F10 (99.63) were extend the release of propranolol HCl upto 24hrs. The formulations were found to be stable and reproducible.

Keywords
Propranolol HCl, Natural polymers, Synthetic polymers, extended release, direct compression.

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INTRODUCTION
Pharmaceutical dosage forms that release the drug slower than normal manner at predetermined rate and necessarily reduce the dosage frequency by two folds are known as extended release dosage forms.

The advantages of extended release dosage forms over conventional forms include the less fluctuation in drug blood levels, frequency reduction in dosing, enhanced convenience and compliance, reduction in adverse side effects and reduction in overall health care costs[1,2].

In Diffusion systems, the release rate of a drug being dependent on its diffusion through an inert membrane barrier. Usually, this barrier is an insoluble polymer. It may be a) Reservoir devices, b) Matrix devices. Matrix devices consist of drug dispersed homogenously throughout a polymer matrix. In the model, drug in the outside layer exposed to the bathing solution is dissolved first and then diffuses out of the matrix. This process continues with the interface between the bathing solution and the solid drug moving toward the interior. For this system, rate of dissolution of drug particles within the matrix must be much faster than the diffusion rate of the dissolved drug leaving the matrix.

The use of polymeric matrix devices to control the release of a variety of therapeutic agents has become increasingly important in the development of modified release dosage forms. This device may be a swell able, hydrophilic monolithic systems, erosion controlled monolithic systems or non-erodible systems. The hydrophilic gel forming matrix tablets are extensively used for oral extended release dosage forms due to their simplicity, cost effectiveness and reduction of the risk of systemic toxicity due to Dose dumping[3,4].

Propranolol HCl is a nonselective beta-adrenergic receptor blocking agent possessing no other autonomic nervous system activity. It is freely soluble in water and slightly soluble in organic solvents. It is readily absorbed from the gastrointestinal tract with oral bioavailability of about 33%. Approximately 90% of circulating propranolol is bound to plasma proteins (albumin and alpha1 acid glycoprotein) Propranolol is highly lipophilic and almost completely absorbed after oral administration. However, it undergoes high first-pass metabolism by the liver and on average, only about 25% of propranolol reaches the systemic circulation. Peak plasma concentrations occur about 1 to 4 hours after an oral dose.

Administration of protein-rich foods increase the bioavailability of propranolol by about 50% with no change in time to peak concentration, plasma binding, half-life, or the amount of unchanged drug in the urine. The volume of distribution of propranolol is approximately 4 liters/kg.

Propranolol crosses the blood-brain barrier and the placenta, and is distributed into breast milk. Propranolol is extensively metabolized with most metabolites appearing in the urine. Propranolol is metabolized through three primary routes, aromatic hydroxylation (mainly 4-hydroxylation), N-dealkylation followed by further side-chain oxidation, and direct glucuronidation. It has been estimated that the percentage contributions of these routes to total metabolism are 42%, 41% and 17%, respectively, but with considerable variability between individuals. The four major metabolites are propranolol glucuronide, naphthyloxylactic acid and glucuronic acid, and sulfate conjugates of 4-hydroxy propranolol[5,6].

MATERIALS AND METHODS:

Propranolol Hydrochloride is gift sample from Dr. Reddy's Pvt Ltd, Hyderabad; Xanthungum, HPMC K100M & K4M are taken from Dow chemical company, USA; Microcrystalline cellulose is taken from Ferro chemicals, USA[7].

PREFORMULATION STUDIES

Drug – excipient compatibility studies:

There is always possibility of Drug - Excipient interaction in any formulation due to their intimate contact. It is also necessary to determine any possible interaction between excipients used in the formulation. This will also indicate success of stability studies[28].

The excipients weighed according to mentioned ratio and shifted through BSS #30 and blended together. The mixture placed in Petri dish and kept at 40^0C/75% RH. The dishes were observed for every week up to 4 weeks for any physical incompatibility like lump formation, color change.

Fourier transform infrared spectroscopy:

Infrared spectra matching approach was used for the detection of any possible chemical reaction between the drug and the polymer. A physical mixture (1:1) of drug and polymer was prepared and mixed with suitable quanta of potassium bromide. About 100mg of this mixture was compressed to form a transparent pellet using a hydraulic press at 10tons pressure. It was scanned from 4000 to 400cm^{-1} in a Shimadzu FTIR 8400 spectrophotometer. The IR spectrum of the physical mixture was done to detect any appearance or disappearance of peaks.

Preparation of Calibration Curve:

Various concentrations of Propranolol HCl were prepared using pH 1.2 HCl media and pH 6.8 buffer media. The absorbance of these concentrations was noted at λ_{max} and calibration curve was plotted taking Concentration on x-axis and Absorbance on y-axis.

The equation for the calibration curve was determined and used for calculation of concentration of unknown samples.

Formulations of Propranolol Hydrochloride matrix tablets[8]:

Sifting: The required quantities of Propranolol Hydrochloride, Avicel PH 101 and HPMC were accurately weighed and passed through sieve no 40.

Mixing: The sifted material was mixed in Plastic bag for 5 minutes.

Sifting: The dried granules were passed through sieve no 30.

Lubrication: Sifted granules were lubricated with Magnesium stearate, which was passed through sieve no 40.

Compression: The total blend was poured into the hopper of 16-station compression machine and tablet weight was set to target weight of 240mg. The tablets were compressed using round shaped punches with 3.7 mm diameter with a hardness of about 4-6kg/cm^2.

Prepared formulations:

The formulations of propranolol HCl were prepared by direct compression technique using HPMC K4M, HPMC K100M, sodium alginate and Xanthan gum as release retarding agents in different ratios employing dibasic calcium phosphate, Microcrystalline cellulose as diluents, talc and magnesium stearate as glidant and lubricant.

FORMULATION-TABLE:

Ingredients	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
Losartan	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Guar gum	160	200	---	---	100	75	100	---	---	100	75	100	---	---	---
HPMC K100M	---	---	160	200	75	100	100	---	---	---	---	---	100	75	100
Xanthun gum	---	----	---	---	---	---	---	160	200	75	100	100	75	100	100
MCC	120	80	120	80	105	105	80	120	80	105	105	80	105	105	80
Mg.stearate	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Talc	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Total tablet wt in mg	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400

Pre-compression evaluation parameters[9]

Angle of repose:

The angle of repose of powder blend was determined by the funnel method. The accurately weight powder blend were taken in the funnel. The height of the funnel was adjusted in such a way the tip of the funnel just touched the apex of the powder blend. The powder blend was allowed to flow through the funnel freely on to the surface. The diameter of the powder cone was measured and angle of repose was calculated using the following equation.

$$\tan\theta = h/r$$

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

Comparison between angle of repose & flow properties

Angle of repose(θ)	Flow
<25	Excellent
25-30	Good
30-40	Moderate
>40	Poor

Bulk density & Tapped density:

Both bulk density (BD) and tapped density (TD) was determined. A quantity of 10 gm of powder blend from each formula, previously shaken to break any agglomerates formed, was introduced in to 50 ml measuring cylinder. After that the initial volume was noted and the cylinder was allowed to fall under its own weight on to a hard surface from the height of 2.5 cm at second intervals. Tapping was continued until no further change in volume was noted. BD and TD were calculated using the following equations.

$$BD = \frac{\text{Weight of the powder blend}}{\text{Untapped Volume of the packing}}$$

$$TD = \frac{\text{Weight of the powder blend}}{\text{Tapped Volume of the packing}}$$

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

$$\text{Hausner's Ratio} = \frac{\text{Tapped density}}{\text{Bulk density}}$$

Scale of Flow ability according to Hausner's ratio

Hausner's ratio	Flow character
1.0-1.11	Excellent
1.12-1.18	Good
1.19-1.25	Fair
1.26-1.34	Passable
1.35-1.45	Poor
1.46-1.59	Very poor
>1.60	Very, very poor

Compressibility index (Carr's Index): CI
Compressibility index is an important measure that can be obtained from the bulk and tapped densities. In theory, the less compressible a material the more flow able it is. A material having values of less than 20% has good flow property.

$$C_I = \frac{(\text{Tapped density} - \text{Bulk density})}{\text{Tapped Density}} \times 100$$

Scale of Flowability according to Carr's index

% comp. index	Flow character
5-12	Free flowing
12-16	Good
18-21	Fair
23-35	Poor
33-38	Very poor
>40	Extremely poor

Post compression evaluation parameters[9]

Weight variation:
The weight of the tablet being made was routinely determined to ensure that a tablet contains the proper amount of drug. The USP weight variation test is done by weighing 20 tablets individually, calculating the average weight and comparing the individual weights to the average. The tablets met the USP specification that not more than 2 tablets are outside the percentage limits and no tablet differs by more than 2 times the percentage limit. USP official limits of percentage deviation of tablet are presented in the table.

Weight variation limits

s.no	Avgwt of tablet(mg)	Maximum% diff. allowed
1	130 or less	10
2	130-324	7.5
3	>324	5

Tablet hardness:
The resistance of tablets to shipping or breakage under conditions of storage, transportation and handling before usage depends on its hardness. The hardness of each batch of tablet was checked by using Monsanto hardness tester. The hardness was measured in terms of kg/cm^2. 3 tablets were chosen randomly and tested for hardness. The average hardness of 3 determinations was recorded.

Friability:
Friability generally refers to loss in weight of tablets in the containers due to removal of fines from the tablet surface. Friability generally reflects poor cohesion of tablet ingredients.

Method

10 tablets were weighed and the initial weight of these tablets was recorded and placed in Roche friabilator and rotated at the speed of 25 rpm for 100 revolutions. Then tablets were removed from the friabilator, dusted off the fines and again weighed and the weight was recorded.

$$\text{friability} = \frac{(w_1 - w_2)}{w_1} \times 100$$

Where: w_1= weight of the tablet before test. w_2 = weight of the tablet after test

Content Uniformity:
The tablets were tested for their drug content uniformity. At random 20 tablets were weighed and powdered. The powder equivalent to 100 mg of drug was weighed accurately and dissolved in 100ml of phosphate buffer of pH 6.8. The solution was shaken thoroughly. The undissolved matter was removed by filtration through Whatman No.1 filter paper. Then transfer 1mL of above solution into 100mL volumetric flask and make up the volume with phosphate buffer of pH 6.8. The absorbance of the diluted solutions was measured at 205nm. The concentration of the drug was computed from the standard curve of the Losartan potassium in phosphate buffer of pH 6.8.

***In vitro* Dissolution studies:**
Tablet was introduced into dissolution test apparatus and the apparatus was set at 50rpm motion at 37^{0}C ± 0.5^{0}C. 5 ml of sample was withdrawn for every hour up to 12 hrs and after that the samples withdrawn for every 4 hrs up to 24 hrs. Samples withdrawn were analysed by UV spectrophotometer at 205nm using 6.8pH buffer as blank [10].

Release kinetics:
To study the release kinetics of in-vitro drug release, data was applied to kinetic models such as Zero order, First order, Higuchi and Korsmeyer-Peppas model [11,12,13].

RESULTS & DISCUSSION

Preformulation parameters

Drug excipient compatibility:

Data for drug excipient compatibility studies

Ingredients	Ratio	Initial	After one week 40°C & 75%RH	After two week 40°C & 75%RH	After three week 40°C & 75%RH	After four week 40°C & 75%RH
Propranolol HCl	1	White powder	No change	No change	No change	No change
Propranolol HCl + Xanthan Gum	1:1	Cream or white	No change	No change	No change	No change
Propranolol HCl +MCC	1:1	White powder	No change	No change	No change	No change
Propranolol HCl + HPMC K4M	1: 1	White powder	No change	No change	No change	No change
Propranolol HCl + HPMC K100M	1: 1	White powder	No change	No change	No change	No change
Propranolol HCl + Sod. Alginate	1: 1	Cream or white	No change	No change	No change	No change

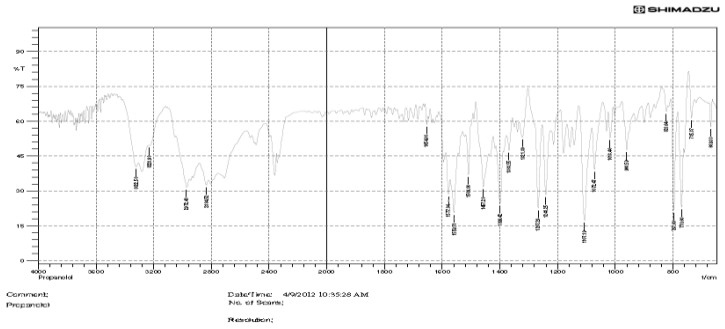
Propranolol HCl + Talc	1: 1	White powder	No change	No change	No change	No change
Propranolol HCl + DCP	1: 1	White powder	No change	No change	No change	No change
Propranolol HCl + Magnesium stearate	1:1	White powder	No change	No change	No change	No change

There is no change in color, hence it was concluded that there is no interaction between drug and excipients.

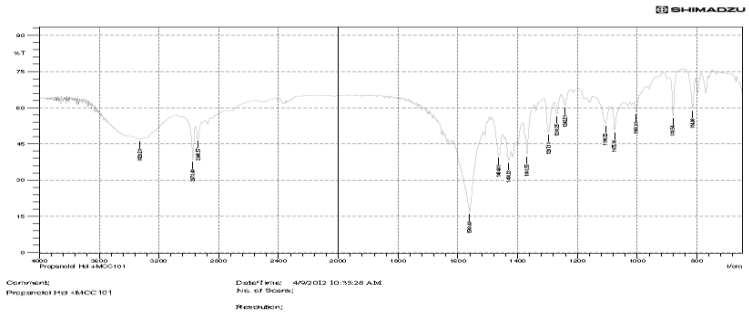
FTIR studies:

FTIR of propranolol HCl and mixtures of excipients (MCC, xanthan gum, sodium alginate, HPMC K4M, HPMC K100M, mg. Stearate, dibasic calcium phosphate and talc) in equal ratios were prepared and evaluated by using IR spectrophotometer (Shimadzu) by using KBr pellet technique.

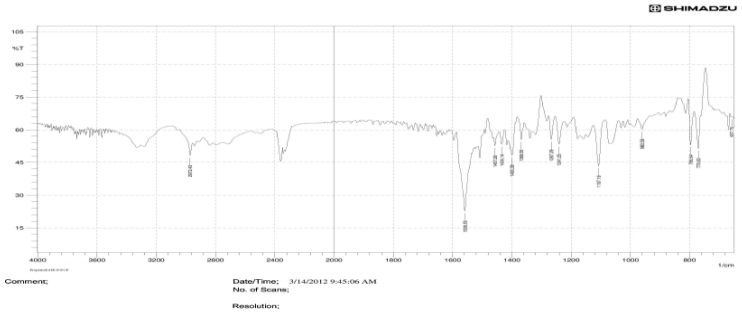
Infra-red spectra of pure propranolol HCl drug



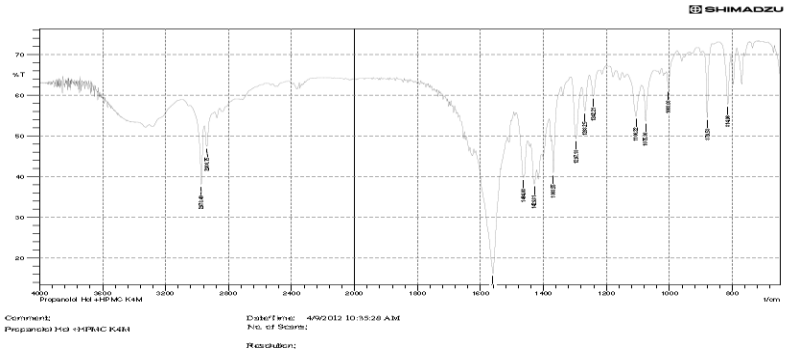
Infra-red spectra of propranolol HCl +MCC



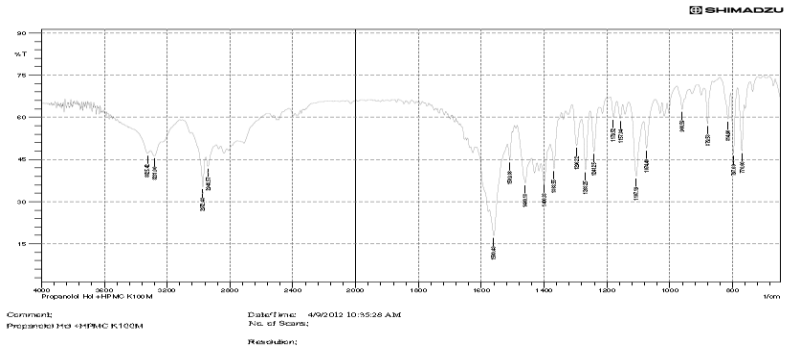
Infra-red spectra of propranolol HCl + DCP



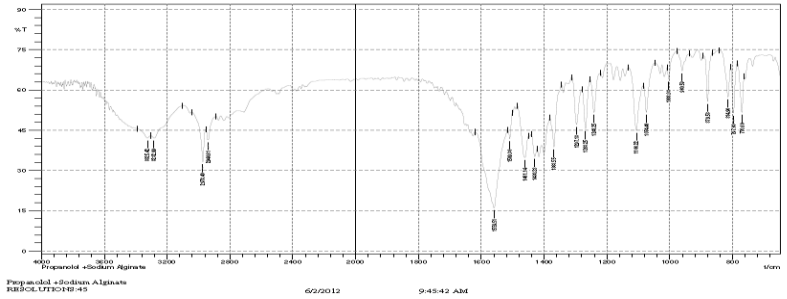
Infra-red spectra of propranolol HCl + HPMC K4M



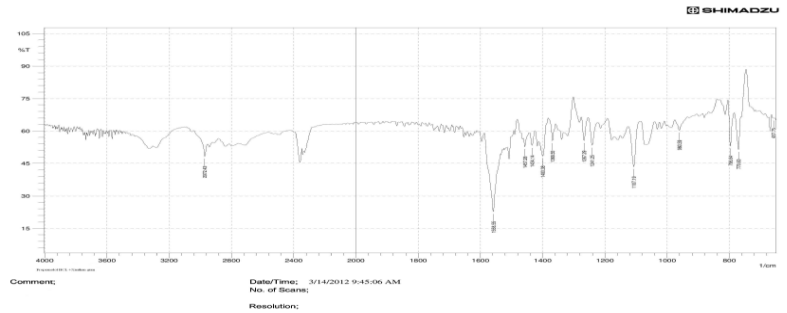
Infra-red spectra of propranolol HCl + HPMC K100M



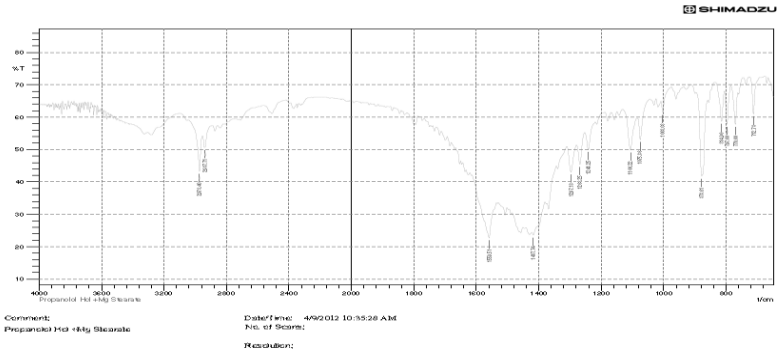
Infra-red spectra of propranolol HCl + Sodium alginate



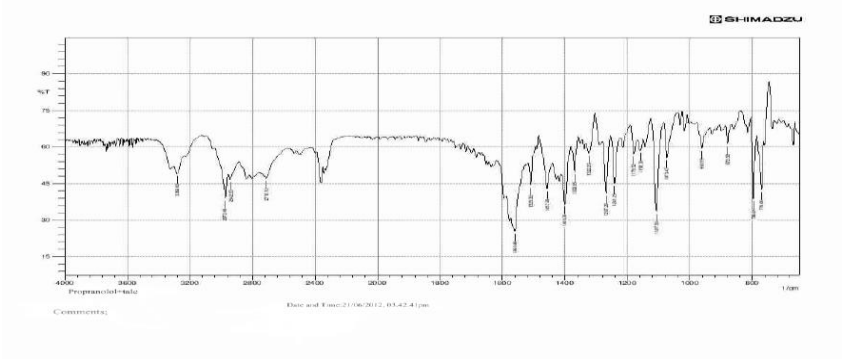
Infra-red spectra of propranolol HCl + Xanthan gum



Infra-red spectra of propranolol HCl + Magnesium stearate



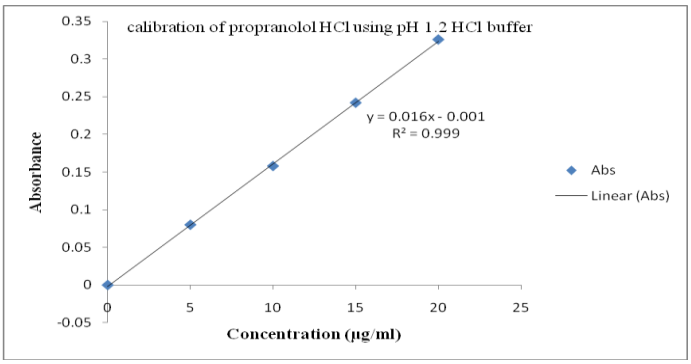
Infra-red spectra of propranolol HCl + talc



Calibration Curves of Propranolol HCl in pH 1.2 HCl buffer:

The calibration curve of propranolol HCl was carried out in pH 1.2 HCl in different concentrations (5, 10, 15, 20) and absorbance was observed or recorded at 290nm.Graph was plotted by taking absorbance on X-axis, concentration on Y-axis. The straight line appeared passing through the origine connecting all the five points indicates that the drug is following Beer's-Lambert's law which is suitable for the UV-Spectrophotometric analysis.

Since there is increase in absorbance with increase in concentration and R^2 value as indicates 0.9997 that line was linear and nearer to 1.

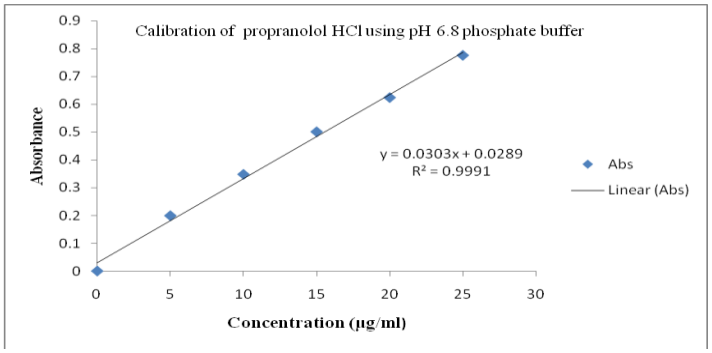


Calibration curve of Propranolol HCl using pH 1.2 HCl media at 290nm

In pH 6.8 phosphate buffer:

The calibration curve of propranolol HCl was carried out in pH 6.8 phosphate buffer in different concentrations (5, 10, 15, 20) and absorbance was observed or recorded at 290nm.Graph was plotted by taking absorbance on X-axis, concentration on Y-axis. The straight line appeared passing through the origine connecting all the five points indicates that the drug is following Beer's-Lambert's law which is suitable for the UV-Spectrophotometric analysis.

Since there is increase in absorbance with increase in concentration and R^2 value as indicates 0.9991 that line was linear and nearer to 1.



Calibration curve of Propranolol HCl using pH 6.8 media at 290nm

Pre compression studies

The powder blends was prepared as planned shown in following table and used for characterization of blend for various flow properties.

Results of Precompression parameters

Formulation code	Bulk density (g/ml) Avg±SD	Tapped density (g/ml) Avg±SD	Carr's index (%) Avg±SD	Hausner's ratio Avg±SD	Angle of repose Avg±SD
F1	0.52 ±0.129	0.65 ±0.042	12.97 ±0.11	1.21 ±0.240	27.65 ± 1.953
F2	0.55 ±0.066	0.64 ±0.03	12.21 ±0.09	1.16 ±0.092	29.27 ± 1.841
F3	0.49 ±0.04	0.57 ±0.012	14.04 ±3.944	1.18 ±0.07	30.65 ± 0.928
F4	0.48 ±0.03	0.55 ±0.030	12.72 ±2.494	1.14 ±0.037	31.75 ± 2.843
F5	0.50 ±0.015	0.58 ±0.020	13.79 ±0.545	1.16 ±0.020	27.14 ± 1.079
F6	0.53 ±0.04	0.61 ±0.040	13.11 ±0.378	1.15 ±0.066	29.41 ± 0.880
F7	0.52 ±0.045	0.55 ±0.04	12.72 ±2.049	1.18 ±0.035	31.48 ± 2.924
F8	0.49 ±0.055	0.58 ±0.059	14.92 ±1.597	1.16 ±0.052	32.65 ± 1.500
F9	0.51 ±0.030	0.58 ±0.06	15.72 ±1.138	1.22 ± 0.15	32.45 ± 5.973
F10	0.52 ±0.051	0.55 ±0.070	12.72 ±0.496	1.18 ±0.085	31.56 ± 0.997
F11	0.51 ±0.06	0.62 ±0.055	17.74 ±1.146	1.21 ±0.040	30.1 ± 2.760
F12	0.61 ±0.030	0.64 ± 0.07	12.57 ±0.523	1.18 ±0.025	32.41 ± 1.424

Post compression studies

Appearance: The tablets were observed visually and did not show any defects such as capping, chipping and lamination.

Physicochemical characteristics

The physical characteristic of propranolol HCl matrix tablets (F1 to F12) such as thickness, diameter, hardness, friability, weight variation and drug content were determined and results of the formulations (F1 to F12) found to be within the limits specified in official books.

Table shows physicochemical characterization of propranolol HCl matrix tablets

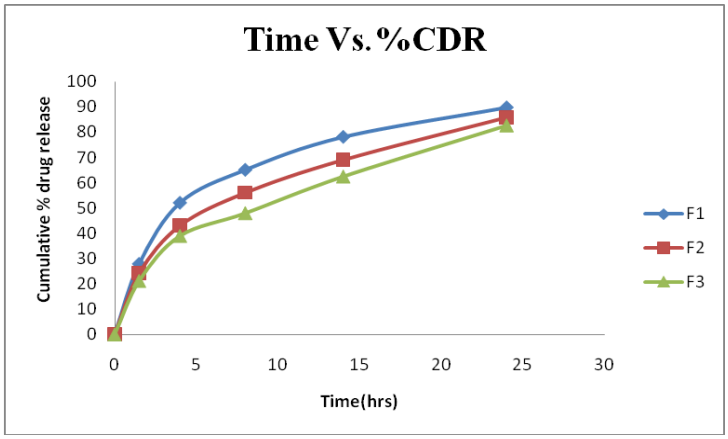
Formulation code	Weight variation	Hardness (kg/cm^2)	Thickness (mm)	Friability (%)	Drug content (%)
F1	251.0 ±3.323	4.8 ±0.633	3.8 ±0.458	0.52 ±0.227	99.50
F2	249.1 ±1.155	5.6 ±0.284	3.6 ±0.065	0.55 ±0.070	100.01
F3	250.6 ±0.922	5.1 ±0.156	3.9 ±0.083	0.51 ±0.071	100.62
F4	250.0 ±0.727	5.2 ±0.136	3.8 ±0.111	0.51 ±0.049	99.31
F5	250.1 ±0.773	5.1 ±0.247	3.8 ±0.198	0.64 ±0.085	100.41
F6	250.9 ±1.097	5.2 ±0.177	3.8 ±0.139	0.67 ±0.069	100.32
F7	250.0 ±0.970	5.1 ±0.189	3.7 ±0.183	0.56 ±0.085	99.10
F8	251.0 ±0.774	5.2 ±0.360	3.6 ±0.226	0.54 ±0.059	99.62
F9	251.0 ±0.583	5.1 ±0.212	3.8 ±0.216	0.40 ±0.069	99.99

F10	250.0 ±1.040	5.5 ±0.191	3.7 ±0.174	0.49 ±0.092	99.12
F11	252.0 ±1.298	5.4 ±0.229	3.8 ±0.210	0.54 ±0.038	99.62
F12	251.0 ±0.843	4.8 ± 0.264	3.8 ±0.145	0.55 ±0.098	99.86

***All are within the specified limits**

***In-vitro* drug release studies of the prepared formulations shown in below Table-It shows *In-Vitro* drug release profile of formulations containing HPMC K4M (F1 to F3)**

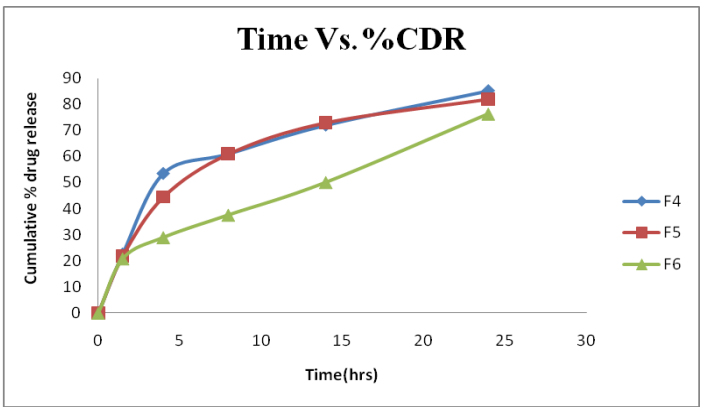
Formulation code	1.5hr	4hr	8hr	14hr	24hr
F1	27.88	52	65	78	89.63
F2	24.22	43	56	69	85.81
F3	21.2	39	48	62.5	82.7



Dissolution profile of F1-F3 formulations

It shows *In-Vitro* drug release profile of formulations containing HPMCK100M (F4 to F6)

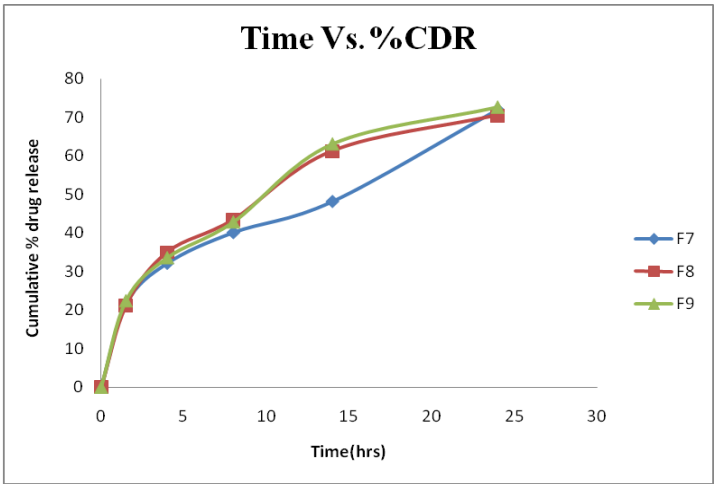
Formulation code	1.5hr	4hr	8hr	14hr	24hr
F4	22.7	53.5	61	72	85.17
F5	21.91	44.5	61	73	82.04
F6	20.88	29	37.6	50.12	76.35



Dissolution profile of F4-F6 formulations

It shows *In-Vitro* drug release profile of formulations containing Sodium alginate (F7 to F9)

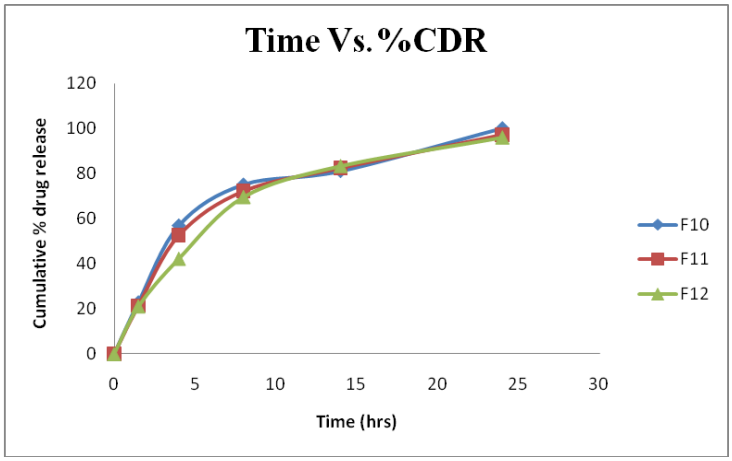
Formulation code	1.5hr	4hr	8hr	14hr	24hr
F7	21.6	32.1	40.05	48.09	71.87
F8	21.15	35	43.45	61.25	70.5
F9	22.42	33.56	42.82	63.04	72.58



Dissolution profile of F7-F9 formulations

It shows *In-Vitro* drug release profile of formulations containing xanthan gum (F10 to F12)

Formulation code	1.5hr	4hr	8hr	14hr	24hr
F10	22.91	56.89	75	81	99.92
F11	21.43	52.56	72.09	82.36	97.05
F12	21.12	42.23	69.56	83.25	95.92



Dissolution profile of F10-F12 formulations

When cumulative % drug release plotted versus time (Figure 3,4,5,6), it was observed that, for three of the polymers used, an increase in polymer concentration from 25% to 50%, induce a decrease in the release rate. The drug release rate from xanthan gum matrix was found to be more as compared to HPMC K15M, HPMC K100M and sodium alginate. This might be due to fast hydration of matrix and its property to form a thick gel layer, which retard the drug release from the tablet. Whereas formulation containing HPMC K4M (F1-F3) gave higher drug release as compared to formulation containing HPMC K100M (F4-F6), sodium alginate (F7-F9) and Xanthan gum (F10-F12), which may be due to quick hydration of polymer matrix, after which matrix might get started to erode.

Kinetics of *In-vitro* Drug Release

The kinetics of *In-Vitro* drug release was determined by applying the drug release data to various kinetic models such as zero order, first order, Higuchi and Korsmeyer- Peppas. The result obtained was shown in following figure.

Different kinetic models for propranolol HCl matrix tablets

Formulation code	Zero order		First order		Higuchi		Korsmeyer-Peppas		Drug release mechanism
	r^2	Slope	r^2	Slope	r^2	Slope	r^2	Diffusion exponent (n)	
F-1	0.8381	3.6019	0.8227	-0.2721	0.9839	0.0489	0.6673	0.3266	Fickian diffusion
F-2	0.8458	3.1425	0.9834	-0.0331	0.9393	0.9951	0.6254	0.4351	Fickian diffusion
F-3	0.8871	3.0484	0.9835	-0.0295	0.9877	15.611	0.6798	0.5736	Non-Fickian diffusion
F-4	0.8622	9.6161	0.941	-0.0321	0.9435	17.601	0.9024	0.4503	Fickian diffusion
F-5	0.7857	3.07	0.9378	-0.0301	0.9623	17.512	0.9505	0.4756	Fickian diffusion
F-6	0.9359	2.7797	0.9696	-0.0237	0.9806	14.665	0.9664	0.4518	Fickian diffusion
F-7	0.8929	2.5321	0.9488	-0.0071	0.9262	11.091	0.9892	0.6318	Non Fickian diffusion
F-8	0.8466	2.6275	0.947	-0.021	0.9861	14.617	0.9898	0.4388	Fickian diffusion
F-9	0.9464	8.4048	0.957	-0.0225	0.9873	15.02	0.988	0.4363	Fickian diffusion
F-10	0.8381	0.0364	0.8815	11.516	0.949	20.907	0.9744	0.3488	Fickian diffusion
F-11	0.9022	11.5	0.9855	-0.0609	0.9583	20.738	0.9218	0.5306	Fickian diffusion
F-12	0.9422	11.756	0.9621	-0.165	0.9724	20.896	0.9635	0.5585	Fickian diffusion

For matrix tablets, an 'n' value near to 0.5 indicates diffusion control and an 'n' value near to 1 indicates relaxation or erosion control. The intermediate value suggests that diffusion and erosion contributes to overall release mechanism. A value of 'n' for all F1-F12 matrices studied here was ranged between 0.3266 to 0.6318; which indicating a Fickian and non-fickian behavior corresponding to swelling, diffusion and erosion mechanism.

CONCLUSION

In the present work, an investigation was made to use Xanthan gum as a natural polymer in the design of extended release oral drug delivery systems. Propranolol HCl was chosen as the model drug with the view of formulating extended release tablets to improve its bioavailability. Drug-excipient compatibility studies were proved by using FTIR. The extended release tablets of propranolol HCl were formulated by direct compression method. The formulated tablets compiled for all the un-official and official tests for the tablets. Release of propranolol HCl from the tablets formulated by employing 25mg of Xanthan gum and 77 mg dibasic calcium phosphate showed that more drug release So, the formulation F-10 was the optimized formula. The polymer Xanthan gum showed better dissolution control compared to the other polymers like HPMC K4M and HPMC K100M and sodium alginate. The release kinetics of all formulations showed that the drug release followed fickian and non-fickian transport. The release kinetics of optimized formula showed fickian transport followed by zero order.

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