FORMULATION AND INVITRO-EVALUATION OF PROPRANOLOL HYDROCHLORIDE SUPERPOROUS HYDROGELS

Narappa Reddy.K.V[1*], Rajasekaran.S[2]

Abstract
Hypertension can be described as a continuous rise in blood pressure above than 120/80 mm Hg. A measure that represents number of patients can be differentiated according to a scale whose possibilities of hypertension associated to cardiovascular disease is sufficient more for merit medical intervention. Propranolol hydrochloride is a medication that belongs to a class of drugs called beta-blockers. Its main specialty lies in its ability to block the effects of adrenaline on the heart and blood vessels, thereby reducing blood pressure, heart rate, and the workload on the heart. One of the unique features of Propranolol Hydrochloride is its ability to cross the blood-brain barrier, which allows it to effectively reduce symptoms of anxiety, such as trembling, sweating, and rapid heartbeat. It has been found to be particularly effective in treating anxiety related to public speaking, social anxiety disorder, and post-traumatic stress disorder (PTSD). Superporous hydrogel were synthesized by using gas blowing technique. Acrylamide and acrylic acid were used as hydrophillic monomers; bisacrylamide (BIS) as a cross linker, distilled deionized water and pluronic F-127 as a foam stabilizer were included in the composition of SPH. SPH of Propranolol Hydrochloride showed good pre-compressional and post-compressional properties, Compatibility studies proved the integrity of the developed tablets. Stability studies indicated that optimized formulation is stable. Thus, the superporous hydrogel of Propranolol Hydrochloride have been successfully prepared to enhance bioavailability of the drug.

Keywords: - Superporous hydrogel, gas blowing technique, Propranolol Hydrochloride, hydrophillic monomers

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INTRODUCTION: -

Hydrogels are crosslinked hydrophilic polymers with a network structure consisting of acidic, basic, or neutral monomers and they have the ability to absorb huge amount of water. The swelling properties of hydrogels are closely related to the factors like the elasticity of the network, the presence of hydrophilic functional groups (such as-OH,-COOH,-CONH2,-SO3 The drugs having a narrow absorption window, i.e. mainly absorbed from the proximal small intestine, bioavailability of those drugs can be well increased by gastric retention. For drugs which are absorbed rapidly from the gastrointestinal tract (GIT), should have slow release from the stomach to improve the bioavailability. Several important properties of SPHs, like fast swelling capacity, large swelling ratio, and surface slipperiness, make them an excellent candidate to develop gastric retention devices [6]. Even though these super porous hydrogels provided drastically fast swelling kinetics and high swelling degree, the mechanical strength of the fully swollen super porous hydrogels was besides poor to be useful. Hence mechanically strong super porous hydrogels can be made by increasing the cross-linking density, but this would result in a very in the polymer chains, small extent of swelling with a loss of the superabsorbent property [7]. the extent of cross linking, and porosity of the polymer. Hydrogel

swell in water with some mechanical strength but their swelling index and mechanical strength are not sufficient to exhibit fast swelling properties [1]. In some cases, the slow swelling is beneficial but there are many situations where a fast-swelling characteristic is more desirable. Therefore, a new generation of hydrogels, which swell and absorb water rapidly, has been developed. Examples of this new generation are superporous hydrogel, which swell to an equilibrium size in a short period of time [2]. The fast swelling and strong mechanical properties of SPHs make them highly useful for various pharmaceutical and biomedical applications [3]. Superporous hydrogels (SPHs) possess an average pore size of greater than 100 microns and swell in equivalent sizes within a very short period because of rapid intake of water by capillary wetting through a number of interconnected microscopic pores [4]. SHPs have a tendency to swell to a large size with a swelling ratio of about 100 or more and their mechanical strength [5] should be high enough to withstand the pressure as gastroretentive drug delivery. Due to the highly porous structure, SPHs has hundred time's greater surface area and shorter diffusion distance than conventional hydrogels do When applied as drug carriers, the highly swollen hydrogels remain in the stomach for a long time, releasing almost all loaded drugs, since their volumes are too big to transport through the pylorus and their sheer bulk obstruct their transport to the next organ via the narrow pylorus. This unique swelling property allows them to be used as gastric retention carriers providing a sustained release through long residence in the stomach [8]. To be used as an effective gastro retentive drug delivery, the hydrogels are required to possess not only fast swelling, but also following properties: biocompatibility, biodegradability, high swelling capacity, high mechanical strength, and stability in acidic condition [9]. The aim of the study was to develop superporous hydrogel of Atenolol, an antihypertensive drug which is highly unstable at basic pH. Hence there was a need to develop system on it so that the formulation would be confined in the stomach and release the drug in a sustained manner in the gastric environment. The superporous structure would swell up by absorbing water through capillary forces and its integrity would be maintained for a sufficient period.

MATERIALS AND METHODS: -

Propranolol hydrochloride was a gift sample received from Piramal Enterprises Ltd., Pithampur,India.,Chitosan (High molecular weight) &Ethanol were obtained from Qualikems Fine chem. Pvt. Ltd.Cholesterol, Disodium hydrogen phosphate, Potassium dihydrogen orthophosphate (KH2PO4),Sodium chloride (NaCl), Acetone , Methanol, Ether, Potassium chloride (KCl)G`lacial acetic acid, Hydrochloric acid (HCl),Ammonium per sulphate, Acrylic acid,N,N-Methylenebisacrylamide, Acrylamide Sigma Alderich,N, N,N',N' tetramethylethylene diamine, Pluronic F-127,Sodium bicarbonate ($NaHCO_3$) were purchased from Qualikems Fine Chem. Pvt. Ltd.

DRUG - EXCIPIENTS COMPATIBILITY STUDY

Drug - excipients interaction study was done to check any interaction between the drug and excipients**.** This study for both PROP HCl was carried out by using FT-IR spectrophotometer by NaCl pallet method. The samples of drugs, Chitosan, acrylamide, pluronic F-127, ammonium per sulphate (APS), N,N,N',N'-tetramethylethylenediamine (TEMED) and their physical mixture were mixed with hard liquid paraffin and the spectra were obtained using FTIR spectrophotometer. The spectrum was scanned over a frequency range 4000-500 cm-1 [10].

FORMULATION AND EVALUATION OF SUPERPOROUS HYDROGEL HYBRID(SPH)

Superporous hydrogel for PROP HCl was prepared by using gas blowing technique with slight modification. All the composition except sodium bicarbonate was sequentially added in the test tubes (20 mm outer diameter × 150 mm in length). For this monomer solution of Acrylamide (50% w/v), acrylic acid (50% w/v), bisacrylamide (BIS) (2.5% w/v) as a cross linker, distilled deionized water, pluronic F-127 (10% w/v) as a foam stabilizer were added in composition. High molecular weight chitosan were taken at different concentration i.e. 0.5, 1.0, 1.5 and 2.0 % w/v as a secondary polymer, ammonium per sulphate (APS) (20% w/v) as an reaction initiator and N,N,N',N'-tetramethylethylenediamine (TEMED) (20% w/v) as a catalyst **Table 1.1**. The test tube was shaken after every ingredients added for proper mixing. The monomer solution pH was adjusted to 5.0 by using HCl buffer (pH 1.2) and 1M NaOH solution. After that sodium bicarbonate (100 mg) was added as a foaming agent in the composition. During adding all ingredients, shaking is done for proper mixing and distributing gas bubble throughout the formulations. After gelation formulation SPH were treated with absolute ethanol to retrieve from test tube. SPH were then kept at 60˚ C in oven for overnight.

Chitosan and cross linker were used in various concentration in the formulation to evaluate the effect on various parameters of formulation like apparent density, porosity, swelling properties and mechanical strength [11].

Table 1.1 Composition of SPH formulations containing PROP HCl

Ingredients	Formulation Code						
	FC_1	FC_2	FC_3	FC_4	FC_5	FC_6	FC_7
Acrylamide (µl) (50%w/v)	200	200	200	200	200	200	200
Acrylic acid (µl)(50%v/v)	200	200	200	200	200	200	200
BIS (%w/v) (70µl)	2.5	2.5	2.5	2.5	2	3.0	3.5
Water (µl)	100	100	100	100	100	100	100
PF-127 (µl) (10%w/v)	100	100	100	100	100	100	100
Chitosan(%w/v) (200 µl)	0.5	1.0	1.5	2.0	1.0	1.0	1.0
APS (µl) (20% w/v)	40	40	40	40	40	40	40
TEMED (µl) (20% w/v)	40	40	40	40	40	40	40
$NaHCO_3$(mg)	100	100	100	100	100	100	100
PROP HCl (mg)	20	20	20	20	20	20	20

CHARACTERIZATION OF SPH

MEASUREMENT OF GELATION KINETICS

Gelation kinetic of developed formulation was determined by tilting method. In this process test tubes were tilted in slight decline position and ensure that solution in the test tube mixture were no longer downward [12-13].

SWELLING RATIO

To determine the swelling ratio, a fully dry SPH was weighed and then dipped in swelling medium. Swelling ratio was determined in HCl buffer (pH 1.2). At regular time periods, the SPH disc was taken out from the medium and again weighed after excessive swelling medium on the surface was blotted. Measurements were carried out in triplicate. Swelling ratio for the entire formulation batch with respect to changing concentration of BIS and chitosan were calculated. Results were determined based on the following equation:

$$\text{Swelling ratio (Q)} = \frac{Ms - Md}{Md \times 100}$$

Where Q - Swelling ratio, Ms - Mass of swollen SPH and Md - Mass of dried SPH.

APPARENT DENSITY, POROSITY AND VOID FRACTION

The dried SPH was immersed in predetermined amount of hexane in the graduated measuring cylinder by using forceps. After that increase in hexane volume was noted.

Density was calculated by following equation:

Apparent density (ρ) = MSPH/VSPH

Where MSPH is the mass of dried SPH and VSPH is the volume of hexane displaced by SPH.

Porosity was measurement by following solvent replacement method. SPH in dried state were dipped overnight in absolute ethanol and weighed was taken after excess ethanol on the surface was blotted. The porosity was calculated from the following equation:

$$\text{Porosity} = \frac{M2 - M1}{\rho V}$$

Where M1 is mass of dried SPH before dipping in ethanol and M2 are the mass of the swollen SPH after immersion in absolute ethanol; ρ relates density of absolute ethanol and V denotes volume of the swollen SPH

Void fraction determination of SPH was carried out by keeping the SPH in hydrochloric acid buffer (pH 1.2) overnight and dimension of swollen hydrogel was calculated. During this period total volume of pore was calculated by subtracting the dried SPH mass from swollen SPH mass.

Void space was calculated by following formula:

$$\text{Void fraction} = \frac{\text{Dimensional of SPH}}{\text{Total pores volume}}$$

ESTIMATION OF DRUG LOADING

Drug content in SPH was estimated by using multiple extraction method. For this, PROP HCl loaded SPH was placed in a beaker containing 50 ml of HCl buffer pH1.2 for extraction and stirred for few minutes. Process was repeated many times until the entire drug was not extracted. After that solution was passed through 0.45 µm filter and drug content was estimated by UV-VIS spectrophotometer at 290 nm [14].

IN VITRO RELEASE STUDY

The drug release from prepared SPH formulation was estimated with USP dissolution apparatus II (Paddle type) at 37 ± 0.5 ˚C in 900 ml of HCl buffer pH 1.2 for stated period of time. The paddle was rotated at 100 rpm and withdrawing 10 ml aliquot from the medium at predetermined time of interval. The withdrawing samples were replaced with fresh buffer. The aliquots sample was passed through 0.45 μm nylon filter and assayed spectrophotometrically at 290 nm [15-17].

SCANNING ELECTRON MICROSCOPY (SEM)

The morphological studies of SPH were carried out by using SEM. For this dried SPH disc were cut to expose their internal structure. The samples were prepared separately on sample holders. These holders were stained with gold palladium using sputter coater for one minute under inert argon gas before electron microscope scanning. Microscopic image of SPH was taken by using SEM [18].

EFFECT OF DIFFERENT PH MEDIA ON SWELLING

Swelling of SPH formulations were evaluated for their sensitivity towards different pH range. For determine the pH dependent swelling behaviour of SPH, various media of different pH media viz: pH 1.2, 3.0, 4.9 and 7.4 were prepared. SPH formulations were kept in different pH media until equilibrium swelling and evaluated with respect to their swelling behaviour

DIFFERENTIAL SCANNING COLORIMETERY

Thermal analysis of both drugs and their SPH formulations were performed using thermal analyzer (PHOENIX DSC- 204 F1, Netzsch-Geratebau GmbH, Germany). Temperature axis and cell constant were calibrated by utilizing indium (In). Accurately weighed drug (2 mg) was transferred to aluminium pans and sealed. Sample was heated over a temperature range of 30-350˚C, under dry nitrogen purging (50 ml/min) in pinholed aluminium pans.

RESULTS AND DISCUSSION

DRUG - EXCIPIENTS COMPATIBILITY STUDY

Table 1.2 Characteristics Peaks for functional group in PROP HCl pure drug

Reported peaks (cm-1)	Observed peaks (cm-1)	Inference
3400-3100	3180	N-H stretching
2955-2900	2981	O-H stretching
1680-1500	1572	Aryl C=C stretching
1260-1000	1260	Aryl O-CH2 asymmetric stretching

Figure 1.1 shows IR Spectrum of Propranolol hydrochloride Drug

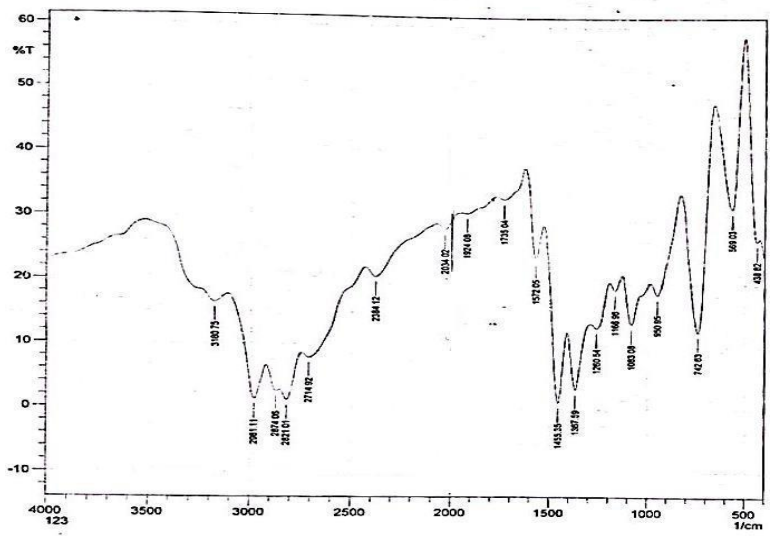


Table 1.3 Characteristics Peaks for functional group in Chitosan

Sr. no.	Observed peaks (cm-1)	Inference
1	3724	C-O stretching
2	3352	N-H stretching
3	1147	O-H stretching

Figure 1.2 shows IR Spectrum of chitosan

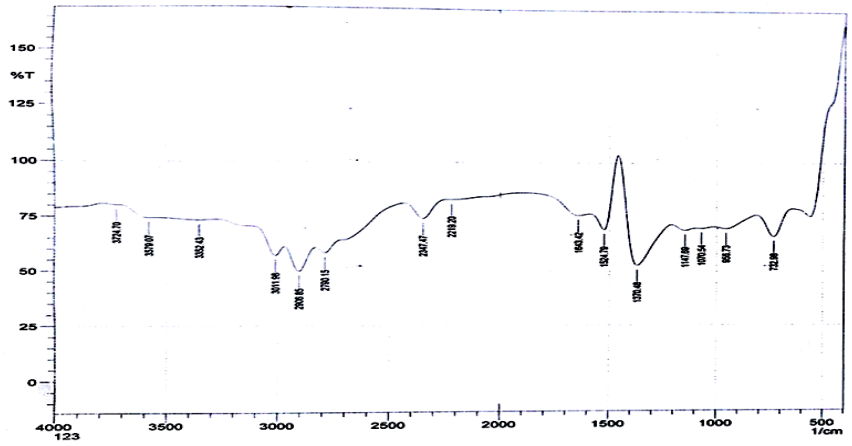


Table 1.4 Characteristics Peaks for functional group in Acrylic acid

Sr. no.	Observed peaks (cm-1)	Inference
1	3255-2755	O-H broad stretching
2	1719	-C=O stretching
3	1404	C-O-H stretching

Figure 1.3 shows IR Spectrum of Acrylic acid

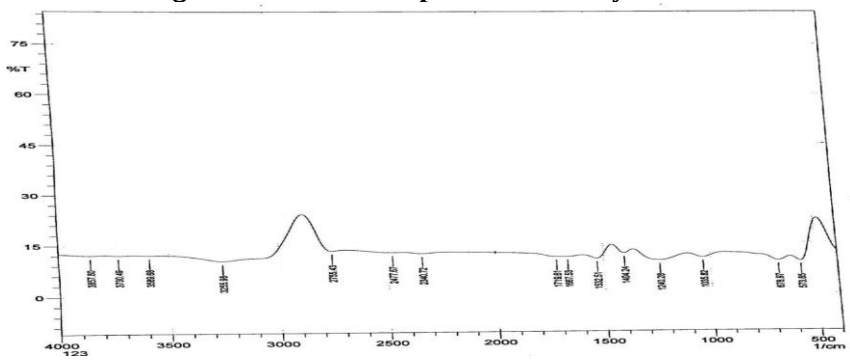


Table 1.5 Characteristics Peaks for functional group in Acrylamide

Sr. No.	Observed peaks (cm-1)	Inference
1	3214-3350	N-H stretching
2	1674	-C=O stretching
3	1118	C-N stretching

Figure 1.4 shows IR Spectrum of Acrylamide

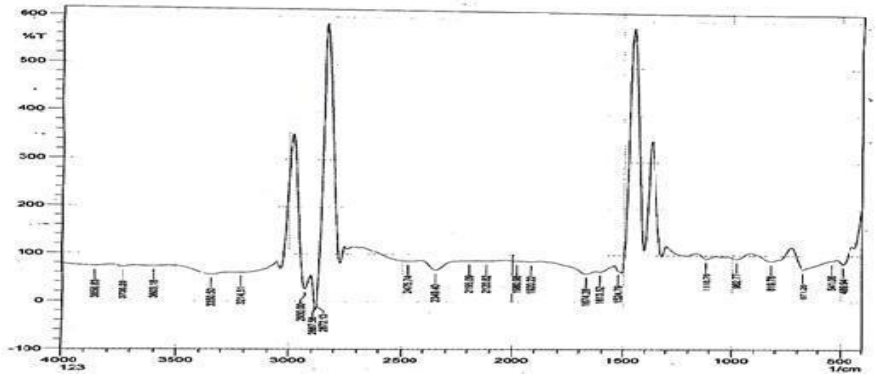
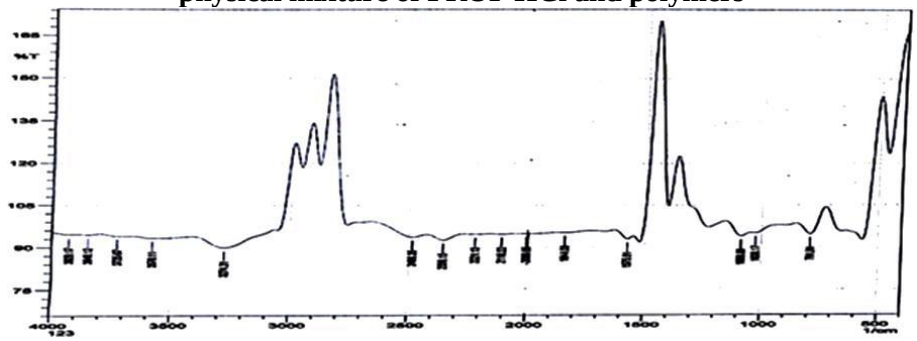


Figure 1.5 shows IR Spectrum of a) PROP HCl b) Chitosan c) Acrylamide d) Acrylic Acid and e) physical mixture of PROP HCl and polymers



MEASUREMENT OF GELATION KINETICS

Gelation kinetic study provides information of time of introducing foaming agents in the solution mixture of monomers. The pH of the solution mixture should be maintained 5.0 before adding foaming agents. Foaming agents should not be added too early or too late after the polymerization process start. This is because during polymerization process viscosity of the monomer solution increased and when foaming agents are added too late then bubble will not be formed and if foaming agents would be added too early then bubble so formed will not be able to maintain for long time. Hence foaming agents should be added few seconds after the gelation process start [19].

SWELLING RATIO

Swelling ratio of SPH in HCl buffer solution pH 1.2 was determined at different time of interval **(Table 1.6)**. Fully swollen SPH formulations were shown in **figure 1.6** and **figure 1.7** The effects of concentrations of chitosan and cross linker (BIS) on swelling ratio were determined.

Table 1.6 Swelling ratio of all SPH formulation of PROP. HCl at different time interval

Time (mins)	Formulation code						
FC1	FC2	FC3	FC4	FC5	FC6	FC7	
2	10.61±0.4	14.94±0.5	9.67 ± 0.4	7.85±0.6	12.39±0.5	5.96±0.5	3.81±0.6
4	19.76±0.2	29.77±0.7	16.78±0.5	12.87±0.4	19.51±0.6	11.19±0.6	9.76± 0.7
6	33.21±0.6	48.06±0.4	31.78±0.4	29.71±0.8	36.08±0.3	24.04±0.3	17.82±0.4
8	48.87±0.4	56.84±0.6	42.94±0.4	38.64±0.3	45.76±0.6	36.12±0.6	29.44±0.7
10	54.91±0.5	68.55±0.8	49.31±0.8	45.72±0.9	52.97±0.4	43.83±0.3	36.07±0.5
12	59.62±0.2	74.48±0.3	56.23±0.6	55.42±0.7	66.68±0.7	53.39±0.4	48.61±0.4
14	71.19±0.3	89.14±0.5	69.77±0.8	64.37±0.4	76.47±0.5	59.72±0.5	56.11±0.7
16	98.34±0.5	106.45±0.7	94.86±0.7	87.47±0.6	104.34±0.8	79.29±0.6	68.62±0.8

Figure 1.6 Scaling of PROP HCl SPH in a) dried and b) swollen form

Figure 1.7 PROP HCl SPH formulations after complete swelling

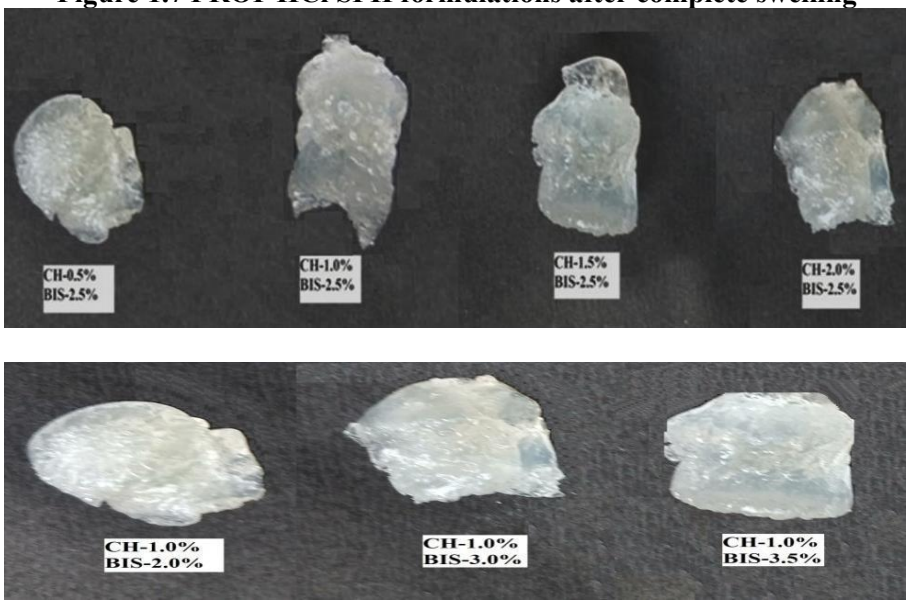


Table 1.7 Apparent Density, Porosity and Void Space of all formulations

Formulation codes	Apparent density (g/cm3)	Porosity (%)	Void fraction (ml/g)
FC1	0.35 ± 0.01	48.39 ± 0.04	1.57 ± 0.01
FC2	0.20 ± 0.02	62.22 ± 0.05	1.88 ± 0.03
FC3	0.44 ± 0.04	42.96 ± 0.03	1.47 ± 0.02
FC4	0.51 ± 0.01	38.59 ± 0.01	1.38 ± 0.01
FC5	0.27 ± 0.02	51.76 ± 0.02	1.67 ± 0.01
FC6	0.60 ± 0.05	35.15 ± 0.04	1.35 ± 0.02
FC7	0.66 ± 0.03	27.51 ± 0.03	1.31± 0.04

ESTIMATION OF DRUG LOADING

Drug loading (%w/w) inside SPH formulations were estimated at 2.66; 2.74; 2.63; 2.58; 2.56; 2.48 and 2.42 %w/w of formulations. Thus, PROP HCl content was found to be 26.60; 27.41; 26.35; 25.86; 25.61; 24.85 and 24.27 µg per mg of SPH formulation for FC1, FC2, FC3, FC4, FC5, FC6 and FC7 respectively. Highest drug loading inside FC2 formulation was observed due to highest swelling ratio and strong interpenetrating network formation [19].

***IN VITRO* RELEASE STUDY**

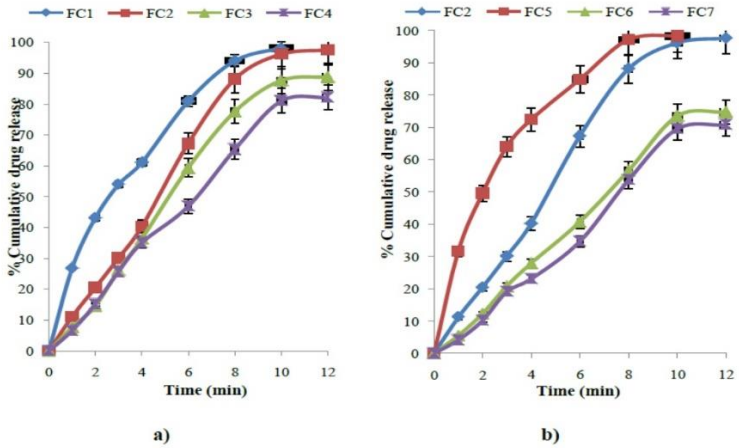
It was observed from the data as shown in **table 1.8** that drug release from SPH was found to be varied as increase in the concentration of chitosan and BIS. At initial (lower) chitosan concentration (0.5%) drug release showed burst effect and release the drug faster due to less strong wall structure of SPH and fast diffusion of drug from matrix. As increasing in concentration of chitosan from 0.5 to 1% w/v, reduced and prolonged drug release was recorded up to 12 hrs. On further increasing the concentration of chitosan from 1 to 1.5 and 2% w/v, drug release was retarded and was observed till 12 hrs. However, drug release was found to be less than that of 1% w/v chitosan concentration at each time point **(figure 5.17a)**. It was due to the fact that increasing chitosan concentration enhanced the viscosity of the formulation and rigid the integrity of structure that resist the back diffusion of drug.Further, increasing the concentration of cross linker also affects the release characteristics of the drug from

SPH **(figure 5.17b)**. It was observed from the **figure 5.17b** that on increasing concentration of BIS from 2 to 3.5% w/v, decreased drug release was recorded. At minimum concentration of cross linker (2% w/v), burst effect was observed due to weaker cross linking density however, while increasing cross linker concentration from 2 to 3.5% w/v drug release was decreased and provide for prolong period of time. It might be due to the fact that with increase in cross linker concentration the cross linking density was increased and hence results in denser network of SPH [20].

Table 1.8 *In vitro* drug release data of SPH formulations

Time(Min)	**Formulation code**						
FC1	**FC2**	**FC3**	**FC4**	**FC5**	**FC6**	**FC7**	
0	0	0	0	0	0	0	0
2	26.28± 0.3	11.13± 0.3	7.63 ± 0.2	6.66± 0.3	31.63± 0.2	5.53± 0.1	4.13± 0.5
4	43.02± 0.2	20.44± 0.2	14.42 ± 0.6	15.13± 0.2	49.55 ± 0.3	12.31± 0.2	10.15± 0.3
6	53.99± 0.4	30.11± 0.4	26.21 ± 0.1	25.68± 0.9	64.02 ± 0.1	20.79± 0.1	19.06± 0.1
8	61.05± 0.1	40.29± 0.1	36.39 ± 0.2	35.11± 0.1	72.48 ± 0.5	27.96± 0.3	23.11± 0.3
10	80.96± 0.5	67.23± 0.5	59.33 ± 0.3	46.88± 0.4	84.90 ± 0.4	40.75± 0.2	34.63± 0.7
12	94.07± 0.7	88.12± 0.7	77.58 ± 0.3	65.32± 0.3	97.22 ± 0.6	56.66± 0.4	53.69± 0.2
14	98.12± 0.4	96.24± 0.3	87.68 ± 0.2	81.08± 0.1	98.29± 0.3	73.53± 0.3	69.55± 0.6
16	-	97.66± 0.3	88.86± 0.6	82.20± 0.8	-	74.75± 0.3	70.76± 0.3

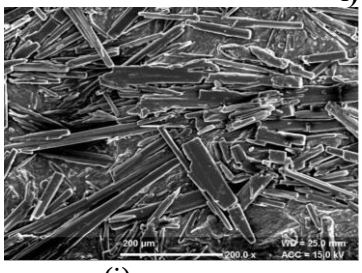
Figure 1.8 *In vitro* drug release data of SPH formulations with changing a) Chitosan and b) Cross linker concentrations



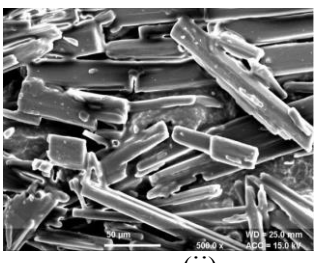
SCANNING ELECTRON MICROSCOPY (SEM)

Morphological characterization of SPH was carried out with the help of scanning electron microscopy (SEM) at different magnifications as shown in **figure 1.9**. It was observed that SPH exhibited tubular structure at low magnification and when magnification was increased then higher porous structure were shown. Highly porous nature of SPH responsible for more penetration of swelling media inside them and hence result in faster and higher swelling. Highly porous structure of SPH is also responsible for effective drug release as swelling media dissolve the drug and taken out from the structure in a controlled way.

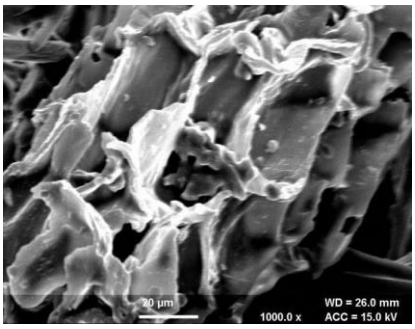
Figure 1.9 Scanning Electron Microscopy (SEM) of FC2 formulation at i) 200x, ii) 500x and iii) 1000x



(i)



(ii)



(iii)

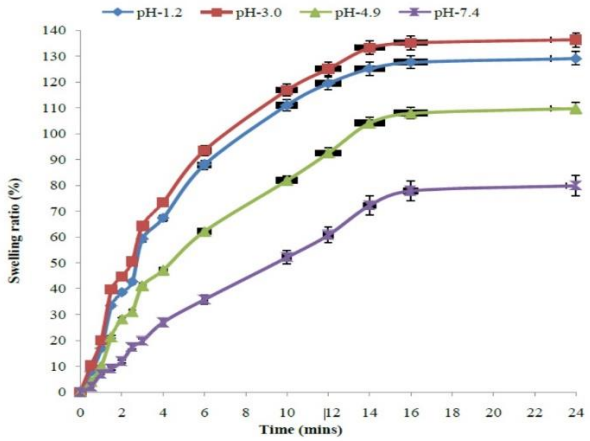
Effect of different pH media on swelling

It was depicted from the results as shown in **table 1.9** that swelling capacity was higher in acidic condition and reduced on exposure of SPH to basic media. Maximum swelling was observed at pH 3 whereas least swelling was obtained at pH 7.4. Chitosan and acrylic acid are responsible for their swelling capacity **(figure 1.10)**. Based on the pKa of chitosan (6.5) and acrylic acid (4.7) swelling capacity was obtained. Under acidic condition (pH~3) amino (-NH2) group comes into consideration and undergoes protonation (NH3+). Thus at this pH NH3+- NH3+ electrostatic repulsion takes place that result in increased in swelling

Table1.9 Effect of pH on swelling ratio of SPH formulation

Time (mins)	**Swelling ratio (%)**			
pH 1.2	**pH 3.0**		**pH 4.9**	**pH 7.4**
2	7.79 ± 0.4	10.23 ± 0.4	4.01 ± 0.2	2.04 ± 0.4
4	16.84 ± 0.6	20.02 ± 0.3	10.11 ± 0.3	7.11 ± 0.3
6	33.41 ± 0.3	39.67 ± 0.2	21.35 ± 0.2	9.02 ± 0.6
8	38.52 ± 0.4	44.63 ± 0.6	28.19 ± 0.6	11.84 ± 0.2
10	42.56 ± 0.2	50.61 ± 0.4	31.07 ± 0.8	17.46 ± 0.6
12	59.21 ± 0.7	64.31 ± 0.8	41.13 ± 0.3	19.66 ± 0.3
14	67.27 ± 0.6	73.51 ± 0.3	47.19 ± 0.2	26.93 ± 0.5
16	87.84 ± 0.9	93.44 ± 0.4	62.15 ± 0.7	35.73 ± 0.3
18	111.02 ± 0.3	116.84 ± 0.6	81.84 ± 0.4	52.07 ± 0.7
20	119.42 ± 0.2	125.11 ± 0.2	92.53 ± 0.3	60.76 ± 0.5
22	125.05 ± 0.6	133.27 ± 0.4	104.16 ± 0.2	72.18 ± 0.4
24	127.64 ± 0.4	135.18 ± 0.5	107.87 ± 0.5	77.80 ± 0.7
26	129.11 ± 0.3	136.33 ± 0.2	109.74 ± 0.4	79.87 ± 0.4

Figure 1.10 Effect of pH on swelling ratio of PROP HCl SPH formulation

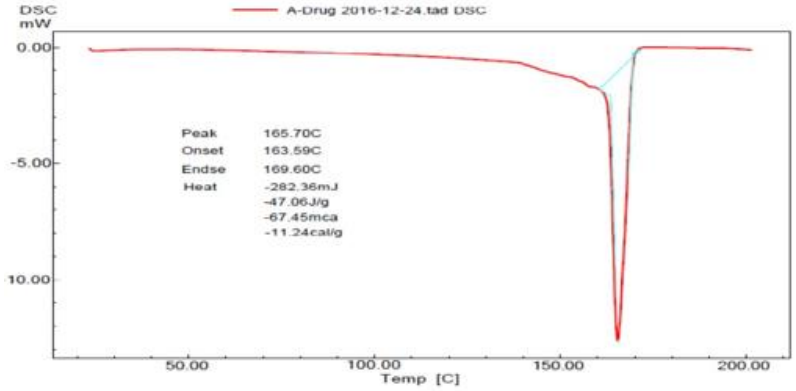


Differential Scanning Colorimetery (DSC)

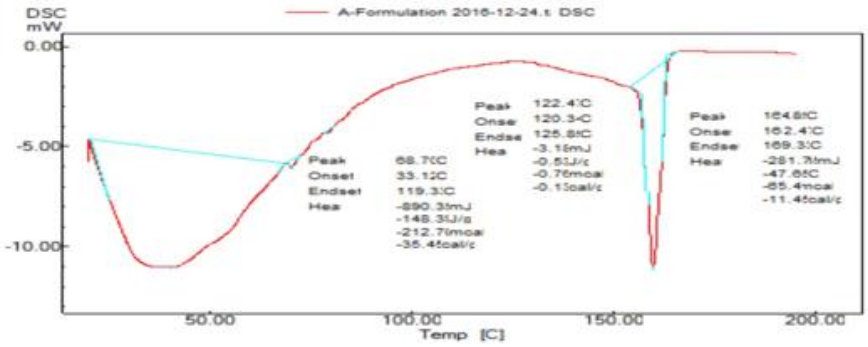
This technique allows a rapid assessment of possible interaction by disclosing transition in

exhibition, dissipation of endothermic or exothermic peaks, and transition in the pertinent enthalpy standards in thermal curves of drug-excipients combinations. DSC – spectrum of drug PROP HCl alone and drug loaded formulation were determined and results were shown in **figure 1.11**. DSC thermogram of drug represented the sharp endothermic peak at 165.7℃ and thermogram of drug loaded SPH showed endothermic peaks at 164.8℃. Since DSC profile of both drug as well as drug loaded SPH depicted the almost similar endothermic peaks that indicated that no physical interaction between drug and polymers [21].

Figure 1.11 DSC Thermogram of a) PROP HCl b) PROP HCl SPH



a)



b)

CONCLUSION

In this work attempt was made to design superporous hydrogel of PROP HCl. Superporous hydrogel system was chosen for oral disintegrating delivery because of their highly porous nature that has the ability to swell up to a large extent after absorbing considerable amount of swelling media. Secondly Superporous hydrogels are an advance generation of hydrogel system that possesses greater tensile strength due to having elastic characteristics. PROP HCl was chosen as because it has good solubility in acidic media. After oral administration it takes around 1-4 hr to achieve peak plasma concentration. PROP HCl possesses half life ($t_{1/2}$) 3-4 hrs. Due to its short half-life, conventional tablet of PROP required frequent dosing that can cause various side effects such as dizziness, uneven heart beats, shortness of breath etc. It possesses better solubility in acidic media but show degradation in alkaline media.

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