CODEN [USA]: IAJPBB ISSN : 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES
SJIF Impact Factor: 7.187
https://doi.org/10.5281/zenodo.21264874

Available online at: http://www.iajps.com Research Article

DEVELOPMENT AND EVALUATION OF SUSTAINED RELEASE TABLET FORMULATION OF ROPINIROLE HYDROCHLORIDE

Katroju Neelima Santhoshi*[1], Bhukya Swapna[2], Dasari Keerthika[2], Vanam Maitreya[2], Shaziya Begum[2]

[1]Assistant Professor, Department of Pharmaceutics, Svs Group of Institutions (Autonomous), Bheemaram, Hanumakonda, Telangana, India, 506015.

[2]Department of Pharmaceutics, Svs Group of Institutions (Autonomous), Bheemaram, Hanumakonda, Telangana, India, 506015.

Abstract:

The sustained release drug delivery is the drug delivery system that achieves the release of drug in the proper amount at regular time interval over an extended period of time and is time independent. The aim of present work was to formulate and evaluate sustained release tablets of Ropinirole using polymers in order to reduce the various side effects associated with Ropinirole as well as to overcome the manufacturing difficulties. For formulating a sustained release drug delivery system, synthetic hydrophilic polymers are used. Tablets were prepared by direct compression method using different drug-polymer concentration. FT-IR study revealed that there was no chemical interaction between the drug and polymers used. Pre-compression and post-compression parameters complied with Pharmacopoeial limit for the tablets. The in vitro release study was performed and the results indicated that the formulation F2 was found to be the optimized formulation which can extend the release up to a period of 8 hours.From the stability studies it was clear that the formulation was stable after 3 months at accelerated condition of $40^0C \pm 2^0C/75\% RH \pm 5\%$ in a stability chamber.

Keywords: *Ropinirole , FTIR studies, Synthetic polymers, Direct compression technique, In vitro drug release studies*

Corresponding author:

K. Neelima Santhoshi,

Assistant Professor, Department of Pharmaceutics,
Svs Group of Institutions (Autonomous), Bheemaram,
Hanumakonda, Telangana, India, 506015.
Email : neelimatatikonda89@gmail.com

QR CODE

Please cite this article in press ***K. Neelima Santhoshi*** *et al* ***Development And Evaluation Of Sustained Release Tablet Formulation Of Ropinirole Hydrochloride****, Indo Am. J. P. Sci, 2026; 13(07).*

1.INTRODUCTION:

The oral route is the most popular route used for administration of drugs, which is due in part to the ease of administration and to the fact that gastrointestinal physiology offers more flexibility in dosage form design than most other routes[1].The terms Sustained release, prolonged release, modified release, extended release or depot formulations are used to identify drug delivery systems that are designed to achieve or extend therapeutic effect by continuously releasing medication over an extended period of time after administration of a single dose'[2]. The advantages of administering a single dose of a drug that is released over an extended period of time, instead of numerous doses, have been obvious to the Pharmaceutical industry for some time[3]. The desire to maintain a near constant or uniform blood level of a drug often translates into better patient compliance, as well as enhanced clinical efficacy of the drug for its intended use.[4] Introduction of sustained release (SR) has given a new breakthrough for novel drug delivery system (NDDS) in the field of Pharmaceutical technology. It excludes complex production procedures such as coating and pelletization during manufacturing and drug release rate from the dosage form is controlled mainly by the type and proportion of polymer used in the preparations.[6] Hydrophilic polymer matrix is widely used for formulating an SR dosage form. Because of increased complication complication and expense involved in marketing of new drug entities, has focused greater attention on development of sustained release or controlled release drug delivery systems[7].

2.MATERIALS AND METHODS:

Ropinirole was collected as a gift sample from Hetero labs, Hyderabad and various excipients and polymers were purchased from AR chemicals, Hyderabad.

2.1 METHODOLOGY

Preparation method:

Tablets of Ropinirole were prepared by direct compression method as per the formulae given in Table. All the materials required as per the formulae were blended in a closed polyethylene bag. The blends were compressed into tablets on a tablet punching machine to a hardness of 6 kg/cm ^{2} using 8 mm concave punches[8].

Table-1: Formulation table of Ropinirole

S.NO.	INGREDIENTS	F1	F 2	F 3	F 4
1	Ropinirole	4	4	4	4
2	Sodium alginate	20	40	-	-
3	Xantham gum	-	-	20	40
6	Microcrystalline Cellulose	71	51	71	51
7	Magnesium stearate	3	3	3	3
8	Talc	2	2	2	2
9	Total Wt	100	100	100	100

Fourier Transform Infrared Spectroscopy (FTIR)

FTIR spectroscopy Ropinirole discs were created by compressing the Ropinirole with KBr and the spectra was scanned in the range between 4000 to 400 cm-^{1}. Perfect operational conditions were maintained. The absorption maxima which is denoted as max in spectrum obtained with the drug substance is compared with the intensity to those of reference spectrum.

EVALUATION STUDIES[9,10,11,12]:

Determination of bulk density and tapped density

a) Bulk Density

Bulk density is defined as the mass of powder divided by bulk volume.

It is calculated using the following equation:

Bulk density = weight of sample taken /volume noted

b) Tap density

An exactly weighed quantity of the powder (W) was carefully poured into the graduated cylinder and the volume (v_o) was measured.

Tapped density = weight of sample taken / tapped volume

Where,

Vo = initial volume

Vf = final volume.

Compressibility index:

Based on the apparent bulk density and the tapped density, the percentage Compressibility of the bulk drug was determined by the following formula.

Carr's index = Tapped density - Bulk density / Tapped density X 100

Hausner's ratio:

It indicates the flow properties of the powder. The ratio of tapped density to the bulk density of the powder is called Hausner ratio.

Hausner's ratio = Tapped density / Bulk density

Angle of repose:

The flow characteristics are measured by angle of repose. Angle of repose is defined as the maximum angle possible between the surface of a pile of the powder and the horizontal plane.

$\tan\theta = h/r$

Where

h = height of pile

r = radius of the base of the pile

θ = angle of repose

Evaluation of tablet[13,14,15]

Weight variation

Prepared 20 tablets were selected unsystematically from each batch and separately weighed. After that average weight of tablets were calculated.

Thickness

Ten tablets were unsystematically selected form single batch and these 10 tablets thickness were determined by using vernier caliper.

Hardness

The hardness of the tablets was measured by utilizing Pfizer hardness tester. It is expressed in kg/cm. 3 tablets were unsystematically chosen and hardness of the tablets were determined.

Friability

Ten tablets were weighed and located in the Roche friabilator, which was then conducted for 25 rpm for 4 min. After revolution dosage forms were redusted and reweighed.

$\% F = \{1-(Wo/W)\} \times 100$

Where,

% F = friability in percentage

Wo = Initial weight

W = Final weight

Content Uniformity

Twenty tablets from each batch were powdered and weighed accurately equivalent to 100 mg of Ropinirole. Required amount of tablet powder transferred into 100 ml of 6.8 phosphate buffer solution by stirring it for 15 min. 1 ml of solution was pipette out into 10 ml volumetric flask and make up the volume with distilled water. After the sample solution analyze the drug by taking absorbance at suitable wavelength using reagent blank.

In- Vitro Release study

In vitro drug release studies from the prepared tablets were conducted for a period of 8 h using a six station USP type II apparatus (paddle) at 37±05and 50 rpm speed.The dissolution studies were carried out in pH 6.8 , at every 1 h interval samples of 1 mL were withdrawn from the dissolution medium and replaced with fresh medium to maintain the volume constant. After filtration and appropriate dilution, the sample solution was analyzed by UV spectrophotometer. The amounts of drug present in the samples were calculated with the help of appropriate calibration curves. Drug dissolved at specified time periods was plotted as percent release versus time curve.

Stability studies

The stability of the drug substances is investigated when developing the formulation. A suitable method of preparation must be chosen for the tableting of sensitive substances. The stability control proceeds after production by periodic examination of stored reference sample of production batches**.**

Ropinirole tablets were placed on desiccant and stored at ambient conditions such as 37oc and 40±2oc and refrigerator 2-8c for a period of 3 months.

4. RESULTS & DISCUSSION:

Drug - excipient compatibility studies (FT-IR)

The compatibility between the drug and the selected lipid and other excipients was evaluated using FTIR peak matching method. There was no appearance or disappearance of peaks in the API and polymer mixture, which confirmed the absence of any chemical interaction between the drug, polymer and other excipients.

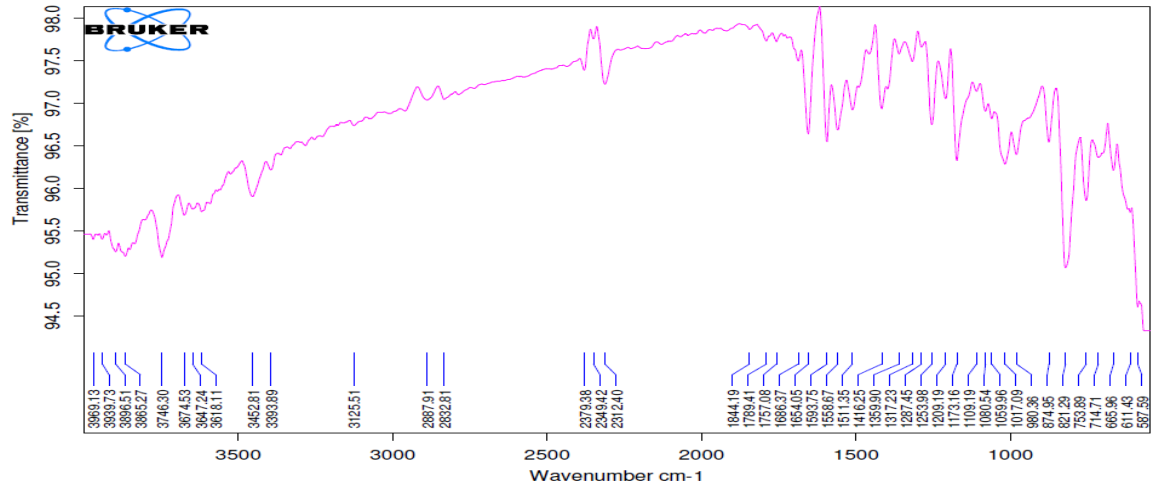

Fig-:1FT-IR Sample for Ropinirole

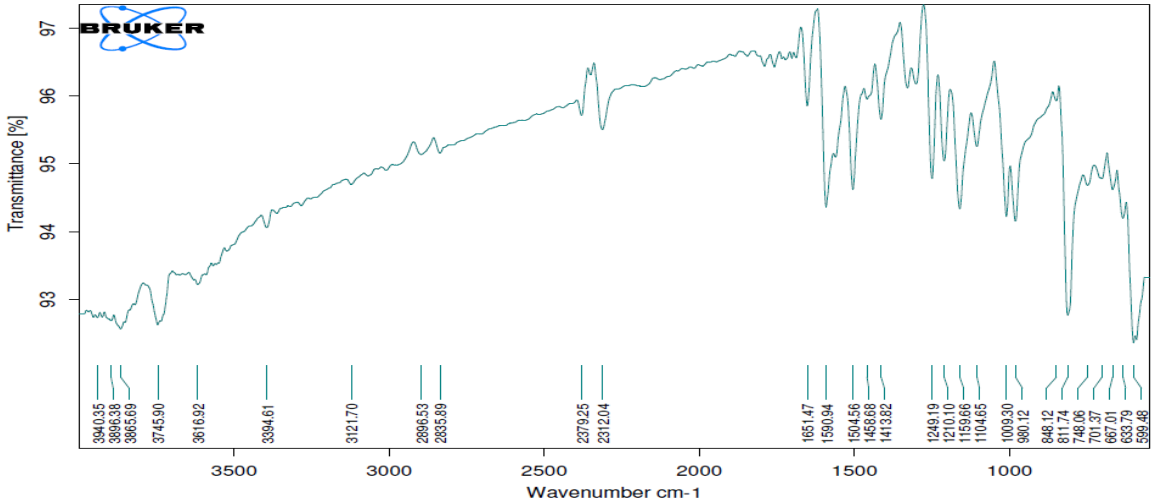

Fig-:2 FT-IR Sample for Optimized Formulation

Evaluation studies

Pre compression parameters

Bulk Density: The bulk density for the formulated blend was carried out for all formulation and found in the range of 0.319-0.332.

Tapped density: The tapped density for the formulated blend was carried out for all formulation and found in the range of 0.421-0.443.

Angle of repose: The angle of repose for the formulated blend was carried out. It concludes that all the formulations blend was found to be in the range of 26 ^{0} to 32 ^{0}

Compressibility index: Compressibility index was carried out, it found between 10% to 25.57% indicating the powder blend have the required flow property for compression.

Table-:2 Results for pre compression parameters

F. no	Bulk density	Tapped density	Compressibility index	Hausner ratio	ANGLE OF REPOSE(^{0})
F1	0.325	0.436	25.45	1.34	27 ^{0}
F2	0.332	0.443	25.05	1.33	28 ^{0}
F3	0.319	0.421	24.22	1.31	30 ^{0}
F4	0.322	0.426	24.70	1.32	31 ^{0}

Post compression parameters

Weight variation:

All the formulated (F1 to F4) tablets passed weight variation test as the % weight variation was within the pharmacopoeial limits of ±7.5% of the weight. The weights of all the tablets were found to be uniform with low standard deviation values.

Thickness:

Tablets mean thickness were uniform in F1 to F4 formulations and were found to be in the range of 3.25mm to 3.46mm.

Hardness:

The measured hardness of tablets of each batch ranged between 5.16 to 5.28 kg/cm^2 .This ensures good handling characteristics of all formulations.

Friability:

The % friability was less than 1% in all the formulations ensuring that the tablets were mechanically stable.

Content Uniformity:

The percentage of drug content for F1 to F4 was found to be between 88.55% and 97.89% of Ropinirole, it complies with official specifications.

Table-:3 Physical parameters of tablets of each batch

F. No.	Weight variation (mg)	Thickness (mm)	Hardness (kg/cm^2)	Friability (%)	Drug content (%)
F1	100	3.21	5.16	0.45	95.36
F2	99	3.28	5.22	0.50	88.55
F3	101	3.27	5.28	0.48	92.50
F4	100	3.16	5.24	0.50	96.85

In-vitro Dissolution Study

All the Four formulation of prepared matrix tablets of Ropinirole were subjected to in-vitro release studies these studies were carried out using dissolution apparatus. The dissolution medium consisted of 900 ml of Standard buffer pH 6.8 for the 8 hrs.

Table-: 4 Dissolution Profile of F1 to F4.

Time (hrs.)	F_1	F_2	F_3	F_4
0	0	0	0	0
1	19.20	18.20	17.11	20.10
2	22.45	25.30	23.11	31.45
3	32.80	35.32	33.76	49.90
4	42.63	44.65	43.23	56.70
5	58.21	59.28	52.11	65.16
6	63.35	68.55	65.22	72.22
7	78.26	80.10	75.16	82.26
8	90.25	92.11	85.12	96.50

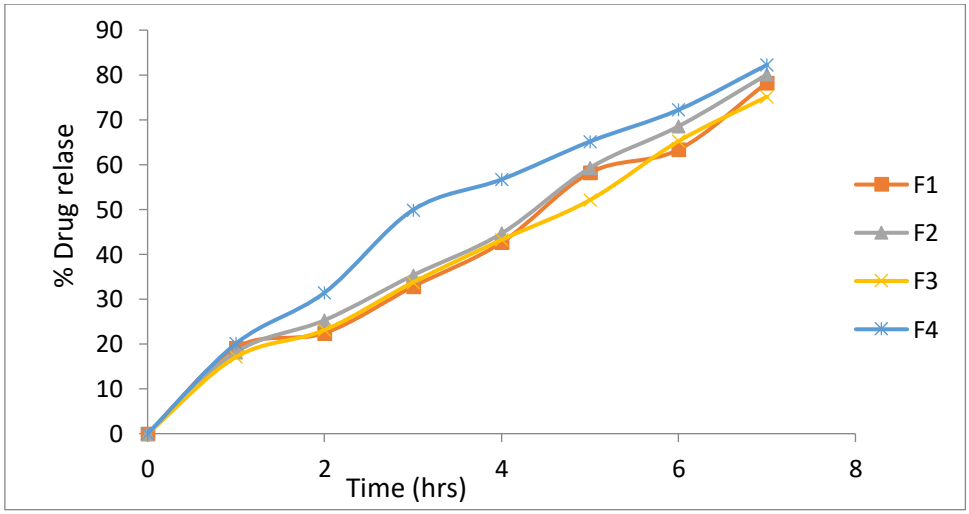

Fig-:3 Dissolution profile of (F1-F4) Formulations

Stability studies

Sustained release tablets of Ropinirole formulated in the present study were subjected to accelerated stability studies. Stability studies of the prepared formulations were performed at ambient humidity conditions, at room temperature, at 40°c and 2-8°c for a period up to 90 days.

Table-: 5 Results of stability studies of optimized formulation F-4

F. Code	Parameters	Initial	1st Month	2nd Month	3rd Month	Limits as per Specifications
F-4	**25^0C/60%RH % Release**	96.17	96.15	94.78	94.10	**Not less than 85 %**
F-4	**30^0C/75% RH % Release**	96.17	95.98	94.55	93.89	**Not less than 85 %**
F-4	**40^0C/75% RH % Release**	96.17	95.80	94.50	93.52	**Not less than 85 %**

4.SUMMARY AND CONCLUSION:

The present study was aimed to formulate sustained release tablet of Ropinirole by direct compression method. IR spectra matching approach was used for detection of any possible chemical interaction between the drug and the polymer. The samples were prepared by pressed pellet technique. FT-IR study revealed the absence of any chemical interaction between drug and polymer used. Preformulation studies of the sustained release powder blend were done. The results of the evaluation suggests that all the powder exhibit good flow properties, so all the formulations were directly compressed to tablets. Post formulation studies of Tablets. Tablets were evaluated for their physical parameters like hardness, thickness, friability, weight variation, and drug content uniformity complies with IP standards. The in-vitro drug release studies were performed using USP type 2 paddle type dissolution apparatus using 6.8 phosphate buffer for 8 hours. The formulation F2 showed the maximum release of drug (96.17 %) at 8th hour. From the release data it is clear that the best sustaining ability was revealed by the formulation F2. The tablets were loaded at accelerated condition at 40 ºC±20C/75% RH±5% in a stability chamber. Samples were withdrawn at 30th , 60th and 90th day and evaluated for the physical appearance, drug content and dissolution characteristics. The result obtained from the study reveals that storage at 40 ºC had no effect on the hardness, disintegration time and dissolution time. The stability studies indicate that the sustained release tablet was suitable for drug delivery of Ropinirole without having any physical stability issues. The formulation F2 could give rise to tablets exhibiting sustained drug release.

5.REFERENCES:

1. Gupta PK and Robinson JR. Oral controlled release delivery. Treatise on controlled drug delivery. 1992;93(2):545-555.
2. Jantzen GM and Robinson JR. Sustained and Controlled- Release Drug Delivery systems. Modern Pharmaceutics. 1995; 121(4): 501-502.
3. Altaf AS, Friend DR, MASRx and COSRx Sustained-Release Technology in Rathbone MJ, Hadgraft J, and Robert MS. Modified Release Drug Delivery Technology, Marcel Dekker Inc., New York, 2003; 126: 996.
4. Gwen MJ and Joseph RR, In Banker GS and Rhodes CT, Eds. Modern Pharmaceutics, Marcel Dekker Inc. New York, 1996; 72(3): 575.
5. Salsa T, Veiga F and Pina ME. Oral controlled release dosage form. I. cellulose ether polymers in hydrophilic matrices. Drug Develop. Ind. Pharm. 1997; 23: 929-938.
6. Wani MS et al. Controlled Release system-A Review. Pharmaceutical Reviews. 2008; 6(1): 41-46.
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. JPSBR: Volume 1, Issue 3: Nov Dec 2011 (143-151) Patel H. 151
8. Vidyadhara S, Rao PR, Prasad JA. Formulation And Evaluation Of Propranolol Hydrochloride Oral Controlled Release Matrix Tablets. Indian J.Pharm Sci, 2004; 66: 188-192.
9. Reddy KR, Mutalik S, Reddy S. Once-daily sustained release matrix tablets of Nicorandil: Formulation and in vitro evaluation,AAPS Pharm. Sci. Tech.,2003; 4: 1-9.
10.Mohammed AD, James LF, Michael HR, John EH, Rajabi-Siahboomi AR. Release of Propranolol hydrochloride from matrix tablets containing sodium carboxy methylcellulose and Hydroxy propyl methyl cellulose. Phar. Dev. Tech.,1999; 4: 313-324.
11. Lee BJ, Ryu SG, Cui JH. Formulation and release characteristics of hydroxypropyl methylcellulose matrix tablet containing melatonin. Drug Dev. Ind.Pharm.,1999; 25:
12.Gwen MJ, Joseph RR, In Banker GS and Rhodes CT, Eds., Modern Pharmaceutics, 3rd Edn, Vol. 72, Marcel Dekker Inc. New York, 1996: 575.
13. Jantzen GM, Robinson JR. Sustained and controlle release drug delivery system. In BankerGS, Rhodes CT, editors. Modern pharmaceutics. 3rd edition New york: Marcel dekkerInc; 1996.p.575-09.
14. Chein Y.W. Oral Drug delivery and delivery systems. In: Noveldrug delivery systems. Marcel Dekker, Inc., New York, 2002;50; 3rd edition: 139-96.
15. Vyas S,P, KharRK.Controlled Drug delivery: Concepts andAdvances .Concepts and Advances.1sted.vallabhprakashan,2002,p,156- 189.