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FORMULATION AND EVALUATION OF FAST DISSOLVING TABLET OF NIMODIPINE USING DIFFERENT SUPER DISINTEGRANTS

Sanjiv Kumar Gupta* and Sunil Kumar*

Agra Public Pharmacy College, Artoni –Agra.

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***Corresponding Author**
Prof. Sanjiv Kumar Gupta
Agra Public Pharmacy College, Artoni –Agra.

ABSTRACT

In present study has been made for the development and evaluation of Fast dissolving tablets of Nimodipine prepared by using super disintegrants like crosspovidone, cross caramellose sodium and sodium starch glycolate by direct compression method. Effect of different super disintegrants on disintegration behavior of tablets was evaluated. All the formulations were evaluated for pre compression like angle of repose carr,s index & post compression parameters hardness, weight variation, wetting time and friability, invitro dissolution etc. Wetting time of formulations containing crosscarmellose sodium was least and tablets showed fast disintegration. Of the nine formulations studied F9 showed short dispersion time with maximum drug release 99.95% in 30Mins. The use of super disintegrant crosspovidone at concentration of 18% given the better release of drug when compared to other superdisintegrants. The proposed Fast dissolving formulation possessed ideal and reproducible characteristics of disintegration time and drug release profile.

KEYWORDS: Nimodipine, In-Vitro Evaluation, Fast dissolving Tablets, wetting time.

1. INTRODUCTION

Oral route of drug administration have wide acceptance of up to 50-60% of total dosage forms. Solid dosage forms are popular duo to simple administration, accurate dosage, self medication, pain avoidance and most significantly the patient compliance. the foremost popular solid dosage form are being tablets and capsules and important drawback of those dosage forms for a few patients however is that the difficulty to swallow. (Indurwade NH 2002). drinking water plays a very important role within the swallowing of oral dosage forms.

Often times people experience inconvenience in swallowing conventional dosage forms like tablets when water isn't available within the case of sickness (kinetosis) and sudden episodes of coughing during the communicable disease, allergic conditions and bronchitis.(Wanatabe 1995) 'Fast dissolve', 'Quick dissolve', 'Rapid melt', 'Quick disintegrating', 'Mouth dissolving', 'Orally disintegrating', 'Oro-dispersible', 'Melt in mouth' etc are the term that represent the identical drug delivery system. Recently fast dissolving tablet technology has been approved by the United State Pharmacopoeia (USP), Centre for Drug Evaluation and Research (CDER). Despite various terminologies used, Fast dissolving tablet are here to supply unique sort of drug delivery with many advantages over the standard oral solid dosage form. (Rakesh K.R 2004) (Pfister WR 2009). Antihypertensive drugs like Nimodipine have the oral problems like difficulty in swallowing, less oral bioavailability, first pass metabolism in conventional tablet dosage forms. to beat such problems the antihypertensive drugs is formulated within the sort of fast dissolving tablets where the drug is rapidly disintegrated in mouth within fraction of seconds and improves the oral drug bioavailability. Rapid dissolving tablets is prepared by methods like direct compression, wet granulation, sublimation, effervescent methods together with superdisintegrants to extend in vitro dispersion time. a number of the newer methods to formulate quick release dosage forms include Zydis, Orasolv, Flashtab, Wowtab, oraquick, Ziplet, etc. Nimodipine may be a long-acting dihydropyridine calcium channel blocker. it's effective within the treatment of heart disease and HYPERTENSION. it's chemically3-(2- methoxyethyl)5- propane-2-yl,6-dimethyl-4-(3-nitrophenyl)-1,4-dihydropyridine-3,5- dicarboxylate is an efficient and well tolerated antihypertensive, but in conventional dosage forms it undergoes first pass metabolism where the oral bioavailability (90%) was reduced to 64%. Hence, within the present study an endeavor has been made to formulate fast dissolving tablets of Nimodipine direct compression method using three superdisintegrants sodium starch glycolate, (SSG) crosscarmellose sodium(CCS) and crospovidone (CP), microcrystalline cellulose (MCC) as diluents with other excipients like sweetener and flavour with a view to develop a convenient means of administration to those patients tormented by difficulties in swallowing, nausea and sickness.

1. MATERIALS

The following materials of pure grade or the best possible Laboratory Reagent (LR) were used as supplied by the manufacturer. The double purified water was used in all experiments.

Table 1: List of chemicals used with grade and supplier.

SR. No.	Materials used	Grade	Manufacturer
1.	Nimodipine	API	Vitttal Pharma, Agra
2.	Microcrystalline cellulose	LR	S D fine chemical Ltd, Mumbai
3.	Sodium starch glycolate	LR	Sigma aldirch, Mumbai
4.	Crosscarmellose sodium	LR	Sigma aldirch, Mumbai
5.	Crospovidone	LR	Sigma aldirch, Mumbai
6.	Mannitol	LR	S D fine chemical Ltd, Mumbai
7.	Magnesium sterarte	LR	S D fine chemical Ltd, Mumbai
8.	Saccharin Sodium	LR	Merk india, Mumbai
9.	Vanilla Flavor	A.Grade	Micro labs, Bangalore
10.	Potassium dihydrogen orthophosphate	LR	Merk india, Mumbai
11.	Sodium hydroxide	LR	Merk india, Mumbai

1.1. Method of formulation development

during this work, direct compression method with the help of super-disintegrants was attempted for the formulation development of rapid dissolving tablets of Nimodipine. The Nimodipine tablets are available in 30mg doses within the market. Dose of 30 mg is chosen for this study. Development of the formulation within the present study was mainly supported the type and concentration of polymers and also the properties of the drug. Various polymers in several concentrations (Polymer ratio 1:2:3) were employed in several formulation. so on get tablets with good physical properties. The formulation design of fast dissolving tablets of Nimodipine is shown in Table.

Table 1.1: Formulation design of Nimodipine fast dissolving tablets.

Sr.No	Ingredients (mg/tablet)	F1	F2	F3	F4	F5	F6	F7	F8	F9
1	Nimodipine	30	30	30	30	30	30	30	30	30
2	Cross carmollose sodium	6	12	18						-
3	Sodium Starch				6	12	18			
4	Cross povidon	-	-	-	-			6	12	18
5	Mannitol	35	29	23	35	29	23	35	29	23
6	Aerosil	3	3	3	3	3	3	3	3	3
7	Magnesium stearate	2	2	2	2	2	2	2	2	2
8	Sod. saccharin	8	8	8	8	8	8	8	8	8
9	Flavour(Vanilla)	4	4	4	4	4	4	4	4	4
10	Microcrystalline	72	72	72	72	72	72	72	72	72

1.2. Manufacture of Nimodipine fast dissolving Tablets

Manufacture of Nimodipine fast dissolving Tablets: Nimodipine fast dissolving tablets were manufactured in nine formulations F1 to F9 using the ingredients mentioned within the Table-1.2 keeping the various formulation batches were prepared to stay with formula shown in table 1. Nimodipine was used with SSG, CP and CCS to formulate the Mouth Dissolving

Tablet. All the ingredients with drug except Magnesium stearate were taken within the mortar. The powder blend was then mixed well by using mortar and pestle for 15 to half-hour, so each mixture was competent # 80 sieve. Finally Magnesium stearate was added as a lubricant and mixed thoroughly. The powder blend was compressed using 16 stations tablet compression machine. Cadmach JMD-4-8, Ahemdabad, India) to produce flat faced tablets Nimodipine weighing 160 mg having diameter of 8 mm.

3. Evaluation of Nimodipine tablets

3.1. Pre-compression parameters

3.1.1. Angle of Repose

The frictional force in an exceedingly loose powder or granules is additionally measured by angle of repose. Angle of repose is defined because the utmost angle possible between the surface of a pile of the powder and horizontal plane. Q= tan-1 (h/r) Where, Q is that the angle of repose his height of pile r is radius of the underside of pile Different ranges of flow ability in terms of angle of repose are given in below table.

Table 3.1: Range of angle of repose.

Angle of Repose (ɵ)	Flow
>25	Excellent
25-30	Good
30-40	Passable

3.1.2 Bulk Density

Loose bulk density (LBD) and tapped bulk density (TBD) of Nimodipine and also the tablet blends were determined using bulk density apparatus. The pure drug was tried and true #18 sieve to interrupt the clumps, if any. Accurately weighed 5 g of the drug or 25 g of polymers was placed during a 100 ml graduated measuring cylinder. Initial volume was observed. The cylinder was tapped initially 100 times from a distance of 14 ± 2 mm. The tapped volume was measured to the closest graduated unit. The tapping was repeated additional 100 times. Again the tapped volume was measured to the closest graduated unit. the identical thing was in hot water powder blends of the tablets. The LBD and TBD were calculated in g per ml using following formula.

LBD = weight of the powder / volume of the packing

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

3.1.3 Compressibility Index (Carr's Index)

The compressibility index of the granules determined by carr's compressibility index. Grading of the powders for his or her flow properties in step with Carr's Index is shown in below table.

Table 3.2: Range of Carr's Index.

% Compressibility	Flow ability
5 – 12	Excellent
12 – 16	Good
18 – 21	Fair Passable
23 – 35	Poor
33 – 38	Very Poor
< 40	Very Very Poor

3.1.4-Hausner ratio: The hausner ratio of the powder was determined by the following equation.

Hausner ratio = TBD / LBD

Lower hausner ratio (<1.25) indicates better flow properties than higher ones (>1.25).

3.2 Post-compression parameters

The tablets after punching of each batch were evaluated for inprocess and finished product internal control tests i.e. thickness, weight uniformity test, hardness, friability, drug content, in vitro dispersion time, water absorption ratio, wetting time and in vitro drug release studies.

3.2.1 Thickness

Thickness of tablets indicates the strength to resist compression force applied during manufacturing process. Thickness of tablets was measured by digital calliper.

3.2.2 Hardness Test

Hardness (diametric crushing strength) could be a force required to interrupt a tablet across the diameter. The hardness of a tablet is a sign of its strength. The tablet should be stable to mechanical stress during handling and transportation. The hardness was tested using Monsanto tester. "The force was measured in kilograms per centimeter square. the hardness of about 3-5 kg/cm is taken into account to be satisfactory for uncoated tablets.

3.2.3 Friability Test

Friability is that the loss of weight of tablet within the container/package, thanks to removal of fine particles from the surface. This in process internal control test is performed to make

sure the power of tablets to resist the shocks during processing, handling, transportation, and shipment. Permitted friability limit is 0.5 to 1.0%. Roche friabilator (Electrolab, Mumbai) was accustomed measure the friability of the tablets. Ten tablets were weighed collectively and placed within the chamber of the friabilator. within the friabilator, the tablets were exposed to rolling, resulting free fall of tablets (6 inches) within the chamber of the friabilator. it had been rotated at a rate of 25 rpm. After 100 rotations (4 minutes), the tablets were taken out from the friabilator and intact tablets were again weighed collectively.

F= W(initial)- W(final)/W(initial) X 100

3.2.4. Weight Variation Test

Twenty tablets were weighed individually and every one together. Average weight was calculated from the whole weight of all tablets. The individual weights were compared with the typical weight. the proportion difference within the weight variation should be within the permissible limits (±7.5%). the whole weight of tablets formulated was 160mg. the proportion deviation for weight uniformity of tablets as per IP limits is shown in below table.

Table 3.3: Range of Weight Variation Test.

Average weight of tablet	Percentage deviation (SD)
80 mg or less	10
More than 80 mg and less than 250 mg	7.5
250 mg or more	5

3.2.5. In -vitro dispersion Time

In vitro dispersion time was measured by dropping a tablet into a petridish containing 10 ml of phosphate buffer pH 6.8 solution (simulated saliva fluid). Three tablets from each formulation were randomly selected and tested. In vitro dispersion time was found and expressed Time in seconds.

3.2.6. Wetting time and Water absorption ratio

Wetting time of dosage form is related with the contact angle. Wetting time of the fast dissolving tablets is another important parameter, which needs to be assessed to give an insight into the disintegration properties of the tablets; a lower wetting time implies a quicker disintegration of the tablet. The wetting time of the tablet can be measured using a simple procedure. Two circular tissue papers of 10 cm diameter are placed in a petridish having the same inner diameter. Ten ml of phosphate buffer solution, 6.8 pH containing Eosin, a water soluble dye, is added to petridish. A tablet is carefully placed on the surface of the tissue

paper so that complete tablet was not immersed in the solution. Then, the time required for buffer to reach upper surface of the tablet is noted as wetting time.

Water absorption ratio is another method in this method a piece of paper folded twice was placed in a small petridish containing 6ml of water. A tablet was put on the paper & the time required for complete wetting wasmeasured. The wetted tablet was then weighed. Water absorption ratio (R) calculated using the formula,

R= 100x (wa-wb) /wb

Where Wa= weight of tablet after absorption

Wb=weight of tablet before absorption

3.2.6. Drug content determination

Three uncoated tablets were selected randomly and average weight was calculated. Tablets were crushed in a mortar and accurately weighed amount of tablet powder was taken from the crushed blend. Then the samples were transferred to three 100 ml volumetric flasks and were diluted up to the mark with phosphate buffer (pH 6.8) solution. The contents were shaken periodically and kept for 24 hours for solvation of drug completely. The mixtures were filtered, appropriately diluted, and absorbences were measured at λmax 250 nm against blank reference. The drug content in each tablet was calculated using the standard calibration curve of Calibration of Nimodipine in phosphate buffer (pH6.8) solution at λmax 250nm in phosphate buffer pH 6.8 solution.

3.2.7. In-vitro disintegration time

The process of breakdown of a tablet into smaller particle is called as disintegration the *in-vitro* disintegration time of fast dissolving tablet was determine using disintegration test apparatus as IP specification: Place one tablet in each of the 6 tube of the basket. Add a disc to each tube and run the apparatus using phosphate buffer (pH-6.8) maintained at 370c as the immersion liquid. The time taken in second for complete disintegration of the tablet with no palpable mass remaining in the apparatus was measured and recorded.

Standard limit for disintegration time is within 3min in water at 37ºC.

3.2.8. In vitro drug release

Procedure for determining In vitro drug release studies

In vitro drug release of the samples was carried out using USP – type II dissolution apparatus (paddle type). The dissolution medium, 900 ml of phosphate buffer (pH 6.8) solution, was

placed into the dissolution flask maintaining the temperature of 37±0.5ºC and rpm of 50. One tablet was placed in each flask of dissolution apparatus. The apparatus was allowed to run for 10 min. Samples measuring 5 ml were withdrawn after every 5, 10, 15, 20,25,30 min.

Samples were filtered through 10 µm filter. The fresh dissolution medium was replaced every time to maintain sink condition. The collected samples were analyzed at 250 nm using dissolution medium as blank. The cumulative percentage drug release was calculated.

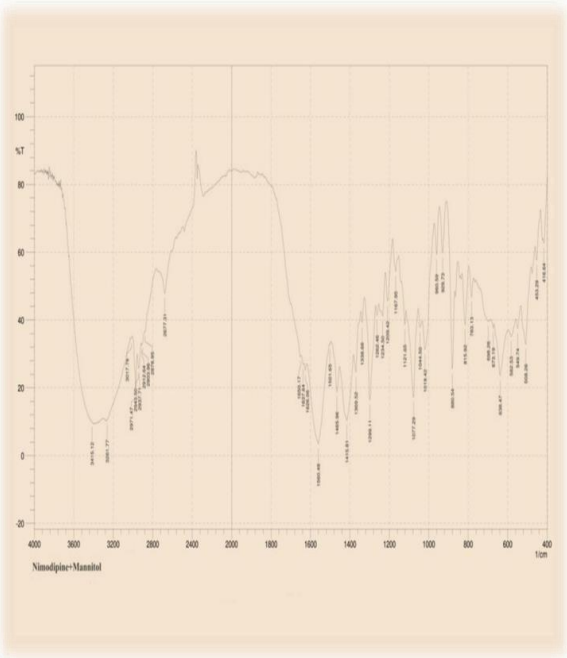
Table 3.4: *In vitro* drug release.

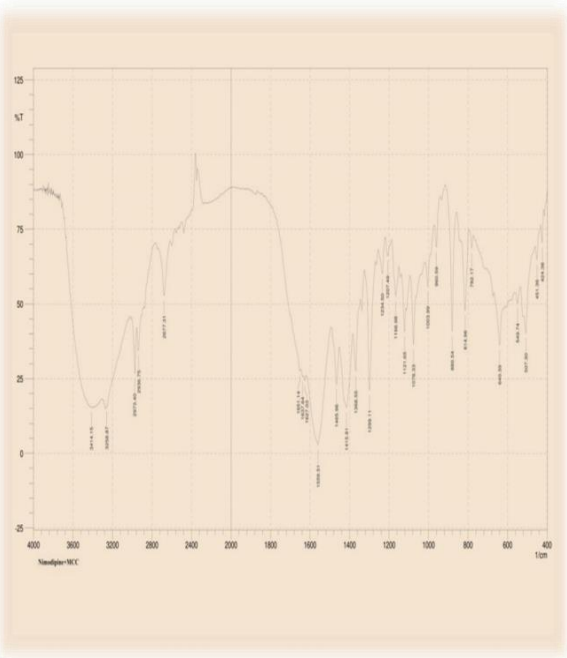
S.no	Requirement	Specification
1.	Apparatus	USP type II
2.	Volume of medium	900ml
3.	Temperature	370c
4.	Paddle speed	50RPM
5.	Dissoluation medium used	6.8
6.	A liquid taken at each time interval	5ml

4. RESULT AND DISCUSSION

4.1. Drug –Polymer interaction Study

FT-IR interpretations of pure drug and physical mixtures





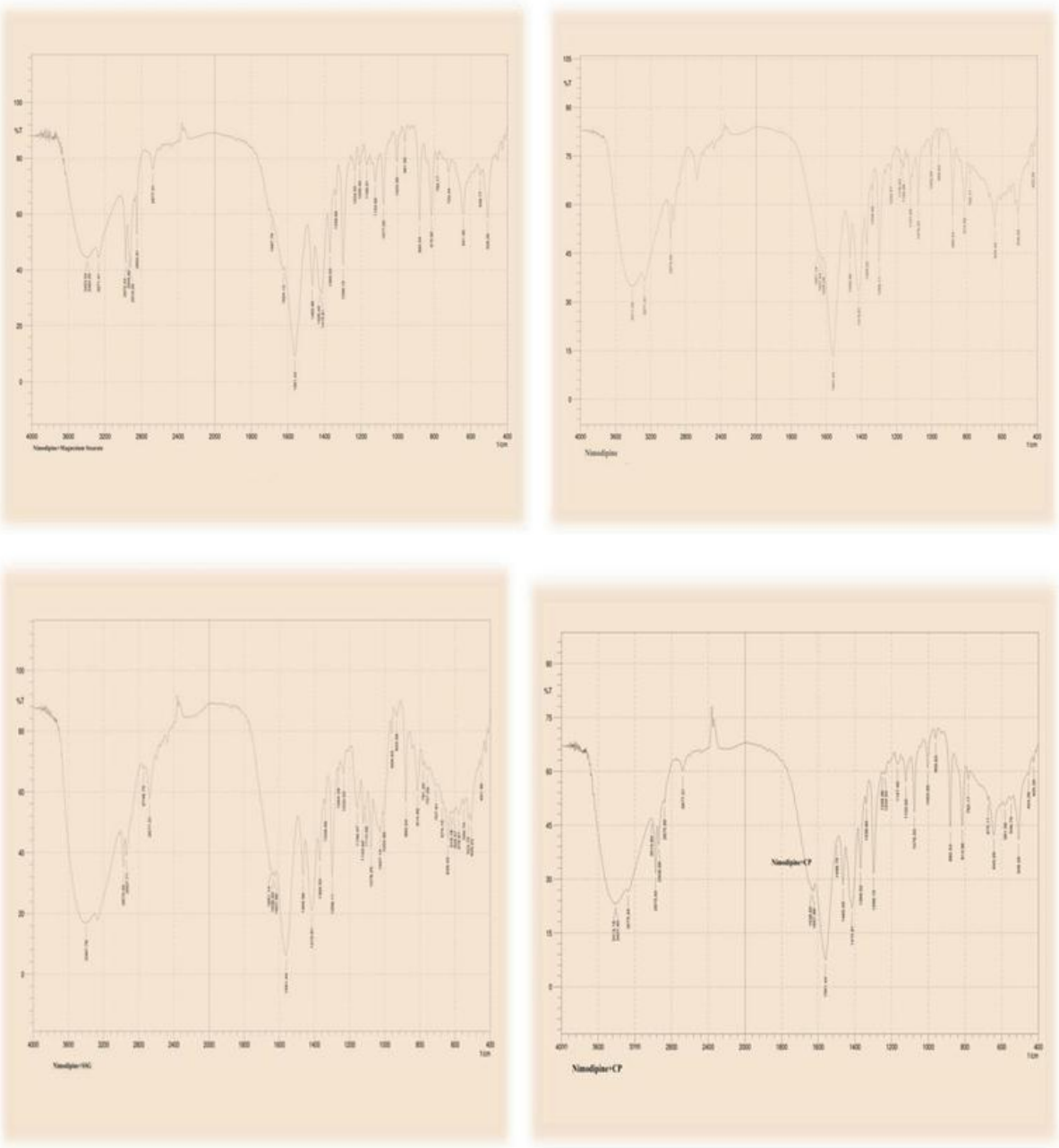


Figure No 4.1 to 4.6: FT-IR Spectra of Nimodipine with different superdisingredient Crospovidone, croscarmullose, sod. starch glycolate

There is no significant change in peaks behavior of functional groups in pure drug amlodipine and drug polymer mixture. When analyzed by the Ir spectroscopy, hence the drug and polymer and excipient mixture. (Figure-)

Table 4.1.: FT-IR interpretations of pure drug and physical mixtures.

S.No	Function al group	Chara cteristic peaks							
			Nimo dipine	Nimodipine : MCC	Nimodipine : SSG	Nimodipine : CCS	Nimodipine : Crospovid one	Nimodipine : Mannitol	Nimodipine : Mg. stearate
1	C-H (Aromati c bending)	680-860 cm^{-1}	782.17 cm^{-1}	782.17 cm^{-1}	781.20 cm^{-1}	781.20 cm^{-1}	782.17 cm^{-1}	783.13 cm^{-1}	782.12 cm^{-1}
2	NO2 (stretchin g)	1300-1600 cm^{-1}	1369.52 cm^{-1}	1368.55 cm^{-1}	1369.52 cm^{-1}	1369.52 cm^{-1}	1369.52 cm^{-1}	1369.52 cm^{-1}	1369.52 cm^{-1}
3	C=C (Aromat ic stretching)	1400-1600 cm^{-1}	1465.96 cm^{-1}	1465.96 cm^{-1}	1415.81 cm^{-1}	1415.81 cm^{-1}	1465.00 cm^{-1}	1415.81 cm^{-1}	1426.42 cm^{-1}
4	N-H (bending)	1580-1650 cm^{-1}	1626.06 cm^{-1}	1627.03 cm^{-1}	1638.60 cm^{-1}	1637.64 cm^{-1}	1627.99 cm^{-1}	1626.06 cm^{-1}	1624.13 cm^{-1}
5	C-H (stretchin g)	2850-3000 cm^{-1}	2973.40 cm^{-1}	2936.75 cm^{-1}	2937.71 cm^{-1}	2936.75 cm^{-1}	2938.68 cm^{-1}	2943.50 cm^{-1}	2934.82 cm^{-1}
6	O-H (stretchin g)	3200-3500 cm^{-1}	3411.26 cm^{-1}	3258.81 cm^{-1}	3397.26 cm^{-1}	3272.38 cm^{-1}	3273.34 cm^{-1}	3261.77 cm^{-1}	3271.41 cm^{-1}

4.2 Evaluation of fast dissolving Tablets

4.2.1 Pre compression parameter

4.2.1.1 Angle of Repose

Angle of repose has been defined as the maximum angle possible the surface of pile of powder and horizontal plan. The angle of repose was to be reported 28.68 to 32.43 (table4.2.1). Which shows passable type of flow.

4.2.1.2 Bulk Density

Bulk density of each formulation was then obtained by sample contained in the cylinder by tapping method. It was calculated 0.38±0.32 to 0.43±0.24(table4.2.1**).**

4.2.1.3 Tapped Density

The tapped density was obtained by sample contained in cylinder. it was calculated 0.48±0.16 to 0.53±0.34.(table4.2.1).

4.2.1.4 Compressibility Index (Carr's Index)

As indirected method of measuring powder flow. Carr,s index of each formulation was calculated 19.34 to 24.22 (table4.2.1).). this shows fair to passable type of flow.

4.2.1.5 Hausner's ratio

Hausner's ratio another indirected method of powder flow properties determination. The hausner's ratio found to be 1.16 to 1.31 which is passable flow table4.2.1).

Table 4.2.1: Pre-compression parameters.

S.No.	Formulation code	Angle of repose	Bulk Density	Tapped Density	Carrs Index	Hausner ratio
1.	**F1**	32.19±0.23	0.42±0.27	0.48±0.16	21.68	1.31
2.	**F2**	30.47±0.16	0.43±0.18	0.49±0.24	23.54	1.12
3.	**F3**	27.28±0.32	0.40±0.32	0.51±0.26	19.70	1.25
4.	**F4**	28.68±0.13	0.41±0.21	0.53±0.34	24.22	1.21
5.	**F5**	29.45±0.29	0.38±0.32	0.55±0.23	20.58	1.16
6.	**F6**	30.37±0.27	0.39±0.26	0.52±0.35	23.57	1.18
7.	**F7**	31.63±0.34	0.41±0.34	0.49±0.29	22.32	1.17
8.	**F8**	32.93±0.34	0.43±0.24	0.51±0.18	21.27	1.24
9.	**F9**	30.56±0.34	0.42±0.29	0.52±0.21	19.34	1.18

The angle of repose less than 32, which reveals good flow property it shown in for formulations F1 – F9. The loose bulk density and tapped bulk density for all formulation (F1 – F9) varied from 0.38 gm/cm^3 to 0.43 gm/cm^3 and 0.48 gm/cm^3 to 0.55gm/cm^3 respectively.

The results of carr's consolidate index or % compressibility index for the entire formulation (F1 – F9) blend range from 15 to 19 shows fair flow properties.

4.2.2. Post-compression parameters

4221. Thickness

The thicknesses of formulated fast dissolving tablets were found to be in range of 2.44 to 2.55 ± 0.03 mm. The values were almost uniform in all F1 to F6 formulations. (table.4.2.2).

4222 Weight variation

Variation in the weights of the formulations was determined by weighing 20 tablet on a digital balance and then calculating the average weight. From the results shown in table.4.2.2); it was observed that all the batches were uniform in weight with no significant difference in the weight of the individual formulation from the average value.

Average weight of all tablets were 149±1.98 to 151±2.34 mg (table 4.2.2). This shows all the tablets gave the result with in official limits.

4223 Hardness Test

Tablet hardness of each formulation was measured by Monsanto hardness tester. The hardness of the formulation was found 3.12 ±0.27 to 3.69±0.25 kg/cm2 (table-4.2.2). Hardness 3-5 show official hardness limit for uncoated tablets. So all formulation tab lets hardness with in limit.

4224 Friability Test

Friability of a tablet denoted its strength. Roche friabilator was used for testing friability. The friability of fast dissolving tablets were 0.212 to 0.312(Table 4.2.2) pass USP limit. 5 to 1%.

Table 4.2.2: Post-compression parameters.

S.No.	Formulation code	Thickness(mm)	WeightVariation	Hardness(kg/cm^2)	Friability
1.	**F1**	2.48	150±1.44	3.14±0.25	0.22
2.	**F2**	2.44	151±2.34	3.69±0.25	0.312
3.	**F3**	2.51	150±0.94	3.12±0.27	0.302
4.	**F4**	2.49	150±0.84	3.20±0.25	0.284
5.	**F5**	2.55	149±1.98	3.47±0.27	0.262
6.	**F6**	2.48	150±1.45	3.51±0.25	0.292
7.	**F7**	2.55	150±1.68	3.12±0.27	0.198
8.	**F8**	2.51	150±1.88	3.20±0.25	0.212
9.	**F9**	2.50	150±2.20	3.50±0.27	0.242

4.2.3. In -vitro dispersion Time

In Vitro dispersion time was measured by dropping a tablet into a petridish containing 10 ml of phosphate buffer pH- 6.8. Time require for complete dispersion of a tablet was measured. In-vitro dispersion time of fasting dissolving tablets were found 26±0.53 to 38±0.54 (Table-4.2.3). All the formulation dispersion time within limit. The formulation containing lower percentage of superdisintegrant have show the low the dispersion time and on other formulation containing the highest percentage of superdisintegration have shown the high dispersion time the results indicated that dispersion time decrease with an increase in concentration of superdisintegration. Formulation F9 shows betterdispersion time(26sec) because the cros povidon highest.

4.2.4. Wetting time

The time required for the buffer to reach upper surface of the tablet was noted wetting time. The wetting time of fast dissolving tablets were found 21±0.98 to 33±0.59(table 7.2.6.) all the formulation show wetting time with in limit. Formulation F9 shows best wetting time because of crospovidone (18%) highest percentage.

4.2.5. Water absorption ratio

The formulation containing lower percentage of superdisintegrant have show the lower the water absorption ratio and on other formulation containing the highest percentage of superdisintegration have shown the higher water absorption ratio the results indicated that water absorption ratio decrease with decrease in concentration of superdisintegration The water absorption ratio was found 48±2.47 to 109.31±.3.49 show all results with in limit. Formulation F9 shows better water absorption ratio.

4.2.6. Drug content determination

Three tablets were selected randomly and average weight was calculated. Tablets were crushed in a mortar and accurately weighed amount of tablet powder was taken from the crushed blend. Then the samples were transferred to three 100 ml volumetric flasks and were diluted up to the mark with phosphate buffer (pH 6.8) solution. The contents were shaken periodically and kept for 24 hours for solvation of drug completely. The mixtures were filtered, appropriately diluted, and absorbance's were measured at λmax 250 nm against blank reference uniformity of content of fast disintegrating tablets were 98.41±1.86 to 100.23±0.89.

4.2.3. Post-compression parameters; %drug content, Water absorption Ratio, Wetting Time And In-Vitro Dispersiontime.

S.No.	Formulation code	%drug content	Waterabsorption Ratio	Wetting Time	In- Vitro Dispersiontime(sec)
1.	**F1**	99.43±1.92	48±2.47	31±0.42	34±0.62
2.	**F2**	98.41±1.86	54.73±1.32	29±0.63	33±0.73
3.	**F3**	99.68±1.91	60.19±3.28	24±0.29	31±0.67
4.	**F4**	99.69±1.68	76.83±2.59	33±0.59	38±0.54
5.	**F5**	98.73±0.55	102±2.03	32±0.52	37±0.92
6.	**F6**	99.27±1.16	99.31±2.38	30±0.16	36±0.89
7.	**F7**	99.34±0.97	78.66±4.83	25±0.37	30±0.84
8.	**F8**	99.76±1.21	95.73±2.34	22±0.46	29±0.41
9.	**F9**	100.23±0.89	109.31±.3.49	21±0.98	26±0.53

4.2.7. *In-vitro* disintegration time

In-vitro disintegration time The process of breakdown of a tablet into smaller particle is called as disintegration the in-vitro disintegration time of fast dissolving tablet was determine using disintegration test apparatus as IP specification: Place one tablet in each of the 6 tube of the basket. Add a disc to each tube and run the apparatus using phosphate buffer (pH-6.8) maintained at 370c as the immersion liquid. The time taken in second for complete disintegration of the tablet with no palpable mass remaining in the apparatus was measured and recorded. Formulation F9 showing best disintegration time (35 sec) because the crospovidon acts by both swelling and wicking actions and highest percentage.

Table 4.2.7: *In-vitro* disintegration time.

S.No.	Formulationcode	Disintegrationtime(sec)
1.	F1	45±2.62
2.	F2	43±2.73
3.	F3	41.19±2.67
4.	F4	125±2.54
5.	F5	120±2.92
6.	F6	96±.2.89
7.	F7	42±2.84
8.	F8	40±2.41
9.	F9	35±2.76

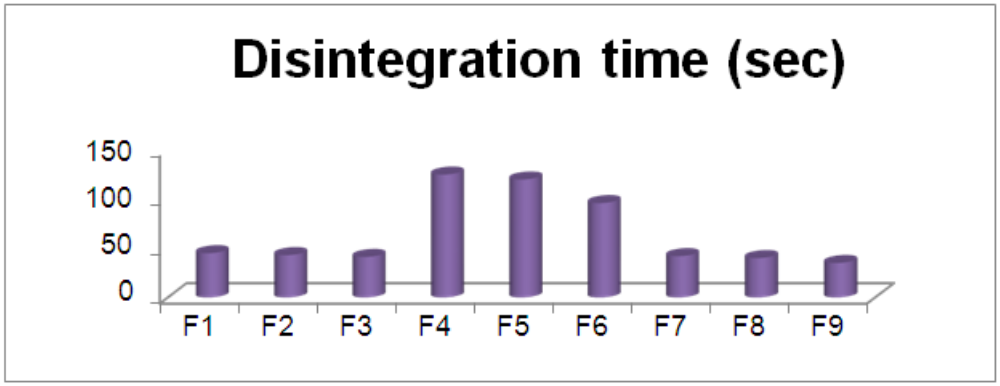


Fig. 4.2.7: *In-vitro* disintegration time.

4.2.8. *In-vitro* release

In-vitro release: % cumulative drug release profile for all the nine formulation is shown in (Table.4.2.8.). the tablets of formulation F4,F5,F6 containing sodium starch glycolate shows 82.70, 84.44, 92.02% of drug at the end of 35 min. the drug release profile will not shown up to 100% which 16% Plagiarised 84% Unique 694 Words 5788 Characters could be due to sodium starch glycolate(SSG). SSG is found to release drug only by swelling method. ssg swelling only 7 to 12 in less than 30min. due to this to much swelling takes place in three dimensions which sustain the release of drug. Further the tablets of formulation F1,F2,F3, (cross carmellose sodium) showed 93.32, 94.7,95.51% of drug release at the end of 35min. in this case the % drug release not shows upto 100% because cross carmellose sodium swell 4 to 8 fold only but swelling occurs two dimension and here also no wickingaction take place so release percentage is much higher to sodium starch glycollate formulation but less than cros povidone formulation. the cros povidone formulations showed 96.69, 98.23,95.95% of drug release within 35min. the maximum drug release was obtained since cros povidone acts by both swelling and wicking actions which aids to release of the drug.

Table 4.2.8: *Invitro*drug release.

S.No.	Time(min)	F1	F2	F3	F4	F5	F6	F7	F8	F9
1.	0	0	0	0	0	0	0	0	0	0
2.	5	61.72	67.41	73.04	43.96	48.18	60.41	71.98	75.45	79.35
3.	10	78.90	80.69	82.28	49.58	59.68	77.88	80.37	84.52	87.47
4.	15	83.39	84.64	85.67	57.22	64.76	83.00	83.46	88.21	89.78
5.	20	86.71	87.37	89.52	63.31	69.00	85.44	87.39	92.39	93.51
6.	25	88.59	90.04	91.04	70.20	75.94	87.14	91.76	95.64	96.43
7.	30	89.49	93.76	94.17	76.24	80.71	89.54	95.56	97.82	98.39
8.	35	93.62	94.70	95.51	82.70	84.44	92.02	96.59	98.23	99.95

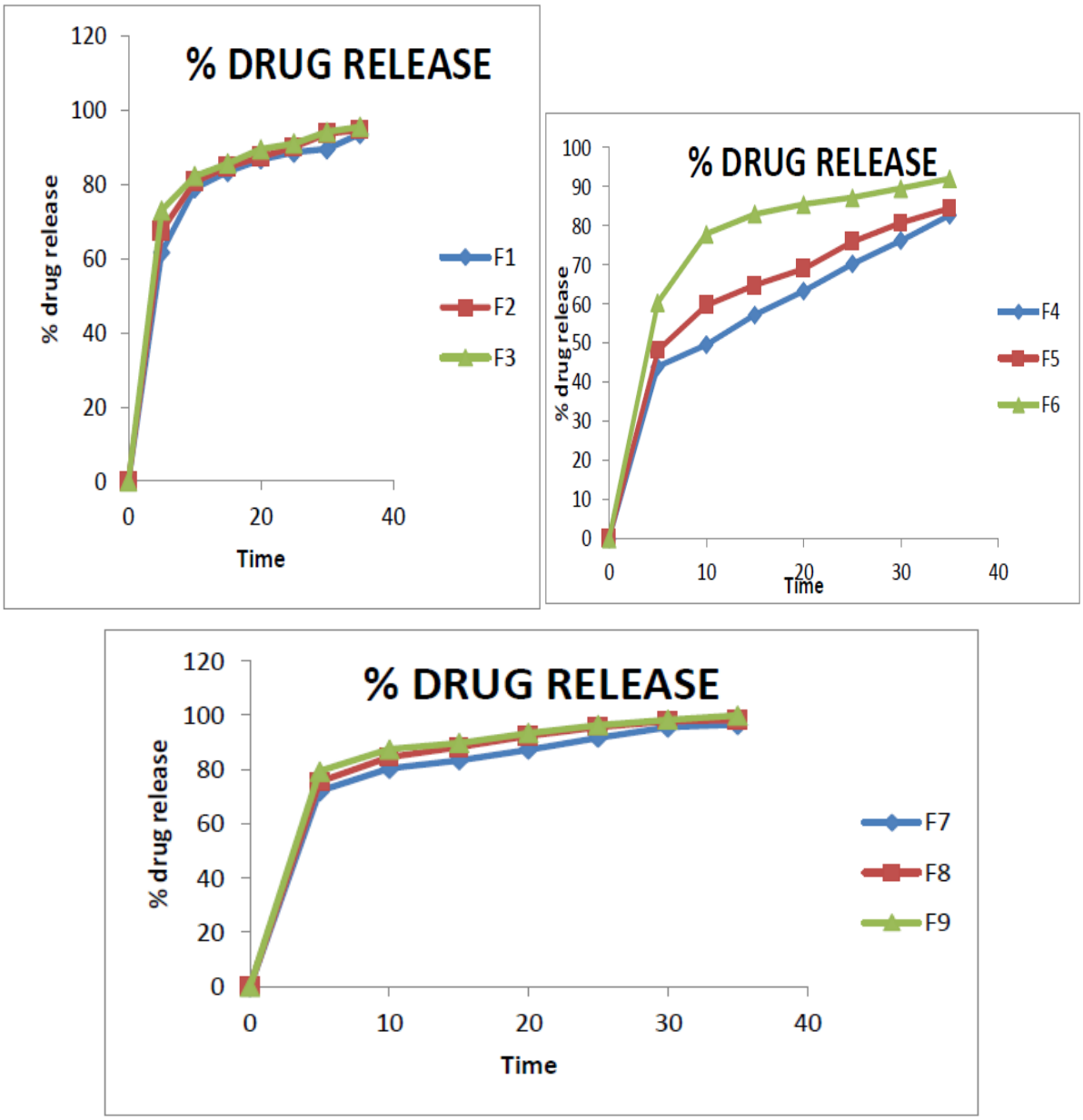


Fig. 4.2.8a,b,c: *Invitro*drug release of F1 to F9.

5. SUMMARY AND CONCLUSION

5.1 Summary

The objective of present study was to arrange and evaluate the fast dissolving tablet of Nimodipine using super –disintegrants like Croscarmellose sodium, crospovidone and sodium starch glycolate in numerous concentrations by direct compression method. The use of superdisintegrants for preparation of fast disintegrating tablets is very effective and commercially feasible. These superdisintegrants accelerate disintegration of tablets by virtue of their ability to soak up an oversized amount of water when exposed to an aqueous environment. The absorption of water ends up in breaking of tablets and so faster

disintegration. This disintegration is reported to own a sway on dissolution characteristics likewise. Prepared fast disintegrating tablet gets dispersed within the mouth quickly and releases the drug fast. Nimodipine orally disintegrating tablets were prepared by direct compression method. The compositions of the formulations are shown within the Table 6.3. shows the information obtained from the evaluation of tablets. All batches of the tablets were preliminarily evaluated for various physical parameters like hardness, friability, drug content, wetting time, disintegration and dissolution which were reported in Table -4.1.1 and Table 4.2.2 all above properties and value were concerning boundary of ordinary limit. All the tablets maintained hardness within the range 3.14 to 3.69 kg/cm2. The loss in total weight of the tablets because of friability was within the range of 0.22-0.312%. The drug content in numerous formulation was highly uniform and within the range of 95-99%. Wetting time is employed as an indicator of the convenience of tablet disintegration and located to be 35-135sec. The results of In-vitro disintegration were within the prescribed limits and accommodates the standards for orally disintegrating tablets, the worth were with 35- 135sec. In vitro dissolution studies are shown in table (4.2.8) and fig. 4.2.8a,b and c. The concept of super disintegrant addition method proved to be beneficial so as to lower the disintegration time. The quicker disintegration time could also be attributed to faster water uptake by the tablets. Dissolution profiles revealed that, after 35 minutes, formulations F1-F9 illustrated Drug release of 93.62, 94.70, 95.52, 91.86, 82.70, 84.44, 92.02, 96.59, 98.23 and 99.95 respectively. Among all the formulations, F9 formulation shows better dissolution efficiency and rapid disintegration with release of 99.59 Christ Within 35 Min. The prepared fast dissolving tablets shows the properties of fast disintegration time (35 to 128 sec).

5.2 CONCLUSION

The Fast disintegrating tablets of Nimodipine were formulated by using the superdisintegrants like sodium starch glycolate, Cross caramellose sodium and Crosspovidone. the employment of super disintegrant crosspovidone at concentration of 18% given the higher release of drug when put next to other superdisinte grants. The proposed Fast disintegrating formulation possessed ideal and reproducible characteristics of disintegration time and drug release profile. Thus, the "patient –friendly dosage form "especially for pediatric, geriatric, bedridden, and non-cooperative patients will be successfully formulated using this technology, and also provides faster and better drug release, thereby, improving the bioavailability of drug as compared to the traditional marketed formulation.

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