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HYDROPHILLIC AND HYDROPHOBIC GELUCIRES IN THE DESIGN AND EVALUATION OF CONTROLLED RELEASE MATRIX TABLETS OF NIFEDIPINE

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ABSTRACT

Controlled release matrix tablets of nifedipine are prepared by employing a new class of polymers called Gelucires. Two different types of gelucires are employed. Hydrophilic gelucire (Gelucire 53/14) is used to prepare solid dispersions of nifedipine to increase its dissolution rate. The solid dispersions were evaluated for drug content, solubility, dissolution rate and drug-polymer interaction. Nifedipine dispersed in hydrophilic gelucire is then converted into matrix tablet employing hydrophobic gelucire (43/01) and hydroxypropyl methyl cellulose. The prepared tablets were found to be of optimum hardness, uniform weight and acceptable friability. The drug release was found to be dependent on the ratio drug : gelucire in the solid dispersion and also on the type of release retarding polymer employed – gelucire (43/01) or hydroxypropyl methyl cellulose. Kinetics of the drug release data was evaluated out by employing the relevant equations of first order, zero order, Higuchi square root and Korsmeyer – Peppas. The drug release data suggested that the release of the drug is first order and that the drug release is diffusion controlled.

Key words: Nifedipine, Gelucire, Hydroxypropyl methyl cellulose, Solid dispersion, Controlled release.

INTRODUCTION

Nifedipine is used in the treatment of angina pectoris and in the management of hypertension. It is practically insoluble in water and its absorption is dissolution rate limited. Nifedipine has a short biological half life of 2-3 hours[1] and is eliminated rapidly and its anti-hypertensive effect lasts only for a few hours and hence, to improve its therapeutic efficacy and patient compliance, controlled release products are needed for nifedipine. There are a few reports on the formulation of sustained release products of nifedipine employing coated granules[2] and matrix tablets[3]. Of the various methods that are employed for SR products,

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matrix tablets are very widely employed for various drugs[4]. This is probably because design and manufacture of matrix tablets is easy and also a number of polymers are available for the preparation of matrix tablets. In this present work, matrix tablets of nifedipine were prepared by employing a newer class of polymers-gelucires[5]. Polyethylene glycol glycerides composed of mono-, di- and triglycerides and mono- and diesters of polyethylene glycol (PEG) are called as gelucires[5]. They are a group of inert semi-solid waxy amphiphilic excipients, which are surface active in nature and disperse or solubilize in aqueous media forming micelles, microscopic globules or vesicles.

They have been widely studied as controlled release matrices as well as for improvement of physicochemical properties of drug. They are identified with respect to their melting point and HLB value. The wide varieties of gelucire are characterized by a wide range of melting points from about 33^{o}C to about 64^{o}C and most commonly from about 35^{o}C to about 55^{o}C, and by a variety of HLB values of from about 1 to about 14, most commonly from about 7 to about 14.

While the hydrophilic property of gelucire is normally useful in the dissolution enhancement, the hydrophobic variety is used in the design of novel controlled release products. There are not many reports on the utility of gelucires in the formulation of fast dissolving or controlled release dosage forms. In the present investigation, solid dispersions of poorly soluble nifedipine in gelucire (53/14) are first prepared and then incorporated into hydrophobic gelucire (43/01) matrices and compressed into tablets.

EXPERIMENTAL

Materials

Nifedipine is a gift sample from Torrent Pharmaceuticals, Ahmadabad; Gelucire (43/01) and Gelucire (53/14) are obtained from Genova Life Sciences, Bangalore**;** HPMC (HPMC K4M) was obtained as gift samples from Colorcon Asia Pvt Ltd, Mumbai. All other excipients were purchased from M/s. Loba Chemicals, Mumbai. All the solvents and other chemicals are of analytical grade.

All the experiments were carried out under subdued light conditions to prevent the photodegradation of nifedipine

Preparation of matrix tablets of nifedipine

The matrix tablets of nifedipine are prepared by wet granulation method employing

the formula given in Table 1. Each time, a batch of 50 tablets were prepared and evaluated. The weighed quantity of nifedipine, hydroxylpropyl methyl cellulose and lactose are taken in a mortar and thoroughly blended. The powder blend is now granulated by adding suitable quantity of water. The dough mass is now passed through sieve No. 20 and resulting granules are dried at 50^{o}C for 1 hour. The dried granules are now blended with magnesium stearate and talc in polyethylene bag and are latter compressed on a 16 station rotary tablet machine.

Table 1: Composition of nifedipine matrix tablet prepared employing HPMC alone

Ingredient	Amount (mg)
Nifedipine	20
Lactose	175
HPMC (5 cps)	15
Talc	5
Magnesium stearate	5

Preparation of solid dispersions

The solid dispersions of nifedipine in gelucire (53/14) were prepared by solvent method and by kneading method.

Solvent method

Solid dispersions of nifedipine (N), in gelucires (G) were prepared in two ratios (N-G), 9 : 1 and 4 : 1. Nifedipine (900 mg) was dissolved in 100 mL of methylene chloride. To a clear solution, gelucire (100 mg) was added and stirred to dissolve. The solvent is removed under vacuum and the mass obtained was scrapped and dried in a desiccator over anhydrous calcium chloride over night and was crushed, pulverized and sifted through mesh No. 100.

Kneading method

Nifedipine and gelucire were accurately weighed and wetted with water and then thoroughly kneaded for 30 min in a glass mortar. The dried powder was passed through sieve No. 100 and stored in a desiccator until further evaluation.

Evaluation of solid preparations

Drug content uniformity

From each batch, four samples of 50 mg each were taken and analyzed for nifedipine content. 50 mg of solid dispersion was weighed into a 50 mL volumetric flask. 40 mL of methanol was added and contents were thoroughly mixed to dissolve nifedipine from the solid dispersions. The solution was made up to volume with methanol. This solution was suitably diluted with phosphate buffer of pH 7.4 and assayed for nifedipine content by measuring absorbance at 238 nm using phosphate buffer of pH 7.4 as blank. The results are given in Table 2.

Table 2: Nifedipine content of various solid dispersions in gelucire (53/14)

Solid dispersion	Nifedipine content in sample (%)				Mean X	S.D.	C.V.
	1	2	3	4			
Solvent method							
N – G (9 : 1)	91.55	90.65	92.05	91.65	91.475	0.591	0.006
N – G (4 : 1)	81.45	80.91	80.94	80.65	80.988	0.335	0.004
Kneading method							
N – G (9 : 1)	90.75	91.25	90.54	90.35	90.723	0.338	0.003
N – G (4 : 1)	81.25	82.50	80.70	80.15	81.15	1.006	0.012

N-G (Nifedipine – Gelucire)

Dissolution rate studies

The dissolution rate of nifedipine in pure form and from various solid dispersions and physical mixtures was studied using USP dissolution rate test apparatus (Lab India Model DISSO) employing a paddle stirrer. In 900 mL of dissolution medium (0.1 N Hydrochloric acid), a sample equivalent to 10 mg of nifedipine was added and a speed of 50 rpm and a temperature of $30^{o}C \pm 1^{o}C$ were employed in each test. A 5 mL aliquot of dissolution medium was withdrawn at different time intervals, suitably diluted and assayed spectrophotometrically at 238 nm using Shimadzu UV-150-02 spectrophotometer. The percent of nifedipine dissolved at various time intervals was calculated and plotted against time. The results are given in Tables 3 and shown in Figs. 1 and 2. From these dissolution

profiles, T_{50} (time taken for 50 % dissolution), dissolution efficiency and K_1 values were recorded and given in Table 4.

Table 3: Dissolution of nifedipine from various solid dispersions

Time (min)	Nifedipine powder	Mean percent of nifedipine dissolved from solid dispersion			
		Solvent method		Kneading method	
		N – G (9 : 1)	N – G (4 : 1)	N – G (9 : 1)	N – G (4 : 1)
5	2.68	36.69	45.65	11.25	16.66
10	5.05	40.41	57.65	21.75	24.85
20	6.12	52.4	68.25	36.66	31.63
30	7.31	59.26	76.35	47.25	40.85
45	10.31	65.4	87.25	57.85	57.45
60	13.65	75.28	96.25	64.25	64.86
90	16.12	76.15	97.15	71.25	71.05
120	18.25	81.75	98.0	77.56	80.05

Table 4: Dissolution parameters of various solid dispersions prepared

Solid dispersion	Dissolution efficiency $(D.E.)_{30}$ %	Dissolution rate K_1 (min^{-1})	T_{50} (min)
Solvent method			
N – G (9 : 1)	56.66	0.012	16
N – G (4 : 1)	75	0.032	6
Kneading method			
N – G (9 : 1)	43.33	0.002	35
N – G (4 : 1)	46.66	0.012	32

IR studies

IR Spectra of nifedipine and its solid dispersions in gelucire were obtained using - Shimadzu IR Spectrophotometer (Model IR 470 U). IR spectra were obtained by preparing a film of the preparation dispersed in nujol. IR spectra of nifedipine and its solid dispersions are shown in Fig. 3.

X-ray diffraction

X-ray powder diffraction patterns of nifedipine and its solid dispersions were obtained using X-ray powder diffractometer (Miniflex Table top X-ray diffractometer JP Rigaku), employing Cu K_α radiation. The diffractograms were run at 2^o/min in terms of 2 θ angle. The diffractograms of nifedipine and various solid dispersions are shown in Fig. 4.

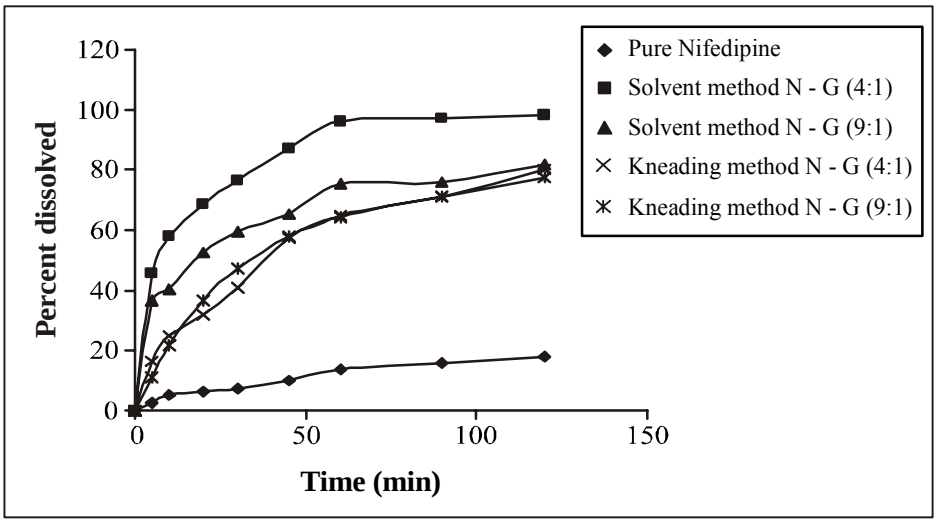


Fig. 1: Dissolution profiles of various solid dispersions of nifedipine in gelucire (53/14)

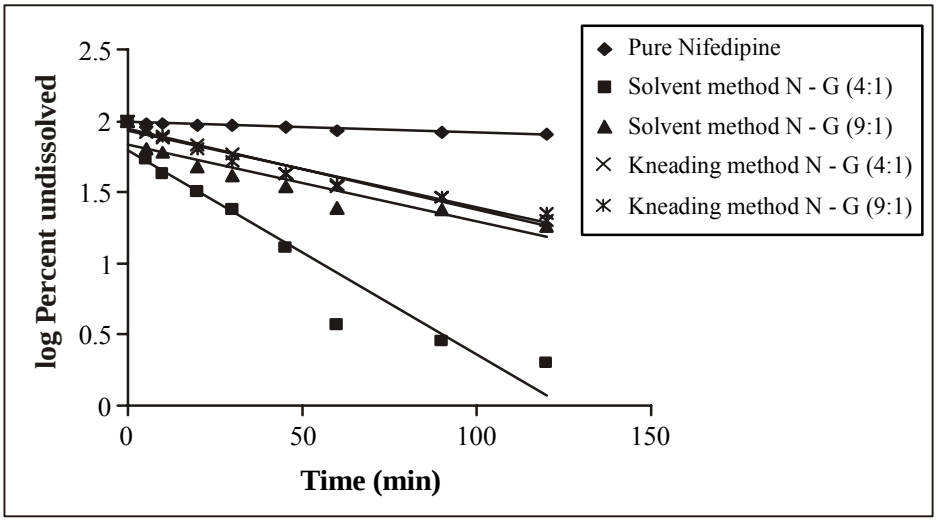
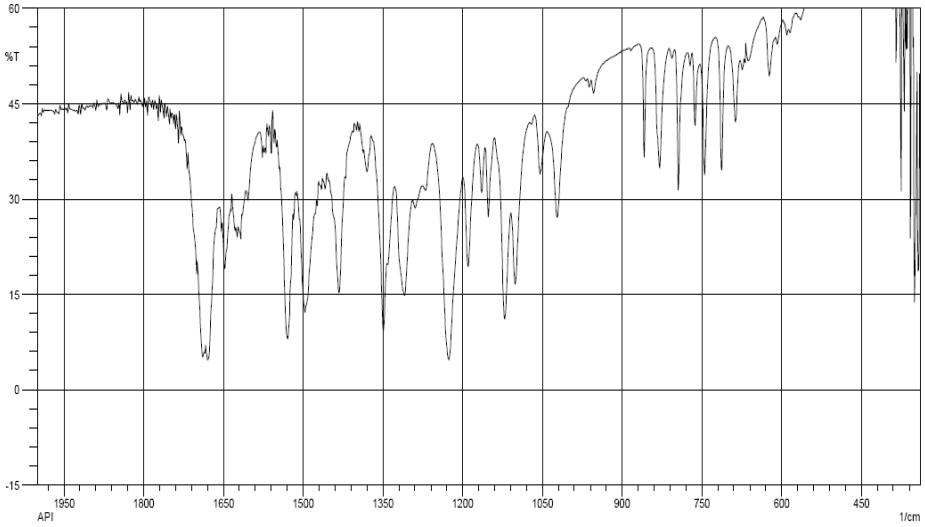
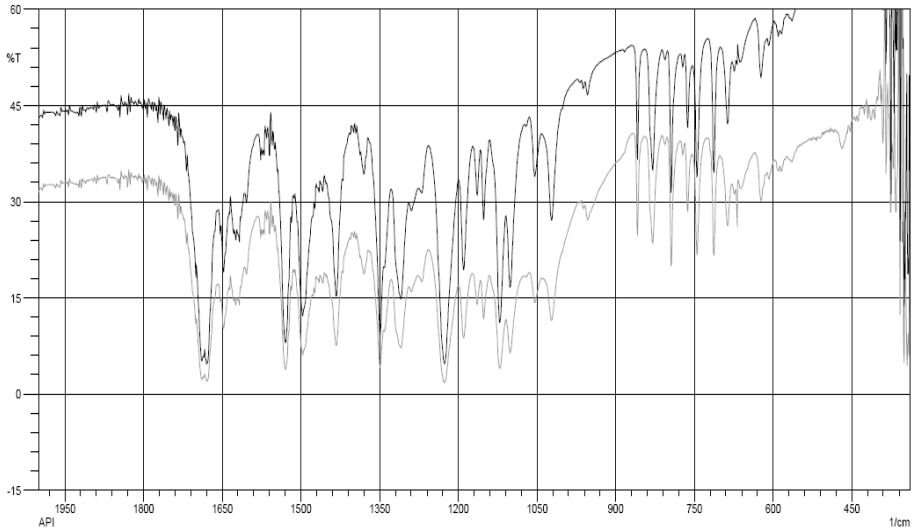


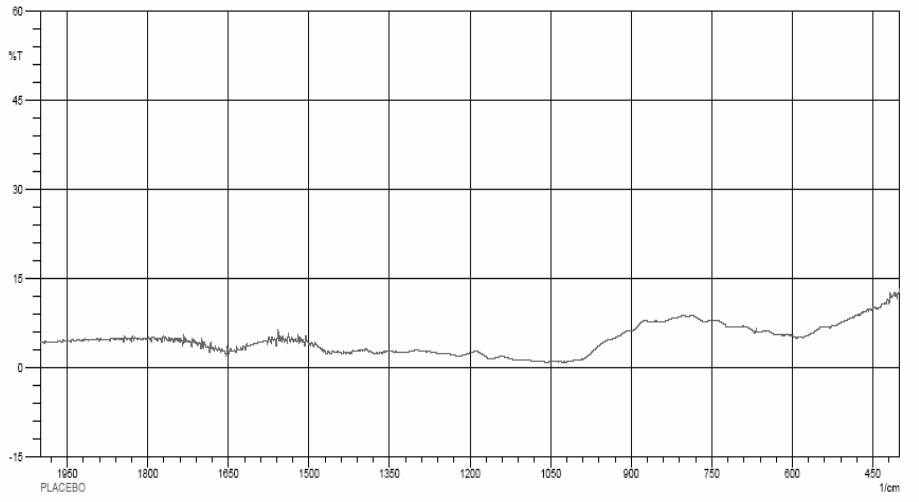
Fig. 2: First order plot for the dissolution of niedipine from solid dispersions



(a) Nifedipine



(b) Nifedipine - gelucire solid dispersion



(c) Gelucire

Fig. 3: IR spectra of (a) Nifedipine, (b) Nifedipine-gelucire solid dispersion and (c) Gelucire

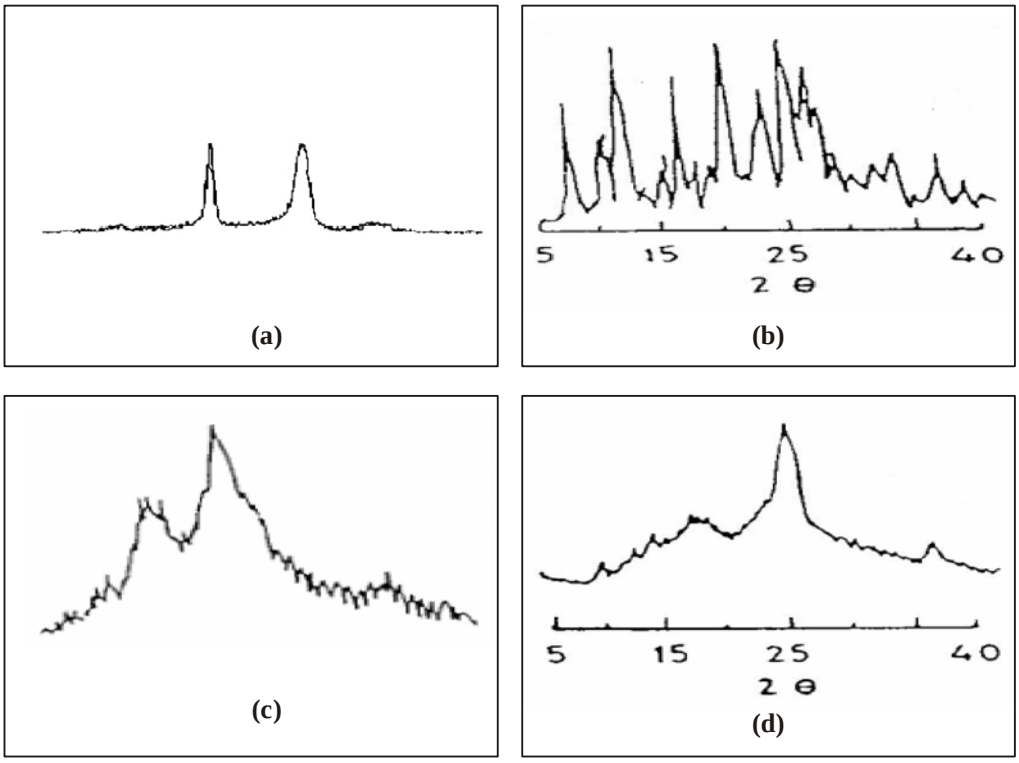


Fig. 4: XRD Spectra of (a) Gelucire, (b) Nifedipine, (c) N-G (9 : 1) – Kneading method and (d) N-G (9 : 1) – Solvent method

Solubility studies

Solubility studies were carried out to evaluate the effect of gelucire on the solubility of nifedipine.

Determination of solubility

The solubility of nifedipine in distilled water alone and in the presence of gelucire was determined. An excess amount of nifedipine was placed in glass bottles containing 20 mL of distilled water containing 1 % gelucire. The bottles were thoroughly shaken for 6 hours and kept aside for 24 hours at R.T. (25^{o}C). At the end of this period, the solutions were filtered and the filtrate was collected into dry container. The solutions were suitably diluted and assayed for nifedipine content. The results are given in Table 5.

Table 5: Solubility of nifedipine in distilled water and in water containing 1% gelucire (53/14)

Product	Solubility (mg/100 mL)
Nifedipine powder	0.82
Nifedipine – Gelucire (53/14)	3.62

Preparation of matrix tablets employing nifedipine – gelucire solid dispersions

Matrix tablets of N – G dispersions were prepared by employing the dispersions i.e. prepared by solvent method; this is because the dispersion prepared by solvent method gave higher dissolution than the one prepared by kneading method. Matrix tablets were prepared by employing HPMC 5 cps or gelucire (43/01).

Procedure

In case of matrix tablets prepared by employing hydroxypropyl methyl cellulose, the dispersion, hydroxypropyl methyl cellulose and lactose are thoroughly blended in a mortar. The blend is then granulated by adding suitable quantity of water and the granules obtained are dried at 40°C. To the resulting granules, talc and magnesium stearate were added and compressed on a rotary tablet punching machine. The formulae of various matrix tablets prepared are shown in Table 6.

In case of matrix tablets prepared by employing gelucire (43/01), the solid dispersion is first mixed in molten gelucire (43/01) and then blended with rest of the ingredients and subjected to direct compression.

Evaluation of matrix tablets

Drug content

Ten tablets of nifedipine containing the equivalent of 20 mg of nifedipine were collected randomly, powdered and shaken with 20 mL of methanol for 1 hour. The resulting solution was diluted to 100 mL with phosphate buffer of pH 7.4 and then filtered. The filtrate was suitably diluted and analyzed for nifedipine by measuring the absorbance at 238 nm.

Table 6: Composition of matrix tablets employing nifedipine dispersions

Ingredients	F1	F2	F3	F4
N – Gel (9 : 1)	22.2	22.2	-	-
N – Gel (4 : 1)	-	-	25	25
Lactose	172.8	172.8	170	170
HPMC – 5 cps	15	-	15	-
Gelucire (43/01)	-	15	-	15
Talc	5	5	5	5
Magnesium striate	5	5	5	5

Hardness

Hardness of the tablet was determined using the Monsanto hardness tester. The lower plunger was placed in contact with the tablet and a zero reading was taken. The plunger was then forced against a spring by tuning threaded bolts until the tablet fractured. Then the final reading was recorded. The hardness was computed by deducing the initial reading from the final reading.

Weight variation

Twenty tablets were collected a random and were weighed collectively and individually. From the collective weight, average weight was calculated. The percent weight variation was calculated using formula.

$$\% \text{ Weight variation} = [\text{Average wt.} - \text{individual wt.}/\text{Average wt.}] \times 100 \quad \ldots(1)$$

Friability

The Roche friability test apparatus was used to determine the friability of the tablets. About 10 tablets were selected, de-dusted and weighed. Then these were placed in a drum

and rotated for 100 times in 4 minutes. The tablets were de-dusted to remove any loose dust and were re-weighed. The percentage friability was calculated by the formula.

$$\% \text{ Friability} = [\text{Initial wt.} - \text{Final wt.} / \text{Initial wt.}] \times 100 \quad \ldots(2)$$

The details of drug content, hardness, friability and weight variation are given in Table 7.

Table 7: Drug content, hardness, weight variation and friability of different formulations

Formulation	Drug content (percent)	Hardness ($kg - cm^2$)	Weight variation (mg)	Friability (percent)
F1	99.05 ± 1.05	5.2 ± 0.82	219.50 ± 1.05	0.27 ± 0.02
F2	99.25 ± 0.75	5.4 ± 0.64	220.25 ± 0.45	0.42 ± 0.05
F3	99.56 ± 0.26	6.0 ± 0.25	220.56 ± 0.05	0.26 ± 0.01
F4	99.36 ± 0.85	5.6 ± 0.45	221.05 ± 0.25	0.35 ± 0.06

Drug release studies

The drug release study from the tablets containing pure nifedipine or the nifedipine – gelucire solid dispersion was performed by employing USP dissolution rate test apparatus type-1 employing a basket stirrer. The drug release study is performed in 0.1 N hydrochloric acid (containing 20% methanol) for first 2 hours and also in phosphate buffer of pH 7.4 (containing 20% methanol) for the remaining 10 hours. Samples of the medium are withdrawn at regular intervals and replaced by fresh medium and the absorbance of the withdrawn samples was measured at 238 nm. The results of the drug release study are given in Table 8 and shown in Fig. 5.

Table 8: Nifedipine release from various matrix tablets prepared employing solid dispersions

Time (hrs.)	Mean percent of nifedipine released from				Theoretical SR profile
	F1	F2	F3	F4	
1	11.63	10.92	14.75	13.78	25.00
2	21.38	20.24	28.86	27.63	31.90
3	27.82	26.81	35.21	32.85	38.80

Cont…

Time (hrs.)	Mean percent of nifedipine released from				Theoretical SR profile
	F1	F2	F3	F4	
4	35.63	33.25	42.85	41.25	45.70
6	47.35	44.81	54.38	52.45	59.50
8	60.21	58.25	67.73	64.88	73.30
10	72.85	70.63	79.85	77.93	87.10
12	77.31	75.16	91.25	88.27	100.00

Table 9: Release rate constants for the various matrix tablets prepared

Formulation	Zero order		First order		Higuchi	Peppas equation	
	k_o (mg/hr)	r	k_1 (hr^{-1})	r	r	r	n
N	2.678	0.983	0.035	0.983	0.983	0.983	0.735
F1	6.285	0.986	0.124	0.992	0.992	0.999	0.773
F2	6.166	0.987	0.117	0.992	0.991	0.996	0.818
F3	6.926	0.986	0.179	0.952	0.995	0.995	0.725
F4	6.753	0.987	0.161	0.966	0.994	0.993	0.739

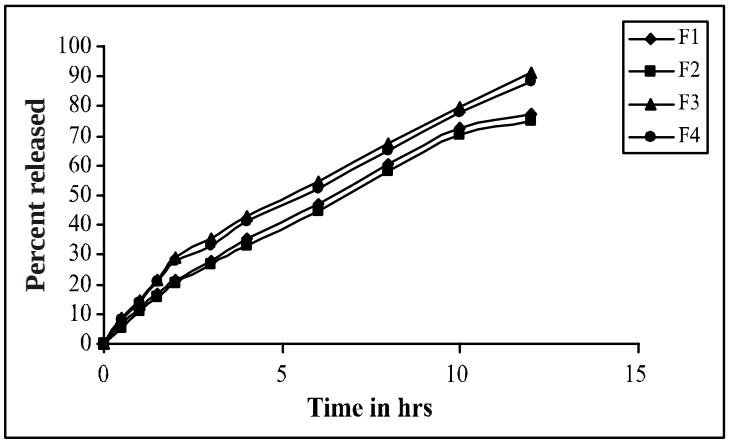


Fig. 5: Drug release profile for various formulations of nifedipine

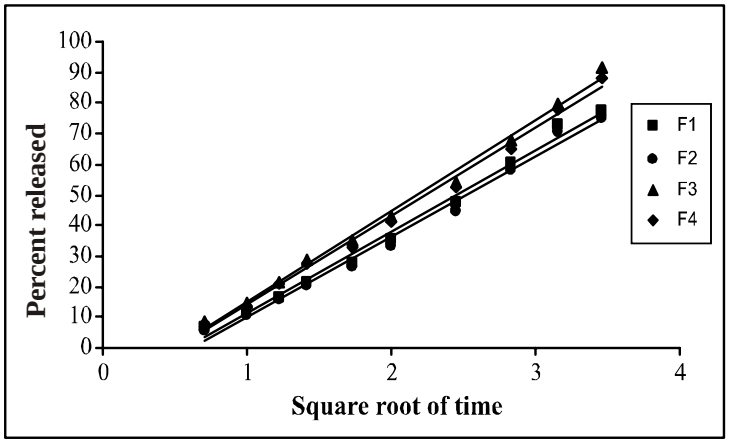


Fig. 6: Higuchi plot for the nifedipine release from various formulations

RESULTS AND DISCUSSION

Initially, the matrix tablets containing only pure nifedipine are prepared employing hydroxypropyl methyl cellulose. The drug release study showed that at the end of 12 hours, only about 37 % drug was released. This small amount of drug release is probably because of a very low solubility and dissolution of the drug nifedipine. Since for a drug to be released from a matrix tablet, its dissolution in the dissolution fluids in the matrix is a prerequisite, the drug release from the matrix tablet might have been very slow. Thus, nifedipine powder as such is unsuitable for preparing controlled release matrix tablets. So in the present work, physically modified from of nifedipine is prepared by preparing a dispersion of the drug in a water soluble carrier to result in a more rapidly dissolving nifedipine with the objective of verifying the feasibility of employing these dispersed forms of nifedipine in a matrix tablet for achieving a faster but controlled release of nifedipine.

The solid dispersions of nifedipine in gelucire are prepared by solvent or kneading method. All the solid dispersions prepared were found to be fine powders. The percent drug contents of various solid dispersions are given in Table 2. There was no significant loss of drug during the preparation of solid dispersions and the proportion of drug and carrier remained the same as that initially taken. Low S.D. and C.V. values in the percent drug content ensured uniformity of drug content in each batch.

The usual method of evaluation of *in vitro* dissolution testing is the comparison of the time taken for given proportions of active drug to be released into solution and figures such as T_{20}, T_{50} and T_{90} values are often used. Alternatively the fraction of drug in solution after a given time is used for comparison i.e. 60 % dissolution in 30 minutes.

Another parameter suitable for the evaluation of *in vitro* dissolution has been suggested by Khan[6], who introduced the idea of dissolution efficiency (D.E). D.E is defined as the area under dissolution curve up to a certain time 't' expressed as a percentage of the area of the rectangle described by 100 % dissolution in the same time.

$$\text{Dissolution efficiency (D.E.)} = \frac{{}_{o}\int^{t} y\, dt}{Y_{100}\, t} \times 100 \qquad \ldots(3)$$

The dissolution efficiency can have a range of values depending on the time intervals chosen. In any case, constant time intervals should be chosen for comparison. For example, the index $D.E._{.30}$ could relate to the dissolution of the drug from a formulation after 30 minutes could only be compared with $D.E._{.30}$ of other formulations. Summation of the drug dissolution data into a single figure D.E., enables ready comparison to be made between a large numbers of formulations.

T_{50} and $D.E_{30}$ values were calculated from the dissolution data and are given in Table 4. The dissolution of nifedipine in pure form and from various solid dispersions followed first- order kinetics. The dissolution plots are shown in Figs. 1 and 2.

It was observed that the dissolution efficiency (N-G 9 : 1 and 4 : 1 are 56.66% and 75%, respectively) and dissolution rate (N-G 9 : 1 and 4 : 1 are 0.012 min^{-1} and 0.032 min^{-1}, respectively) of the products prepared by solvent method are higher than that obtained with kneading method, which showed a dissolution efficiency (N-G 9 : 1 and 4 : 1 are 43.33% and 46.66%, respectively) and rate (N-G 9 : 1 and 4 : 1 are 0.002 min^{-1} and 0.012 min^{-1}, respectively). This higher dissolution obtained with products prepared by solvent method is probably because the drug is more uniformly dispersed in the polymer solution preventing their aggregation back again after the solvent is removed. This resulted in a more homogeneous distribution of the drug in the polymer, where as such an opportunity to uniformly disperse in the polymer is not available in the kneading method. This probably resulted in lower dissolution for the solid dispersion prepared by kneading method.

The solubility of nifedipine was found to be 0.82 mg/100 mL and 3.62 mg/100 mL in distilled water and in distilled water containing 1 % gelucire, respectively. Thus, the solubility of nifedipine was markedly increased in the presence of gelucire by 4 folds in the presence of gelucire.

The X-ray diffractograms of gelucire (53/14), pure drug nifedipine and the dispersions are shown in Fig. 4. It is can be seen that the pure drug, which is highly crystalline as evident from the sharp diffraction peaks is converted into an amorphous form

in the solid dispersions, as the crystalline peaks have disappeared. It can also be noticed that the extent of reduction in crystallinity is more with the dispersion prepared by the solvent method Fig. 4 (d) than in the case of the kneading method Fig. 4 (c). So the increased dissolution of the drug from the solid dispersions is probably because of the crystalline drug nifedipine being converted into an amorphous form and also because of the increased wetting action of gelucire on the drug.

The IR spectra of nifedipine in pure form and in N-G (9 : 1) and N-G (4 : 1) solid dispersions are shown in Fig. 3. IR spectra of nifedipine in pure form and in the two solid dispersions were identical. Principal IR absorption peaks of nifedipine at 1121 cm^{-1} (-C-O-ester), 1380 cm^{-1} (-C-CH_3), 1530 cm^{-1} (NO_2), 1625 cm^{-1} (-C=C-aromatic), and 1689 cm^{-1} (C=O ester) were all observed in the spectra of nifedipine as well as its dispersions. These spectral observations thus indicated no interaction between nifedipine and the carriers used in the preparation of solid dispersions.

Since dispersions prepared by solvent method showed higher dissolution, dispersion prepared by that method are employed further. Two types of matrix tablets containing nifedipine solid dispersions are prepared, one containing N-G (9 : 1) or N-G (4 : 1) dispersions. Similarly, the matrix former was either HPMC (5 cps) or gelucire (43/01). The drug release study (Fig. 5) showed that in case of formulation F1, which contains N-G (9 : 1) and HPMC 5 cps, the percent release at the end of 12 hrs was about 77 %. No significant difference in percent drug release was found between the two matrix tablets that contained HPMC or gelucire (43/01); for example, F2 which contained the same dispersion as F1 and gelucire as the matrix former gave a release of about 75 % at the end of 12 hrs as compared to F1 (HPMC matrix), which gave 77 % release.

Whereas in the cases of F3 and F4, which contained N-G (4 : 1) dispersion, there was a faster drug release compared to F1 and F2. For example from F3, the percent release at the end of 12 hrs was found to be 91.25 % and in case of F4, it is 88.27 %. This higher release is probably because of higher dissolution exhibited by N-G (4 : 1) dispersion, which is present in F3 and F4. From the results of drug release study, it is observed that the drug release is dependent upon the nature of release retarding matrix material and also the nature of solid dispersion that is employed in the matrix tablet preparation.

Drug release mechanism

Plots of the amount of the drug released vs. square root of time (Fig. 6) were found to be linear in all the cases indicating the drug release mechanism from the matrix tablets might be of diffusion type as proposed by Higuchi[7]. Accordingly the drug release from these

matrix tablets involves penetration of dissolution fluid, dissolution of the drug in dissolution fluid leaching out of the drug through intestinal channel or pores.

To know the mechanism of drug release from these formulations, the data were treated according to first – order (log cumulative percent of drug remaining versus time), Higuchi's (cumulative percent of drug released versus square root of time), and Korsmeyer's (log Mt/M_{α} versus log time) equations[8,9], along with zero – order (cumulative amount of drug released versus time) pattern. The various kinetic parameters of drug release are shown in Table 8. When the data were plotted according to the zero order equation, the formulations showed linearity with correlation coefficient values between 0.8237 and 0.9227. When the data plotted according to the first – order equation, the formulations showed a good linearity, with significantly higher correlation coefficient values than zero order plots, (0.9786 to 0.9912). Although it is desirable for a controlled release device to deliver the drug in zero – order kinetics, it is extremely difficult to attain such pattern as the kinetics of release is affected by the physico-chemical composition of surrounding medium and processing variables. According to the n values (between 0.5 and 1), obtained in the Peppas plot, shown in Table 9, one may conclude that the drug release follows non-Fickian anomalous diffusion.

CONCLUSIONS

Summary

In the present work, sustained release tablets of nifedipine are designed. The findings of the investigations are summarized here.

- Matrix tablets of nifedipine are initially formulated employing hydroxypropyl methyl cellulose (5 cps). These tablets gave a very slow release of about only 37% at the end of 12 hours.
- Solid dispersion in gelucire by solvent method resulted in fast dissolving product of nifedipine with increased solubility in the presence of gelucire and also showing no interactions with the gelucire.
- These nifedipine-gelucire solid dispersions are then converted into matrix tablets by direct compression employing hydrophobic gelucire (43/01) or granulated with hydroxypropyl methyl cellulose and the resulting granules compressed.
- A faster but controlled release of nifedipine from these matrix tablets was obtained; spread over a period of 12 hours.

- So water soluble gelucires and water insoluble gelucires can be employed appropriately in the design of controlled release tablets of poorly soluble drugs such as nifedipine.

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REFERENCES

1. T. S. Foster and S. R. Haman, J. Clin. Pharmcol., **23**, 161 (1983).
2. F. Pattarino, Effect of Poloxamers on Nifedipine Micro Particles prepared by Hot Air Coating Technique, European J. Pharmaceut. Biopharmaceut., **65**, 198-203, (2007).
3. Yu Cui, Formulation of Sustained-Release Matrix Tablet of Nifedipine, J. Kor. Pharm. Sci., **32**, No. 2, 95-101 (2002).
4. B. Mishra and J. Seena, Development and Characterisation of Matrix Tablets of Ketorolac Tromethamine, Indian Pharm., **2**, 86-89 (2003).
5. M. T. Sheu and A. H. O. Hsia, Polyglycolized Saturated Glycerides as Carrier and Enhancer for Drug Penetration, Chin Pharm. J., **53**, 107-111 (2001).
6. K. A. Khan, J. Pharm. Pharmacol., **27**, 48-49 (1975).
7. T. Higuchi, J. Pharm. Sci., **52**, 1145 (1963).
8. R. W. Korsemeyer, R. Gurny, E. M. Doelker, P. Buri and N. A. Peppas, Int. J. Pharm., **21**, 25 (1983).
9. P. L. Ritger and N. A. Peppas, J. Control. Rel., **5**, 37 (1987).

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