IJPPR
INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH
An official Publication of Human Journals
ISSN 2349-7203
HUMAN

Human Journals
**Research Article**
May 2015 Vol.:3, Issue:2


# Formulation and Evaluation of Sustained Release Bilayer Tablets of Venlafaxine HCL

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**Submission:** 10 May 2015
**Accepted:** 15 May 2015
**Published:** 25 May 2015



**Keywords:** Sustained release bilayer tablet, Venlafaxine HCl, HPMC K100, Eudragit RL, Sodium starch glycolate

**ABSTRACT**

The present study was to formulate and evaluate sustained release bilayer tablets of Venlafaxine HCl. The tablets were prepared by wet granulation method by using superdisintegrant sodium starch glycolate (SSG) for immediate release layer and mucoadhesive materials such as HPMC K100, carbopol, sodium CMC, Eudragit RL for sustained release layer. The prepared granules were evaluated for bulk density, tap density, compressibility index and angle of repose. The tablets were evaluated for thickness, hardness, weight variation, drug content uniformity, friability and *in vitro* drug release studies. *In vitro* drug release studies were performed by using USP type II apparatus (paddle method) at 50 rpm in 900 ml of 0.1N HCl as dissolution medium for first 2 hours and later replacing it with 900 ml pH 6.8 phosphate buffer solution for the remaining time period at 37±0.5$^0$C. The formulation F9 containing Eudragit RL 15 % showed sustained release of drug without disintegration upto 12 hours. Hence, formulation F9 was considered as optimized formulation which showed the best drug release profile upto 12 hours. The results of FTIR analysis showed that there was no physical and chemical interaction between drug and other excipients.

## INTRODUCTION

Oral route is the most preferred route for administration of drugs. Tablets are the most popular oral formulations available in the market and preferred by the patients and physicians alike. In long term therapy for the treatment of chronic disease conditions, a conventional formulation are required to be administered in multiple doses, and therefore lacks patient compliance [1]. Sustained release tablet formulations are much desirable and preferred for such therapy because they offer better patient compliance, maintain uniform drug levels, reduce dose and side effects, and increase safety margin for high-potency drugs [2]. Oral drug delivery continues to rise in popularity as formulation scientists look for ways to control drug release and improve patient convenience. However, developing oral sustained release tablets for water soluble drugs with constant release rate has always been a challenge to the pharmaceutical technologist. Most of these water soluble drugs if not formulated properly, may readily release the drug at a faster rate and produce a toxic concentration of drug on oral administration [3].

In the last decade, interest in developing a combination of two or more Active Pharmaceutical Ingredients (API) in a single dosage form (bilayer tablet) has increased in the pharmaceutical industry, promoting patient convenience and compliance. Bilayer tablets allows for designing and modulating the dissolution and release characteristics [4]. The term bilayered tablets containing subunits that may be either the same (homogeneous: one layer of drug for immediate release while second layer for extended release) or different (heterogeneous: sequential release of two drugs in combination or separate two incompatible substances) [5]. The important advantages of bilayer tablets are ability to combine different release rate IR and SR in the same tablet for chronic condition requiring repeated dosing; retain potency and ensure dose accuracy; blood level of a drug can be held at consistent therapeutic level for improved drug delivery, accuracy and safety; reduction of adverse effects [6, 7].

Venlafaxine (Fig. 1) is a bicyclic antidepressant, and is usually categorized as a serotonin norepinephrine reuptake inhibitor (SNRI), but it has been referred to as a serotonin-norepinephrine-dopamine reuptake inhibitor (SNDRI). It works by blocking the transporter "reuptake" proteins for key neurotransmitters affecting mood, thereby leaving more active neurotransmitters in the synapse [8].

## MATERIALS AND METHODS

The chemicals used in the study were pure drug like Venlafaxine HCl (yarrow chemicals) and polymers like HPMC K100, cabopol, sodium CMC, Eudragit RL (Hi media Lab Pvt. Ltd, Mumbai) and other excipients like Microcrystalline cellulose, Magnesium stearate, Talc, sodium starch glycolate (yarrow chemicals).

### Preformulation study

Preformulation studies were conducted to identify the compatibility of drug with polymers. These studies were conducted by using FTIR method. In this method, the IR spectra of pure drug and physical mixtures containing drug and polymers were produced and analysed.

### Preparation of bilayer sustained release tablets

### Preparation of immediate release layer

The drug and excipients of Table 1 were passed through a 60 # size mesh prior to the preparation of the dosage form. The entire ingredients are weighed separately and mixed thoroughly for 10 min to ensure uniform mixing in geometrical ratio. 120 mg of the powder mix was accurately weighed and manually fed into the die on immediate release layer and compressed to hardness of layer of tablet.

### Preparation of sustained release layer of Venlafaxine HCl

The drug and excipients of Table 2 were passed through a 60 # size mesh prior to the preparation of the dosage form. The entire ingredient are weighed separately and mixed thoroughly for 10 min to ensure uniform mixing in geometrical ratio. 180mg of the powder mix was accurately weighed and fed into the die on sustained release layer and compressed to get tablets of hardness.

### Evaluation

### Hardness test

The Monsanto hardness tester was used to determine the tablet hardness. The tablet was held between a fixed and moving jaw. Scale was adjusted to zero; load was gradually increased until the tablet fractured. The value of the load at that point gives a measure of hardness of the tablet. Hardness was expressed in $Kg/cm^2$.

**Friability test**

Tablet strength was tested by Roche friabilator. Pre-weighed tablets were allowed for 100 revolutions (4 min), taken out and were dedusted. The percentage weight loss was calculated by rewriting the tablets. The % friability was then calculated by,

$$F = \frac{(W_{initial}) - (W_{final})}{(W_{intial})} \times 100$$

**Uniformity of weight**

20 tablets from each of the formulation were weighed individually with an analytical weighing balance (Model: AY-200, SHIMADZU Corporation, and JAPAN). The average weights for each brand as well as the percentage deviation from the mean value were calculated.

**Drug content uniformity**

Accurately weighed quantity of the powder tablet equivalent to 20mg of the drug and 80mg of tablet powder was transferred to 100ml volumetric flask separately. 50ml of buffer solution of pH 6.8 was added. And then the volume was made upto 100ml with the same buffer solution, mixed solution was filtered through the membrane filter. 5ml of the filtrate was diluted to 50 ml with same buffer solution and examined under U.V. Spectrophotometry at 227 nm.

***In vitro* drug release**

The release of Venlafaxine HCl from sustained release tablets was determined by using Dissolution type II test apparatus. The dissolution test was performed using 900 ml 0.1N HCl solution at 37 ± 0.5ºC temperature and at 50 rpm for first two hours. At specified time intervals, samples of 5 ml were withdrawn from the dissolution medium and that amount was replaced with fresh medium to maintain the volume constant. The samples were filtered and diluted to a suitable concentration with 0.1 N HCl. The absorbance of the diluted samples was measured at 227 nm for Venlafaxine HCl by using UV spectrophotometer. Cumulative percentage drug release was calculated using an equation obtained from standard curve. Dissolution test was continued for 10 hrs using pH 6.8 phosphate buffer.

## RESULTS AND DISCUSSION

The standard graph of Venlafaxine HCl has shown good linearity with $R^2$ value 0.989 in pH 6.8 buffer solution which suggests that it obeys the "Beer-Lambert's law". The standard equation obtained y = 0.002x + 0.02 was used for estimating the drug amount.

### Evaluation of Drug –Polymer interaction

Drug – excipient compatibility is confirmed by FTIR Spectroscopy for which, FTIR spectra of Venlafaxine HCl, HPMC, Eudragit RL, sodium CMC, carbopol were compared with FTIR spectrum of the physical mixture of Venlafaxine HCl, HPMC, Eudragit RL, sodium CMC, carbopol. The spectrum of Venlafaxine HCl showed a characteristic peaks at 3365 $cm^{-1}$ (N-H stretching), 3069 $cm^{-1}$ (=C-H stretching), 2850 $cm^{-1}$ (CH stretching), 1611 $cm^{-1}$ (C=C stretching), 1440 $cm^{-1}$ (C-O-H stretching), 1301 $cm^{-1}$ (C-O stretching), 3458 $cm^{-1}$ (OH stretching) indicating purity of the drug. The characteristic peaks of Venlafaxine HCl were prominently observed in FTIR spectra of physical mixture (Venlafaxine HCl, HPMC, Eudragit RL, sodium CMC, carbopol) with slight shift in position and characteristic peaks of HPMC, Eudragit RL, sodium CMC, carbopol were also observed in the spectrum of physical mixture. There was no change observed in drug characteristic peaks in optimized formulation F9 (Fig. 2).

### Evaluation of flow properties

Prepared granules of the different formulations were evaluated for angle of repose, loose bulk density, tapped bulk density, and compressibility index given in Table 3. The Venlafaxine HCl tablets were evaluated for hardness, thickness, friability, weight variation and drug content uniformity. The hardness was in the range of 6.8 to 7.2 $kg/cm^2$, which was in accordance with the bilayer tablet. The thickness was from 2.92 to 2.93 mm suggested uniformity in thickness for bilayer tablet. The friability was less than 1% indicated good handling of the layer. The weight variation results suggested uniformity in weight of layers. The content uniformity was in range of 98.13 to 98.76% indicated uniform dispersion of Venlafaxine HCl in the layer (Table 4).

### *In vitro* drug release studies

*In vitro* drug release studies were carried out using USP XXII dissolution apparatus type II (Electrolab, Mumbai, India) at 50 rpm. The dissolution medium consists of 900 ml of 0.1N

HCl for first two hour and pH 6.8 phosphate buffer for remaining hour, maintained at 37 ± $0.5^0$C. The drug release at different time intervals was measured using an ultraviolet visible spectrophotometer at 227 nm. The study was performed in triplicate. Drug release profiles i.e. percentage cumulative drug releases verses time of all the formulations are shown in Fig. 3.

**Release kinetics**

The *in vitro* release data i.e. percentage CDR and time of formulation F9 was processed as shown in Table 5, the charts of zero order (percent of drug release v/s time), first order (logarithm of the percent drug remained v/s time), Higuchi (fraction of drug release v/s square root of time), Korsmeyer-Peppas (log percent drug release v/s log time) were plotted (Fig. 4), in order to establish drug release mechanism and kinetics of drug released from sustained release layer. Drug release from formulation F9 followed Higuchi model and Peppa's model reveals that drug release mechanism was fickian (n=0.255). This indicates that the drug release majorly depends on swelling and diffusion. For remaining formulations, the goodness of best fit was evaluated by regressional analysis of the said models. The correlation coefficient $r^2$ according to all the models is mentioned in Table 6. On over observation, remaining all formulations followed Higuchi / first order drug release patterns.

**Stability studies**

Stability studies were carried out on selected formulation (F9) as per ICH guidelines. There was not much variation in matrix integrity of the tablets at all the temperature conditions. There was no significant change in drug content, physical stability, hardness, friability and drug release (Table 7).

**CONCLUSION**

The present research was carried out to develop a bilayer tablet of Venlafaxine HCl using superdisintegrant sodium starch glycolate for fast release layer and combination of HPMC K100, sodium CMC, Eudragit RL and carbopol as matrix material in case of sustained release layer. The tablets showed an initial burst release which served as loading dose followed by sustained release upto 12 hours. Among four matrix materials and their combinations, formulation F9 containing 15% Eudragit RL showed better drug release. The pharmacokinetic advantage is that, the drug release from fast releasing layer leads to a sudden rise in the blood concentration. However, the blood level is maintained at steady state as the

drug is released from sustained releasing layer. This modified release bilayer tablets will reduce dosing frequency, increase the bioavailability and provide better patient compliance.

## REFERENCES


1. Chien YW. Novel Drug Delivery System, ed. by Marcel Dekker, New York, USA; 1992:139-96.
2. Vyas SP, Khar RK.Controlled Drug Delivery: Concepts and Advances, Vallabh Prakashan, Delhi; 2002:155-95.
3. Saleh MA, Yellela SR, Srinivas SP, Satyanaryana V. *In vitro* and *in vivo* evaluation of guar gum matrix tablets for oral controlled release of water-soluble diltiazem hydrochloride. AAPS PharmSciTech; 2005:6(1): E14-E21.
4. Remya P.N., Damodharan N., Sulakshan Kumar C.V, Formulation and evaluation of bilayered tablets of ibuprofen and methocarbamol, Int. J. Pharm. Tech. Res. 2010, 2(2), 1250-5.
5. Moiz, Prathima Srinivas. M, Sadanandam.M, Formulation and evaluation of bilayered tablets of montelukast and levocetrizine dihydrochloride Using natural and synthetic polymers, International Journal of Drug Delivery, 2011,3 (4) 597-618.
6. Mohamed Halith. S, Jayaprakash S. Kulathuran Pillai K.**,** Formulation and evaluation of bilayer tablets of amlodipine besilate and metprolol succinate, Der Pharmacia Lettre, Scholars Research Library, 2011: 3 (4)143-5.
7. Jadhav R.T, Payal H. Patil, Pratibha R. Patil, Formulation and evaluation of bilayered tablet of piracetam and vinpocetine, J. Chem. Pharm. Res., 2011, 3(3):423-31.
8. http://en.wikipedia.org/wiki/Venlafaxine

**Table 1. Formulation for immediate release layer (Loading Dose) of Venlafaxine HCl**

| Ingredients | Weight in (mg) |
|---|---|
| Venlafaxine HCl | 25 mg |
| Sodium starch glycolate | 30 mg |
| PVP in alcohol | 6 mg |
| Magnesium stereate | 3 mg |
| Talc | 6 mg |
| MCC | 50 mg |

**Table 2. Formulation of sustained release layer (Maintenance Dose) of Venlafaxine HCl**

| Ingredients (mg) | $F_1$ | $F_2$ | $F_3$ | $F_4$ | $F_5$ | $F_6$ | $F_7$ | $F_8$ | $F_9$ | $F_{10}$ | $F_{11}$ | $F_{12}$ | $F_{13}$ | $F_{14}$ | $F_{15}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Venlafaxine HCl | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| MCC | 70 | 62.5 | 55 | 77.5 | 70 | 62.5 | 77.5 | 77.5 | 70 | 73 | 73 | 73 | 52 | 25 | 55 |
| PVP in Alcohol | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| Magnesium stearate | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Talc | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| HPMC K100 | 45 | 52.5 | 60 | - | - | - | - | - | - | 21 | - | - | - | 90 | - |
| Sodium CMC | - | - | - | 37.5 | 45 | 52.5 | - | - | - | - | 21 | - | - | - | 60 |
| Carbopol | - | - | - | - | - | - | 37.5 | - | - | - | - | 21 | 21 | - | - |
| Eudragit RL | - | - | - | - | - | - | - | 37.5 | 45 | 21 | 21 | 21 | 42 | - | - |

**Table 3. Compression parameters for Venlafaxine HCl immediate and sustained release layer (n = 3)**

| Formulation Code | Angle of repose | Loose bulk density (LBD) (g/ml) | Tapped bulk density (TBD) (g/ml) | Compressibility index (%) |
|---|---|---|---|---|
| | **Immediate release layer** | | | |
| **$I_1$** | 26.22 ± 1.78 | 0.262 ± 0.003 | 0.289 ± 0.014 | 9.71 ± 1.33 |
| | **Sustained release layer** | | | |
| **$F_1$** | 25.22 ± 1.32 | 0.254 ± 0.005 | 0.273 ± 0.013 | 8.54 ± 0.75 |
| **$F_2$** | 27.15 ± 1.41 | 0.284 ±0.004 | 0.322 ± 0.011 | 11.63 ± 1.63 |
| **$F_3$** | 26.22 ± 1.78 | 0.262 ± 0.003 | 0.289 ± 0.014 | 9.71 ± 1.33 |
| **$F_4$** | 29.45 ± 1.52 | 0.294 ±0.009 | 0.235 ± 0.012 | 10.20 ± 1.48 |
| **$F_5$** | 28.12 ± 1.57 | 0.279 ± 0.006 | 0.295 ± 0.016 | 11.56 ± 0.78 |
| **$F_6$** | 26.12 ± 1.73 | 0.314 ±0.006 | 0.282 ±0.015 | 8.94 ± 0.61 |
| **$F_7$** | 31.15 ± 1.38 | 0.301 ± 0.001 | 0.317 ± 0.018 | 9.87 ± 1.41 |
| **$F_8$** | 30.26 ± 1.34 | 0.268 ± 0.007 | 0.291 ±0.019 | 10.71 ± 1.76 |
| **$F_9$** | 32.35 ± 1.81 | 0.297 ± 0.003 | 0.325 ± 0.011 | 11.40 ± 1.58 |
| **$F_{10}$** | 28.23±1.72 | 0.284±0.006 | 0.312±0.016 | 11.24±1.64 |
| **$F_{11}$** | 25.22 ± 1.32 | 0.254 ± 0.005 | 0.273 ± 0.013 | 8.54 ± 0.75 |
| **$F_{12}$** | 27.15 ± 1.41 | 0.284 ±0.004 | 0.322 ± 0.011 | 11.63 ± 1.63 |
| **$F_{13}$** | 26.22 ± 1.78 | 0.262 ± 0.003 | 0.289 ± 0.014 | 9.71 ± 1.33 |
| **$F_{14}$** | 27.21±1.54 | 0.254±0.002 | 0.276±0.018 | 10.65±1.44 |
| **$F_{15}$** | 25.64±1.21 | 0.276±0.006 | 0.296±0.012 | 9.94±1.64 |

**Table 4. Post-compression parameters of Venlafaxine HCl Bilayer tablets (n = 3)**

| Formulation Code | Hardness ($kg/cm^2$) | Thickness (mm) | Friability (%) | Weight Variaton (mg) | Drug content (%) |
|---|---|---|---|---|---|
| $F_1$ | 7.2±0.02 | 2.92±0.19 | 0.43±0.05 | 298± 1.88 | 98.21 ± 0.31 |
| $F_2$ | 6.9±0.04 | 2.93±0.42 | 0.21±0.01 | 298± 1.88 | 98.45 ± 0.54 |
| $F_3$ | 6.8±0.07 | 2.93±0.34 | 0.33±0.03 | 300± 1.09 | 98.34 ± 0.65 |
| $F_4$ | 6.8±0.02 | 2.93±0.46 | 0.19±0.08 | 301± 1.09 | 98.76 ± 0.44 |
| $F_5$ | 6.9±0.02 | 2.93±0.75 | 0.26±0.02 | 302± 1.60 | 98.51 ± 0.28 |
| $F_6$ | 6.9±0.04 | 2.93±0.33 | 0.13±0.04 | 298± 1.09 | 98.62 ± 0.47 |
| $F_7$ | 7.1±0.03 | 2.92±0.42 | 0.18±0.07 | 298± 1.60 | 98.13 ± 0.71 |
| $F_8$ | 7.0±0.06 | 2.92±0.44 | 0.15 ± 0.02 | 298± 1.06 | 98.57 ± 0.39 |
| $F_9$ | 7.0±0.05 | 2.91±0.54 | 0.10±0.05 | 300± 1.01 | 98.24 ± 0.58 |
| $F_{10}$ | 6.9±0.01 | 2.92±0.66 | 0.17±0.05 | 300± 1.01 | 98.32± 0.43 |
| $F_{11}$ | 6.8±0.06 | 2.92±0.42 | 0.23±0.09 | 300± 1.01 | 98.67± 0.57 |
| $F_{12}$ | 7.2±0.02 | 2.92±0.33 | 0.32±0.05 | 301± 1.06 | 98.60± 0.46 |
| $F_{13}$ | 7.2±0.02 | 2.91±0.23 | 0.41±0.03 | 301± 1.08 | 98.34± 0.58 |
| $F_{14}$ | 7.2±0.02 | 2.93±0.37 | 0.37±0.04 | 301± 1.07 | 98.74± 0.22 |
| $F_{15}$ | 7.1±0.03 | 2.92±0.17 | 0.40±0.05 | 298± 1.06 | 98.21± 0.59 |

**Table 5. Model fitting for drug release kinetics of formulation F9**

| **Time (hours)** | Log time | SQRT | %CDR | %CDR remaining | Log % CDR remaining | Log % CDR |
|---|---|---|---|---|---|---|
| 0.15 | -0.823 | 0.387 | 33.39 | 66.61 | 1.823 | 1.5236 |
| 0.30 | -0.547 | 0.547 | 37.23 | 62.77 | 1.797 | 1.5708 |
| 0.45 | -0.346 | 0.670 | 44.79 | 55.21 | 1.742 | 1.6511 |
| 1 | 0 | 1 | 46.21 | 53.79 | 1.730 | 1.6647 |
| 2 | 0.3010 | 1.414 | 55.84 | 44.16 | 1.645 | 1.7469 |
| 3 | 0.477 | 1.732 | 62.25 | 37.75 | 1.576 | 1.7941 |
| 4 | 0.6020 | 2 | 69.97 | 30.03 | 1.477 | 1.8449 |
| 5 | 0.698 | 2.236 | 75.10 | 24.9 | 1.396 | 1.8756 |
| 6 | 0.778 | 2.449 | 77.04 | 22.96 | 1.360 | 1.8867 |
| 7 | 0.8450 | 2.645 | 82.80 | 17.2 | 1.235 | 1.9180 |
| 8 | 0.9030 | 2.828 | 90.51 | 9.49 | 0.9772 | 1.9566 |
| 9 | 0.954 | 3 | 94.80 | 5.2 | 0.7160 | 1.9768 |
| 10 | 1 | 3.162 | 96.93 | 3.07 | 0.4871 | 1.9864 |
| 11 | 1.041 | 3.316 | 97.66 | 2.34 | 0.3692 | 1.9897 |
| 12 | 1.079 | 3.464 | 98.54 | 1.46 | 0.1643 | 1.9836 |

**Table 6. Correlation coefficients of different release kinetic models for different bilayer tablet formulations**

| Formulation | Zero order | First Order | Higuchi | Peppa's model | |
|---|---|---|---|---|---|
| | $R^2$ | $R^2$ | $R^2$ | $R^2$ | n value |
| F1 | 0.932 | 0.988 | 0.981 | 0.967 | 0.234 |
| F2 | 0.955 | 0.976 | 0.975 | 0.965 | 0.256 |
| F3 | 0.965 | 0.966 | 0.965 | 0.988 | 0.278 |
| F4 | 0.977 | 0.944 | 0.954 | 0.976 | 0.235 |
| F5 | 0.986 | 0.945 | 0.937 | 0.958 | 0.287 |
| F6 | 0.923 | 0.956 | 0.977 | 0.968 | 0.268 |
| F7 | 0.952 | 0.944 | 0.978 | 0.956 | 0.269 |
| F8 | 0.936 | 0.987 | 0.957 | 0.948 | 0.296 |
| F9 | 0.949 | 0.946 | 0.991 | 0.975 | 0.255 |
| F10 | 0.837 | 0.992 | 0.944 | 0.954 | 0.219 |
| F11 | 0.966 | 0.967 | 0.968 | 0.924 | 0.300 |
| F12 | 0.955 | 0.991 | 0.944 | 0.945 | 0.305 |
| F13 | 0.899 | 0.942 | 0.939 | 0.952 | 0.288 |
| F14 | 0.913 | 0.964 | 0.949 | 0.965 | 0.295 |
| F15 | 0.944 | 0.955 | 0.969 | 0.978 | 0.248 |

**Table 7. Percentage drug release from optimized formulations F9 after stability period**

| No. of days | Percentage drug released (F9) | | |
|---|---|---|---|
| | 25 °C / 60 %RH | 30 °C / 65 %RH | 40 °C / 75 %RH |
| 0 | 98.21 | 98.10 | 98.42 |
| 15 | 98.45 | 98.64 | 98.33 |
| 30 | 98.34 | 98.57 | 98.21 |
| 45 | 98.76 | 98.08 | 98.09 |
| 60 | 98.51 | 98.66 | 98.55 |
| 75 | 98.62 | 98.58 | 98.07 |
| 90 | 98.13 | 98.43 | 98.19 |

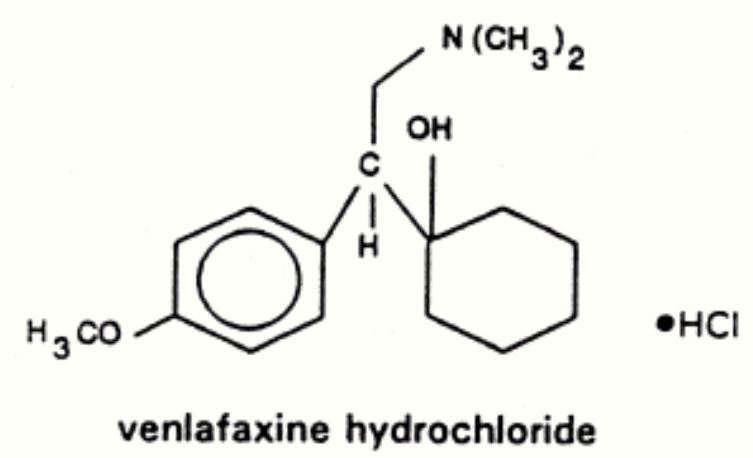


**Fig. 1.**

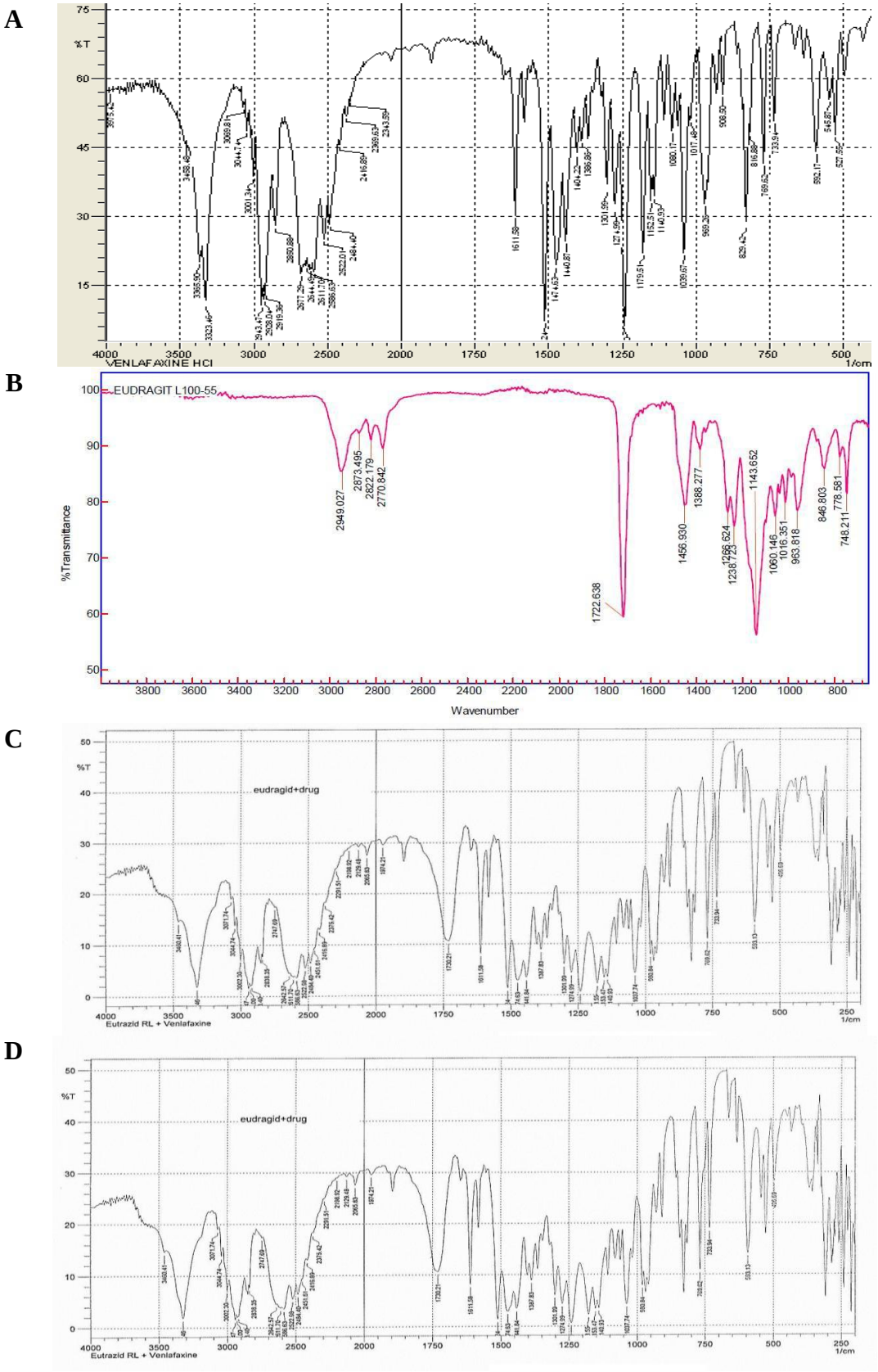


**Fig. 2: FT-IR Spectra of (A) Venlafaxine HCl, Eudragit RL (B), physical mixture of Venlafaxine HCl & Eudragit RL (C) and formulation F9 (D)**

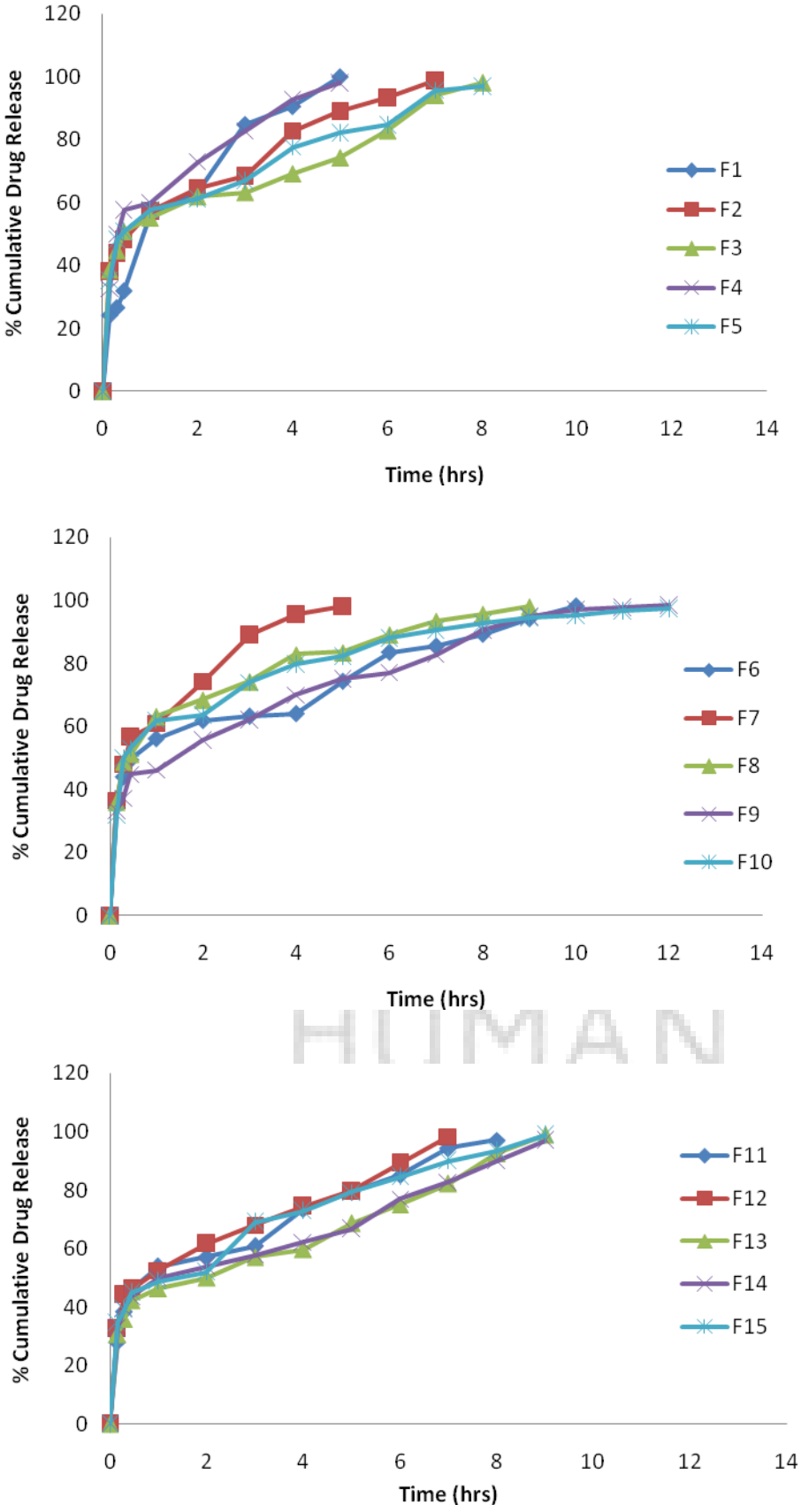


**Fig. 3: *In vitro* dissolution profiles of F1 to F15 formulations**

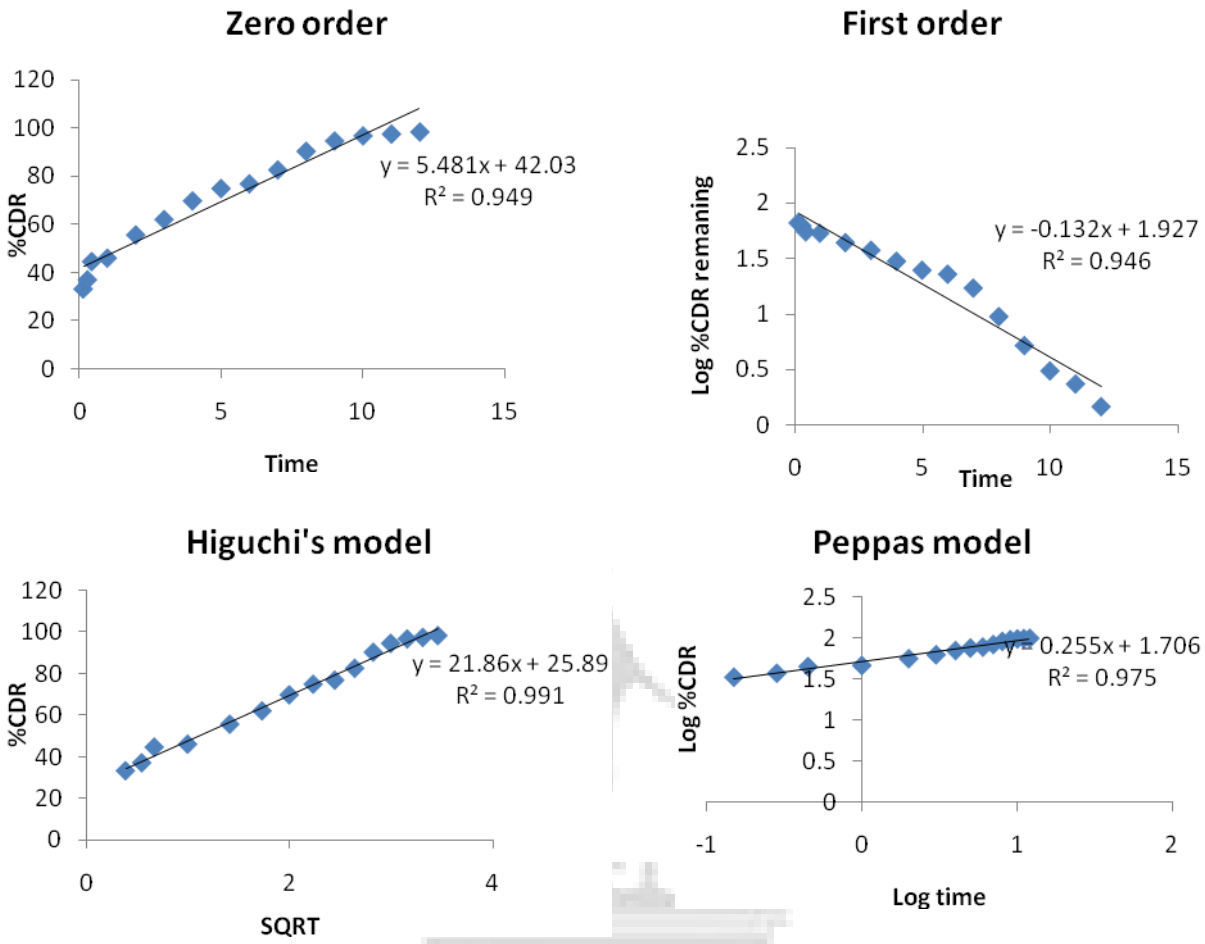


**Fig. 4: Drug release kinetics of formulation F9**