FORMULATION AND CHARACTERIZATION OF CAP-IN-CAP TECHNOLOGY FOR BIPHASIC DELIVERY OF LORNOXICAM

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ABSTRACT
In the present research work, the study of new technology capsule-in-a-capsule for biphasic delivery of lornoxicam was done. In this technology the advantages of fast releasing liquid-filled-capsules and slow release beads-filled-capsules were combined to achieve the optimum biphasic delivery of drug. Lornoxicam slow releasing beads were prepared by ionotrophic gelation method by using hydrophilic polymer and were filled into a smaller capsule. Lornoxicam fast releasing liquid dispersion was prepared by using PVP K-30 as a solubility enhancer and further dissolving in PEG 400. This fast releasing liquid and slow releasing beads-filled-capsule are then inserted into a bigger capsule body and closed with the cap by sealing. The various formulation batches were subjected to physicochemical studies, entrapment efficiency, drug content, in vitro drug release and stability studies. The polymer-Drug interaction studies reveal that there was no interaction between drug and polymers employed in this study. The optimized capsule-in-a-capsule formulation released 29.61±0.27% at the end of 30 min and 96.56±0.75% of drug at the end of 12h. The stability results indicate that the various parameters of our optimized formulation are not affected on storage at 45°C/75%RH up to 2 months.


1. INTRODUCTION[1-5]
Biphasic drug delivery systems are designed to release a drug at two different rates or in two different periods of time i.e. they are either quick/slow or slow/quick.[1] In arthritic disorders, this drug treatment has been found to be more advantageous when it is delivered in a biphasic manner rather than extended release single phase preparations. In the first phase of drug
release, the immediate release dose fraction (also called “loading-dose”) reaches a therapeutic drug level in the blood plasma quickly after administration, which is responsible for quicker on set of action and higher patient compliance in migraine cases. The second phase consists of extended release dose fraction (called the “maintenance-dose”), which maintains an effective therapeutic level for a prolonged period. Examples of such biphasic drug delivery systems are bilayer tablets, drug layered matrices, or combinations of immediate, and extended release multiparticulates.\(^2\) A variuos therapeutic applications can be achieved by using single oral capsule dosage form comprising capsule-in-a-capsule technology. By this method a smaller prefilled capsule can be easily inserted into a larger liquid filled capsule. As per the formulation requirements both the smaller and larger capsules may be of gelatin or HPMC and if necessary they can also be coated. Multiple release profiles can also be easily achieved by filling immediate release formulation in outer larger capsule and sustained or controlled release formulation in inner smaller capsule. In addition to modifying release profiles, it is also possible to target the inner and outer capsule to different areas of the GI tract (small intestine or colon) with an appropriate coating.\(^3\) It also increases time within the therapeutic window due to lower peak plasma concentration. The smaller and larger capsules may even contain different actives for use with combination therapies or actives that are incompatible. Smaller capsule contains powder; semisolid or liquid formulation or larger capsule contains semi-solid or liquid formulation. This method is suited for both neutraceutical and pharmaceutical use. It is a simplified drug regimen.\(^4,5\)

Lornoxicam is a non-steroidal anti-inflammatory drug and it belongs to the oxicam class. It has potent analgesic with excellent anti-inflammatory properties in a range of painful and/or inflammatory conditions In the present work, capsule-in-a-capsule technology for biphasic delivery of lornoxicam has been developed using PVP K-30 and PEG 400 in immediate release phase and sodium alginate, HPMC polymers in sustained release phase.\(^6\)

Figure 1: Capsule in capsule technology example.
2. MATERIALS AND METHODS

2.1 Drugs and Chemicals
Lornoxicam was obtained as gift sample from Abbott pharmaceuticals, Mumbai, India. PEG 400 and PVP K30 were purchased from Loba Chemie Pvt. Ltd., Mumbai. HPMC, Sodium alginate and calcium chloride was purchased from SD Fine Chemicals, Mumbai. Empty hard gelatin capsules (size 0 and size 2) were obtained as a gift sample from manga Capsules, Nashik. All other materials used were of analytical grade.

2.2 Pre-formulation studies
2.2.1 Fourier Transform Infrared (FTIR) spectral analysis
The pure drug lornoxicam, polymers and physical mixtures of drug and polymers used in this experiment were evaluated by recording the spectra using FT-IR Spectrophotometer (Perkin Elmer, spectrum-100, Japan). The evaluation was performed by taking 5% of sample in potassium bromide (KBr) and the mixture was ground into a fine powder and then compressed into KBr pellets at a compaction pressure of 4000 Psi for 2 min. The range of scanning was 400 to 4000 cm$^{-1}$ and the resolution was 1 cm$^{-1}$

2.3 Formulation of lornoxicam capsule-in-a-capsule:
Lornoxicam capsule-in-a-capsule formulation consists of two phases; immediate and sustained releasing phases. The immediate and sustained releasing doses of lornoxicam were found to be 3.24mg and 8mg respectively.$^{[7]}$

Calculation of theoretical release profile of lornoxicam from sustained release formulations$^{[8]}$
The total dose of Lornoxicam for a twice-daily sustained release formulation was following available pharmacokinetic data
Volume of distribution ($V_d$) = 0.2 Liter per kg
By taking average body weight of 60 kg
Then,
\[ V_d = 0.2 \times 60 = 12 \text{ liter} \]
$C_{max}$ = maximum plasma concentration of Lornoxicam
\[ = 270 \mu\text{g per liter} \]
\[ = 0.270 \text{ mg per liter} \]
Therefore, loading dose ($D_L$) can be calculated by:
\[ D_L = C_{\text{max}} \times V_d \]
\[ D_L = 0.270 \times 12 \]
\[ D_L = 3.24 \text{ mg} \]

**Calculation of maintenance dose**

\[ D_t = D_L \left(1 + 0.693 \times \frac{t}{t_{1/2}} \right) \]

Where,

- \( D_t \) = total dose
- \( D_L \) = loading dose
- \( t_{1/2} \) = half life of drug
- \( t \) = time during which sustained release is desired

\[ D_t = 3.24 \left(1 + 0.693 \times \frac{12}{4} \right) \]
\[ D_t = 10.78 \text{ mg is total dose} \]
\[ D_L = 3.24 \text{ (Loading dose)} \]
\[ D_m = 8 \text{ mg (Maintenance dose)} \]

### 2.3.1 Preparation of sustained release beads of lornoxicam in core capsule

**Preparation of beads by ionotropic gelation technique**

Ionotropic gelation technique was used to prepare the Lornoxicam alginate sustained release beads. Three different batches (Table 1) of beads were tried. Sodium alginate was dissolved in deionised water at a concentration of 3% w/v; accurately weighed 100 mg quantity of Lornoxicam was uniformly dispersed in 50ml of sodium alginate solution by using mechanical stirrer at 500rpm. Bubble free dispersion was dropped into 100ml of aqueous calcium chloride solution containing different concentrations of HPMC, through a syringe with a needle of size no. 18 and stirred at 100rpm. After stirring for 15min the formed beads were separated by filtration, washed with distilled water and dried at 60°C for 6 hours.
Table 1: Composition of sustained release beads filled capsules.

<table>
<thead>
<tr>
<th>Batch code</th>
<th>Lornoxicam</th>
<th>Sodium alginate % (w/v)</th>
<th>Calcium chloride % (w/v)</th>
<th>HPMC % (w/v)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BFC-1</td>
<td>8 mg</td>
<td>3</td>
<td>5</td>
<td>0.5</td>
</tr>
<tr>
<td>BFC-2</td>
<td>8 mg</td>
<td>3</td>
<td>5</td>
<td>1.0</td>
</tr>
<tr>
<td>BFC-3</td>
<td>8 mg</td>
<td>3</td>
<td>5</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Each batch contains 100 mg of lornoxicam. Drug equivalent to 8 mg is taken for single sustained release dose.

2.3.2 Filling of prepared beads in a small capsule

Special leak proof capsule was used in this formulation. The prepared optimized sustained release beads equivalent to 8 mg of Lornoxicam were filled in the size 2 hard gelatine capsule and was sealed with 15% (m/m) warm gelatine solution. The filled capsules were stored at room temperature until testing.[10]

2.3.3 Preparation of immediate release liquid phase of lornoxicam in outer capsule

Accurately weighed amounts of drug and PVP K-30 were physically mixed and then kneaded with small amount of the methanol to form a thick paste by kneading and hence was dried at
45°C in an oven. Pass the mass through the sieve no. 30 and store in the desiccator. The drug:carrier complex of lornoxicam prepared was solubilized in PEG 400 to give a final drug concentration of and further sonicated for 1h. 

![Figure 4: Liquid filled capsule.](image)

**Table 2: Composition of liquid fills of lornoxicam.**

<table>
<thead>
<tr>
<th>Batch code</th>
<th>Drug</th>
<th>Polymer</th>
<th>Ratio</th>
<th>Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>LFC 1</td>
<td>Lornoxicam</td>
<td>PVP K-30</td>
<td>1:1</td>
<td>PEG 400</td>
</tr>
<tr>
<td>LFC 2</td>
<td>Lornoxicam</td>
<td>PVP K-30</td>
<td>1:2</td>
<td>PEG 400</td>
</tr>
</tbody>
</table>

### 2.3.4 Preparation of Capsule-in-a-Capsule Drug Delivery System

Special leak proof capsules for both smaller and bigger size was used in this formulation. To prepare a novel capsule-in-a-capsule technology the prepared optimized sustained release beads equivalent to 8 mg of lornoxicam were filled in size 2 hard gelatin capsule and was sealed with 15% (m/m) warm gelatin solution. This prepared sustained release smaller capsule was filled into a bigger capsule body size 0 which was further filled with the liquid dispersion of lornoxicam equivalent to 3.25 mg as loading dose using medicine droppers. After closing with cap the bigger capsule was also sealed with 15% (m/m) warm gelatin solution. The filled capsules were stored at room temperature until testing. 

![Figure 5: Cap-In-Cap formulation.](image)
2.4 Evaluation parameters

2.4.1 Drug-excipients compatibility study
Compatibility study was carried out by using Fourier transform infrared spectrophotometer (Shimadzu 8400s). FTIR study was carried out on pure drug. Physical mixture of drug and polymers were prepared and samples kept for 1 month at 40°C. The infrared absorption spectrum of Lornoxicam and physical mixture of drug and polymers was recorded using KBR disc over the wave number 4000 to 400 cm⁻¹.[12]

2.4.2 Percentage yield
The practical percentage yield was calculated from the weight of dried microcapsules recovered from each batch in relation to the sum of the initial weight of starting materials. The percentage yield was calculated using the following formula;
% Yield = Practical mass (microcapsules) / Theoretical mass (Polymer + drug) X 100[10]

2.4.3 Measurement of micromeritic properties of microbeads[12]
2.4.3.1 The flow properties: were investigated by measuring the angle of repose of drug loaded microbeads using fixed-base cone method. Microbeads were allowed to fall freely through a funnel with a sound stem of 20 to 30 mm diameter which attached to the burette stand the height of which was adjusted to 2 cm above the horizontal flat surface until the apex of the conical pile just touches to the tip of the funnel. The graph paper sheet was placed below the funnel. The powder was allowed to flow through the funnel freely onto the surface of the graph paper sheet. Circle was marked around the heap covering approximately 90% of total microbeads bed. The height and diameter of the cone was measured and angle of repose was calculated by using the following formula. Each experiment was carried out in triplicate.

\[
\tan \theta = \frac{h}{r}
\]

Where,

h=cone height,

r= radius of circular base formed by the microbeads on the ground.

2.4.3.2 The Bulk and Tapped densities: were measured in a 10ml graduated cylinder as a measure of packability of the microbeads. The sample contained in the measuring cylinder was tapped mechanically by means of constant velocity rotating cam. The
initial bulk volume and final tapped volume were noted from which, their respective densities were calculated.

Table 3: Scale of flowability determined by different methods.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Flow character</th>
<th>Angle of Repose (θ°)</th>
<th>HR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Excellent</td>
<td>25-30</td>
<td>1.00-1.11</td>
</tr>
<tr>
<td>2</td>
<td>Good</td>
<td>31-35</td>
<td>1.12-1.18</td>
</tr>
<tr>
<td>3</td>
<td>Fair-aid not needed</td>
<td>36-40</td>
<td>1.19-1.25</td>
</tr>
<tr>
<td>4</td>
<td>Passable</td>
<td>41-45</td>
<td>1.26-1.34</td>
</tr>
<tr>
<td>5</td>
<td>Poor</td>
<td>46-55</td>
<td>1.35-1.45</td>
</tr>
<tr>
<td>6</td>
<td>Very poor</td>
<td>56-65</td>
<td>1.46-1.59</td>
</tr>
<tr>
<td>7</td>
<td>Very, very poor</td>
<td>&gt;66</td>
<td>&gt;1.60</td>
</tr>
</tbody>
</table>

**Bulk density** \((\rho_0) = \frac{M}{V_0}\)

**Tapped density** \((\rho_t) = \frac{M}{V_t}\)

**2.4.3.3 Hausner’s ratio:** The ratio of microbeads was determined by comparing the tapped density to the bulk density by using the equation\(^{12}\)

\[
\text{Hausner’s ratio} = \frac{\text{Bulk}}{\text{Tapped}}
\]

\[
D_{\text{mean}} = \frac{\Sigma nd}{\Sigma n}
\]

Where,

- \(n\) = Number of microcapsules checked
- \(d\) = Mean size range

**2.4.4 Degree of swelling**

Swellability of the microcapsules was determined by allowing the microcapsules to swell in the phosphate buffer pH 6.8. 100 mg of accurately weighed microbeads were immersed in little excess of phosphate buffer pH 6.8 for 24 hours and washed thoroughly with deionised water and blotted with filter paper to remove excess surface liquid. The % swelling was arrived at using the following formula;

**Degree of Swelling** = \(\frac{W_s - Wo}{Wo}\)

Where,

- \(Wo\) is the weight of microcapsules before swelling
- \(W_s\) is the weight of microcapsules after swelling. \(^{13}\)
2.4.5 Drug entrapment efficiency

Accurately weighed quantities of beads equivalent to 8 mg of lornoxicam were placed in 25mL of 0.1N HCl. The solution was centrifuged using the centrifuge at 4200 rpm for 30min; the supernatant layer of the liquid was assayed by UV-spectroscopy at 375nm. The encapsulation efficiency was determined by the following equation.

\[
\% \text{ Drug Entrapment Efficiency} = \frac{\text{Actual drug content}}{\text{Theoretical drug content}} \times 100 \quad [13]
\]

2.4.6 Drug content uniformity

Immediate release dispersion equivalent to 3.25 mg and sustained release beads equivalent to 8 mg of Lornoxicam were extracted in phosphate buffer of pH 6.8. The solution was filtered through a Millipore filter (0.45μm pore size) and the drug content was determined spectrophotometrically at λ max of 376nm after suitable dilution. The studies were carried out in triplicate and the mean values were noted indicating the reproducibility of the results. [13]

2.4.7 In-vitro release studies

Dissolution studies were carried out using USP dissolution test apparatus II basket type (Electrolab TDL-08L) at a rotation speed of 100rpm and at 37 ± 0.5°C using 900 ml of 0.1N HCl (pH 1.2) for two hours and remaining hours in pH 6.8 phosphate buffer. A 10 ml sample was withdrawn at 30min time intervals and replaced by an equal volume of pre-warmed 0.1N HCl (pH 1.2) and phosphate buffer pH 6.8, respectively. Samples withdrawn were filtered through whatmann filter paper (0.45 micron). The amount of lornoxicam released was analyzed at 375nm and 376nm for samples tested in 0.1N HCl and the phosphate buffer pH 6.8 respectively, using a Shimadzu UV-spectrophotometer. The studies were carried out in triplicate and the mean values plotted versus time with standard error of mean, indicating the reproducibility of the results.

2.4.8 Release kinetics studies

The analysis of a drug release mechanism from a pharmaceutical dosage form is an important but complicated process and is practically evident in the case of matrix systems. To study the release kinetics in vitro release data was applied to kinetic models such as zero-order, first order, Higuchi and Korsemeyer-Peppas. [14]
2.4.9 Stability studies
Stability studies were carried out as per ICH Q1A guidelines. During the stability studies, the product is exposed to normal conditions of temperature and humidity. The optimized formulation capsules were stored in glass bottles and subjected to accelerated stability studies as per ICH Q1A (R2) guidelines i.e. 40°C ± 2°C /75 % RH ± 5% RH. Sampling was done at predetermined time intervals of 0, 2 months. Capsules were evaluated for the drug content and in vitro release profile. It was also noted that no leakage or visible change in appearance was apparent during the time of storage under ambient temperature.

**Packaging material:** The Capsules were wrapped in aluminum foils.

**Sampling points:** The optimized formulations were subjected to stability for a period of two months. The samples were withdrawn at the end of two months.\[15\]

2.5 RESULT AND DISCUSSION

2.5.1 Drug-excipients compatibility study
FTIR of mixture of PEG 400, HPMC, Sodium Alginate, and PVP-K30 with Lornoxicam The IR spectra of lornoxicam with PEG 400, Sodium alginate and HPMC, did not reveal any extra peak which confirms the absence of chemical interactions between Lornoxicam and excipients used.

![FTIR spectra](image)

**Figure 6:** FTIR spectra of pure Lornoxicam, Lornoxicam + PEG 400, Lornoxicam + Sodium alginate, Lornoxicam + HPMC.
2.5.2 The percentage yield
The percentage yield of prepared microbeads of all batches is given in table No 4. It was observed that increasing the polymer ratio in the formulation significantly lowers the product yield, due to the formation of high viscous polymer dispersion which may be lost during manufacturing process.

2.5.3 Measurement of micromeritic properties of microbeads
Microbeads were subjected for measurement of angle of repose by using fixed base cone method and results of test obtained are shown in Table No 4. Angle of repose value between 25- 30° and below indicates excellent flow property of the beads i.e. less or no interparticulate friction or resistance to movement between particles. From the hausner’s ratio data it shows in the range of 1.11- 1.23 which conclude that it has good flow properties. Each value represents mean ± SD of three determinations.

2.5.4 The degree of swelling
The dynamic swelling study of prepared microbeads was carried out in phosphate buffer pH 6.8. The results are presented in Table 4. The swelling of microbeads depends upon the concentration of polymers used. As the concentration increases, the degree of swelling increases.

Table 4: Evaluated characteristics of sustain release beads.

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Batch code</th>
<th>Angle of repose (θ ± S.D)</th>
<th>Bulk density (gm/ml) ± S.D.</th>
<th>Tapped density (gm/ml) ± S.D.</th>
<th>Hausner’s ratio ± S.D.</th>
<th>Degree of swelling (%)</th>
<th>Percentage yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BSF1</td>
<td>25.16 ± 0.02516</td>
<td>0.595 ± 0.96</td>
<td>0.733 ± 0.80</td>
<td>1.23 ± 0.20</td>
<td>1.119 ± 0.025</td>
<td>95.85%</td>
</tr>
<tr>
<td>2</td>
<td>BSF2</td>
<td>26.443 ± 0.0503</td>
<td>0.622 ± 1.10</td>
<td>0.755 ± 0.36</td>
<td>1.21 ± 0.40</td>
<td>1.137 ± 0.015</td>
<td>92.34%</td>
</tr>
<tr>
<td>3</td>
<td>BSF3</td>
<td>28.913 ± 0.1010</td>
<td>0.665 ± 0.73</td>
<td>0.782 ± 0.05</td>
<td>1.17 ± 0.58</td>
<td>1.186 ± 0.012</td>
<td>89.48%</td>
</tr>
</tbody>
</table>

Table 5: Drug entrapment Efficiency and Drug content of different batches of formulation.

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Batch code</th>
<th>Drug entrapment efficiency (%)</th>
<th>Drug content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BSF1</td>
<td>95.23 ± 0.026</td>
<td>89.56 ± 0.064</td>
</tr>
<tr>
<td>2</td>
<td>BSF2</td>
<td>96.49 ± 0.15</td>
<td>92.58 ± 0.016</td>
</tr>
<tr>
<td>3</td>
<td>BSF3</td>
<td>98.59 ± 0.016</td>
<td>97.63 ± 0.049</td>
</tr>
<tr>
<td>4</td>
<td>LIF1</td>
<td>-</td>
<td>98.68 ± 0.064</td>
</tr>
<tr>
<td>5</td>
<td>LIF2</td>
<td>-</td>
<td>98.73 ± 0.016</td>
</tr>
</tbody>
</table>
2.5.5 In-vitro release studies
The dissolution of sustained release beads was carried out. The study concludes that by increasing the concentration of polymer gives more sustaining effect (as shown in figure 8). on the basis of dissolution study, batch BSF3 was selected for final formulation. The study concludes that maximum fast release is achieved by LIF2 formulation (as shown in figure 7). The in-vitro dissolution study capsule-in-capsule system was carried out. It shows optimal release profiles of the drug delivery system. The drug release at the end of two hours was found to be 29.61 ± 0.27% and 96.56 ± 0.75% at the end of 12th hours. Optimal release profiles were obtained.

![Figure 7: Dissolution profile of various batches of liquid filled capsules.](image)

![Figure 8: Dissolution profile of various batches of HPMC coated beads.](image)
2.5.6 Release kinetics studies

In order to determine the mechanism of drug release form the formulation, the *in-vitro* dissolution data was fitted to Zero order, First order, Higuchi plot and Korsemeyer-peppa’s plot. The drug release from capsule-in-a-capsule formulation fits well with Higuchi model followed by zero order, first order and Korsemeyer-peppa’s model. The *in-vitro* release data was further fitted to Korsmeyer-Peppas model which is generally used to analyze the release mechanism when more than one type of release phenomenon is operational. Good linearity was observed with high ‘$R^2$’ value. The value of release exponent ‘n’ is an indicative of release mechanism. The value of ‘n’ obtained for the optimized formulation was found to be 0.85 suggesting probable release by non-Fickian or anomalous diffusion. The analysis of experimental data in the light of the Korsmeyer-Peppas equation, as well as the interpretation of the corresponding values of n, leads to a better understanding of the balance between these mechanisms. The value of ‘n’ obtained for the optimized formulation was found to be 0.79, which indicates that the release mechanism of lornoxicam from capsule-in-a-capsule formulation is non-Fickian transport, which suggests that both dissolution and diffusion of the drug in matrices and also its own erosion modulate drug release.
Figure 10: Korsemeyer peppas plot.

Figure 11: First order plot.

Figure 12: Zero order plot.
2.5.7 Stability studies

Stability studies were carried out as per ICH Q1A guidelines. During the stability studies, the product is exposed to normal conditions of temperature and humidity. The optimized formulation capsules were stored in glass bottles and subjected to accelerated stability studies as per ICH Q1A (R2) guidelines i.e. 40°C ± 2°C /75% RH ± 5% RH. Sampling was done at predetermined time intervals of 0, 2 months. The results of accelerated stability studies reveal that the optimized capsule-in-a-capsule formulation did not show any change in appearance, drug content and in vitro release characteristics during the study period table

Table 6: Results of stability studies.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Initial values</th>
<th>After 2 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Normal</td>
<td>No signs of leakage</td>
</tr>
<tr>
<td>% Drug content of liquid-filled capsules (LFC-2)</td>
<td>97.8±0.68</td>
<td>97.01±0.15</td>
</tr>
<tr>
<td>% Drug content of beads-filled capsules (BFC-3)</td>
<td>98.28±0.74</td>
<td>98.03±0.53</td>
</tr>
<tr>
<td>% Drug release at the end of 30min and 12h</td>
<td>29.61±0.27% of drug at the end of 30 min and 96.56±0.75% at the end of 12th h</td>
<td>29.52±0.58 of drug at the end of 30 min and 96.34 ±0.86% at the end of 12th h</td>
</tr>
</tbody>
</table>

DISCUSSION

A novel biphasic drug delivery system was successfully developed by filling smaller beads-filled-capsule into a bigger liquid dispersion-filled-capsule body. The bigger capsule body was sealed with 15% (m/m) warm gelatin solution. The best fast releasing liquid dispersion (BFC-3) and slow releasing beads (LFC-2) of Lornoxicam were selected through in-vitro dissolution studies. Optimized capsule-in-a-capsule formulation released 22.65±0.74% of
drug at the end of 30min and 95.04±0.88% of drug at the end of 12h. It was also found to be stable at 40°C/75% RH for a period of 2 months as per ICH guidelines.

REFERENCES
