CHAPTER 8

STABILITY STUDIES ON SELECTED TABLET FORMULATIONS
LIST OF PAPERS PUBLISHED

1. FORMULATION AND EVALUATION OF HP-β-CYCLODEXTRIN COMPLEXES OF MEFENAMIC ACID TABLETS
   Nagabhushanam M.V. *, Prasada Rao Ch.V.

2. IN-VITRO DISSOLUTION STUDIES ON SOLID DISPERSIONS OF CELECOXIB
   Prof.M.V.Nagabhushanam1*, Ch.V.Prasada Rao2, Ch.Prabhakar3
   *International Journal of Pharmacy and Technology. IJPT | Sep-2011 | Vol. 3 | Issue No 3 | 2886-2895. ISSN: 0975-766X

3. HYDROPHILIC POLYMERS AND SUPERDISINTEGRANTS FOR DISSOLUTION ENHANCEMENT OF CELECOXIB
   Ch.V.Prasada Rao 1*, M.V.Nagabhushanam2, Ch.Prabhakar3.

4. INFLUENCE OF WATER-SOLUBLE POLYMERS ON THE DISSOLUTION OF MEFENAMIC ACID SOLID DISPERSIONS
   Ch.V.Prasada Rao1*, Prof.M.V.Nagabhushanam2

5. ENHANCEMENT OF DISSOLUTION PROFILE OF MEFENAMIC ACID BY SOLID DISPERSION TECHNIQUE
   Ch.V. Prasada Rao1* and M.V.Nagabhushanam2
   INTERNATIONAL JOURNAL OF RESEARCH IN PHARMACY AND CHEMISTRY IJRPC 2011, 1(4)/ 1127-1134. ; ISSN: 22312781
6. ENHANCEMENT OF DISSOLUTION RATE OF POORLY SOLUBLE DRUG MEFENAMIC ACID BY SOLID DISPERSION
CH V Prasada Rao¹*, MV Nagabhushanam ², CH Prabhakar³
Research Journal of Pharmaceutical, Biological and Chemical Sciences

7. TERNARY SOLID DISPERSIONS OF CELECOXIB: FROM PHYSICAL CHARACTERIZATION TO DISSOLUTION ENHANCEMENT
Nagabhushanam M V1*, Prasada Rao Ch V 2, Beena Devi M3, Suresh Kumar J4 Journal of Pharmaceutical Research ; Vol. 12, No. 2, April-June 2013

8. DISSOLUTION ENHANCEMENT STUDIES ON SELECTED CLASS II DRUG CELECOXIB.
M.V.Nagabhushanam , V.Prasada Rao , Ch.Prabhakar
The Indian Pharmacist, Volume X; No.4, October 2011,53-56.

9. PHARMACOKINETIC AND BIOAVAILABILITY EVALUATION OF LORNOXICAM SOLID DISPERSIONS IN SUPERDISINTEGRANTS
CH.V.Prasada Rao*, M.V.Nagabhushanam, K.R.S.Sambasiva Rao

10. PHARMACOKINETIC AND BIOAVAILABILITY STUDIES OF CELECOXIB SOLID DISPERSIONS IN SUPERDISINTEGRANTS
CH.V.Prasada Rao*, M.V.Nagabhushanam, K.R.S.Sambasiva Rao
REFERENCES OBJECTIVES, SCOPE AND PLAN OF RESEARCH WORK


REFERENCES CHAPTER I DISSOLUTION AND BIOAVAILABILITY OF DRUG FROM SOLID DOSAGE FORMS


immediate-release solid oral dosage forms based on a biopharmaceutics classification system, August 2000.


27. Keiji Sekiguchi and Noboru Obi. Studies on absorption of eutectic mixture. i. a comparison of the behaviour of eutectic mixture of sulfathiazole and that of

28. Arthur H. Goldberg, Milo Gibaldi, and Joseph L. Kanig. Increasing
dissolution rates and gastrointestinal absorption of drugs via solid solutions
and eutectic mixtures II: Experimental evaluation of a eutectic mixture: Urea-


30. Arthur H. Goldberg, Milo Gibaldi, and Joseph L. Kanig. Increasing
dissolution rates and gastrointestinal absorption of drugs via solid solutions
and eutectic mixtures I: Theoretical considerations and discussion of the

Lippold. Investigations on the predictability of the formation of glassy solid

32. Karel Six, Geert Verreck, Jef Peeters, Marcus Brewster, and Guy Van den
Mooter. Increased physical stability and improved dissolution properties of
itraconazole, a class II drug, by solid dispersions that combine fast- and

33. George Z. Papageorgiou, Dimitrios Bikiaris, Feras I. Kanaze, Evangelos
Karavas, Anagnostis Stergiou, and Emmanouil Georgarakis. Tailoring the
release rates of econazole using solid dispersions in polymer blends. Drug

34. Carsten Timpe. Drug solubilization strategies: Applying nanoparticulate
formulation and solid dispersion approaches in drug development. Am. Pharm.

35. Hajime Konno and Lynne S. Taylor. Ability of di®erent polymers to inhibit
the crystallization of amorphous felodipine in the presence of moisture.

36. Alfred C.F. Rumondor, Igor Ivanisevic, Simon Bates, David E. Alonzo, and
Lynne S. Taylor. Evaluation of drug-polymer miscibility in amorphous solid

37. Shan-Yang Lin, Chao-Ming Liao, Ging-Ho Hsiue, and Run-Chu Liang. Study
of a theophylline-eudragit L mixture using a combined system of microscopic


47. Devalina Law, Eric A. Schmitt, Kennan C. Marsh, Elizabeth A. Everitt, Weili
REFERENCES CHAPTER I LITERATURE REVIEW ON DISSOLUTION ENHANCEMENT TECHNIQUES


13. Vikas Anand; Dissolution rate enhancement of BCS class II drugs by ordered mixing; *Journal of Comprehensive Pharmacy (IJCP)*; IJCP-TA-2011-01.


65. Xiang TX, Anderson BD.; Molecular dynamics simulation of amorphous indomethacin-poly(vinylpyrrolidone) glasses: solubility and hydrogen bonding


92. Shinde VR, Shelake MR, Shetty SS, Chavan-Patil AB, Pore YV, Late SG.; Enhanced solubility and dissolution rate of lamotrigine by inclusion
complexation and solid dispersion technique.; **J Pharm Pharmcol.** (2008) Sep;60(9); doi: 10.1211/jpp.60.9.0002.


107. Jie-Xin Wang Qian-Xia Zhang, Yue Zhou, Lei Shao, Jian-Feng Chen.; Microfluidic syntheses of amorphous cefuroxime axetil nanoparticles with


REFERENCES CHAPTER 2


by solid dispersion in polyethylene glycol-polysorbate 80 mixture.” AAPS PharSci Tech


44. Teofilo Vasconcelos, Bruno Sarmento, Paulo Costa; “Solid dispersions as a strategy to improve oral bioavailability of poor water soluble drugs”.


46. Christian Leuner, Jennifer Dressman,” Improving drug solubility for oral delivery using solid dispersions.”


50. Sukmadjaja Asyarie, Faizatun, Heni Rachmawati,: In Vivo and In Vitro Evaluation of a Solid Dispersion System of Gliclazide: PEG 6000


57. Gorajana, Adinarayana; Ying, chanchiew; Shuang, Yeen; Fong, pooi; Tan, Zhi; Gupta, jyoti; Talekar, Meghana; Sharma, Manisha; Garg, Sanjay. “Development of Solid Dispersion Systems of Dapivirine to Enhance its Solubility.” Current Drug Delivery, Volume 10, Number 3, June 2013, pp.309-316 (8).


78. Rajashree Panigrahi, K.A.Chowdary, Gitanjali Mishra, Manas Bhownik, Saiprasanna Behera.” Comparative Evaluation Studies of Natural


95. Shobhit Kumar, Satish Kumar Gupta, Pramod Kumar Sharma: “Dissolution rate enhancement of aceclofenac by solid dispersion technique.” *Asian...*


International Journal of Applied Pharmaceutics: Vol 2 Issue 1,2010


113. G.Ashwini Kumar, Ram Kumar Choudhary and Ch.Chaitanya.” Enhancement of Solubility and Dissolution rate of Irbesartan by solid dispersion technique.”


REFERENCES CHAPTER 3


Containing Celecoxib Solid Dispersion.; *Dissolution Technologies* November (2009).


38. Ram R. Patlolla, Mahavir Chougule, Apurva R.Patel, Tanise Jackson, Prasad N.V.Tala, Mandip Singh.; Formulation, characterization and pulmonary deposition of nebulized celecoxib encapsulated nanostructured lipid carriers.;


47. Chawla A, Sharma P, Pawar P.; Eudragit S-100 coated sodium alginate microspheres of naproxen sodium: Formulation, optimization and in vitro evaluation/ Alginatne mikrosfere naproksen natrija oblozene Eudragitom S-
469


REFERENCES CHAPTER 4


REFERENCES CHAPTER 6

4. Chowdary KPR and Sunil Kumar; Formulation development of selected drugs by direct Compression Method; IJPRD.2011; 3167: 273-279.
27. RamaniRashminGordhanbhai; Development of Novel Coprocessed Excipients for the Design and Evaluation of Fast Dissolving Metoclopramide Hydrochloride Tablets; Department of pharmaceutical technology, H.K.E. Society’s college of pharmacy.2010; 5-105.


37. Ayyappan J, Umapathi P, Darlinquine; Development and Evaluation of a Directly Compressible Co-processed Multifunction Sustained Release Agent


REFERENCES CHAPTER 7


SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

One of the areas of current interest in pharmaceutical biotechnology which has a significant impact on clinical therapy is enhancement of dissolution rate and bioavailability of insoluble and poorly soluble drugs.

The enhancement of dissolution rate and oral bioavailability of poorly soluble drugs remains one of the most challenging aspects of drug development. Among the various methods for enhancement of the dissolution rate and oral bioavailability, solid dispersion technologies were found to be very successful with a number of drugs. In the present investigation studies were carried out on enhancement of dissolution rate, bioavailability and anti inflammatory activity of lornoxicam, mefenamic acid, celecoxib and naproxen by solid dispersion technologies employing various water-soluble and water dispersible carriers alone and in combination. A new class of tablet excipients called ‘superdisintegrants’ were evaluated as carriers for solid dispersions and for enhancing the dissolution rate and oral bioavailability of poorly soluble drugs. The feasibility of formulating the solid dispersions developed into compressed tablets was also investigated. The solid dispersions were also evaluated for in vivo pharmacokinetics, bioavailability and.

Lornoxicam, mefenamic acid, celecoxib and naproxen are non-steroidal anti-inflammatory drugs (NSAIDS) with highly selective COX-2 inhibitory action. The very poor aqueous solubility and wettability of these drugs give rise to difficulties in the design of pharmaceutical formulations and lead to variable oral bioavailability. Hence these two drugs are selected in the present investigation for enhancing their dissolution rate and oral bioavailability through solid dispersion technologies.

Solid dispersions of (i) lornoxicam (ii) mefenamic acid (iii) celecoxib (iv) naproxen in PEG 6000, PVP K 30, HPMC 5cps (water solublise carriers) and in micro crystalline cellulose (MCC), pregelatinised starch (PGS), dicalcium phosphate (DCP) (water dispersible superdisintegrants) alone and in combination were prepared and evaluated by invitro and invivo methods. From the results obtained the following conclusions are drawn.

1. All the solid dispersions prepared were found to be fine and free flowing powders.
2. The drug content was uniform in a batch of solid dispersion in all the cases.

3. The dissolution of lornoxicam, mefenamic acid, celecoxib and naproxen from all the solid dispersions was rapid and several times higher than the dissolution of the corresponding pure drugs.

4. All solid dispersions prepared by kneading method gave higher enhancement in the dissolution rate of the drugs than the ones prepared by physical mixing.

5. Drug dissolution from all solid dispersions followed first order kinetics.

6. The kinetics of dissolution of drug from the Solid Dispersions has followed the following order:
   Korsmeyer-Peppas > Higuchi > First Order > HixonCrowel cube root > Zero Order.

7. All the dissolution parameters estimated i.e., T_{50}, percent dissolved in 10 min, DE_{30}, and K_{1} values indicated rapid and higher dissolution of the drug (lornoxicam, mefenamic acid, celecoxib and naproxen) from solid dispersions than that of corresponding pure drugs.

8. The addition of hydrophilic polymers markedly enhanced the dissolution rate and dissolution efficiency of selected drugs.

9. Among the three water soluble carriers tested, PEG, PVP and HPMC, HPMC solid dispersions gave higher dissolution than PEG, PVP solid dispersions.

10. A concentration of 20% (corresponding to drug: carrier ratio of 1:1:5) is considered optimum for enhancing the dissolution rate in the case of water soluble carriers, PEG, PVP and HPMC.
11. Water dispersible superdisintegrants gave much higher enhancement in the dissolution rate and dissolution efficiency than water soluble carriers with lornoxicam, mefenamic acid, celecoxib and naproxen.

12. Among the superdisintegrants tested, pregelatinised starch gave highest enhancement to the dissolution rate and efficiency of lornoxicam, mefenamic acid, celecoxib and naproxen.

13. Low coefficient of variation values in the percentage of drug content indicated uniformity of drug content in each batch of solid dispersion prepared.

14. In each case the dissolution rate ($K_1$) and $DE_{30}$ values were increased as the concentration of carrier (superdisintegrants) in the solid dispersion was increased.

15. The higher dissolution rates and $DE_{30}$ values observed with solid dispersions are partially due to the solubilizing effect of hydrophilic polymers.

16. The solubility and dissolution rate of all the four anti inflammatory drugs studied were markedly enhanced by solid dispersions.

17. All ternary systems, showed significantly better dissolution parameters than the corresponding binary systems.

18. Ternary solid dispersions were significantly more effective in terms of dissolution efficiency, percent dissolved in 10 minutes, $DE_{30}$ values.

19. The order of increasing dissolution rate with various superdisintegrants was $PGS > DCP > MCC$ with lornoxicam, mefenamic acid, celecoxib and naproxen.
20. Solid dispersions in combined carriers gave much higher rates of dissolution, severaltimes higher than the dissolution rate of pure drugs and their dispersions in individual carriers.

21. HPMC combined superdisintegrants gave higher dissolution rates than PEG, PVP combined superdisintegrants.

22. In PEG, PVP and HPMC combined series, the order of increasing dissolution rate with various superdisintegrants was PGS > DCP > MCC.

23. DSC, SEM and XRD studies indicated a reduction in crystallinity and partial amorphization of the selected drugs because of the partial amorphization of the drugs.

24. Statistical analysis of all dissolution parameters showed that for all the systems the rank order in terms of both dissolution efficiency, percent dissolved in 10 minutes, relative dissolution rate was always : kneading > physical mixture.

25. Overall, the superdisintegrants alone and in combination with PEG, PVP and HPMC gave a marked enhancement in the dissolution rate of lornoxicam, mefenamic acid, celecoxib and naproxen. Among all pregelatinised starch (PGS) was found to be a good carrier for solid dispersions for enhancing the dissolution rate of lornoxicam, mefenamic acid, celecoxib and naproxen, four poorly soluble drugs. With Lornoxicam :PGS (1:6) alone it provided a 24.10 fold increase in dissolution rate and in combination at 2:2:10 ratio, 27.67 fold (with PEG) and 38.03 fold (with PVP), 80.93 fold (with HPMC) increase in the dissolution rate of lornoxicam. With Mefenamic Acid:PGS (1:6) alone it provided a 6.05 fold increase and in combination at 2:2:10 ratio 6.80 fold (with PEG) and9.47 fold (with PVP), 27.82 fold (with HPMC) increase in the dissolution rate of mefenamic acid. Celecoxib : PGS (1:6) alone it provided a 6.01 fold increase and in combination at 2:2:10 ratio 38.6 fold (with PEG) and 53.09 fold (with PVP), 103.63 fold (with HPMC) increase
in the dissolution rate of celecoxib. Naproxen alone it provided a 6.21 fold increase and in combination at 2:2:10 ratio 28.48 fold (with PEG) and 43.03 fold (with PVP), 53.57 fold (with HPMC) increase in the dissolution rate of narpro xen.

26. Dissolution data obeyed Hixson-Crowell’s cube root law with all solid dispersions indicating that the drug dissolution from the solid dispersions is occurring from discretely suspended (monodisperse) particles.

27. The enhanced dissolution rate of lornoxicam, mefenamic acid, celecoxib and naproxen from their solid dispersions in superdisintegrants is due to (i) partial conversion of the drug into amorphous form and a reduction in crystallinity (ii) reduction in particle size and deposition of the drug in ‘miniscular’ form on the surface of the carriers (iii) the easy and rapid dispersibility of superdisintegrants and (iv) absence of aggregation and agglomeration between drug particles due to the presence of carriers.

28. FTIR spectra indicated no interactions between medicaments and superdisintegrants used as carriers in solid dispersions.

29. FTIR spectra showed reduced absorption bands which suggest physical interaction between drugs and hydrophilic polymers, superdisintegrants. Since there is no total disappearance of the bands, it can be said that there is no chemical interaction between drug and selected excipients. FTIR spectra indicated no interactions between medicaments and superdisintegrants used as carriers in solid dispersions.

Solid dispersions of lornoxicam, mefenamic acid, celecoxib and naproxen in superdisintegrants alone and in combination with PEG, PVP and HPMC in each case, were formulated into tablets with modified starches as tablet additives and were evaluated. A total of 17 tablet formulations were made and evaluated for all tablet characters including dissolution rate.
30. All formulated tablets were of good quality fulfilling official (I.P.) and other requirements with regard to content of active ingredient, hardness, friability and disintegration time.

31. Starch phosphate, a new modified starch, was found to be a promising disintegrant in tablet formulations and can be used in a concentration of 5 – 10% as an efficient disintegrant.

32. Starch-PEG co-processed excipients developed was found to be a promising directly compressible vehicle for the preparation of compressed tablets with fast dissolution characteristics.

33. All the tablets formulated employing solid dispersions in superdisintegrants exhibited rapid and higher dissolution of drug when compared to plain tablets formulated with pure drugs.

34. Drug dissolution from all formulated tablets followed first order kinetics.

35. The increasing order of dissolution rate of formulated tablets with various carriers was PGS > DCP > MCC. The same order of performance was observed with tablets formulated employing superdisintegrants alone and in combination with PEG, PVP and HPMC.

36. A 2.05 and 2.65 fold increase in the dissolution rate of lornoxicam, was observed respectively with tablets formulated employing its solid dispersions (using starch phosphate, starch-PEG as disintegrant) in HPMC-PGS when compared to plain tablets.

37. A 9.66 and 10.19 fold increase in the dissolution rate of mefenamic acid, was observed respectively with tablets formulated employing its solid dispersions (using starch phosphate, starch-PEG as disintegrant) in HPMC-PGS when compared to plain tablets.
38. A 7.67 and 9.55 fold increase in the dissolution rate of celecoxib, was observed respectively with tablets formulated employing its solid dispersions (using starch phosphate, starch-PEG as disintegrant) in HPMC-PGS when compared to plain tablets.

39. A 10.37 and 10.82 fold increase in the dissolution rate of naproxen, was observed respectively with tablets formulated employing its solid dispersions (using starch phosphate, starch-PEG as disintegrant) in HPMC-PGS when compared to plain tablets.

40. Lornoxicam, mefenamic acid, celecoxib and naproxen tablet formulations based on their solid dispersions in HPMC-PGS were quite stable during stability testing at 40°C and 74% RH for 6 months with regard to various physical characters and dissolution rate. The rapid dissolution characteristics of these tablets remained unaltered.

41. The pharmacokinetic studies indicated rapid and higher oral absorption of lornoxicam, celecoxib when administered as solid dispersion in HPMC-PGS. Both Ka and AUC were markedly increased by solid dispersion in HPMC-PGS. Ka of lornoxicam, celecoxib were increased by 2.54 and 8.61 fold respectively with their solid dispersions when compared to the corresponding pure drugs.

42. The inflammation due to carrageenan was reduced rapidly and to a greater extent in the case of solid dispersions when compared to the corresponding pure drugs. The solid dispersions exhibited rapid onset and higher anti-inflammatory activity than the pure drugs.
Recommendations

The dissolution rate and dissolution efficiency of lornoxicam, mefenamic acid, celecoxib and naproxen could be enhanced several times by their solid dispersion in superdisintegrants alone and in combination with PEG, PVP and HPMC. Superdisintegrants particularly pregelatinized starch, dicalcium phosphate, microcrystalline cellulose were found to be good carriers giving solid dispersions with enhanced dissolution rate and efficiency. These solid dispersions in superdisintegrants could also be compressed into tablets. Lornoxicam, mefenamic acid, celecoxib and naproxen tablets formulated employing their solid dispersions in superdisintegrants also exhibited enhanced dissolution rate and efficiency, several times higher than those of plain tablets and commercial tablets tested. Starch-PEG co-processed excipients developed in this study was found to be a promising directly compressible vehicle for the preparation of compressed tablets with fast dissolution characteristics. These tablets were quite stable with regard to various physical characteristics and enhanced dissolution rate. Solid dispersions in HPMC-PGS also exhibited rapid onset and higher anti-inflammatory activity than the corresponding pure drugs.

Thus, solid dispersion in superdisintegrants is recommended as an effective and efficient technique for enhancing the dissolution rate, dissolution efficiency, oral bioavailability and anti-inflammatory activity of lornoxicam, mefenamic acid, celecoxib and naproxen, four poorly soluble drugs. Superdisintegrants are inert safe and non-toxic excipients that are currently used in compressed tablet formulations to enhance the dissolution rate and bioavailability of insoluble and poorly and poorly soluble drugs.
STABILITY STUDIES ON SELECTED TABLET FORMULATIONS

MATERIALS AND METHODS

The following formulations were subjected to stability studies.

1. LF2 (Lornoxicam tablets formulated employing L:HPMC : PGS 1:1:5, solid dispersion using Starch-PEG co processed excipient as disintegrant)

2. MF2 (Mefenamic acid tablets formulated employing MA:HPMC : PGS 1:1:5, solid dispersion using Starch-PEG co processed excipient as disintegrant)

3. CF2 (Celecoxib tablets formulated employing C:HPMC : PGS 1:1:5, solid dispersion using Starch-PEG co processed excipient as disintegrant)

4. NF2 (Naproxen tablets formulated employing N:HPMC : PGS 1:1:5, solid dispersion using Starch-PEG co processed excipient as disintegrant)

In each case, the tablets were packed in screw capped HDPE bottles and were stored at 40°C and 75% RH for 3 months. After storage for 3 months, the products were tested for drug content, hardness, friability and disintegration time and dissolution rate. The results are given in Tables 8.1-8.9.
**Table 8.1: Recommended Stability Storage Conditions for Various Products in Zone I and II Countries (ICH/USFDA Draft)**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Product</th>
<th>Accelerated</th>
<th>Intermediate</th>
<th>Long-term</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Solid oral dosage forms, Solids for reconstitution, Dry and lyophilized Powders in vials</td>
<td>40º C/75% RH</td>
<td>30º C/80% RH</td>
<td>25º C/80% RH</td>
</tr>
<tr>
<td>2.</td>
<td>Liquids in glass bottles, Vials or sealed glass ampoules which provide an impermeable barrier to water loss</td>
<td>40º C/15% RH</td>
<td>30º C/40% RH</td>
<td>25º C/40% RH</td>
</tr>
<tr>
<td>3.</td>
<td>Drug products in semi permeable and permeable containers large volume pareneters (LVPs), small volume pareneters (SVPs), Ophthalmics, Otics and Nasal sprays packaged in semipermeable containers such as plastic bags, semirigid plastic containers, ampoules, vials or bottles with or without droppers/applicators which may be susceptible to water loss.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Drug products intended to be stored at refrigerator temperatures.</td>
<td>25º C/60% RH or 25º C/ambient humidity for liquid products</td>
<td>5º C ± 3 ºC with monitoring, but not control of humidity</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Stability storage conditions for drug products intended to be stored at freezer temperature.</td>
<td>5º C ± 3º C/ambient humidity</td>
<td></td>
<td>-15º C ± 5º C</td>
</tr>
<tr>
<td>6.</td>
<td>Stability storage conditions for some inhalation products.</td>
<td>Additional storage conditions may apply to inhalation powders and suspensions inhalation alcohols when significant change in aerodynamic particle size distribution or in dose content uniformity occurs at accelerated conditions (40º C / 75% RH) conditions being finalized.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 8.2.
Drug Content of various Tablets before and after Storage for Stability Study

<table>
<thead>
<tr>
<th>Formulation</th>
<th>% Drug Content (per tablet)</th>
<th>Hardness (kg/sq.cm)</th>
<th>Friability (Percent)</th>
<th>Disintegration time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before Storage</td>
<td>After Storage</td>
<td>Before Storage</td>
<td>After Storage</td>
</tr>
<tr>
<td>LF 2</td>
<td>97.66</td>
<td>97.50</td>
<td>7.5</td>
<td>7.4</td>
</tr>
<tr>
<td>MF 2</td>
<td>99.65</td>
<td>99.51</td>
<td>7.52</td>
<td>7.40</td>
</tr>
<tr>
<td>CF 2</td>
<td>99.35</td>
<td>99.03</td>
<td>7.62</td>
<td>7.50</td>
</tr>
<tr>
<td>NF 2</td>
<td>99.65</td>
<td>99.52</td>
<td>6.87</td>
<td>6.58</td>
</tr>
</tbody>
</table>

Table 8.3.
Dissolution profile of lornoxicam Tablets from formulation LF2 before and after storage for three months stability study

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Percent Lornoxicam Dissolved (x± s.d., n = 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LF2 Before Storage</td>
</tr>
<tr>
<td>5</td>
<td>60.88±0.18</td>
</tr>
<tr>
<td>10</td>
<td>66.65±0.32</td>
</tr>
<tr>
<td>20</td>
<td>74.54±0.57</td>
</tr>
<tr>
<td>30</td>
<td>84.21±0.49</td>
</tr>
<tr>
<td>45</td>
<td>93.55±0.74</td>
</tr>
<tr>
<td>60</td>
<td>96.87±0.89</td>
</tr>
<tr>
<td>90</td>
<td>99.89±0.61</td>
</tr>
<tr>
<td>120</td>
<td>100.02±0.06</td>
</tr>
</tbody>
</table>
Fig. 8.1. Dissolution profiles of Lornoxicam Tablets from formulation LF2 before and after storage for three months stability study.
Table 8.4.

Dissolution profile of Mefenamic acid Tablets from formulation MF 2 before and after storage for three months stability study

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>MF2 Before Storage</th>
<th>MF2 After Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>65.80±0.35</td>
<td>62.07±0.85</td>
</tr>
<tr>
<td>10</td>
<td>69.84±0.56</td>
<td>65.32±0.96</td>
</tr>
<tr>
<td>20</td>
<td>79.20±0.71</td>
<td>70.25±0.97</td>
</tr>
<tr>
<td>30</td>
<td>86.19±0.85</td>
<td>83.64±0.88</td>
</tr>
<tr>
<td>45</td>
<td>95.44±0.65</td>
<td>92.37±0.91</td>
</tr>
<tr>
<td>60</td>
<td>100.0±0.52</td>
<td>99.15±0.96</td>
</tr>
<tr>
<td>90</td>
<td>100.0±0.59</td>
<td>99.65±0.97</td>
</tr>
<tr>
<td>120</td>
<td>100.0±0.21</td>
<td>99.87±0.93</td>
</tr>
</tbody>
</table>

Fig.8.2. Dissolution profile of Mefenamic acid Tablets from formulation MF 2 before and after storage for three months stability study
Table 8.5. Dissolution profile of Celecoxib Tablets from formulation CF2 before and after storage for three months stability study

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Percent Celecoxib Dissolved (x± s.d., n = 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CF2 Before Storage</td>
</tr>
<tr>
<td>5</td>
<td>81.15±0.27</td>
</tr>
<tr>
<td>10</td>
<td>86.78±0.38</td>
</tr>
<tr>
<td>20</td>
<td>92.91±0.57</td>
</tr>
<tr>
<td>30</td>
<td>98.49±0.79</td>
</tr>
<tr>
<td>45</td>
<td>100.01±0.09</td>
</tr>
<tr>
<td>60</td>
<td>100.01±0.91</td>
</tr>
<tr>
<td>90</td>
<td>100.01±0.37</td>
</tr>
<tr>
<td>120</td>
<td>100.01±0.84</td>
</tr>
</tbody>
</table>

Fig. 8.3. Dissolution profile of Celecoxib Tablets from formulation CF2 before and after storage for three months stability study
Table 8.6. Dissolution profile of Naproxen Tablets from formulation NF 2 before and after storage for three months stability study

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Percent Naproxen Dissolved (x± s.d., n = 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NF2 Before Storage</td>
</tr>
<tr>
<td>5</td>
<td>65.52±0.71</td>
</tr>
<tr>
<td>10</td>
<td>69.11±0.52</td>
</tr>
<tr>
<td>20</td>
<td>79.03±0.61</td>
</tr>
<tr>
<td>30</td>
<td>89.66±0.19</td>
</tr>
<tr>
<td>45</td>
<td>95.20±0.38</td>
</tr>
<tr>
<td>60</td>
<td>98.49±0.46</td>
</tr>
<tr>
<td>90</td>
<td>100.01±0.50</td>
</tr>
<tr>
<td>120</td>
<td>100.01±0.84</td>
</tr>
</tbody>
</table>

Fig.8.4. Dissolution profile of Naproxen Tablets from formulation NF 2 before and after storage for three months stability study.