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# Formulation and Evaluation of Microcapsules containing Flurbiprofen

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**Abstract**

Microencapsulation technologies to prolong release of Flurbiprofen are constantly being development microcapsules. Formulation of Flurbiprofen microcapsules for the prolonged release of drug. The formulations F5 and F6 were found to be best among all other formulation. The biodegradable hydrophilic polymer Ethyl cellulose and HPMC are suitable for the preparation of prolonged release microcapsules. Viscosity of polymer plays the major role in formulation of microcapsules of Flurbiprofen. There is no interaction between the drug and polymer of microcapsules of Flurbiprofen. The microcapsules of Flurbiprofen can be used as an anti bacterial agent and have improved the patient compliance.

**Keywords**: Microcapsules, Flurbiprofen, Anti-bacterial agents

## Introduction

The microcapsules were prepared by solvent evaporation method. Various formulations of microcapsules were prepared using gradually increase ethyl cellulose, HPMC concentration. In this method the polymer is dissolved in a definite volume of internal phase (Chloroform, Ethanol) and then the drug is also dissolved in the polymer solution. This drug polymer solution is them dispersed in an external medium (Liquid paraffin) consisting 1% span 80 in a 500 ml of beaker. The whole system was stirred at a 800-1000 rpm using mechanical stirrer equipment with three propellers for 3-4 hrs at 25-40$^0$c to ensure the evaporation of the solvent. The smooth-walled, rigid and discrete microcapsules were formed. The microcapsules were collected by decantation and the product was washed with petroleum ether (40-60$^0$C), four times and dried at room temperature for 3 hrs.

| Ingredients | F1 (mg) | F2 (mg) | F3 (mg) | F4 (mg) | F5 (mg) | F6 (mg) |
|---|---|---|---|---|---|---|
| Flubiprofen | 100 | 100 | 100 | 100 | 100 | 100 |
| Ethyl cellulose | 100 | - | 200 | - | 300 | - |
| HPMC | - | 100 | - | 200 | - | 300 |

**Organoleptic Properties**

| | | |
|---|---|---|
| **Colour** | **:** | Pale Yellow |
| **Crystalinity** | **:** | Crystaline |
| **Taste** | **:** | Metallic |
| **Odour** | **:** | Odourless |

**pH determination:** The pH value of Flurbiprofen was found to be 6.0 which is nearly to standard. So it shows that the drug is acidic.

**Melting Point:** The melting point of was 251$^0$-256$^0$C which is nearly to standard of Flurbiprofen. So it shows that the drug is pure.

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**Solubility properties**

**Table 1: Solubility properties**

| Solvents (10ml) | Solubility properties of the drug (10mg) |
|---|---|
| Water | ++++ |
| Chloroform | +++ |
| Liquid Paraffin | ++++ |
| Petroleum Ether | + |
| Ethanol | +++ |

\+ Insoluble
++ Poorly soluble
+++ Slightly soluble
++++ Freely soluble

Its shows the Flurbiprofen is excellent soluble in aqueous organic solvent.

**Partition coefficient:** The partition coefficient of Flurbiprofen was found to be 0.99. The result has been shown that the drug is hydrophilic.

**Particle size determination:**

The result of the microscopic evaluation of particle size of the Flurbiprofen particles are given below in table-

**Table 2: Particle size determination**

| S.No | Size Range | Mid point (M.P) | No. of particle (N) | M.P × N | M.P×N×L.C |
|---|---|---|---|---|---|
| 1 | 0-1 | 0.5 | 04 | 2 | 2.6 |
| 2 | 1-2 | 1.5 | 09 | 13.5 | 17.55 |
| 3 | 2-3 | 2.5 | 18 | 45 | 58.5 |
| 4 | 2-4 | 3.5 | 22 | 77 | 100.01 |
| 5 | 4-5 | 4.5 | 25 | 112.5 | 135 |
| 6 | 5-6 | 5.5 | 22 | 121 | 157.3 |
| | | | ∑n= 100 | | ∑d=470.96 |

**Least count (L.C) = 1.3**

Particle size of Flurbiprofen= ∑d \ ∑n
= 470.96\ 100
= 4.70

Particle size was found to be 4.70 µm show that drug particle are distributed in range of 1-6 µm and maximum number of particle are present in size range of 4-6µm. This distribution pattern also indicates that the drug is amorphous in nature.

**Absorption Maximum (λmax):** The solution were scanned in the UV region between 200-400 nm and found that Flurbiprofen exhibited λmax at 362 nm which is nearby to the standard value of Flurbiprofen. This so the drug is pure.

**Identification Of Drug:** The identification of drug was done by UV spectrophotometer method. The highest peak showed at 362 nm which is nearby to the standard value of Flurbiprofen. This so the drug is pure.

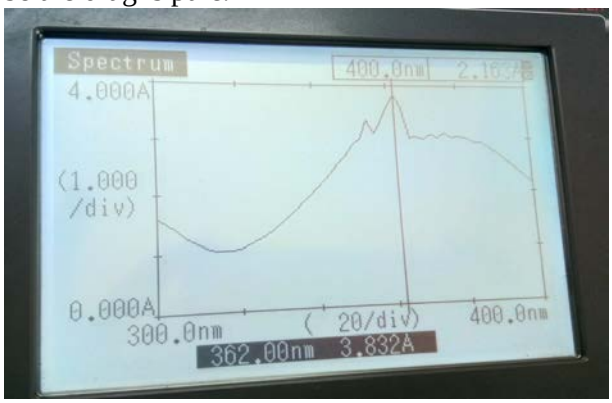


**Fig. 1: Identification Curve**

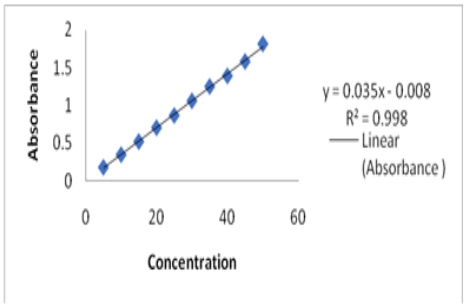


**Fig. 2: Calibration Curve**

For preparation of standard curve, solution of the drug sample were prepared in distilled water and there absorbance were measured at 362 nm the linearity range were found to be 5-50 µg/ml. The Flurbiprofen obey Beer's law in the range 5-50 µg/ml.

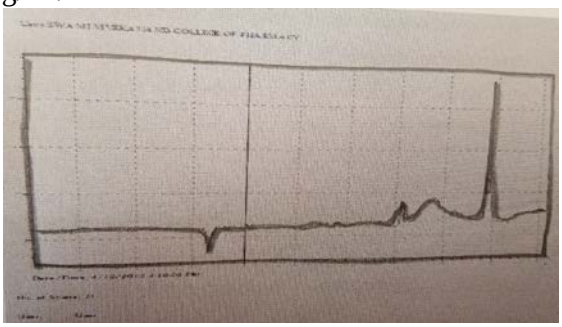

**Fig. 3: IR Spectra**

IR Spectrum of drug sample has been interpreted and correlate with standard IR spectrum of Flurbiprofen. There is no change in functional

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group of drug sample or same with standard shown in figure. It shows that the drug sample is Flurbiprofen.

**Drug Excipients Compatibility Study:**

**Table 3: Flurbiprofen with Polymer Compatibility**

| Additives (100 mg each with drug) | Observation at $60^0$c for 2 week | Remarks |
|---|---|---|
| Flurbiprofen | No change | Accepted |
| Drug + Ethyl cellulose | No change | Accepted |
| Drug + HPMC | No change | Accepted |

**Particle Size:** Particle size of microcapsules varied somewhat among the formulation variation in the method of preparation of various formulations. Particle size was found to be satisfied when prepared by solvent evaporation method. Microcapsules prepared by solvent evaporation method showing lesser size than other methods. The mean particle size of the microcapsules significantly increases with increasing polymer concentration. It was observed that, on increasing the polymer amount the average particle size increased. The particle size of formulations in the range between 4.32µm to 6.90 µm.

**Table 4: Particle Size of Microcapsules of Flurbiprofen**

| Formulations | F1 | F2 | F3 | F4 | F5 | F6 |
|---|---|---|---|---|---|---|
| Particle size (µm) | 4.32 | 5.61 | 5.95 | 6.21 | 6.58 | 6.90 |

**Percentage yield:** The maximum percentage yield was found to be range between 95.5 to 99%. Formulation F4 is better than the other formulations because its percentage yield 99%.

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**Table 5: Percentage yield of Microcapsules of Flurbiprofen**

| Formulations | F1 | F2 | F3 | F4 | F5 | F6 |
|---|---|---|---|---|---|---|
| Percentage yield | 98 % | 95.5 % | 96 % | 99 % | 97 % | 97.5 % |

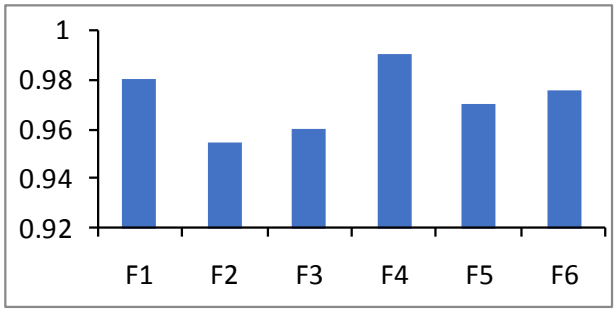


**Fig. 4: Percentage Yield of Formulations**

**Estimation of Drug Content:** The amount of Flurbiprofen estimated from drug content microcapsules different formulations was found to be range of 72 % to 93 %. The F5 and F6 formulations are better than other formulations because in this formulations increasing the polymer concentration.

**Table 6: Drug Content of Microcapsules of Flurbiprofen**

| Formulations | F1 | F2 | F3 | F4 | F5 | F6 |
|---|---|---|---|---|---|---|
| % Drug content | 93 % | 87 % | 84 % | 79 % | 76 % | 72 % |

**Drug entrapment efficiency:** The drug entrapment efficiency was found in the range between 63.79 – 93.66 %. The F1 and F2 formulations is better than other formulation because in this formulations are similar the drug and polymer ratio.

**Table 7: Drug entrapment efficiency of Microcapsules of Flurbiprofen**

| Formulations | F1 | F2 | F3 | F4 | F5 | F6 |
|---|---|---|---|---|---|---|
| % Entrapment efficiency | 93.66 % | 86.78 % | 78.73 % | 75.28 % | 67.24 % | 63.79 % |

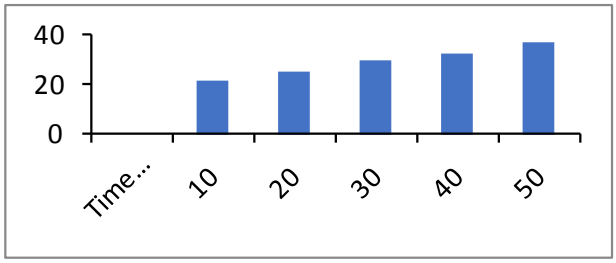


**Fig. 5: Drug Entrapment Efficiency of Formulations**

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**Wall thickness:** The wall thickness of Flurbiprofen microcapsules formulations was found to be in the range between 0.48 to 0.82 µm. The concentrations of polymer are increasing in formulations than the wall thickness is also increases.

**Table 8: Wall thickness of Microcapsules of Flurbiprofen**

| Formulations | F1 | F2 | F3 | F4 | F5 | F6 |
|---|---|---|---|---|---|---|
| Wall thickness (µm) | 0.48 | 0.59 | 0.62 | 0.68 | 0.75 | 0.82 |

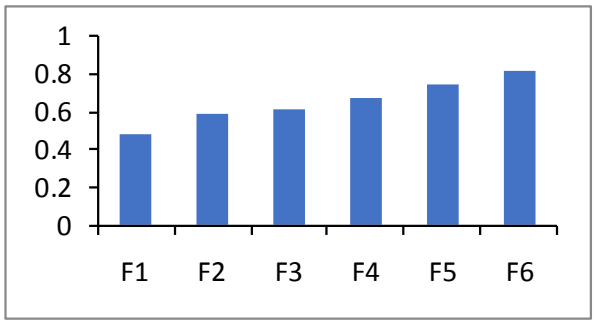


**Fig. 6: Wall Thickness of Formulations**

**In vitro Drug release studies:** All the six formulation of prepared microcapsules of Flurbiprofen were subjected to in vitro release studies these are carried out in dissolution medium (PBS pH 6).

**Cumulative % drug released of microcapsules formulations F1 – F6.**

**Table 9: Drug Release of Microcapsules of Flurbiprofen**

| Time Interval (min.) | F1 | F2 | F3 | F4 | F5 | F6 |
|---|---|---|---|---|---|---|
| 10 | 22 | 27 | 30 | 32 | 35 | 38 |
| 20 | 25 | 29 | 32 | 34 | 37 | 41 |
| 30 | 30 | 31 | 36 | 37 | 39 | 42 |
| 40 | 33 | 34 | 38 | 41 | 40 | 45 |
| 50 | 37 | 39 | 43 | 44 | 42 | 48 |
| 60 | 41 | 42 | 45 | 46 | 47 | 49 |

The result shows that formulation F6 having quick release in 12.5±0.69 second.

It indicates that amongst the prolonged release polymer ethyl cellulose and HPMC show better released profile microcapsules.

In vitro drug release was found between 86 – 98 % within 30 min of the study. The formulation F5 and F6 containing ethyl cellulose and HPMC in equal proportion have shown highest drug release (98±0.88) within 30 min compared to other formulations.

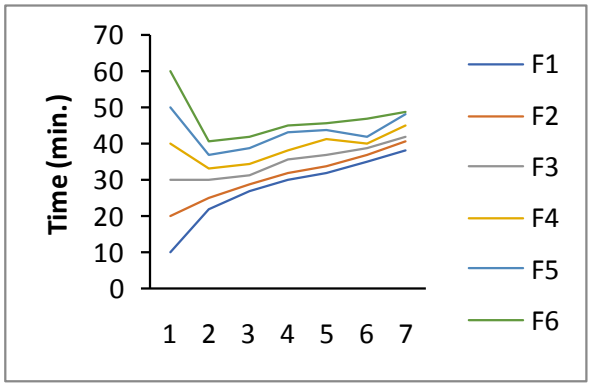


**Fig. 7: In Vitro Drug Release of Formulations**

## Conclusion

Microcapsules are packed in suitable packaging and stored under the following condition for a period as prescribed by ICH guidelines for accelerated studies. In order to determine the change in particle size, percentage yield, wall thickness, entrapment efficiency, in vitro drug release tudies, estimation of drug content study of different formulation.

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