RESEARCH PAPER

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# A Comparative Evaluation of Norfloxacin Containing Microcapsules of Two Coating Materials

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**Norflixacin was microencapsulated with Gelatin (G) and Cellulose Acetate (CA).by simple coacertation and complex emulsion techniques. The microcapsules were found to be spherical and mono nuclear type. The cellulose acetate microcapsules were large sizes and discrete where as gelatin microcapsules were small and aggregated. Also, drug release from the cellulos acetate microcapsules was found to be slower than that obtained from gelatin microcapsules.**

MICROCAPSULATION has become the subject of investigation throughout the world in recent years. Various polymers are available as coating materials with different physico-chemical properties. As the properties of finished microcapsules, to a large extent depend on the properties of the coating material, a comparative study of the two polymers that is gelatin and cellulose acetate was undertaken. Norfloxacin was used as a model drug to evaluate these polymers.

## EXPERIMENTAL

### Materials

Norfloxacin USP, (Dr. Reddy's Lab., Hyderabad), Gelatin (Loba chemie, Bombay), Cellulose Acetate (acetyl content is 98%-99.5%, Rolex Lab., Bombay), Sodium sulfate (E. Merck, India), Formaldehyde (Ranbaxy Lab., Punjab), Acetone (Ranbaxy), Liquid paraffin and Petroleum ether (60°C-80°C, B.D.H. Chemicals, India).

### Preparation of gelatin microcapsules

Coacervation Phase separation by the addition of salt technique was adopted for this work[1]. one gram of Norfloxacin was encapsulated with gelatin as the coating material. Microcapsules with different core to coating ratios were preparared by this method. The ratios used were 1:1 (G1), 1:2 (G2) and 1:4 (G3).

### Preparation of cellulose acetate microcapsules

Complex emulsion technique, that is emulsification of the polymer solution in an immiscible liquid medium followed by coacervation phase separation by the addition of a non solvent, was adopted for this work.[2] one gram of Norfloxacin was encapsulated with cellulose acetate as the coating material. Microcapsules with different core to coating ratios were prepared by this method. The ratios used were 1:1 (C1), 1:2 (C2) and 1:4 (C3).

### Drug content uniformity

From each batch of microcapsules, three samples of 50 mgs each were taken and dissolved in concentrated hydrochloric acid separately and the solutions were filtered and then diluted with hydrochloric acid buffer, pH 1.2, to a suitable concentration. Then they were analyzed Spectrophotometrically at 278 nm.

**Table 1**

| Microcapsules | | Percent Drug Content % | Coat Thickenss (mcm) | T50 (min) | T90 (min) | K. $10^{-2}$ 1/min |
|---|---|---|---|---|---|---|
| G1 | [1:1] | 78.52 | 13.95 | 28.2 | 93.7 | 2.450 |
| G2 | [1:2] | 71.72 | 26.22 | 32.2 | 107.1 | 2.150 |
| G3 | [1:4] | 64.60 | 45.30 | 45.1 | 150.0 | 1.530 |
| C1 | [1:1] | 90.40 | 45.84 | 47.8 | 158.8 | 1.450 |
| C2 | [1:2] | 86.63 | 94.40 | 120.5 | 400.5 | 0.575 |
| C3 | [1:4] | 82.33 | 129.16 | 180.5 | 600.0 | 0.383 |

T50 - Time taken for 50% drug release
T90 - Time taken for 90% drug release
K - First order release rate constant

### Size analysis

Microcapsule sizes were measured microscopically. Approximately 100 microcapsules were taken and mounted under the microscope and size of the each microcapsule was measured by using a calibrated eye piece. Norfloxacin was passed through sieve number 180 before encapsulation.

### Coating thickness

In this case, all the microcapsules obtained were assumed to be uniform, smooth and spherical. The average coat thickness could be calculated by relationship given by Luu et al[3], that which is given below.

$$h = \frac{r(1-p)d1}{3[pd2+(1-p)d1]}$$

Where,
h = coating thickness
r = radius of the microcapsule
p = proportion of the medicament in the microcapsules
d1 = density of the core material
d2 = density of the coating material

### Release rate studies

The release of the drug from the microcapsules was studied using the rotating basket method of USP. The dissolution medium used was hydrochloric acid solution at pH 1.2. Accurately weighed microcapsules, equivalent to 100 mgs of norfloxacin, were taken in the dissolution basket and basket was fixed with stirrer and immersed in 1000 ml of dissolution medium at 37 ± 1°. The basket was rotated at 100 rpm. Samples were withdrawn at regular time intervals over a period of 5 hrs and analyzed for the drug content.

### Results and Discussion

Gelatin microcapsules were small, spherical in shape but aggregated. Aggregated microcapsules could be separated by sieving. The sifted product was free flowing. Cellulose acetate microcapsules were found to be large in size, spherical in shape with smooth surface, discrete and free flowing. Both the microcapsules were mononuclear type.

Size distribution of gelatin microcapsules formed with core to coating ratio of 1:4 [G3] showed that

DRUG RELEASE PROFILES OF GELATIN AND CELLULOSE ACETATE MICROCAPSULES

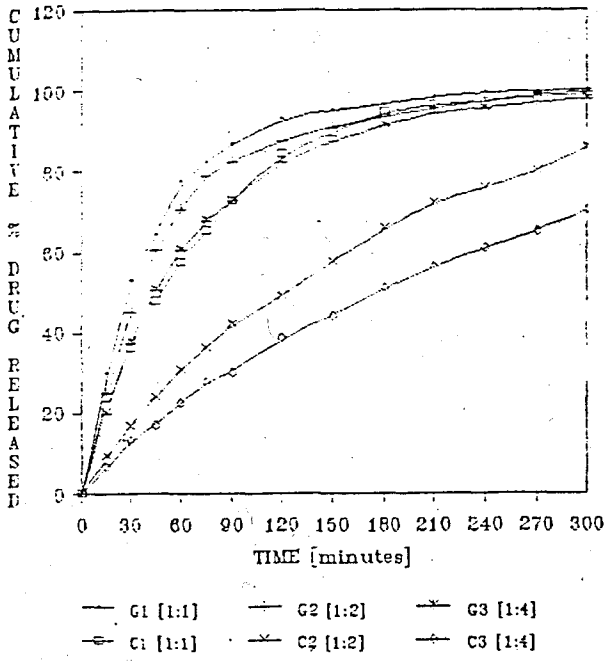


Fig. 1

FIRST ORDER RELEASE KINETICS OF GELATIN AND CELLULOSE ACETATE MICROCAPSULES

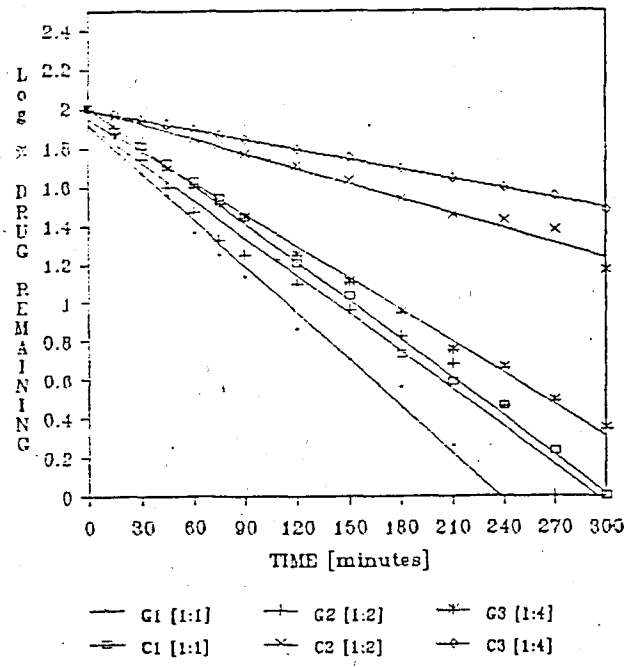


Fig. 2

generally about 28% and 40% were found to be in the range of 238 and 365 μm size, where as cellulose acetate microcapsules formed with 1:4 [C3] showed that 36% and 28% were found to be in the range of 1035 and 1135 μm size.

Drug content of various microcapsules is given in **Table 1.** Coefficient of variation within the mean drug content was found to be less than 5% indicating uniformity of drug content in a batch of microcapsules.

The microcapsules prepared with different proportions of core to coating materials were found to have varying coat thickness. Coating thickenss of gelatin microcapsules formed with core to coat ratio 1:4 [G3] was found to be 45.30 μm. where as cellulose acetage microcapsules formed with core to coating ratio 1:4 [C3] was found to be 129.20 μm.

Uncapsulated norfloxacin was found to dissolve within 5 min. in hydrochloric acid solution at pH 1.2, whereas, norfloxacin release from different microcapsules was found to be slow and spread over extended periods of time. Drug release depended on percent coat material in all cases of microcapsules. Percent drug release from these microcapsules decreased with an in increase percent coat meterial **(Fig. 1).**

Release rates of norfloxacin from all the microcapsules prepared were compared by calculating T50 (time taken for 50% drug release). T90 (time taken for 90% drug release) and K (release rate constant) (Table 1). These parameters were calculated by plotting the graph log % remaining vs time. **(Fig 2).** Release of norfloxacin from gelatin microcapsules was found to be very rapid, when comapred to cellulose acetate microcapsules (Fig 1). This rapid release may be due to the hydrophilic

nature of the gelatin and also the drug release from the gelatin microcapsules probably may be controlled by diffusion and dissolution. Drug release from all the cases of microcapsules followed first order kinetics. This was observed from the plot, log % remaining vs time which was linear (Fig 2).

## REFERENCES


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