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Research Article

PREPARATION AND CHARACTERISATION OF BORA RICE ACECLOFENAC MICROSPHERES

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ABSTRACT

Objective: The present research work is based on the applicability of bora rice as a natural polymer for preparing sustained aceclofenac bora rice microspheres.

Methods: The microspheres were prepared by "emulsion solvent diffusion technique." The physicochemical characterizations of the prepared microspheres (percentage drug entrapment efficiency, scanning electron microscopy, percentage drug loading) were carried out as well as the *in vitro* drug release was carried out in phosphate buffer pH 6.8.

Result: The prepared microspheres were found to have a regular spherical shape, percentage drug entrapment efficiency of 52.6%. The *in vitro* release study in phosphate buffer pH 6.8 showed a sustained release of the drug for 24 hrs.

Conclusion: The bora rice as a natural biodegradable polymer could efficiently sustained the release of aceclofenac for 24 hrs.

Keywords: Bora rice, Aceclofenac, Scanning electron microscope, Sustained release.

INTRODUCTION

Orally administered conventional dosage forms are the most commonly used dosage form due to their inexpensiveness, easy accessibility, etc. But still, they suffer from the drawbacks of frequent dosing, patient in compliance, and poor bioavailability [1]. These limitations are being overcome by controlled drug delivery systems as they achieve several advantages over conventional dosage forms such as good bioavailability, reduction of dosing interval, patient compliance, ease of administration. The controlled release drug delivery systems could easily control the rate of drug release, sustaining the duration of therapeutic activity and/or targeting the delivery of the drug to a tissue. Drug at desired rate, reproducible amount is released by controlled drug delivery system [2]. Among the several types of controlled drug delivery systems, microspheres have gained a lot of interest in the research field for drug targeting as well as sustained drug delivery. Microspheres made up of biodegradable natural polymers have gained plenty of interest for sustained drug delivery as natural polymers are biodegradable, biocompatible, inert, inexpensive, easily accessible etc. [3]. Taking into account the several advantages associated with natural polymers, we have decided to utilize Bora rice as the polymer for preparing sustained release microspheres loaded with model drug "aceclofenac" (a non-steroidal anti-inflammatory drug) used extensively in the treatment of rheumatoid arthritis, osteoarthritis and ankylosing spondylitis. The conventional orally administered dosage forms of aceclofenac recommends 100 mg dose twice day [4]. The frequent dosing is due to its disadvantages of short biological half-life of 3-4 hrs, which in turn leads to poor bioavailability as well as patient incompliance. In order to overcome these drawbacks, Bora rice microspheres loaded with "aceclofenac" were prepared for the sustained release effect.

METHODS

Aceclofenac was obtained as a gift sample from Cipla Pharmaceuticals. Bora rice was locally obtained from market. All other chemicals used in the study were of analytical grade and were procured commercially.

Preparation of microspheres

Aceclofenac loaded microspheres were prepared by the emulsion solvent diffusion method [5]. The compositions are shown in Table 1.

Table 1: Formulation table of aceclofenac bora rice microspheres

S. No.	Aceclofenac (mg)	Bora rice (% w/v)	Ethyl cellulose (mg)	Span 80 (% w/v)
F1	20	0.5	500	1
F2	20	1	500	1
F3	20	1.5	500	1
F4	20	2	500	1
F5	20	2.5	500	1
F6	20	3	500	1
F7	20	3.5	500	1

The oil phase was prepared by blending methanol (7 ml) and acetone (10 ml). To 15 ml of dichloromethane, 0.5 g of ethyl cellulose was added and then added to the blend of acetone and methanol. To the blend of the oil phase 20 mg of model dug "aceclofenac" was added and kept on magnetic stirring. An aqueous dispersion of bora rice in water was prepared by heating at 75°C. A primary emulsion o/w was prepared by adding the oil phase drop-wise to the aqueous phase using a disposable syringe with a No. 22 needle in the 2:3 ratios. Then, a secondary emulsion "o/w/o" was prepared by adding the primary emulsion to the oil phase (containing 1% w/v span 80 as stabilizer) using a disposable syringe with a No. 22 needle in the ratio 2:3:10. The emulsion obtained was allowed to stabilize for 1 hr, followed by heating at 30-40°C, which temperature was maintained for 2-3 hrs. The microspheres were collected by filtration and were dried.

Characterization of aceclofenac bora rice microspheres

Drug entrapment efficiency and drug loading

The various formulations of aceclofenac bora rice microspheres were subjected for percentage drug entrapment efficiency and percentage drug loading determination [6]. 50 mg of microspheres from various formulations were weighed and crushed. The powdered of microspheres were dissolved with 10 ml ethanol in 100 ml volumetric flask, and the volume was made up with 0.1 N HCl. The filtration of this resulting solution was undertaken through Whatmann filter paper No. 44. After filtration, suitable dilution was carried out with 0.1 N HCl

and the absorbance were measured at 275 nm against 0.1 N HCl as a blank. The percentage drug entrapment efficiency was calculated as follows:

$$\text{Percentage drug entrapment efficiency} = \frac{\text{Experimental drug concentration}}{\text{Theoretical drug concentration}} \times 100$$

Similarly, the percentage drug loading was calculated by applying the formula

$$\text{Percentage drug loading} = \frac{\text{Experimental drug concentration}}{\text{Quality of microspheres taken}} \times 100$$

Morphology of microspheres

The shape of the microspheres was determined by scanning electron microscope (SEM) JSM-6360 (JEOL, Japan). The microspheres were dried, and gold coating was applied under vacuum followed by observation at higher and lower magnification.

***In vitro* release studies**

The *in vitro* drug release rate from bora rice microspheres loaded with aceclofenac was carried out with dialysis membrane using the USP Type II dissolution apparatus (Paddle type) [7]. A weighed amount of microspheres equivalent to 100 mg drug were dispersed in 10 ml of phosphate buffer pH 6.8 which was put into the dialysis membrane tied at both ends. Then one end was tied to the paddle, and then the dialysis membrane was dispersed in 900 ml of phosphate buffer pH 6.8 maintained at 37±0.5°C and stirred at 100 rpm. At preselected time intervals 2 ml sample was withdrawn and replaced with an equal amount of phosphate buffer pH 6.8. The collected samples were suitably diluted with phosphate buffer pH 6.8 and analyzed spectrophotometrically at 275 nm to determine the concentration of drug present in the dissolution medium. The dissolution studies were repeated using phosphate buffer pH 6.8 as dissolution medium.

RESULTS AND DISCUSSION

The SEM photomicrographs showed that the prepared microspheres had regular and spherical shape as shown in Fig. 1.

The particle size of the microspheres was found to be increasing as the polymer concentration was increasing. It was due to the increasing viscosity of the medium with increasing polymer concentration. Due to more viscous aqueous dispersion, high shearing stress was required for particle size reduction. Thus, shearing reduction particle size was not possible. As a result, increased particle size with increasing polymer concentration was observed. The percentage drug entrapment efficiency and percentage drug loading was found to be initially increasing with increased polymer concentration until it reached the optimum polymer concentration. It was observed the at an optimum polymer concentration of 1.5% w/v, the highest percentage drug entrapment efficiency and percentage drug loading of 52.6% and 0.66% was obtained respectively as shown in Table 2.

It was because as the polymer concentration was increasing, surface area for the entrapment of drug also increased. After the optimum polymer concentration, there was a reduction in the percentage drug entrapment efficiency and percentage drug loading. It was due to the viscosity associated maximum shearing stress required causing lower entrapment and drug loading. The *in vitro* release study showed a sustained release effect for the various formulations for 24 hrs as given in Fig. 2. The highest release of 88% was obtained with formulation F3 as shown in Table 3. It was observed that small particle sized microspheres exposed more surface area to the dissolution medium and faster release than that of bigger sized particle. Thus, highest release was observed with formulation F3 while formulations F4, F5, F6, and F7 showed lowest release due to their bigger size.

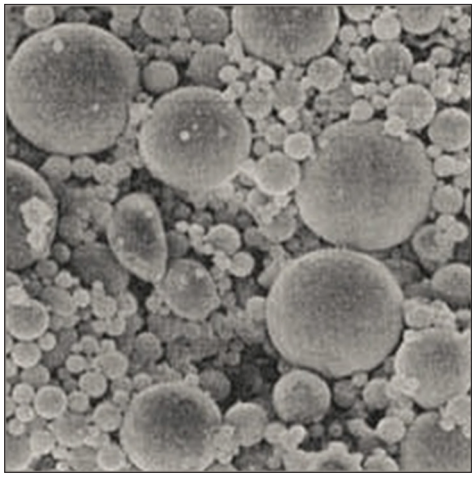

Fig. 1: Scanning electron microscope photomicrograph of aceclofenac bora rice microspheres

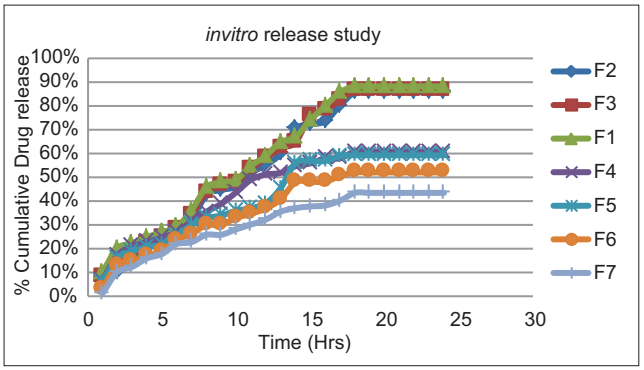

Fig. 2: *In vitro* release study of aceclofenac bora rice microspheres

Table 2: Percentage drug entrapment efficiency and percentage drug loading

S. No	Percentage drug entrapment efficiency	Percentage drug loading
F1	10.8	0.27
F2	45.8	0.57
F3	52.6	0.66
F4	33.1	0.41
F5	24	0.3
F6	13	0.16
F7	10	0.13

Table 3: *In vitro* release study of aceclofenac bora rice microspheres

***In vitro* release study for 24 hrs**	
S. No.	**Percentage drug release**
F1	85.6
F2	86.3
F3	88
F4	60.7
F5	59.1
F6	51.9
F7	43.3

CONCLUSION

From the present study, it can be concluded that bora rice, a biodegradable, biocompatible, nontoxic, naturally available, inexpensive polymer got

the capability of reducing the drawbacks of poor bioavailability, short biological half-life associated with "aceclofenac" by sustaining its release effective for 24 hrs as well as showing good entrapment efficiency. Hence, bora rice could be used further as a naturally available polymer or as an excipient in the pharmaceutical field.

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