International Journal of Biological Macromolecules 57 (2013) 105–110

Contents lists available at SciVerse ScienceDirect

International Journal of Biological Macromolecules

journal homepage: www.elsevier.com/locate/ijbiomac

Short communication

Mimosa pudica seed mucilage: Isolation; characterization and evaluation as tablet disintegrant and binder

Munish Ahuja, Ashok Kumar*, Parvinder Yadav, Kuldeep Singh

Drug Delivery Research Laboratory, Department of Pharmaceutical Sciences, Guru Jambheshwar University of Science and Technology, Hisar 125 001, Haryana, India

ARTICLE INFO

Article history:
Received 3 January 2013
Received in revised form 5 February 2013
Accepted 2 March 2013
Available online xxx

Keywords:
Disintegrant
Binder
Mucilage
Hydrochlorothiazide
Paracetamol

ABSTRACT

In the present study *Mimosa pudica* seed mucilage was isolated, characterized and evaluated as tablet binder and disintegrant. Several properties of mucilage like high swelling index and gelling nature prompted us to explore its applications as disintegrating and binding agent. Disintegrant properties were evaluated by formulating directly compressed hydrochlorothiazide tablets containing 1%–10% (w/w) of seed mucilage as disintegrant and compared with the standard disintegrants. The disintegration time of mucilage containing tablets was found to be in the order of 3% > 1% > 5% > 7.5% > 10%. On comparative evaluation with standard disintegrants, it was observed that the order of disintegration of tablets was Ac-Di-Sol < mucilage (3%, w/w) < corn starch. The results of liquid uptake studies were consistent with the disintegration time studies. The binding and granulating properties of mucilage were evaluated by formulating the paracetamol tablets using the *Mimosa* mucilage at 6%, 8%, and 10% (w/w) concentration as the binder and compared with tablets prepared using PVP-K25 (1.7%, w/w) and acacia (6.8%, w/w) as the binder. *Mimosa* mucilage at 10% (w/w) concentration provided tablets with adequate hardness and friability. In conclusion, *M. pudica* seed mucilage is a potential tablet disintegrant and binder.

1. Introduction

Natural gums, mucilages and their derivatives are widely employed in pharmaceutical and food industry, as these are generally considered as non-toxic and safe for human and animal consumption [1]. These natural polysaccharides are obtained from plant exudates and seeds of land and marine plants sources. Mucilages are produced by normal metabolic processes and are usually formed from the cell wall or deposited as layers on it. Chemically, mucilages are polyuronides comprising of sugar and uronic acid units [2]. Non-toxicity, low cost and easy availability of natural polysaccharides makes them a preferred choice over synthetic polymers. Mucilages are partially soluble in water in which they swell and form gel. Mucilages of okra, dika nut, *Ocimum gratissimum*, *Plantago ovata*, *Eulophia campestris* have earlier been evaluated for their pharmaceutical applications as binding agent [3–7], suspending agent [8], disintegrating agent [9] mucoadhesive [10,11] and sustained release matrices [12,13].

Mimosa pudica Linn. (family Mimosaceae) is an annual creeping or perennial herb, found widely distributed in tropical and subtropical parts of India. *M. pudica* seed mucilage is composed of D-xylose and D-glucuronic acid [14]. *Mimosa* seed mucilage was earlier evaluated for sustained release [15] and bioadhesive applications [16,17]. In the present investigation *M. pudica* seed mucilage was isolated, characterized and evaluated as binder and disintegrant using different concentrations employing paracetamol and hydrochlorothiazide respectively as the model drug. Formulated tablets were further compared with tablets prepared using standard binders and disintegrants.

2. Materials and methods

2.1. Materials

M. pudica seeds were procured from the local market of Hisar (India) and were authenticated by taxonomists of Forest Research Institute (Dehradoon, India), and sample was submitted in Department of Pharmaceutical Sciences (authentication voucher no: Pcog/2007/65). Hydrochlorothiazide and paracetamol were obtained as gift sample from (GMH Lab. Pvt. Ltd., Baddi, India). Cross carmellose (Ac-Di-Sol), and spray dried lactose were generously gifted by Jubilant Organosys Pvt. Ltd., (Noida, India). Lactose monohydrate, corn starch, talc, PVP-K25, and gum acacia were procured from Hi-Media Lab. Pvt. Ltd., (Mumbai, India). All other chemicals used were of reagent grade and were used as received.

* Corresponding author. Tel.: +91 1662 263515.
E-mail address: ashokchauhan123@gmail.com (A. Kumar).

0141-8130/$ – see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.ijbiomac.2013.03.004

Table 1
Composition of hydrochlorothiazide tablets.

Ingredients	Quantity/tablet (mg)						
	D1	D2	D3	D4	D5	D6	D7
Hydrochlorothiazide	50	50	50	50	50	50	50
Spray dried lactose	195.5	190	185.5	179.2	173	190	190
Mucilage	2.5	8	12.5	18.8	25	–	–
Ac-Di-Sol	–	–	–	–	–	8	–
Starch	–	–	–	–	–	–	8
Talc	2	2	2	2	2	2	2
Total weight	250	250	250	250	250	250	250

2.2. Isolation of mucilage

Mucilage of *M. pudica* was isolated by drying the hydrated mucilage in oven at 50 °C and separating the dried mucilage from the entrapped seeds and husk by sieving and winnowing respectively as reported earlier [15].

2.3. Characterization of mucilage

The isolated mucilage was standardized by determining swelling index, loss on drying, bulk density, tapped density, compressibility index as per the standard procedures [18–20]. Further, the isolated mucilage was characterized by FT-IR, DSC, XRD and SEM studies.

2.3.1. Preparation of tablets

Directly compressed hydrochlorothiazide tablets containing different concentration of mucilage were prepared and compared with the tablets prepared using the established disintegrants as per the formula given in Table 1. Briefly drug, diluent, lubricant and disintegrant were screened through sieve number 36 to break any agglomerates. The drug was manually blended with diluent and disintegrant in polybags. The blend so obtained was lubricated in polythene bags, and directly compressed using 8 mm biconvex punches and dies in a single station, hand-operated, tableting machine (R&D Model, Konark Instruments, Ambala, India).

Tablets of paracetamol were prepared by wet granulation method (Table 2). A physical blend of paracetamol and lactose monohydrate was moistened with the aqueous solution of different binders and the wet mass so obtained was passed through sieve number 8 and dried at a temperature of 60 °C for 4 h. The dried granules were again screened through sieve number 18 and blended with weighed amount of corn starch (as a disintegrant) and talc (as lubricant) in polythene bags and then finally compressed using 8 mm biconvex punches and die in a single station hand operated tablet machine.

2.3.2. Physical evaluation of granules

The granules of paracetamol as prepared above were evaluated for percentage of fines, angle of repose, tapped density, bulk density and Carr's index.

2.3.3. Evaluation of tablets

The various batches of directly compressed hydrochlorothiazide tablets and wet granulated paracetamol tablets were evaluated for weight variation, thickness, diameter, hardness, friability, disintegration test, content uniformity and dissolution rate as per the standard procedures [19,21].

2.3.3.1. Weight variation. The weight of 10 randomly selected tablets was measured individually using an electronic balance (AND, Japan) and % relative standard deviation was calculated.

2.3.3.2. Hardness. Ten tablets of each batch were tested for hardness using Monsanto hardness tester. The results are reported as the mean of 10 individual measurements.

2.3.3.3. Thickness and diameter. Thickness and diameter of 10 tablets were measured using vernier caliper (Aerospace, China) and the mean thickness value was calculated.

2.3.3.4. Friability. The friability of tablets was determined using a Roche friabilator (Campbell Electronics, Mumbai, India). Six tablets of each batch were weighed and placed into the friabilator drum, and subjected to 100 revolutions in 4 min. The tablets were removed, dedusted and reweighed. Friability was calculated as the percentage weight loss.

$$\%\text{Friability} = \frac{\text{initial weight} - \text{final weight}}{\text{initial weight}} \times 100$$

2.3.3.5. Disintegration test. Six tablets of each batch were tested for disintegration test for uncoated tablets as per the procedure of Indian Pharmacopeia [20]. Water maintained at 37 ± 0.5 °C was used as the disintegration medium.

2.3.3.6. Content uniformity. Assay of randomly selected 10 tablets from each batch were carried according to the procedure of Indian Pharmacopeia [20].

2.3.3.7. Dissolution study. Dissolution study on prepared batches of hydrochlorothiazide and paracetamol tablets were conducted under sink conditions in triplicate using six tablets of each batch

Table 2
Composition of paracetamol tablets.

Ingredients	Quantity/tablet (mg)				
	B1	B2	B3	B4	B5
Paracetamol	200	200	200	200	200
Lactose monohydrate	20	20	20	20	20
Mucilage	6.0%, w/w	8.0%, w/w	10%, w/w	–	–
PVP-K25	–	–	–	1.7%, w/w	–
Acacia	–	–	–	–	6.8%, w/w
Corn starch	20	20	20	20	20
Talc	2	2	2	2	2