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RESEARCH ARTICLE

Evaluation of Binding Property of *Ocimum Tenuiflorum* Linn. Seed Mucilage Isolated By Defatting Method.

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ABSTRACT

In the present study *Ocimum Tenuiflorum Linn* seed mucilage was evaluated to determine if it posseses the tablet binding property. For this purpose the seed mucilage was used in different concentrations as binder in the formulations and compared with tablet prepared with starch as binder. Six tablet formulations were prepared in which F1 to F5 contained 1-5 % ocimum seed mucilage and F6 contained 5 % starch. These tablets were evaluated for hardness, thickness, friability, disintegration, content uniformity, in vitro drug release. The results indicated that mucilage is required in less concentration to give equivalent binding effect produced by starch in 5 %. Thus ocimum seed mucilage shows potential to use as binder in tablet formulations in lesser concentration than starch which may the cut cost of formulation to some extent.

KEYWORDS: Tablet binder, seed mucilage, defatting method, ocimum Tenuiflorum

INTRODUCTION:

Binders are agents used to impart cohesive qualities to the powdered material during the production of tablets [(1)].In recent years, plant derived polymers have evoked tremendous interest in pharmaceutical industries. Mucilages are pharmaceutically important polysaccharides with their diverse pharmaceutical applications such as thickener, binder, disintegrant, superdisintegrant, suspending agent, gelling agent, emulsifier, stabilizing agent, drug release retardant [(1)], suppository bases, paper-making [(2)], humidifying agent[(3)], and also as film formers[(4)]. By the term "plant mucilage" is meant those substances which are soluble, or at least swell very perceptibly in water and which, upon the addition of alcohol, are precipitated in a more or less amorphous or granular mass[(2)]. These polymers such as natural gums and mucilage are biocompatible, cheap and easily available and are preferred over semi synthetic and synthetic excipients because of their lack of toxicity, low cost, availability, soothing action, non irritant nature, edible properties[(2,5)] also capable of multitude chemical modifications.

MATERIALS AND METHODS:

Materials:

Diltiazem Hydrochloride was obtained as a gift sample from the Cipla Ltd, Mumbai. Ocimum seeds were purchased from local market. Lactose was purchased from Qualigens, Mumbai. Sodium starch glycolate (SSG) and Microcrystalline cellulose (MCC) were obtained as gift samples from Maple Biotech, Bhosari, Pune. Talc,Magnesium stearate, methyl paraben, propyl paraben were purchased from Loba Chemie Pvt. Ltd, Mumbai

METHODS:

ISOLATION OF THE MUCILAGE FROM OCIMUM SEEDS [(6)]:

The *Ocimum Tenuiflorum Linn.* Seeds were blended and defatted in Soxhlet apparatus using petroleum ether as defatting agent. After defatting the material was soaked in distilled water for 12 h. The swollen mass was spread on a tray and dried in an oven at 60^0C. The dried mass then passed through sieve no. 30. The mucilage was winnowed and again passed through mesh no. 60. The mucilage obtained was stored in desicator until use.

DRUG MUCILAGE COMPATIBILITY STUDY:

FTIR SPECTROSCOPY: [(7-9)]

The Mucilage and Diltiazem HCl were mixed in 1:1 ratio. This mixture was mixed with KBr in the ratio of 1:200. The spectrum was recorded using FTIR.(JASCO M-4100, ATR PRO-410). The scanning range was 600 to 4000 cm^{-1}.

DIFFERENTIAL SCANNING CALORIMETER STUDIES(DSC):[(7-9)]

The compatibility between mucilage and Diltiazem HCl was studied by Differential Scanning Calorimetry (DSC) (Mettler, Toledo, USA). The mixture of Diltiazem HCl and Mucilage 1:1 ratio was subjected to the temperature range from 30-280^0C in presence of reference material.

PREPARATION OF TABLETS:

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All the ingredients with drug were weighed accurately. The ingredients were mixed properly in mortar. The starch and mucilage were used as binding agent in the formulations. The coherent mass was produced by adding sufficient quantity of distilled water. The wet mass was then passed through the mesh # 16 to form the uniform granules. The granules were then dried in the oven at 60^0C. The dried granules were placed in the die cavity of (10 mm) and compressed using round flat punch on 8-station rotary tabletting machine (CIP, D8 Lab press, Ahmadabad). The hardness was kept between 9.5 to 10 kg /cm^2. Table 1shows the formulation details.

Sr. no.	Ingredients	F1 Mucilage (mg)	F2 Mucilage (mg)	F3 Mucilage (mg)	F4 Mucilage (mg)	F5 Mucilage (mg)	F6 Starch (mg)
1	Diltiazem HCl	30	30	30	30	30	30
2	Starch	-	-	-	-	-	5% w/w
3	Mucilage	1% w/w	2% w/w	3% w/w	4% w/w	5% w/w	-
4	SSG	35.38	35.38	35.38	35.38	35.38	35.38
5	Methyl Paraben	0.35	0.35	0.35	0.35	0.35	0.35
6	Propyl Paraben	0.82	0.82	0.82	0.82	0.82	0.82
7	Talc	5.88	5.88	5.88	5.88	5.88	5.88
8	Mg. Stearate	5.88	5.88	5.88	5.88	5.88	5.88
9	MCC	124.23	122.5	120.93	119.3	117.63	117.63
10	Lactose	124.23	122.5	120.93	119.3	117.63	117.63
Total		330	330	330	330	330	330

Table No. 1: Formulations with Ocimum seed mucilage as binder under study and starch as standard binder.

PRE-COMPRESSION EVALUATION: [10-13]

The granules were evaluated for following parameters Bulk density, Tapped density, % Compressibility index, Hausner's ratio.

POST-COMPRESSION EVALUATION :[10, 11, 13-16]

The tablets were evaluated for following parameters such as Hardness, Thickness, Friability, Weight variation, Disintigration test, Content uniformity, In-vitro drug release.

HARDNESS TESTING:

The hardness of the tablet given as the crushing strength was determined using Monsanto hardness tester (Rolex India).

TABLET THICKNESS DETERMINATION:

Thickness of each tablet was determined using the Electronic Digital Vernier Caliper (Aerospace).

FRIABILITY:

20 tablets were weighed and placed in a Roche Friabilator (Electrolab EF-2 Friabilator, USP), which were then operated for 100 revolutions. The tablets were then dusted and reweighed.

WEIGHT VARIATION:

20 tablets were weighed and the average weight was determined, from average weight, individual deviation was measured to help ensure that a tablet contains proper amount of drug.

DRUG CONTENT UNIFORMITY:

Drug content uniformity test was performed to check dose uniformity in the formulation. Randomly three tablets were weighed and powdered. A quantity equivalent to 5 mg of diltiazem hydrochloride was placed a 100 ml volumetric flask and dissolved in sufficient quantity of distilled water, sonicated for 5 minutes and made up the volume up to the mark and filtered through membrane filter. After appropriate dilutions with solvent, the drug content was determined by UV spectrophotometer at 237 nm (Shimadzu 1800, Tokyo, Japan) against suitable blank using standard plot equation.

IN- VITRO DISINTEGRATION TIME:

In-vitro disintegration time was determined for tablets using disintegration test apparatus. A tablet was placed in each of the six tubes of the apparatus and one disc was added to each tube. The 0.1N HCl was maintained at a temperature of 37 ± 0.5^0 C and time taken for

complete disintegration of the tablet with no palpable mass remaining in the apparatus (Electrolab ED-2L, USP) was measured in minutes.

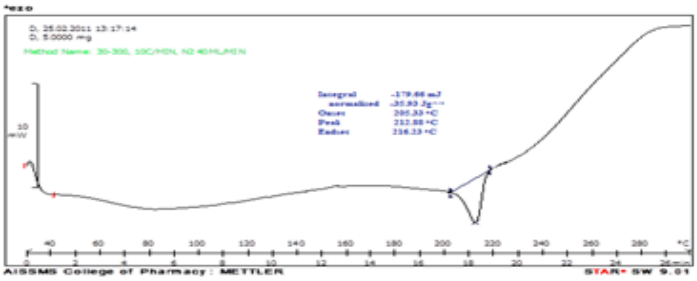
IN-VITRO DRUG RELEASE:

The in-vitro drug release of the selected formulation was carried out using USP dissolution apparatus Type II (Electrolab, India). The dissolution medium used was 900 ml of 0.1N HCl, the paddles were rotated at speed of 50 rpm and temperature was maintained at 37°C ± 0.5°C. Five ml of sample were withdrawn at specific time intervals and replaced with equal quantity of fresh dissolution medium maintained at same temperature. Then absorbance was taken at 237nm using UV-spectrophotometer (Shimadzu 1800, Tokyo, Japan).

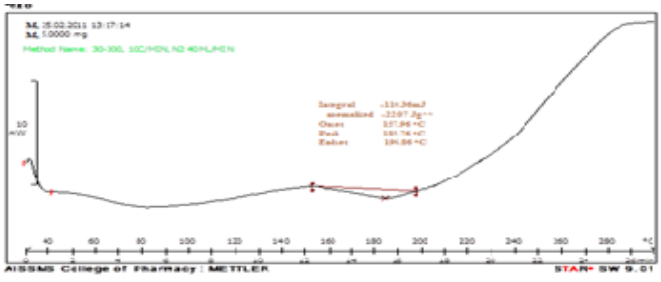
RESULTS AND DISCUSSION:

To evaluate binding property of *Ocimum Tenuiflorum* Linn. seed mucilage, it was compared with starch (5% w/w) mucilage as a binder used in commercially available formulation. Model drug used in the formulation was diltiazem HCl. Compatibility testing between drug and ocimum seed mucilage was carried out using DSC and FTIR, the spectra with results are shown in Fig.1and 2 respectively. The DSC and FTIR spectra showed that the drug and mucilage were compatible with each other. Six tablet formulations were prepared where in five formulations mucilage was used as binder, the concentration of mucilage in the formulations was varied between 1-5% w/w. In sixth formulation starch 5% w/w was used as binder. The granules prepared were subjected to pre-compression evaluation for bulk and tapped densities, % compressibility index, Hausner's ratio. The results are shown in table 2 indicated that the granules had good flow properties. Table 3 shows the post-compression evaluation of the prepared tablets. The results of thickness, hardness and weight variations were within acceptable limits. The friability of prepared formulations using ocimum seed mucilage as binder was in the range of 0.21% to 0.27%, comparable with the friability of formulations using starch as binder which was 0.27%. This indicated that stability of tablets to mechanical shock during handling and transportation .The disintegration time of F1, F2, F3, F4, F6 was within acceptable range but formulation F5(5% w/w Mucilage) showed disintegration time of 46 minutes. When formulation F1 to F5 (1-5% w/w Mucilage) were compared with F6 (5% w/w Starch) it was clear that to achieve the equivalent binding effect of 5% w/w starch, a concentration of 2% mucilage was sufficient. To act as binder ocimum seed mucilage would be required in concentration less than 5% w/w which would further reduce cost of the formulation. The in vitro drug release was carried out on Formulations F1, F2, F3, F4, F6, the % drug release is shown in table 4.The fig.3 shows release profile of F1, F2, F3, F4, F6. The formulation F5 was not subjected to in vitro drug release as its disintegration time was more than 30 minutes.

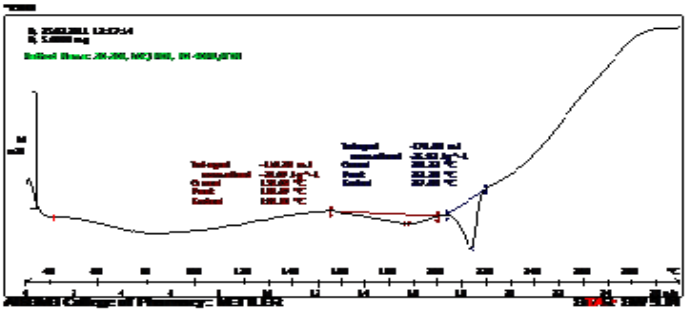
DSC THERMOGRAMS:



Diltiazem HCL DSC



Mucilage DSC



Diltiazem HCL+Mucilage DSC

Drug	Temperature (°C)		
	Onset	Peak	Endset
Diltiazem HCl	201.33	212.88	216.33
Diltiazem HCl – Mucilage	206.23	213.39	217.60

Figure No. 1: DSC curves of Drug, Mucilage, Drug and Mucilage.

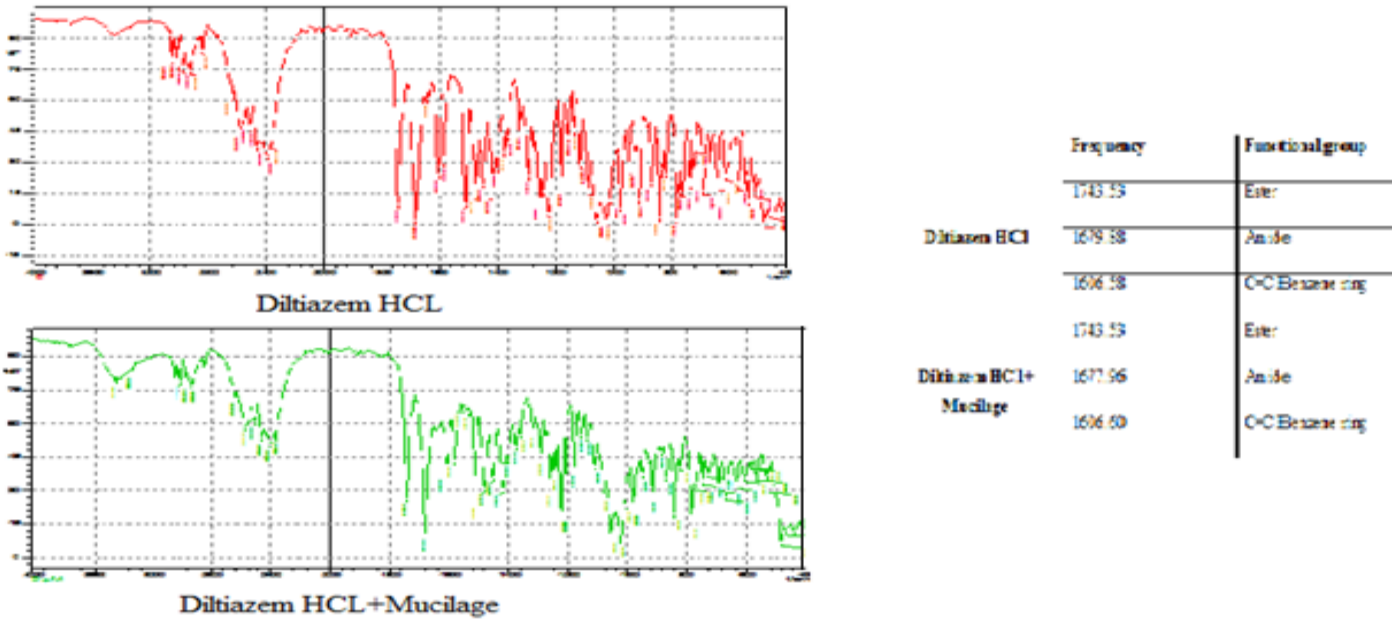


Figure No. 2: FTIR spectra of Drug, Drug + Mucilage.

Parameters	F1	F2	F3	F4	F5	F6
Bulk density (g/ml)	0.45	0.44	0.45	0.44	0.43	0.47
Tapped density (g/ml)	0.51	0.50	0.53	0.52	0.52	0.53
Compressibility index (%)	11.4	11.8	15.1	16.3	15.6	11.3
Hausner's ratio	1.1	1.13	1.17	1.2	1.2	1.1

Table 2: Pre-compression parameters of the granules

Parameters	Formulations					
	F1	F2	F3	F4	F5	F6
Hardness (kg/cm^2)	9.5	9.5	9.5	9.5	9.5	9.5
Weight Variation	Within acceptable limits					
Thickness (mm)	3.5	3.5	3.5	3.5	3.5	3.5
Friability (%)	0.26	0.24	0.27	0.21	0.21	0.27
Disintegration time (min.)	10	13	14.5	14.5	46	13
Content Uniformity (%)	98.99	98.78	99.31	98.46	98.87	98.77

Table 3: Post-compression evaluation of the prepared tablets:

Cumulative % Drug Release					
Time (Min.)	**F1**	**F2**	**F3**	**F4**	**F6**
5	30.78	28.94	27	23.48	31.24
10	72.94	58.23	66.56	70.08	73.74
15	98.81	98.07	98.55	94.46	98.16
20	99.95	99.86	100.43	100.27	100.58
25	99.50	99.18	99.68	99.82	100.36
30	99.80	99.05	99.78	99.47	98.28

Table No. 4: The cumulative percent drug release is given in table below:

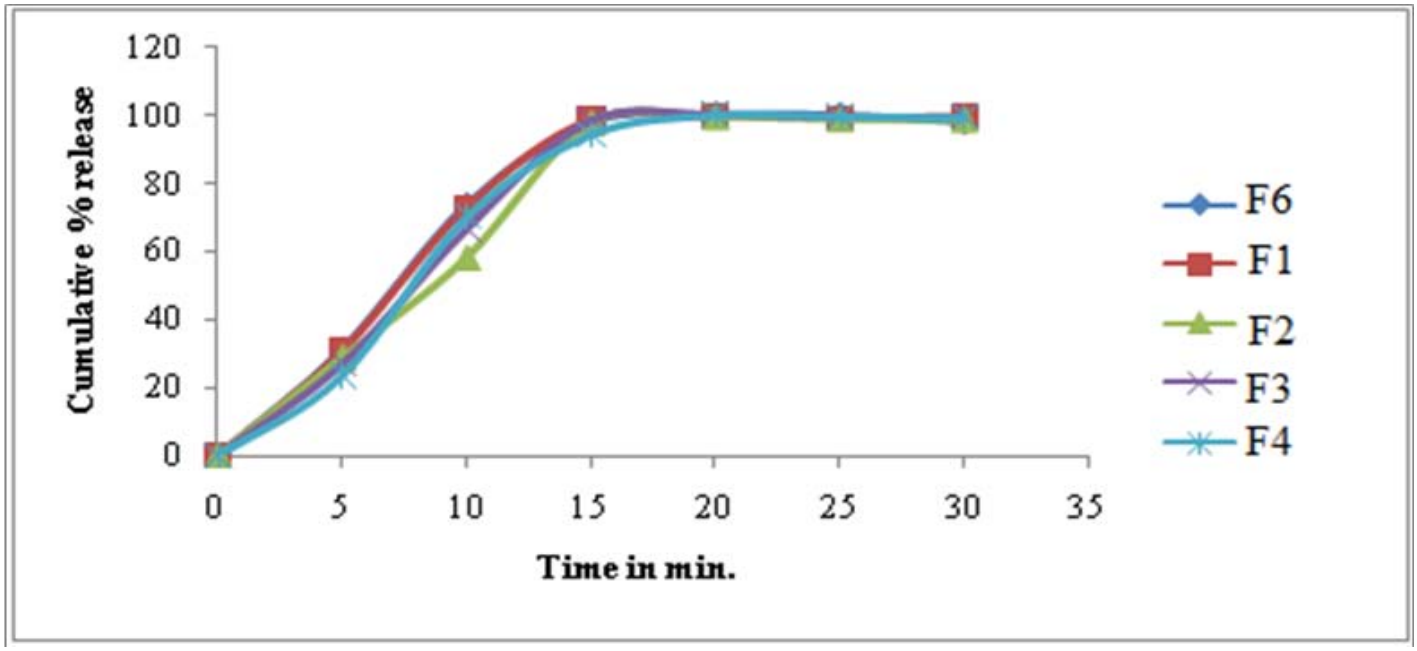


Figure No. 3: Cumulative % drug release

CONCLUSION:

Natural products are now gaining significant attention due to their eco-friendly nature, easy availability and low cost. In our study ocimum seed mucilage has shown better results than standard binder starch, we conclude that ocimum seed mucilage can be used as an effective tablet binder.

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