Asian J. Exp. Sci., Vol. 21, No. 1, 2007, 63-67

Evaluation of the Suspending Properties of *Cassia tora* Mucilage on Sulphadimidine Suspension

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Abstract : Some excipients are currently available for the formulation of pharmaceutical suspensions. The purpose of this study is to search for a cheap and effective natural excipient that can be used as an effective alternative for the formulation of pharmaceutical suspensions. The suspending properties of *Cassia tora* (family Leguminosae) were evaluated comparatively with those of compound tragacanth, *Acacia* and gelatin at concentration range of 0.5 – 4.0% w/v in sulphadimidine suspension. Characterization tests were carried out on purified *Cassia tora* mucilage. Sedimentation volume (%), rheology and particle size analysis were employed as evaluation parameters. The values obtained were used as basis for comparison of the suspending agents studied. *Cassia* mucilage is safe for use as a suspending agent in human and pet foods based on the levels of use, which are comparable to the use levels of other suspending agents. *Cassia tora* mucilage (2.5%w/v) produced a comparable suspending ability as 4%w/v compound tragacanth. Also, the suspending ability of all the materials was found to be in the order: *Cassia tora* > Compound tragacanth gum > *Acacia* gum > Gelatin. At all concentrations employed, C*assia tora* mucilage had the strongest suspending ability relative to the other materials. The results suggest that, due to the high viscosity of *Cassia tora* mucilage, its mucilage can be a stabilizer of choice when high viscosity is desired. It can also serve as a good thickening agent in both pharmaceutical and food industries.

Key words: *Cassia tora*, suspending agents, rheology, *Acacia* gum, Gelatin.

Introduction :

A pharmaceutical suspension, like other disperse systems, is thermodynamically unstable, thus, making it necessary to include in the dosage form, a stabilizer or suspending agent which reduces the rate of settling and permits easy redispersion of any settled particulate matter both by protective colloidal action and by increasing the consistency of the suspending medium (Zografi *et al.*, 1990; Martin *et al.*, 1991; Banker and Rhodes 1998). Suspending agents may be (i) inorganic materials, (ii) synthetic compounds, or (iii) polysaccharides. Natural gums like *Acacia*, tragacanth, khaya, karaya and *Cassia tora* mucilage belong to the latter group (Trease and Evans, 1996). Gums have been wildly used as tablet binders, emulgents and thickeners in cosmetics and suspensions as film-forming agents and transitional colloids (Martin *et al.*, 1991).

Seed gums are important agrochemical used in various industries worldwide. The growing industrial utility

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of these gums in the field of paper, textile, petroleum recovery and pharmaceutical industries has resulted in an impetus in India for intensified research on new sources of gums and their modified products. *Cassia tora* mucilage (CTG) derived from the seeds of *Cassia tora* Linn. is a common herbaceous annual occurring weed throughout India. (Soni and Pal 1996). Although, some work had already been carried out on gums as excipients (Boyinbode and Iranloye 1986; Odeku *et al.*, 1991; Odeku and Akinlosotu 1997), it seems that no work has been done on the suitability of *Cassia tora* mucilage as a suspending agent in sulphadimidine suspension as compared to the relatively common natural agents as *Acacia*, tragacanth and gelatin, using sedimentation volume, rheology and particle size analysis as assessment parameters. *Cassia* mucilage is safe for use as a suspending agent in human and pet foods based on the levels of use of *Cassia* mucilage, which are comparable to the use levels of other suspending agents (Hallaganf *et al*., 1997).

Sulphadimidine was chosen for this investigation because it is a typical representative of practically insoluble drugs which would require a suspending agent to be prepared as a liquid dosage form (The British Pharmacutical Codex, 1994).

Materials and Methods :

The materials used include sulphadimidine (fine powder), gelatin, benzoic acid BP, and amaranth solution (Merck, Germany), *Acacia* gum powder (Myrton Jaunders and Co. Ltd., Liverpool), compound tragacanth powder (Searle Co., England). All solvents used were of analytical grade

Cassia tora mucilage was isolated from seeds as per the method described by (Soni and Pal, 1996). The seed sample had earlier been identified and authenticated in the herbarium Department of Botany, Dr. H. S. Gour University Sagar (M.P). The gum was dried at 50^{o} C for 8 hr, pulverized using blender hydrated in double strength chloroform water for 5 days with intermittent stirring, then strained through a piece of calico cloth. The gum was precipitated from solution using acetone. The precipitated gum was filtered, washed with diethyl either, and then dried in a hot air oven at 40^{o}C. The dried mass was powdered and stored in an airtight container. 1%w/v solution of the crude gum in cool distilled water was subjected to some characterization tests.

Preparation of Sulphadimidine Suspensions : Compound tragacanth powder (0.5 g) and 10 g of sulphadimidine were triturated together with 20 ml of Raspberry syrup to form a smooth paste. Benzoic acid solution (2 ml) and 1 ml of amaranth solution were added gradually with constant stirring and then mixed with 50 ml of chloroform water double strength. The mixture was transferred into a 100 ml amber bottle, made up to volume with distilled water and then shaken vigorously for 2 min (thus making 0.5% w/v of the gum in the preparation). The procedure was repeated using 1.0, 1.5, 2.0, 2.5, 3.0, 3.5 and 4.0% w/v of compound tragacanth powder. The above procedure was repeated with *Acacia* gum, gelatin and *Cassia tora* gum.

Determination of the Suspension Properties :

Sedimentation Volume : Each suspension (50 ml) was stored in a 50 ml-measuring cylinder for 7 days at 35ºC. Observations were made at every hr for 7 hr and then every 24 hr for 7 days. The sedimentation volume, F (%), was then calculated using the following equation (Banker and Rhodes 1998) :

$$F = 100V_u/V_o$$

where, V_u is the ultimate volume of the u sediment and V_o is the original volume of the of suspension.

Rheology : The time required for each suspension sample to flow through a 10 ml pipette was determined and the apparent viscosity ($\eta\alpha$ in mls^{-1})was calculated using the equation :

$$\text{Flow Rate} = \eta_\alpha = \frac{\text{Volume of Pipette (ml)}}{\text{Flow time (Seconds)}}$$

The viscosity (in poise) of the samples was determined at 25º C using the Brookfield Synchro-lectric viscometer, model LVF (Brookfield Laboratories, Massachusetts) at 30 revolutions/min (Spindle #4). All determinations were made in at least triplicate and the results obtained are expressed as the mean values.

Particle Size Analysis : After shaking, 10 ml of each sample was separately transferred into 200 ml cylinder. Distilled water (150 ml) was then added, mixed, and 10 ml aliquot was removed at a distance of 10 cm below the surface of the mixture and at 1, 5, 10, 15, 20, 25 and 30 min. This was transferred into an evaporating dish and evaporated to dryness in an oven at 105º C and the residue weighed. The particle diameter (d in cm) was then calculated using the Stoke's equation (Patel *et al*., 1986) :

$$d = \frac{18\eta h}{(\rho s - \rho 0)} gt$$

where, h is the distance of fall of the particle (cm), t is the time (s), η is the viscosity of the dispersion medium (poise), $\rho s - \rho 0$ is the density gradient between the dispersed particles and the liquid (g cm^{-3}) and g is the gravitational constant (cm s^{-2}).

Results and Discussion :

The effects of the type and concentration of the suspending agents on sedimentation volume, flow rate, viscosity and particle size are as shown in Tables 1 and 2.

Phytochemical tests carried out on *Cassia tora* mucilage confirmed the absence of alkaloids, anthraquinones and carbohydrates in accordance with the belief that gums do not contain carbohydrates, but complex acids built up of less common sugar. A sulphadimidine suspension formulation was prepared in batches containing *Cassia tora* mucilage, compound tragacanth, *Acacia* or gelatin (concentration range of 0 – 4% w/v at 0.5 w/v intervals). The preparations were assessed based on their sedimentation volume, viscosity, and flow rate and particle size analysis. The results showed that sedimentation volume, viscosity and particle size were found to be directly proportional to the concentration of the suspending agents. The reverse was the case for the flow rate. Inverse proportionality was observed between the

Table - 1 : Values of Sedimentation volume (%) of suspension using different concentration of suspending agents.

Suspending agent	Concen-tration w/v	Sedimentation Volume % Time (Hours)								Time (days)						
		0	1	2	3	4	5	6	7	1	2	3	4	5	6	7
C. tora mucilage	0	100	34	32	32	32	32	32	32	30	29	28	28	28	28	28
	2.5	100	96	94	94	88	84	82	78	60	58	54	54	53	53	53
	3.0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Tragacanth	2.5	100	89	79	70	64	60	52	50	42	41	41	40	40	40	40
	3.0	100	91	83	74	67	64	57	52	46	46	45	44	42	41	41
Acacia Gum	2.5	100	80	71	50	45	42	41	40	38	37	37	36	36	36	36
	3.0	100	84	72	52	46	43	42	42	40	39	39	38	37	37	37
Gelatin	2.5	100	58	58	58	58	58	58	58	58	56	56	55	55	55	55
	3.0	100	76	72	72	72	72	72	72	70	70	70	70	70	70	70

Table - 2 : Effect of type and concentration of suspending agents on the flow rate and viscosity of suspensions.

Suspending agents	Concentration (%w/v)	Flow rate ml s^{-1}	Viscosity (poise)
C. tora mucilage	2.5	0.91	2.25
	3.0	Too Viscous	Intermediate
Tragacanth	2.5	1.25	1.10
	3.0	1.00	1.30
Acacia Gum	2.5	1.43	0.85
	3.0	1.11	0.90
Gelatin	2.5	1.67	0.15
	3.0	1.43	0.15

storage time on one hand and sedimentation volume on the other. All the formulations were observed to obey the Stoke's law (Equation 4) when subjected to particle size analysis. The suspending ability of the suspendants (as evaluated by the above assessment parameters) were in the order of *Cassia tora* gum> Compound Tragacanth > *Acacia* > Gelatin (except for the flow rate in which the reverse order was the case). Thus *Cassia tora* mucilage appeared to exhibit the best suspendability of all the materials investigated. In fact, 2.5%w/v of this mucilage produced suspension of optimal properties which compared favourably with the suspension containing 4%w/v compound tragacanth, a traditional suspending agent.

Conclusion : In view of these properties, mucilage of *Cassia tora* mucilage can be employed as stabilizer and thickener of choice when high viscosity is desired especially in cosmetic, pharmaceutical and food industries. The binding and emulsifying properties of the gum are being studied.

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