

Research Article

Evaluation of the suspending properties of *Albizia zygia* gum on sulphadimidine suspension

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Abstract

Purpose: 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.

Method: The suspending properties of *Albizia zygia* gum (family Mimosoideae) 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 *Albizia zygia* gum. Sedimentation volume (%), rheology and particle size analysis were employed as evaluation parameters. The values obtained therefrom were used as basis for comparison of the suspending agents studied.

Results: *Albizia zygia* gum is devoid of alkaloids, anthraquinones and carbohydrates which ensures its "inertness". *Albizia zygia* gum (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: *Albizia zygia* > Compound Tragacanth gum > Acacia gum > Gelatin. At all concentrations employed, *Albizia zygia* gum had the strongest suspending ability relative to the other materials.

Conclusion: The results suggest that, due to the high viscosity of *Albizia zygia* gum, 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: *Albizia zygia*, suspending agents, sedimentation volume, rheology, particle size.

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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^{1, 2, 3}. Suspending agents are (i) inorganic materials, (ii) synthetic compounds, or (iii) polysaccharides. Natural gums like Acacia, Tragacanth, Khaya, Karaya and Albizia belong to the latter group⁴. Gums have been widely used as tablet binders, emulgents and thickeners in cosmetics and suspensions as film-forming agents and transitional colloids².

Albizia zygia (DC) J.F. Macbride (family Mimosoideae) is a gum-producing tree widely found in tropical Africa^{5, 6, 7}. Studies showed that its seed mainly contains amino acids and carbohydrates^{8, 9}. Although some work had been carried out on gums as excipients^{10, 11, 12}, it seems that no work has been done on the suitability of Albizia gum (obtained from the incised trunk of *Albizia zygia*) 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. 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 form¹³.

Materials and Methods

The materials used include sulphadimidine (fine powder), gelatin, benzoic acid BP, and amaranth solution (Merck, Germany), Acacia gum powder (Myrton Jaunders & Co. Ltd.,

Liverpool), compound tragacanth powder (Searle Co. England), chloroform water, double strength (BDH Chemical Ltd., England), and raspberry syrup BP (Best Ltd., England).

Albizia gum was obtained from the trunk of *Albizia zygia* at a local farm in Ipara-Remo, Ogun State, Nigeria. The plant sample had earlier been identified and authenticated in the herbarium Department of the Forestry Research Institute of Nigeria, Ibadan. The gum was dried at 50 °C for 8 hr, pulverized using an Osterizer blender (Model 857, Willamette Industries, USA), 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 95% ethanol. The precipitated gum was filtered, washed with diethyl ether, and then dried in a hot air oven at 40 °C. The dried mass was powdered and stored in an airtight container.

Before purification, 1%w/v of the pulverized 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 1ml 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 Albizia gum.

Determination of the Suspension Properties

Sedimentation Volume: Each suspension (50 ml) was stored in a 50 ml-measuring cylinder for 7 days at 35 °C. 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 equation³:

$$F = 100V_u/V_o \dots\dots\dots (1)$$

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

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

$$\text{Flow rate} = \eta_\alpha = \frac{\text{Volume of pipette (ml)}}{\text{Flow time (s)}} \dots\dots (2)$$

The viscosity (in poise) of the samples was determined at 25 °C using the Brookfield Synchro-lectric viscometer, model LVF (Brookfield Laboratories, Massachusetts) at 30 revolutions per 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 105 °C and the residue weighed. The particle diameter (d in cm) was then calculated using the Stokes equation¹⁴:

$$d = \frac{18\eta h}{(\rho_s - \rho_0) g} \dots\dots (3)$$

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

Table 1: Values of sedimentation volume (%) of sulphadimidine suspensions using different concentrations of suspending agents

Suspending agents	Conc. (%w/v)	Sedimentation Volume (%)														
		Time (hr)							Time (days)							
		0	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Albizia gum	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
Compound	2.5	100	89	79	70	64	60	52	50	42	41	41	40	40	40	40
Tragacanth	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	37	36	36	36
	3.0	100	84	72	52	46	43	42	42	40	39	39	38	37	37	37
Gelatin	2.5	100	62	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

volume, flow rate, viscosity and particle size are as shown in Tables 1 – 2.

Phytochemical tests carried out on *Albizia zygia* gum confirmed the absence of

> Compound Tragacanth > Acacia > Gelatin (except for the flow rate in which the reverse order was the case). Thus *Albizia* gum appeared to exhibit the best suspendability of all the materials investigated. In fact,

Table 2: Effects of the type and concentration of suspending agents on the flow rate and viscosity of sulphadimidine suspensions

Suspending agent	Concentration (%w/v)	Flow rate (ml s ⁻¹)	Viscosity (poise)
Albizia gum	2.5	0.91	2.25
	3.0	Too viscous; indeterminable	
Compound 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

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 *Albizia* gum, compound tragacanth, acacia or gelatin (concentration range of 0 –4%w/v at 0.5w/v intervals). The preparations were assessed based on their sedimentation volume, viscosity, 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 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 *Albizia* gum

2.5%w/v of this gum 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 *Albizia zygia* gum can be employed as stabilizer and thickener of choice when high viscosity is desired especially in cosmetic, pharmaceutical and food industries. The binding properties of the gum in tablets are being studied.

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