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 group\(^4\). Gums have been widely used as tablet binders, emulgents and thickeners in cosmetics and suspensions as film-forming agents and transitional colloids\(^2\).

**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 form\(^13\).

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 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 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 equation:

$$F = 100 \frac{V_u}{V_o} \quad \ldots \ldots \quad (1)$$

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 ($\eta_a$ in mls$^{-1}$) was calculated using the equation:

$$\text{Flow rate} = \eta_a = \frac{\text{Volume of pipette (ml)}}{\text{Flow time (s)}} \quad \ldots \ldots \quad (2)$$

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 equation:

$$d = \frac{18 \eta h}{(r_s - r_0) g t} \quad \ldots \ldots \quad (3)$$

where $h$ is the distance of fall of the particle (cm), $t$ is the time (s), $\eta$ is the viscosity of the dispersion medium (poise), $r_s - r_0$ 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>
<thead>
<tr>
<th>Suspending agents</th>
<th>Conc. (%w/v)</th>
<th>Sedimentation Volume (%)</th>
<th>Time (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>Albizia gum</td>
<td>2.5</td>
<td>100 96 94 94 88 84 82 78</td>
<td>60 58 54 54 53 53 53 53</td>
</tr>
<tr>
<td></td>
<td>3.0</td>
<td>100 100 100 100 100 100 100 100</td>
<td>100 100 100 100 100 100 100 100</td>
</tr>
<tr>
<td>Compound</td>
<td>2.5</td>
<td>100 89 79 70 64 60 52 50</td>
<td>42 41 41 40 40 40 40 40</td>
</tr>
<tr>
<td>Tragacanth</td>
<td>3.0</td>
<td>100 91 83 74 67 64 57 52</td>
<td>46 46 45 44 42 41 41 41</td>
</tr>
<tr>
<td>Acacia gum</td>
<td>2.5</td>
<td>100 80 71 50 45 42 41 40</td>
<td>38 37 37 37 36 36 36 36</td>
</tr>
<tr>
<td></td>
<td>3.0</td>
<td>100 84 72 52 46 43 42 42</td>
<td>40 39 39 38 37 37 37 37</td>
</tr>
<tr>
<td>Gelatin</td>
<td>2.5</td>
<td>100 62 58 58 58 58 58 58</td>
<td>58 56 56 55 55 55 55 55</td>
</tr>
<tr>
<td></td>
<td>3.0</td>
<td>100 76 72 72 72 72 72 72</td>
<td>70 70 70 70 70 70 70 70</td>
</tr>
</tbody>
</table>
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 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 > 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, 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.

**Acknowledgement**

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**References**

Femi-Oyewo et al., 2004

Albizia zygia gum and sulphadimidine suspension


