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Original Research Article

Assessment of *Colocasia esculenta* Mucilage as Suspending Agent in Paracetamol Suspension

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Abstract: The purpose of this study is to search for more affordable as well as effective natural excipients that can be used as viable alternative for the formulation of pharmaceutical suspension. The suspending properties of mucilage of *Colocasia esculenta* were evaluated comparatively with those of compound tragacanth and acacia in Paracetamol suspension. Characterization tests were carried out on *Colocasia esculenta* mucilage. Sedimentation volume, rheology, pH, degree of flocculation and redispersibility were the evaluation parameters. The values obtained were used as basis for comparison of the suspending agents studied. *Colocasia esculenta* mucilage showed comparable suspending ability as acacia and compound tragacanth although *Colocasia esculenta* mucilage was found to be less viscous than acacia and compound tragacanth. Also, the redispersibility of the materials was found to be in the order: *Colocasia esculenta* mucilage > Acacia > Compound Tragacanth. The Study indicates that *Colocasia esculenta* mucilage may be useful as a pharmaceutical adjuvant and as a suspending agent.
Keywords: Paracetamol, suspension, suspending agent, mucilage, *Colocasia esculenta*.

INTRODUCTION

Plant derived polymers are widely employed in the pharmaceutical industry as thickeners, suspending agents, emulsifying agents, binders and film formers. With the increase in demand for natural gums, it has become necessary to explore the newer sources of gums to meet the industrial demands.

These polymers such as natural gums and mucilage are biocompatible, cheap and easily available and are preferred to semi synthetic and synthetic excipients because of their lack of toxicity, low cost, availability, soothing action and non irritant nature [1]. A number of plant gums / hydrocolloids have been used as binding, suspending or emulsifying agents in solid or liquid dosage formulations [2].

A Pharmaceutical suspension is a coarse dispersion in which internal phase is dispersed uniformly throughout the external phase [3, 4]. The internal phase consisting of insoluble solid particles having a specific range of size which is maintained uniformly throughout the suspending vehicle with aid of single or combination of suspending agent. The external phase (suspending medium) is generally aqueous in some instance, may be an organic or oily liquid for non oral use [5].

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 redisperse of any settled particulate matter both by protective colloidal action and by increasing the consistency of the suspending medium. Suspending agents may be (i) inorganic materials, (ii) synthetic compounds, or (iii) polysaccharides.

Although, some work had already been carried out on gums as excipients; it seems that no work has been done on the suitability of *Colocasia esculenta* mucilage as a suspending agent in Paracetamol suspension

The purpose of the study was to formulate and evaluate a new, effective natural suspending agent that can be used as an effective alternative for the formulation of pharmaceutical suspension.

MATERIALS AND METHODS

MATERIALS

The fresh *Colocasia esculenta* tubers were collected from Abraka main market in Ethiope East Local Government Area of Delta State in Nigeria. The plant was authenticated at the Pharmacognosy

Department of the faculty of Pharmacy, Delta State University, Abraka. All other reagents used were of analytical grade and distilled water was used throughout the experiments.

Extraction of Mucilage

The fresh *Colocasia esculenta* tubers were collected and washed with water. The tubers were crushed and soaked in water for 6 hours, boiled for 30 minutes and left to stand for 1 hour to allow complete release of the mucilage into the water. The mucilage was extracted using a muslin cloth bag to remove the marc from the solution. Acetone (three times the volume of filtrate) was added to precipitate the mucilage. The mucilage was separated, dried in an oven at 40°C, collected, ground, passed through a # 80 sieve and stored in a desiccator until use [6, 7].

Preparation of Paracetamol Suspension

Suspensions of 5%w/v Paracetamol in water were made using 2% and 4% of suspending agents like Acacia, Tragacanth and *Colocasia esculenta* mucilage. Acacia gum (2 g) and 5 g of Paracetamol were triturated together with 10 ml of Raspberry syrup to form a smooth paste. Benzoic acid solution (1 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 2% w/v of the gum in the preparation). The procedure was repeated using 4.0 % w/v of Acacia gum. The above procedure was repeated with tragacanth powder and *Colocasia esculenta* mucilage.

Table-1: Formulation of Paracetamol suspension

Ingredients in gm	Formulations with different concentrations of mucilage (%w/v)	
	2%	4%
Paracetamol	5 g	5 g
Mucilage	2 g	4 g
Raspberry	10 ml	10 ml
Amaranth	1 ml	1ml
Benzoic acid	1 ml	1ml
Purified Water Q.S. to	100 ml	100 ml

EVALUATION OF SUSPENTIONS

Sedimentation Volume

The sedimentation volume is ratio of the ultimate height (Hu) of the sediment to the initial height (Ho) of the total suspension as the suspension settles in a cylinder under standard conditions. It was determined by keeping a measured volume of the suspension in a graduated cylinder in an undisturbed state for a certain period of time and note the volume of the sediment, which is expressed as ultimate height (Hu) [8].

Rheology

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

Flow rate = $\eta\ \alpha$= Volume of pipette (ml)/ Flow time (seconds)

The viscosity (centipoises) of the sample was determined at room temperature using a rotational viscometer; model NDJ-1 at 12 rpm (spindle #1). The viscosities of each suspension were read directly from the viscometer [9].

pH

The pH of each of the prepared suspension was determined at intervals of one week for 21 days using pH meter (Hanna HI 1270). At the end of each period, each suspension was shaken to reconstitute before taking the pH [10].

Degree of Flocculation

The degree of flocculation was determined using the equation

$\beta = F/F\infty$

where F is ultimate sedimentation volume in flocculated suspension.

F ∞ is ultimate sedimentation volume in deflocculated suspension.

The sedimentation volume gives only a qualitative account of flocculation since it lacks a meaningful reference point. The degree of flocculation is more fundamental parameter than F since it relates the volume of flocculated sediment to that in a deflocculated system [11]

Redispersibility

Suspension produces a sediment on storage, it is essential that it should be readily dispersible so that uniformity of the dose is assured. The method essentially consisted of holding the sample tube straight in upright position between two fingers with thumb at the bottom and the middle finger at the top, followed by almost uniform rotation through 180˚ and brought back to same path. The pair of successive upward and downward movement each of approximately equal

force, constituted one complete shake. The number of shakes required for complete elimination of sediment from the bottom of the tube was recorded [8].

RESULTS AND DISCUSSION

Table-2: Sedimentation volume of suspension of different concentration of suspending agents

Suspending agent	Concentration (%)	Sedimentation volume (F)
Colocassia esculenta	2 %	0.09 ± 0.026
	4 %	0.11 ± 0.000
Tragacanth	2 %	0.06 ± 0.041
	4 %	0.07 ± 0.000
Acacia	2 %	0.04 ± 0.290
	4 %	0.06 ± 0.064

Table-3: Flow rate and Viscosity of suspension

Suspending agent	Concentration (%w/v)	Flow rate ml s^{-1}	Viscosity (Poise)
Acacia	2	1.25 ± 0.094	1.65 ± 0.027
	4	1.11 ± 0.033	1.80 ± 0.175
Tragacanth	2	1.00 ± 0.032	1.60 ± 0.039
	4	0.90 ± 0.090	1.75 ± 0.217
Colocasia esculenta	2	0.76 ± 0.064	1.55 ± 0.010
	4	0.62 ± 0.026	1.70 ± 0.050

Table-4: Redispersibility and pH

Suspending Agent	Conc.	Rate of redispersibility (Cycles)			pH after storage for			
		5 days	10 days	15 days	0th	7th	14th	21th day
Acacia	2	4	6	9	5.96	6.31	6.78	6.47
	4	6	8	11	6.00	6.20	6.82	6.52
Tragacanth	2	6	8	12	6.10	6.52	6.85	6.49
	4	8	10	14	5.80	6.40	6.96	6.54
Colocasia esculenta	2	2	4	6	5.20	5.96	6.55	6.00
	4	3	4	5	5.60	6.10	6.65	6.47

Table-5: Degree of flocculation

Suspending agent	Concentration (w/v)	Degree of flocculation (at the end of 45 days)
Acacia	2 %	1.40 ± 0.050
	4%	1.50 ± 0.010
Tragacanth	2%	1.12 ± 0.100
	4%	1.30 ± 0.070
Colocasia esculenta	2%	1.09 ± 0.050
Mucilage	4%	1.11 ± 0.033

The effects of the type and concentration of the suspending agents on sedimentation volume, flow rate and viscosity are as shown in Tables 2 and 3. From the above results, the sedimentation volume of suspension with *Colocasia esculenta* mucilage as suspending agent showed highest sedimentation volume than Acacia and Tragacanth. The result showed that the sedimentation volume is directly proportional to the concentration of the suspending agents; an increase in the concentration of the suspending agents increased the sedimentation volume. The order of the sedimentation volume was found to be Colocassia esculenta mucilage > Compound Tragacanth > Acacia.

Since the suspension produces sediment on storage it must be readily dispersible so as to ensure the uniformity of the dose. If sediment remains even after shaking vigorously for specified time, the system is described as caked. The redispersion ability of the suspending agents were found in the order of Colocassia mucilage > Tragacanth > Acacia. Colocassia esculenta mucilage has the least redispersion time.

From the table above, the pH of all the suspensions are within the range 5.95-7.22, this is within the acceptable limits for suspensions.

Sedimentation volume provides only a qualitative account of flocculation. The degree of flocculation (ß) is more useful parameter, which is the ratio of ultimate sedimentation volume in the flocculated and deflocculated system. The degree of flocculation for 2% and 4% Colocassia esculenta mucilage were found to be 1.09 and 1.11 which was comparable with Tragacanth. (Table 5)

The suspensions were stable in accelerated storage conditions there were no changes in the physical as well as rheological properties of the suspension. The suspensions prepared with Colocassia esculenta mucilage had good sedimentation volume, redispersibility, viscosity and flow rate when compared with suspensions prepared with Tragacanth and Acacia as standard.

CONCLUSION

The present study indicates that *Colocasia esculenta* mucilage appeared to exhibit good suspendability for paracetamol suspensions compared with Tragacanth and Acacia gums.

In view of these properties, it can be concluded that mucilage of *Colocasia esculenta* has the potential and could possibly be harnessed as a suspending agent, stabilizer and thickener for various pharmaceutical suspension.

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