Research Article

EVALUATION OF THE SUSPENDING PROPERTIES OF *ALOE BARBADENSIS* (ALOE VERA) GUM IN PHARMACEUTICAL SUSPENSIONS

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ABSTRACT

This study aims at the possibility of using the dry gum of *Aloe barbadensis* (Family Liliaceae) as a suspending agent for zinc oxide suspension. The suspending properties of the test material or gum was evaluated and compared with other known compounds such as acacia and Sodium carboxymethylcellulose (NaCMC) at concentrations of 1% W/V, 2% W/V, and 4% W/V in zinc oxide suspension. The dry gum exudate was characterized and the suspension obtained there from evaluated for sedimentation volume (%), pH, redispersibility, and organoleptic properties. The stability of the formulation increased with increase in gum concentration and results obtained shows that the gum has good and stable suspending properties although at equivalent concentrations, both acacia and NaCMC had better suspending properties. Thus aloe gum can be used in preparations where low viscosity is desirable or its concentration doubled or tripled at higher viscosity requirements.

Keywords: *Aloe barbadensis*, acacia, NaCMC, suspending agent, characterization, sedimentation volume, redispersibility, zinc oxide.

INTRODUCTION

Aloe plant has been used by man for both cosmetic and medicinal purposes over the ages[1]. Amongst the many species available, *Aloe ferox, Aloe barbadensis* and *Aloe secundiflora* are the best varieties to obtain the aloe gum[2] from. Although aloe plant is a native of the Mediterranean region, it is now widely grown in many parts of the world. Aloe gum is the solid residue obtained by evaporating the liquid which drains from the transversely cut leaves of the various species of Aloe[3]. Gums have wide application as tablet binders, thickeners and emulgents in cosmetics and suspensions as film forming agents and transitional colloids[4].

A pharmaceutical suspension is a coarse dispersion in which insoluble solid particles are dispersed in a liquid medium[5]. Suspensions like other disperse systems are thermodynamically unstable and thus needs a suspending agent or stabilizer to reduce the rate of settling and to permit easy redispersion of any settled particulate matter both by protective colloidal action and by increase in the consistency of the suspending medium [6, 7, 8].

Suspending agents are classified into;

i) Natural polysaccharides, (ii)Semi synthetic polysaccharides

(iii) Clays or inorganic suspending agents (iv) Synthetic agents.

Aloes, acacia, tragacanth, khaya, karaya belong to natural polysaccharides. Gums are mainly long chain, straight or branched chain polysaccharides that contain hydroxyl groups that are bound to water molecules[9, 10]. These gums are generally non toxic and widely commercially available and cheap [11], hence the interest of this study.

MATERIALS AND METHODS

Acacia (Mayrton Jaunders Ltd, England), NaCMC (BDH Chemical Ltd, England), Zinc oxide (Analar grade), Diethylether and hydrochloric acid (Fisher Scientific Co. USA), End runner mill and Hot air over (Erweka), pH meter (Lomba, India), Glass measuring cylinders, sieves, distilled water, aloe leaves (Sourced locally), and ethylparaben (Analar grade).

Extraction of aloe gum

Fresh leaves of *Aloe barbadensis* harvested from the locally grown plant was properly identified and authenticated at the herbarium of the university. The yellowish mucilage obtained from the cut leaves was homogenized and strained to remove excess water.

The gum was precipitated from the slake by soaking in diethylether, spread and allowed to dry in air before oven drying at 40^0C for 4hrs. The dried gum was pulverized, passed through a 55mm sieve and stored in an airtight glass bottle.

Preparation of Zinc Oxide Suspension

Nine batches of the zinc oxide suspensions were formulated at 1%, 2% and 4% W/V concentrations of the different suspending agents – aloe gum acacia and NaCMC.

A 5.0g quantity of zinc oxide powder, 1.0g of aloe gum was triturated together in a dry porcelain mortar until properly mixed, then 0.05g of ethylparaben added and further triturated. Distilled water was added to form a pourable paste which was transferred to the 100ml measuring cylinder and made up to 100ml volume with water and shaken vigorously for 3 mins, (thus making a 1% W/V of aloe gum in the preparation). The procedure

was repeated using 2% W/V and 4% W/V of the aloe gum. The procedure was repeated with acacia gum and NaCMC. Products were stored at 30^{0}C.

Evaluation of Suspensions

pH measurements: Weekly pH measurements of the suspensions were done for four (4) weeks using a digital pH meter. Results obtained are shown in Table 1 and figures 1-3.

Sedimentation Volume: A 100ml volume of each of the nine different suspensions prepared were stored in different 100ml measuring cylinders for four (4) weeks at 30^{0}C. Observations were done daily for the first seven days after which weekly observations were made for 4 weeks. The initial sedimentation volume(s) were denoted as H_O and the volume at the different times of observation noted as H_t. The rate of sedimentation S_r (%) was calculated using the equation[12].

$$S_r = H_t / H_o \quad \ldots\ldots\ldots\ldots\ldots \quad 1$$

Values obtained are shown in table 2 and fig 4-6.

The percentage of H_t/H_o was plotted against time and the slopes of the graph used to assess the stability of the different suspensions.

Redispersibility Value: The nine batches of the zinc oxide suspension were redispersed simultaneously by shaking the cylinders for a given period of time using a uniform energy and method. The number of shakes at which the base of the measuring cylinder is free of sediments was noted (as shown in Table 3) and represents the redispersibility number. The lower the redispersible number, the more redispersible is the suspension[13].

RESULTS AND DISCUSSIONS

The pH values of the zinc oxide suspensions formulated at 1%, 2%, and 4% w/v concentrations of NaCMC, acacia and *aloe barbadensis* used as suspending agents as shown in table 1 and figures 1-3 indicates that the three suspending agents were fairly stable on storage for 4 wks and the values for acacia and *aloe barbadensis* (both natural polymers) were comparably similar.

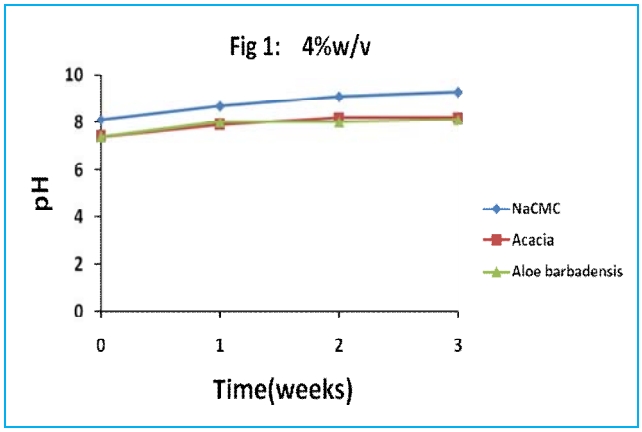
Table 1: pH values of the zinc oxide suspensions using different concentrations of the suspending agents.

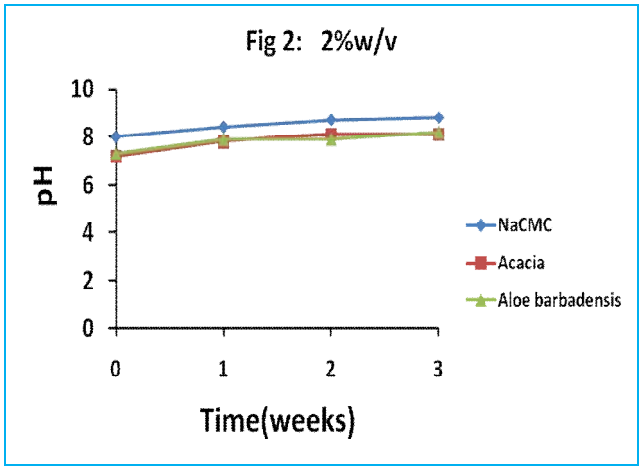
Suspending agents	Concentration % w/v	Time (weeks)			
		0	1	2	3
NaCMC	1	8.0	8.3	8.4	8.5
	2	8.0	8.4	8.7	8.8
	4	8.1	8.7	9.1	9.3
Acacia	1	7.1	7.8	8.1	8.1
	2	7.2	7.8	8.1	8.1
	4	7.4	7.9	8.2	8.2
Aloe barbadensis	1	7.3	7.8	7.9	8.2
	2	7.3	7.9	7.9	8.2
	4	7.4	8.0	8.0	8.1

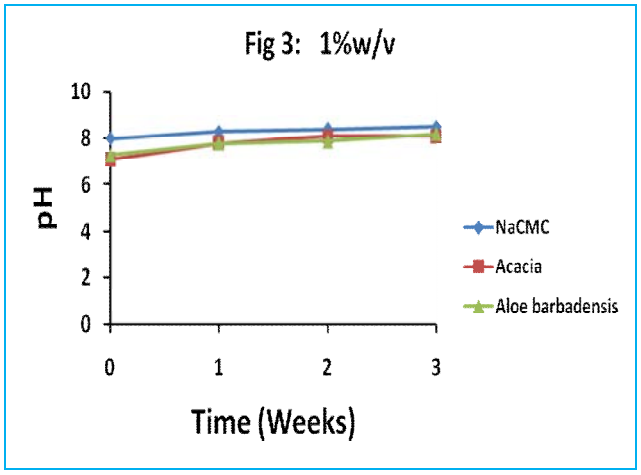
Table 2: Values of sedimentation volume (%) of zinc oxide suspensions using different concentration of suspending agents.

Suspending agent	Concentration % W/V	Sedimentation Volume											
		Time (days)								Time (Weeks)			
		0	1	2	3	4	5	6	7	1	2	3	4
NaCMC	1	100	98	95	90	85	82	80	76	76	65	54	47
	2	100	99	97	95	94	90	88	81	81	77	70	65
	4	100	100	100	100	100	100	100	100	100	98	94	91
Acacia	1	100	97	96	95	93	92	85	83	83	75	61	50
	2	100	98	97	95	94	92	89	86	86	80	70	59
	4	100	99	98	96	95	94	90	88	88	83	73	62
Aloe Barbadensis	1	100	84	76	72	70	65	59	50	48	45	45	45
	2	100	86	78	75	73	68	60	55	50	50	50	50
	4	100	95	81	78	76	70	64	60	60	58	58	58

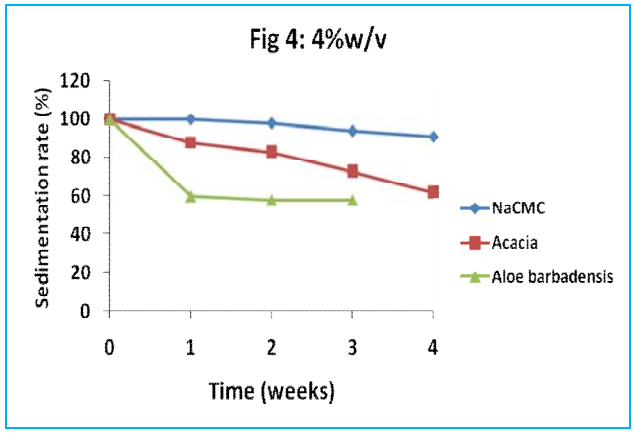
Figures 1-3: Plots of pH values of different concentrations of suspending agents.

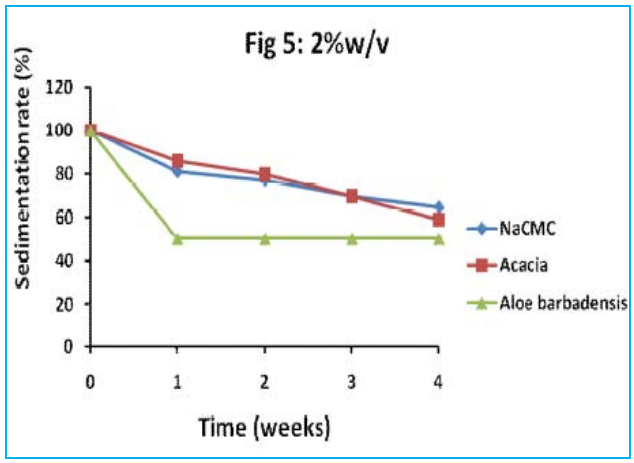


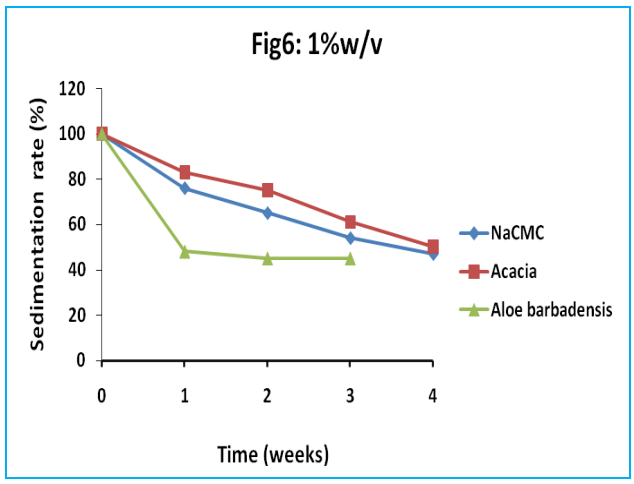




Figures 4-6: Sedimentation rates of different concentrations of suspending agents.







The sedimentation volume (%) of the different suspending agents at the different test strengths as presented in table 2 shows that at all concentrations the *aloe barbadensis* exhibited good suspending characteristics although NaCMC had better suspending qualities. At both 1% and 2%w/v acacia showed a better suspending behaviour than both NaCMC and *aloe barbadensis* (Figure 5 & 6). However, at 4%w/v NaCMC had the best values for the period of storage (Figure 4). This can be explained by the fact that NaCMC is semi-synthetic polymer and would not be degraded easily like a natural polymer over a prolonged storage period.

In terms of redispersibility *Aloe barbadensis* had the best value and is follows by acacia, and NaCMC (table 3)

This infers that Aloe barbadensis formulation would ensure a more uniform dosage administration of the medicament after shaking.

Table 3: Redispersibility after shaking

Suspending agents	Conc (%w/v)	Number of shakes
NaCMC	1	10
	2	16
	4	Incomplete redispersion
Acacia	1	6
	2	8
	4	13
Aloe barbadensis	1	5
	2	6
	4	8

CONCLUSION

The research shows that *aloe barbadensis* has good suspending qualities which are comparable with the standard materials used for the work. It can be employed for those formulations where very high viscosity is not required and this would prevent the need to dilute the viscosity material before use. Possibly an increase in the concentration of the test material may give similar result to the high viscosity material at a lower concentration. Since it is readily available locally it will reduce the cost of importation of other gums thereby enhancing the economy of the country.

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