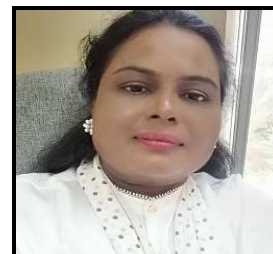


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**COMPARATIVE STUDY OF EFFECTIVENESS OF VARIOUS NATURAL  
SUSPENDING AGENTS IN PHARMACEUTICAL SUSPENSION**

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**ABSTRACT**

**Introduction/background:** A pharmaceutical suspension is a thermodynamically unstable dosage form, a stabilizer or suspending agent is necessary be added to reduce the rate of settling and permits easy redispersion of any settled particles both by protective colloidal action and by increasing the consistency of the suspending medium. **Aim:** To compare the effectiveness of natural suspending agents in pharmaceutical suspension. **Objective:** Preparation and evaluation of suspensions separately to find out the effectiveness *Abelmoschus culentus* extract, Fenugreek extract, Tamarind seed extract, Gum of tragacanth, as suspending agent. Comparative study of all natural suspending agents with standard. **Methodology:** Mortar and pestle method was used to prepare zinc oxide suspension using tragacanth as suspending agent for standard suspension. Fenugreek seed powder, Tamarind Seed powder and ladies finger gum are used as suspending agents in zinc oxide suspension. **Results:** According to ANOVA, there was no statically significant variation of sedimentation parameters found between formulation A-1, B-1 and C-1 and the formulations containing tragacanth as suspending agent. **Conclusion:** In conclusion, from all above evaluation parameters it can be concluded that fenugreek seed powder and Tamarind seed powder used in concentration of 0.25% was proving as good suspending agent in the zinc oxide suspension.

**KEYWORDS**

Zinc oxide suspension, Sedimentation volume, Degree of flocculation and Natural suspending agent.

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**INTRODUCTION**

A pharmaceutical suspension is a dosage form in which internal phase is dispersed uniformly throughout the external phase. The internal phase is consisting 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<sup>1</sup>.

### Suspending Agents

Most of the suspending agents perform two functions. Besides acting as a suspending agent they also imparts viscosity to the solution. Suspending agents form film around particle and decrease inter-particle attraction. Suspending agents also act as thickening agents. They increase in viscosity of the solution, which is necessary to prevent sedimentation of the suspended particles as per Stoke's law. A good suspension should have well developed thixotropic property. At rest the solution is sufficient viscous to prevent sedimentation and thus aggregation or caking of the particles. When agitation is applied the viscosity is reduced and provide good flow characteristic from the mouth of bottle<sup>2</sup>.

### List of Suspending Agents

- Alginates
- Methylcellulose
- Hydroxyethylcellulose
- Carboxymethylcellulose
- Sodium Carboxymethylcellulose
- Microcrystalline cellulose
- Acacia Tragacanth
- Xanthan gum
- Bentonite
- Carbomer
- Powdered cellulose
- Gelatin

The selection of amount of suspending agent is dependent on the presence of other suspending agent, presence or absence of other ingredients which have an ability to act as a suspending agent or which contributes viscosity to the medium<sup>3</sup>. The stability of the suspensions depends on the types of suspending agents rather than the physical properties of the drugs. The physical stability of suspension was mainly

dependent on the type of suspending agent rather than the physical characteristics of the drug.

A pharmaceutical suspension is a thermodynamically unstable dosage form, a stabilizer or suspending agent is necessary be added to reduce the rate of settling and permits easy redispersion of any settled particles both by protective colloidal action and by increasing the consistency of the suspending medium<sup>4</sup>.

Ideal qualities of good suspension

- It should settle slowly and easily re-dispersed on shaking it
- It should readily and evenly pour from container.
- It should be chemically inert.
- It should not form hard cake.
- It should prevent degradation of drug or to improve stability of drug.
- It should mask the taste of bitter drugs

In order to get ideal suspension, we need to choose suitable suspending agents.

Suspending agents are (i) inorganic materials, (ii) synthetic compound, (iii) polysaccharides. Natural gum like:

1. Fenugreek seeds Powder
2. Tamarind Seed powder
3. Ladies Finger powder

### Natural Gums

Natural polysaccharide gums represent a group of polymers which swell to form highly viscous solutions or dispersions in aqueous media. They have found wide application in pharmaceutical formulations such as polymer matrices in sustained release solid dosage forms, binders in tablets, stabilizers or suspending agents in liquid dosage forms, and in bio adhesive drug delivery systems. Poly saccharide gums used in the pharmaceutical and food industries<sup>5</sup>.

The natural gums like tragacanth, acacia gum or gum Arabic and xanthan gum amongst others. They have the advantage of biocompatibility, low cost and relatively wide spread availability compared to their synthetic counterparts.

Gums are widely employed in the pharmacy as thickeners, suspending agents, emulsifying agents, binders and film formers. In this research, Fenugreek gum, Tamarind Seed and Ladies Finger were used as suspending agents.

#### **Fenugreek seeds and leaves**

Fenugreek is an herb similar to clover that is native to the Mediterranean region, southern Europe, and western Asia<sup>2</sup>. The seeds are used in cooking, to make medicine, or to hide the taste of other medicine. Fenugreek seeds smell and taste somewhat like maple syrup. Fenugreek leaves are eaten in India as a vegetable<sup>6</sup>.

#### **Tamarind Seed**

Tamarind is a hardwood tree known scientifically as *Tamarindusindica*. It's native to Africa but also grows in India, Pakistan and many other tropical regions. The tree produces bean-like pods filled with seeds surrounded by a fibrous pulp. The pulp of the young fruit is green and sour. As it ripens, the juicy pulp becomes paste-like and more sweet-sour. Interestingly, tamarind is sometimes referred to as the "date of India"<sup>7</sup>.

#### **Ladies Finger**

Okra is type of green vegetable, long finger like, having a small tip at the tapering end. Its head shows a bulge, lighter green in shade, which is often removed as inedible portion. The cross section cut okra shows white colored round seed spread entirely inside the vegetable. One of the peculiar sings of this vegetable is the internal stickiness. The ladies finger may be cut into round pieces or sliced in to four halves or may be put whole in a mix vegetable curry. The taste is very specific to the vegetable and generally liked by children<sup>8</sup>.

#### **Zinc oxide suspension**

Zinc oxide as mixture with about 0.5% iron (III) oxide ( $Fe_2O_3$ ) is called calamine and is used in calamine lotion. There are also two minerals. Zincite and hemimorphite, which have been historically called calamine. When mixed with eugenol, a ligand, zinc oxide eugenol is formed, which has applications as a restorative and prosthodontics in dentistry<sup>9</sup>.

Zinc oxide can be used in ointments, cream and lotion to protect against sunburn and other damage to the skin caused by ultraviolet light. It is the broadest spectrum UVA and UVB reflector that is approved for use as sunscreen, zinc oxide sits on the skin's surface and is not absorbed into the skin, and blocks both UVA (320-400nm) and UVB (280-320nm) rays of ultraviolet light. Because zinc oxide (and the other most common physical sunscreen, titanium dioxide) are not absorbed into the skin, they are nonirritating, nonallergic, and non-comedogenic<sup>9</sup>.

Many sunscreen use nanoparticles of zinc oxide (along with nanoparticles of titanium dioxide) because such small particles do not scatter light and therefore do not appear white. Although there has been concern that they be absorbed into the skin.

#### **AIM AND OBJECTIVES**

The aim of this study to find out effective natural suspending agent which can be used as alternative for synthetic suspending agent in the formulation of pharmaceutical suspension.

- Preparation and evaluation of suspensions to find out the effectiveness *Abelmoschus culentus* extract as suspending agent.
- Preparation and evaluation of suspensions to find out the effectiveness *Fenugreek* extract as suspending agent.
- Preparation and evaluation of suspensions to find out the effectiveness *Tamarind* seed extract as suspending agent.
- Preparation and evaluation of suspensions to find out the effectiveness Gum of tragacanth as suspending agent.
- Comparative study of all natural suspending agents with standard

#### **MATERIAL AND METHODS**

##### **Chemicals and materials used**

1% (w/v) sodium metabisulphate, Fenugreek Gum, Tamarind Gum, *Abelmoschus culentus* (Ladies Finger) Gum, Pedalium Murex Gum, Tragacanth gum, Zinc Oxide, Distilled water, Acetone, Potassium dihydrogenphosphate.

## Methods

### Isolation of gum from Tamarind Seed

The crushed seeds of *Tamarindusindica* were soaked in water for 24 h, boiled for 1 h, and kept aside for 2 h for the release of gum into water. The soaked seeds were taken and squeezed in a muslin bag to remove marc from the filtrate. Then, to the filtrate, equal quantity of absolute ethyl alcohol was added to precipitate the gum. The gum was separated by filtration. The marc was not discarded but it was sent for multiple extractions with decreasing quantity of extracting solvent, i.e., water with the increase of number of extractions. The isolation was continued until the material was free of gum. The separated gum was dried in hot air oven at temperature 40°C. The dried gum was powdered and stored in airtight containers at room temperature.

### Extraction of the Ladies Finger Mucilage

About 200g of fresh immature Ladies finger were purchased from local Market. After removal of the seed, the fresh immature fruits were sliced, homogenized and extracted with cold water containing 1% (w/v) sodium metabisulphate. The crude mucilage was centrifuged at 3000rpm for 5 min and the gum was precipitated from the supernatant with acetone. The precipitated gum was washed several times with acetone. The obtained cream colored product was filtered. A light green colored powder was obtained after complete removal of moisture. This was stored in a well closed amber colored specimen bottle till ready for use.

Fenugreek seeds Powder is purchased from store.

Mortar and pestle method was used to prepare zinc oxide suspension using tragacanth as suspending agent for standard suspension. Fenugreek seed powder, Tamarind Seed powder and ladies finger gum are used as suspending agents in zinc oxide suspension.

Formulation A-1 was prepared by using tragacanth as suspending agent and potassium dihydrogenphosphate as flocculation agent but in formulation A-2 preparation, flocculation agent was not used.

Formulation B-1 has fenugreek seed powder suspending agent and potassium dihydrogenphosphate flocculation agent. On other hand, in formulation B-2, flocculation agent was not used.

Formulation C-1 was prepared by using tamarind seed powder as suspending agent and potassium dihydrogenphosphate as flocculation agent but formulation C-2 has no flocculation agent.

Formulation D-1 has ladies finger as suspending agent and dihydrogenphosphate flocculation agent. Formulation D-2 has not flocculation agent.

### A -1) Standard Suspension

Preparation of zinc oxide suspension with Tragacanth as suspending agent

1. 0.125g Tragacanth Powder, 5g of zinc oxide and 0.125g of Potassium Dihydrogenophosphate were titrated together with 5ml of glycerin till smooth paste was formed.
2. 0.1g of benzoic acid was added as a preservative.
3. 35ml of chloroform water was added gradually.
4. Mixture was transferred to cylinder and was made up to 50 ml with distilled water.

### A-2) Procedure for blank suspension

Preparation of suspension without Tragacanth as suspending agent

1. 5g of zinc oxide is mixed together with 5ml of glycerin till smooth paste was formed
2. 0.1g of benzoic acid was added as a preservative.
3. 35ml of chloroform water was added gradually.
4. Mixture was transferred to cylinder and was made up to 50ml with distilled water.

### B-1) Preparation of zinc oxide suspension with fenugreek seeds Powder as suspending agent and Potassium Dihydrogenophosphate as flocculating agent

1. 0.125g of fenugreek seeds Powder, 5g of zinc oxide and 0.125g Potassium Dihydrogenophosphate were triturated

together with 5ml of glycerin till smooth paste was formed

2. 0.1g of benzoic acid was added as a preservative.
3. 35ml of chloroform water was added gradually.
4. Mixture was transferred to cylinder and was made up to 50ml with distilled water.

**B-2) Preparation of zinc oxide suspension with fenugreek seeds Powder as suspending agent and without Flocculating agent**

1. 0.125g of fenugreek seeds Powder and 5g of zinc oxide were triturated together with 5ml of glycerin till smooth paste was formed
2. 0.1g of benzoic acid was added as a preservative.
3. 35ml of chloroform water was added gradually.
4. Mixture was transferred to cylinder and was made up to 50ml with distilled water.

**C-1) preparation Zinc oxide Suspension using Tamarind Seed as Suspending Agent and Potassium Dihydrogenophosphate as Flocculating Agent.**

1. 0.125g of Tamarind Seed Powder, 5g of zinc oxide and 0.125 of and Potassium Dihydrogenophosphate were triturated together with 5ml of glycerin till smooth paste was formed
2. 0.1g of benzoic acid was added as a preservative.
3. 35ml of chloroform water was added gradually.
4. Mixture was transferred to cylinder and was made up to 50ml with distilled water.

**C-2) preparation Zinc Oxide Suspension using Tamarind seed as suspending Agent and without Flocculating Agent**

1. 0.125g of Tamarind Seed Powder and 5g of zinc oxide were triturated together with 5ml of glycerin till smooth paste was formed
2. 0.1g of benzoic acid was added as a preservative.
3. 35ml of chloroform water was added gradually.

4. Mixture was transferred to cylinder and was made up to 50ml with distilled water.

**D-1) Preparation of zinc oxide Suspension using ladies finger as suspending agent and Potassium Dihydrogenophosphate as Flocculating Agent**

1. 0.125g of Ladies Finger Powder, 5g of zinc oxide and 0.125g of potassium dehydrogenate were triturated together with 5ml of glycerin till smooth paste was formed
2. 0.1g of benzoic acid was added as a preservative.
3. 35ml of chloroform water was added gradually.
4. Mixture was transferred to cylinder and was made up to 50ml with distilled water.

**D-2) Preparation of zinc oxide Suspension using ladies finger as suspending agent and without flocculating agent**

1. 0.125g of Ladies Finger Powder, 5g of zinc oxide and 0.125g of potassium dehydrogenate were triturated together with 5ml of glycerin till smooth paste was formed
2. 0.1g of benzoic acid was added as a preservative.
3. 35ml of chloroform water was added gradually.
4. Mixture was transferred to cylinder and was made up to 50ml with distilled water.

**EVALUATION OF SUSPENSION**

Two parameters had been evaluated,

**Sedimentation volume**

It is a ratio of the ultimate volume of sediment (Vu) to the original volume of sediment (VO) before settling.

**Degree of Flocculation**

It is the ratio of the sedimentation volume of the flocculated suspension (F) to the sedimentation volume of the suspension when deflocculated.

**RESULTS AND DISCUSSION**

**Evaluation of sedimentation volume**

The evaluation was carried on formulation A-1 on one hand and formulation B-1, C-1 and D-1. According to ANOVAs there was no statically

significant variation of sedimentation volume found between formulation A-1, formulations B-1 and formulation C-1.

**Evaluation of Degree of Flocculation:**

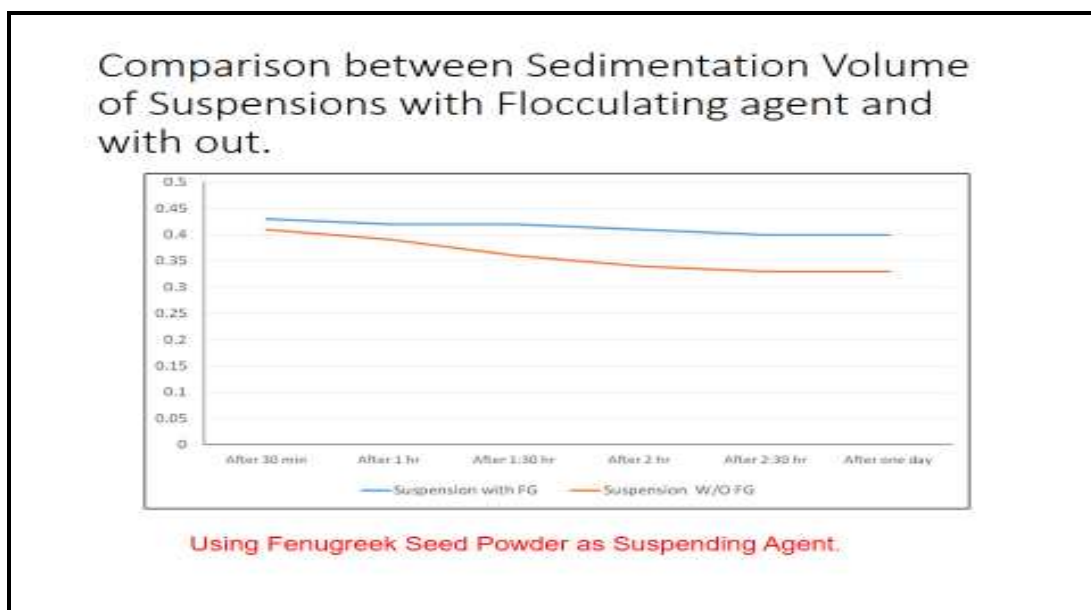
The evaluation was carried on formulation a on one hand and formulation B, C and D. According to ANOVAs there was no statically significant variation of degree of flocculation found between formulation A, B and C.

These evaluations were repeated for two times and standard deviation was found. The results were plotted as Figure No.1, 2, 3, 4, 5, 6 and 7.

From these values, it was found that Fenugreek seed powder and Tamarind seed powder could be used as suspending agent, as there is no significant variation in the sedimentation parameters between the formulations containing tragacanth as suspending agent and Fenugreek seed powder or Tamarind seed powder.

**Table No.1: Composition of the Formulations**

S.No	Ingredients	A-1	A-2	B-1	B-2	C-1	C-2	D-1	D-2
1	Tragacanth	0.125g	-	-	-	-	-	-	-
2	fenugreek seeds	-	-	0.125g	0.125g	-	-	-	-
3	Tamarind Seed	-	-	-	-	0.125g	0.125g	-	-
4	Ladies Finger	-	-	-	-	-	-	0.125g	0.125g
5	Dihydrogenphosphate	0.125g	-	0.125g	-	0.125g	-	0.125g	-
6	Glycerin	5 ml	5ml	5ml	5ml	5ml	5ml	5ml	5ml
7	Benzoic acid	0.1g	0.1g	0.1g	0.1g	0.1g	0.1g	0.1g	0.1g
8	Chloroform water	35ml	35ml	35ml	35ml	35ml	35ml	35ml	35ml
9	Distilled water	Up to 50ml	Up to 50ml	Up to 50ml	Up to 50ml	Up to 50ml	Up to 50ml	Up to 50ml	Up to 50ml
10	Zinc oxide	5g	5g	5g	5g	5g	5g	5g	5g



**Figure No.1: Comparison between sedimentation volume of suspensions with flocculating agent and without fenugreek seed powder of formulation A and B**

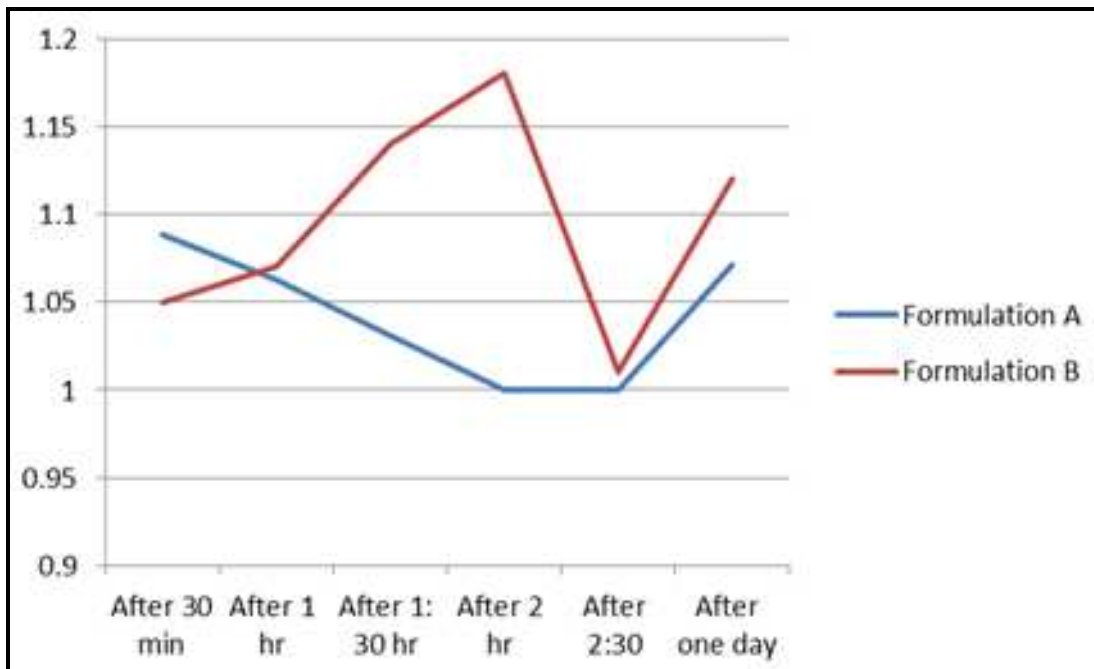


Figure No.2: Degree of flocculation of formulation A and B

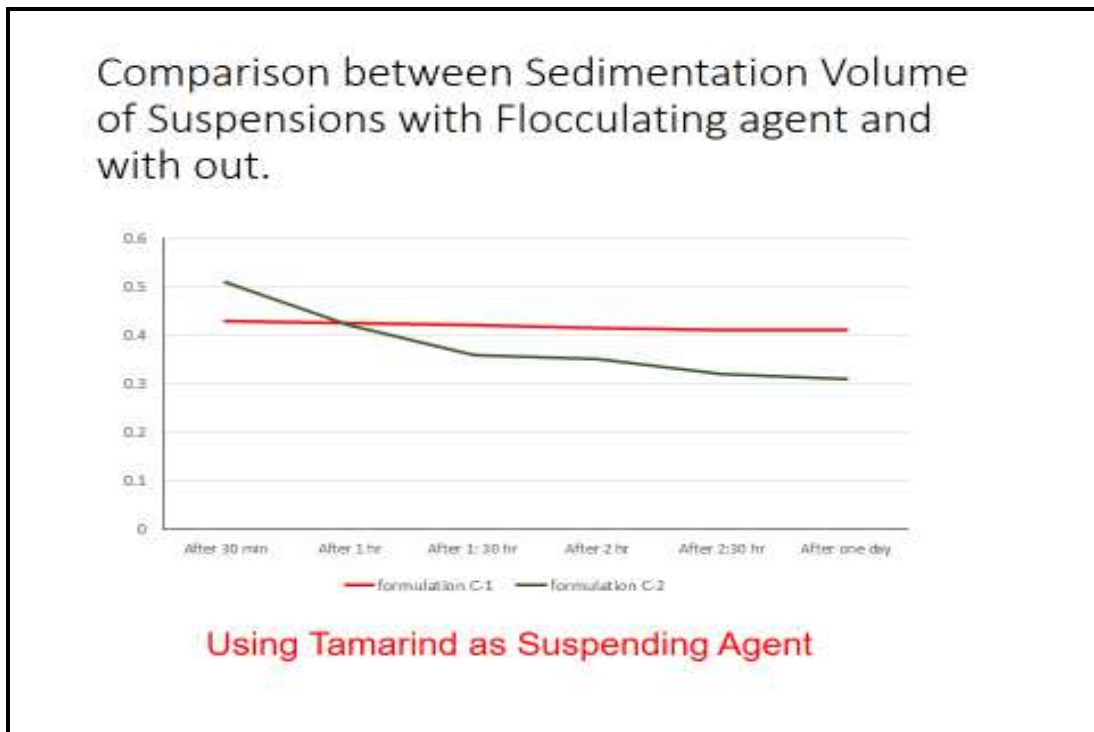


Figure No.3: Comparison between Sedimentation Volume of Suspensions with Flocculating agent and with out

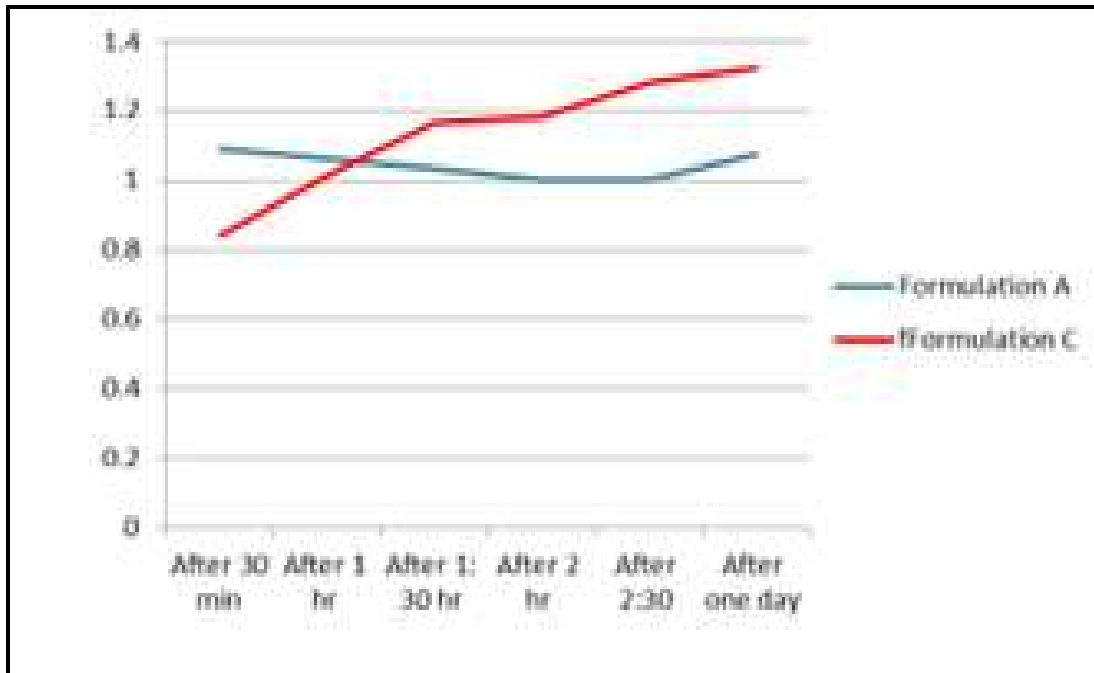


Figure No.4: Degree of flocculation of formulation A and C

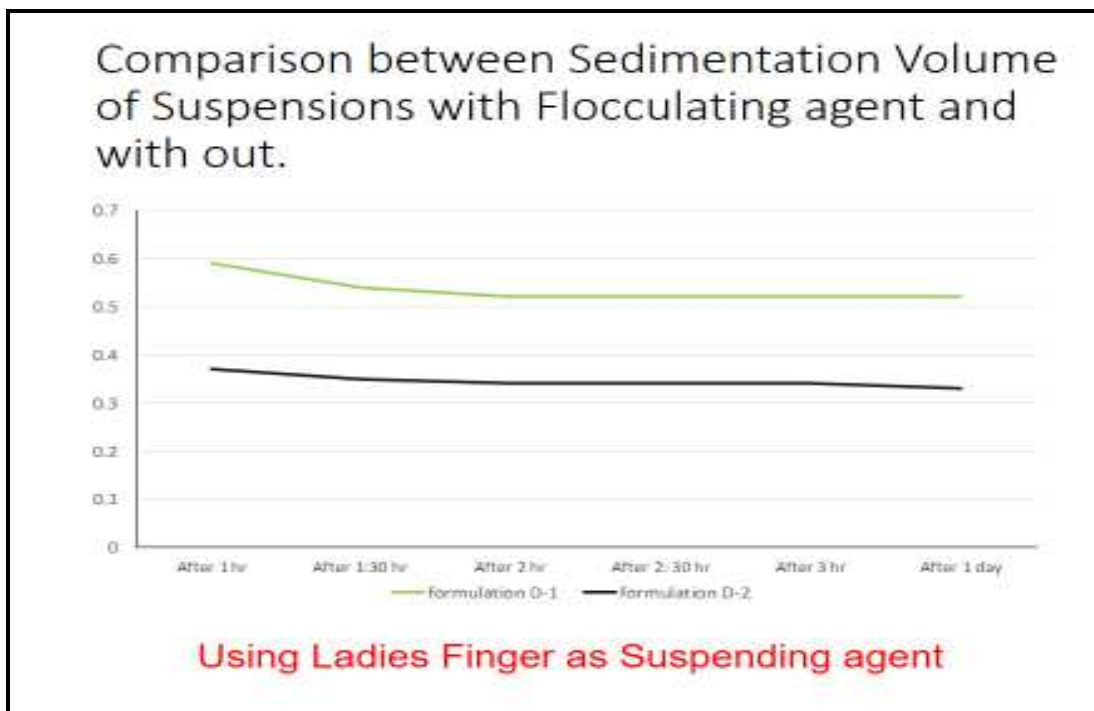


Figure No.5: Comparison between Sedimentation Volume of Suspensions with flocculating agent and without



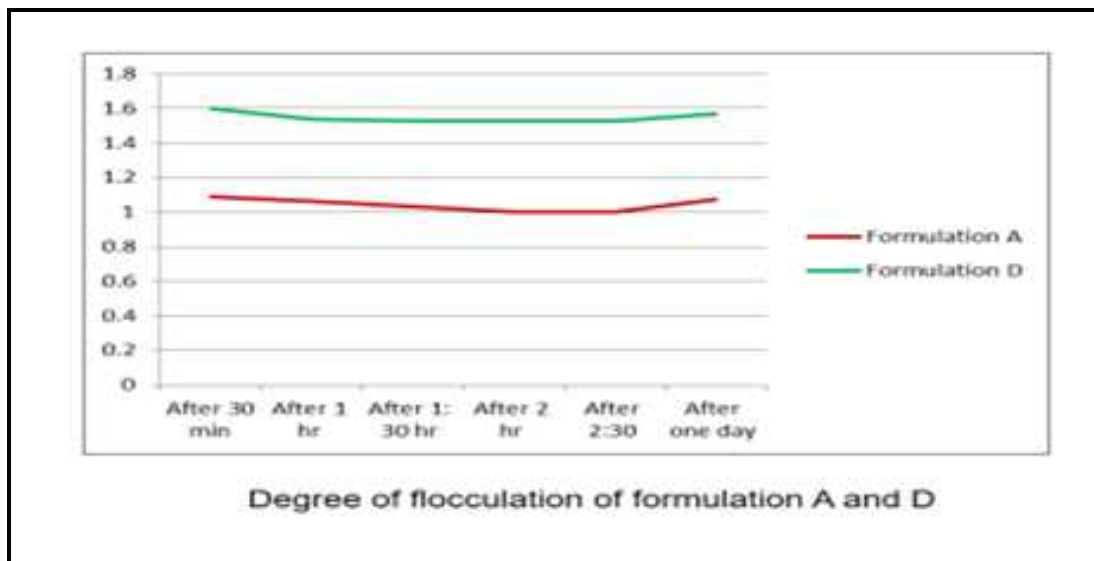


Figure No.6: Degree of flocculation of formulation A and D

## CONCLUSION

Natural plant is more important than synthetic materials because they are nontoxic, less expensive and freely available.

In this study is to find a cheap and effective natural suspending agent which can be used as an alternative suspending agent for pharmaceutical suspension.

Zinc oxide was used as pharmaceutical suspension and Tamarind, ladies finger and fenugreek seed were used as natural suspending agent.

From all formulations, A-1, B-1 and C-1 formulations showed similar sedimentation volume and formulation A, B and C have similar degree of flocculation.

In conclusion, from all above evolution parameters it can be conclude that fenugreek seed powder and Tamarind seed powder used in concentration of 0.25% was proving as good suspending agent in the zinc oxide suspension.

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## CONFLICT OF INTEREST

We declare that we have no conflict of interest.

## REFERENCES

1. Dipak Kumar Dash, Pharmaceutics, effect of particle size on stability of suspension, *Himalayan Pharmacy Institute, Sikkim*.
2. Rakesh K. Tekada. Dosage form design consideration, *National Institution of Pharmaceutical Development and Research, Academic Press*, 1<sup>st</sup> Edition, 2018, 811-812.
3. Santosh Kumar R and Naga Satya Yagnesh T. Pharmaceutical suspensions: Patient compliance oral dosage forms, *World Journal of Pharmacy and Pharmaceutical Sciences*, 5(12), 1471-1537.
4. Malviya Rishabha, Srivastava Pranati, Kumar Upendra. Formulation and comparison of suspending properties of different natural polymers using paracetamol, *J. Drug Dev. and Res*, 2(4), 2010, 886-891.
5. Martin A and Swarbrick J. American pharmacy, *Lippincott, Philadelphia*, 6<sup>th</sup> Edition, 1966, 205.
6. Ansel C, Allen L V, Popvich N G. Disperse system, *Pharmaceutical Dosage*, 8<sup>th</sup> Edition, 2011, 387-389, 398.

7. Abascal K and Yarnell E. Botanical galactagogues, *Alternative and Complementary Therapies*, 14(6), 2008, 288-294.
8. Yahia E M. Autonomous University of Queretaro, *Mexico and Salih N K E, Agricultural Research Corporation, Sudan*, 2011, 442.
9. Naseer Hussain, Tasneem Abbasi. Enhancement in the productivity of ladies finger (*Abelmoschus esculentus*) with concomitant pest control by the vermi composting of the weed salvinia (*Salviniamolesta*, Mitchell), *International Journal of Recycling of Organic Waste in Agriculture*, 6(4), 2017, 335-343.

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