

Formulation and evaluation of herbal nanosuspension of *Scoparia dulcis*

Afnan KV ^{1,*}, Jamsheer KA ², Safa Muhammed P ¹ and Raheena KA ¹

¹ Department of pharmaceuticals, Al Shifa College of Pharmacy, Poonthavanam PO, Perinthalmanna, Kerala, India - 679325.

² Al Shifa College of Pharmacy, Poonthavanam PO, Perinthalmanna, Kerala, India - 679325.

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Abstract

Background: The aim of this study is to formulate nanosuspension of *Scoparia dulcis*. This plant species is mainly used as an analgesic, antipyretic, and urinary issues as well as stomach disorders, kidney stones, hypertension, diabetes, and inflammation. In this study alcoholic extracts of *Scoparia dulcis* are used. The ionic gelation method is the most suitable method to formulate polyherbal nanosuspension.

Methods: Herbal nanosuspension was prepared by the emulsion ionic gelation method. Chitosan (CS) is a polymer, and Sodium tripolyphosphate (STPP) is an inorganic compound. Polyethylene glycol (PEG) is used as a stabilizer.

Result: The herbal nanosuspension formulations were evaluated for pH, viscosity, and stability.

Conclusion: Using optimal nanoparticles herbal nanosuspension is formulated. The F4 formulation has proper viscosity and stability.

Keywords: *Scoparia dulcis*; Herbal nanosuspension; Ionic gelation method; Chitosan; Polyethylene glycol

1. Introduction

Many illnesses and disorders can benefit from using medicinal herbs as an alternative. They are inexpensive and frequently provide fewer negative effects. Even when used in conjunction with other medications, herbal remedies can still have negative impacts on health [1].

According to recent estimates from the World Health Organization (WHO), 80% of people worldwide rely on herbal remedies for some part of their basic medical needs. Around 21,000 plant species have the potential to be used as medicinal plants, according to the WHO [2,3].

The use of medicinal herbs is seen to be quite safe because there are rarely any negative side effects. The major benefit is that these treatments work in harmony with nature. The usage of herbal remedies can benefit people of all ages and genders, which is a key fact [4-6].

Solid colloidal particles known as nanoparticles have sizes between 10 and 1000 nm. Drugs can be linked to a nanoparticle matrix, dissolved in it, or trapped inside of it. Drugs may potentially be absorbed on the surface of these systems since they have such high surface areas. Drugs, proteins, and DNA are efficiently transported to target cells and organs via polymer-based nanoparticles. Their nanoscale size encourages stability in the bloodstream and efficient diffusion through cell membranes [5-7].

*Corresponding author: Afnan KV

Around the world, *Scoparia dulcis*, sometimes called "sweet broom weed," is found in tropical and subtropical climates. Traditional uses of the plant include analgesic, antipyretic, and urinary issues as well as stomach disorders, kidney stones, hypertension, diabetes, and inflammation. *Scoparia dulcis* is a rich source of flavones, terpenes and steroids, phenols, tannins, saponins, amino acids, coumarins, and carbohydrates[8-12].

2. Materials and methods

2.1. Extracts and chemicals

Scoparia dulcis extract from Sreedha Phyto Extracts Pvt. Ltd, Jaipur, Rajasthan, Other than those already specified, the laboratory chemicals utilized in the investigation were of the analytical reagents grade and several types of equipment employed in the formulation of herbal nanosuspension were,

2.2. Methodology

2.2.1. Formulation of nanosuspension [6].

Nanosuspension is prepared by the ionic gelation method. It is based on the interaction between positively charged chitosan solution and negatively charged sodium triphosphate solution (TPP). Chitosan solution (0.1%w/v) was prepared by dissolving chitosan in 100 ml of 1.5%v/v of acetic acid, and the resulting solution was stirred at 1500rpm for 30 min on a magnetic stirrer (Different concentrations of 0.1%, 0.2%, 0.3%, 0.4%, and 0.5% were prepared). TPP solution of 0.1% was prepared by dissolving 100 mg of TPP in 100 ml of deionized water. 100 mg of extracts of *Scoparia dulcis* was added to the TPP solution and mix to form a homogenous mixture by stirring with a glass rod. Add the above mixture of TPP and extract solution drop by drop (10 ml) to the chitosan solution and kept stirring at 2,500 rpm for 3 h on a mechanical stirrer. Nanoparticles were obtained by the addition of a TPP and extract solution to a chitosan solution. The nanoparticle suspension is then centrifuged at 15,000 rpm for 10 min using a high-speed centrifuge. Discard the sediment and preserve the supernatant.

Table 1 Working formula for herbal Nano suspension

Formulations	Extract (mg)	Chitosan(cs) %w/v	Glacial acetic acid(%v/v)	STPP (mg)	PEG %v/v	Water	Sodium benzoate(%w/w)	Agitation time
F1	100	0.1	1.5	200	10	qs	0.05	90
F2	100	0.2	1.5	200	10	qs	0.05	90
F3	100	0.3	1.5	200	10	qs	0.05	90
F4	100	0.4	1.5	200	10	qs	0.05	90
F5	100	0.5	1.5	200	10	qs	0.05	90
F6	100	0.6	1.5	200	10	qs	0.05	90

STPP: Tri poly phosphate (sodium triphosphate), CS: Chitosan

2.2.2. Evaluation of herbal Nano suspension

Measurement of pH [13].

The pH of Nano suspension formulations was determined by using a digital pH meter. Prepared Nano suspension was taken in a 10ml beaker and pH was measured using a pH meter after calibrating the pH meter. The measurement of the pH of each formulation was done in triplicate and average values were calculated.

Measurement of viscosity [14].

The Nano suspension was taken in a beaker and the spindle model S64 at 10rpm (Brookfield viscometer: LV DV-1 Prime) was dipped in it for about 5 minutes and then the reading was taken.

Stability studies [15].

The stability of pharmaceutical preparation should be evaluated by accelerated stability studies. It was carried out according to ICH guidelines by storing the samples at $25\pm 2^{\circ}\text{C}$ with $60\pm 5\%$ RH and $40\pm 2^{\circ}\text{C}$ with $75\pm 5\%$ RH for 3 months using a stability chamber (Remi, India). The samples are collected at 0, 1, 2, and 3 months. It is then evaluated at 0, 1, 2, and 3 months for drug content as well as any changes in their physical appearance, and chemical stability during the storage period (after 3 months) was checked.

3. Results and discussion

3.1. pH detection- Digital pH meter

The pH of different formulations was studied using a digital pH meter and the results were found to be 6.4-6.8 and were given in Table No: 2. So, this pH range is suitable for our formulations.

Table 2 pH of the formulations

Formulation Code	pH of nanosuspension
F1	6.5
F2	6.7
F3	6.4
F4	6.7
F5	6.8
F6	6.6

3.2. Viscosity

Viscosity was studied using Brookfield viscometer spindle S64, at 10rpm in different formulations was found to be 903-984(cps) and was given in Table No: 3

Table 3 Viscosity of the formulations

Formulation Code	Viscosity of nanosuspension (cps) (at 10rpm)
F1	903
F2	911
F3	921
F4	984
F5	971
F6	979

3.3. Stability studies

The stability studies were carried out according to ICH guidelines by storing the samples at $40 \pm 2^\circ\text{C}$ with $75 \pm 5\%$ RH for 3 months using a stability chamber. Results of the stability study show a slight color change in the appearance and change in drug content of the *Scoparia dulcis* Nano suspension after exposure to stability conditions.

Table 4 Stability study

Temperature	Evaluation parameters	Observation(months)			
		0	1	2	3
		Yellowish	No	Slight	Slight
$40 \pm 2^\circ\text{C}$	Physical appearance	brown	colour change	colour change	colour Change
RH = 75%					

4. Conclusion

The aim of the study was to formulate and evaluate *Scoparia dulcis* alcoholic extract into nanosuspension. The dried powder of *Scoparia dulcis* was purchased. The phytochemicals present in the extract were identified by qualitative phytochemical screening. The alcohol extract contains carbohydrates, tannins, flavonoids, saponins, steroids, terpenes, and phenols.

Herbal nanosuspension was prepared by changing the concentration of chitosan. The method used for the preparation of Nano suspension was the Ionic gelation method. PEG is used as a stabilizer and Sodium benzoate is used as a preservative.

Stability studies of formulation F4 revealed that there was no significant difference in the physical and chemical parameters. Thus, the formulation F4 was found to be stable for 3 months.

It was finally concluded that formulation F4 was found to be having better characteristics than other formulations. The results provide scientific evidence to support the traditional use of *Scoparia dulcis* herbal nanosuspension for analgesic, antipyretic, and urinary issues as well as stomach disorders, kidney stones, hypertension, diabetes, and inflammation. Clinical and human trials have to be carried out after the scale-up studies of the optimized formulation.

Compliance with ethical standards

Acknowledgments

All the authors have contributed equally.

Disclosure of conflict of interest

No conflict of interest.

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