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Formulation And Evaluation Of Nano Based Herbal Gel

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ABSTRACT

Plant extracts may be used to create nano based gel in an environmentally friendly manner. In addition to being more ecologically friendly, these techniques enhance the generated nanogel functional capabilities and biocompatibility. Herbs have been used in traditional medicine for thousands of years, providing a good substitute or addition to traditional pharmaceutical drugs. Because of their large and complex content of biocompounds with various redox capabilities, which create a dynamic reaction environment for nanogel synthesis, plants with medicinal or traditional herbal uses are good candidates to be employed to produce nanogel. The properties of the nano based gel are significantly impacted by other synthesis parameters, including temperature, time synthesis, pH, and salt precursor concentration. The creation of nanoparticles, gel preparation, and nanogel characterization are some of the phases in the formulation and assessment process. On the global market, there is an increasing need for herbal formulations.

Keyword: Nano based gel, Herbs.

1. INTRODUCTION

Drugs or biomolecules are delivered using colloidal drug delivery systems that use nanoparticles a kind of particle with a size range of 10 to 1000 nm. The Latin term from which "nano" is derived implies "midget." Nanometers are one thousand millionth of a meter since nano size is one thousand millionth of a given unit. These nanometer-sized drug carriers are made from natural, semisynthetic, and synthetic polymeric materials. Because of their polymeric carrier, drugs or biomolecules can be absorbed, dissolved, or retained inside the matrix-like structure of nanospheres. Encased in a polymeric membrane, the medication or bioactive chemical forms a core within a vesicular structure known as a nanocapsule.

Made of macromolecules or polymers, nanoparticles are solid particles or particulate dispersions with sizes ranging from 10 to 1000 nm. When the active principle (drug or physiologically active component) is encapsulated, dissolved, adsorbed, or trapped, they can be utilized therapeutically as drug carriers. Macromolecular compounds comprise them. The production of nanospheres or nanocapsules depends on the preparation technique. The drug is contained within an acavity encir

cled by a special polymer membrane in nanocapsules, whereas in nanospheres it is evenly and physically distributed within a dense polymeric matrix. When in touch with biological fluids, polymeric nanoparticles exhibit remarkable durability, and their makeup enables regulated drug release. Drug delivery systems, biological markers, imaging, medications, healthcare goods, and the identification, diagnosis, and treatment of various ailments are just a few of the many potential uses for nanoparticles. Although their ability to be used as injectable carriers is limited by their immune system's quick detection, they are still effective drug delivery vehicles that can be used with the majority of administration routes.

2. MATERIALS AND METHODS

2.1 Collection of plant material

The plants have been selected on the basis of its availability and Folk use of the plant. Ethnobotanical surveys were conducted in different tribal localities of Madhya Pradesh. Drying of fresh plant parts were carried out in sun but under the shade. Dried leaves of Leaves of *Terminalia bellirica* was preserved in plastic bags and closed tightly and powdered as per the requirements.

2.2 Extraction of Plant Material

Leaves of *Terminalia bellirica* was shade dried at room temperature. 50 gm of dried powdered Leaves of *Terminalia bellirica* has been extracted with solvent using ethanol-water solvent in maceration process for 48 hrs, Filtered and dried using vacuum evaporator at 40^0C. The percentage yield of each extract was calculated by using following formula:

$$\text{Percentage yield} = \frac{\text{Weight of Extract}}{\text{Weight of powder drug Taken}} \times 100$$

2.3 Phytochemical Screening

The *Terminalia bellirica* extract acquire was subjected to the precursory phytochemical analysis following standard methods by Khandelwal and Kokate. The extract was screened to identify the presence of various active principles of alkaloids, glycosides, phenols, flavonoids, Terpenoids, Saponins, Steroids.

2.4 Estimation of total Phenolic, flavonoid and alkaloid Content

2.4.1 Total Phenolic content estimation

The total phenolic content of the extract was determined by the modified Folin-Ciocalteu method. 10 mg Gallic acid was dissolved in 10 ml methanol, various aliquots of 5- 25µg/ml was prepared in methanol.10 mg of dried extracted dissolve in 10 ml methanol and filter. Two ml (1mg/ml) of this extract was for the estimation of phenols. 2 ml of extract or standard was mixed with 1 ml of Folin-Ciocalteu

reagent (previously diluted with distilled water 1:10 v/v) and 1 ml (7.5g/l) of sodium carbonate. The mixture was vortexed for 15s and allowed to stand for 15min for colour development. The absorbance was measured at 765 nm using a spectrophotometer.

2.4.2 Total flavonoids content estimation

Determination of total flavonoids content was based on aluminium chloride method.10 mg quercetin was dissolved in 10 ml methanol, and various aliquots of 5- 25µg/ml were prepared in methanol. 10 mg of extract dissolved in 10 ml methanol and filter. Three (1mg/ml) of this extract was for the estimation of flavonoid. 1 ml of 2% $AlCl_3$ methanolic solution was added to 3 ml of extract or standard and allowed to stand for 15 min at room temperature; absorbance was measured at 420 nm.

2.5 Optimization of formulation of Copper nanoparticles

Table 7.1: Different formulation of Copper nanoparticles

Formulation Code	Extract (mg/ml)	Cu_2S (mm)	Ratio
CPF1	50	1	1:1
CPF2	50	2	1:1
CPF3	50	3	1:1
CPF4	50	1	1:2
CPF5	50	2	1:2
CPF6	50	3	1:2

2.6 Formulation development of gel

7.10.1 Method of preparation

Measured amounts of methyl paraben, glycerin, polyethylene glycol, and hydroalcoholic extract of cleome leaves were dissolved in approximately 100 milliliters of water. A mechanical stirrer, sometimes known as a sonicator, was then used to quickly spin the mixture. Carbopol 940 was then gradually added to the beaker with the liquid above while being stirred. To neutralize the mixture until the gel formed, a steady, constantly churning triethanolamine solution was added.

Carbopol 940 – Gelling Polymer

Triethanolamine - gelling agent, pH Adjusting agent, Neutralizer

Methyl Paraben - Preservative

Distilled Water, Glycerin and Polyethylene Glycol – Solvents

Table 7.2: FORMULATION OF GEL

Ingredients (mg)	F1	F 2	F3
Terminalia bellirica	50	50	50
Carbopol 940	500	750	1000
Glycerin	10	10	10
Polyethylene Glycol 600	0.2	0.2	0.2
Methyl Paraben	0.08	0.08	0.08
Triethanolamine	1.0	1.0	1.0
Distilled Water	100 ml	100ml	100ml

2.7 Evaluation of gel

A. Appearance and consistency:

The gel compositions' textures were visually inspected, and the table displays the findings.

B. Washability

They were personally inspected to determine how simple and thorough the water wash was after the prepared compositions were applied to the skin. The outcomes were recorded.

C. Extrudability determination of formulations

The gel compositions were put into aluminum collapsible tubes, which were then sealed. By pushing the tubes, the material was extruded, and the extrudability of the formulation was noted.

D. Determination of Spreadability

We used two common 6x2 glass slides. The gel formulation, whose spreadability required evaluation, was applied to one of the diapers. The formulation was positioned 6 cm between the first and second slides, which were placed atop each other. The gel mixture was uniformly spread between the two slides to form a thin layer because the top slide weighed 20 grams.

E. Determination of pH

A digital pH meter was used to measure the anti-acne gels' pH. The electrode was dipped into the gel solution until a steady reading was obtained after 1 gram of gel had been dissolved in 25 milliliters of clean water. There were two pH readings taken for each composition.

F. Drug content

To evaluate the medication's composition, a 10 ml volumetric flask was filled with 1 gram of gel and methanol. Three milliliters of stock solution and one milliliter of 2% AlCl3 solution have been mixed together.

G. Viscosity

The viscosity of the generated gel was measured using a Brookfield digital viscometer. The viscosity was measured at room temperature (between 25 and 30 oC) and 10 rpm using spindle number six. The appropriate mouth-sized container was filled with the appropriate amount of gel.

***H. In vitro* diffusion profile**

A weighed quantity of formulation equivalent to 1g of gel was applied to rat skin, which was thereafter slowly immersed in 100 ml of receptor medium while being continuously spun. The network's overall temperature was 37±1 ºC. At different intervals of up to four hours, a 5 ml aliquot was removed and spectrophotometrically analyzed at 295 nm.

3. RESULTS AND DISCUSSION

3.1 Result of Percentage Yield

Yield of Extraction: The yield of extracts produced from the sample using hydroalcohol solvents is displayed in Table

Table 3.1: % Yield of Leaves of *Terminalia bellirica*

S. No.	Solvents	% Yield
1.	Water	7.3

3.2 Phytochemical screening of extract

A tiny portion of the dried extracts were subjected to standard techniques for the individual analysis of phytochemicals, such as alkaloids, glycosides, saponins, flavonoids, and phenol, for each sample. A little quantity of each extract was suitably reconstituted into the distilled water to reach a concentration of 1 mg per milliliter.

Table 3.2: Phytochemical screening of extract *of* Leaves of *Terminalia bellirica*

S. No.	Constituents	Methanol extract
1.	Alkaloids	-Ve
2.	Glycosides	+Ve
3.	Flavonoids	+Ve
4.	Saponins	+Ve
5.	Phenolics	+Ve
6.	Proteins and Amino Acids	-Ve
7.	Carbohydrate	+Ve
8.	Diterpenes	-Ve

9.	Tannin	+Ve

3.3 Results of estimation of total flavonoids and phenol content

Table 3.3: Estimation of total flavonoids and phenol content of Leaves of *Terminalia bellirica*

S. No.	Extracts	Total phenolic content (mg/100mg of dried extract)	Total flavonoids content (mg/ 100 mg of dried extract)
1.	**Methanol**	3.152	3.371

3.4 Results of gel Formulation

1 Evaluation of Physical Characteristics

Table 3.4: Results of Physical Characteristics

Formulation	Colour	Clogging	Homogeneity	Texture	Washability	Extrudability
GF1	Brown	Absent	Good	Smooth	Good	Good
GF2	Brown	Absent	Good	Smooth	Good	Good
GF3	Brown	Absent	Good	Smooth	Good	Good

2 Results of Spreadability

Table 3.5: Results of spreadability

Formulation	Spreadability*(gcm/sec)
GF1	10.51±0.27
GF2	9.41±0.71
GF3	8.64±0.82

*Average of three determinations (n=3 ±SD)

3 Results of Viscosity

Table 3.6: Results of Viscosity

Formulation	Viscosity* (cp)
GF1	3241
GF2	3155
GF3	3017

*Average of three determinations (n=3 ±SD)

4 Results of flavonoid Content

Table 3.7: Results of flavonoid content in gel using $AlCl_3$ method

Formulation	Flavonoid Content (mg/100mg)
GF1	3.0274±0.025
GF2	2.914±0.041
GF3	3.172±0.053

*Average of three determinations (n=3 ±SD)

5 Results of pH

Table 3.8: Results of pH

Formulation	Ph
GF1	6.98±0.01
GF2	7.01±0.02
GF3	6.97±0.01

*Average of three determinations (n=3 ±SD)

6 Results of *In Vitro* Drug Release Study

Table 3.9: *In vitro* drug release study of prepared formulation

S. No.	Time (hr)	% Cumulative Drug Release		
		GF1	GF2	GF3
1	0.25	21.38	19.27	18.31
2	0.5	33.47	31.66	28.28
3	1	44.94	45.71	42.53
4	1.5	59.73	58.34	52.38
5	2	75.51	71.14	64.71
6	2.5	88.35	84.52	72.62
7	3	99.75	92.52	80.27
8	4	-	99.82	91.49

***In-vitro* drug release study of F1, F2 and F3**

7 Results of Stability study of optimized formulation

Table 3.10: Results of Stability study of optimized Polyherbal formulation

Formulation Code	Months	Spreadability	pH
Polyherbal Formulation (F2)	**I**	9.41±0.71	7.01±0.02
	II	9.32±0.58	7.02±0.01
	III	9.24±0.44	7.00±0.01

CONCLUSION

As a result, a great deal of study has been conducted to look at their properties and applications for a range of products, such as electrical devices, water purification, antibacterial agents in wound dressings, and anticancer agents. Phytochemical screening reveals that a number of phytoconstituents, such as Glycosides, saponins, flavonoids, phenol, tannin, Carbohydrate, are contained separately in the hydroalcoholic extract of *Terminalia bellirica*. There were 3.371 mg/100 mg of total flavonoids and 3.152 mg/100 mg of phenol in the hydroalcoholic extract of Cleome viscose, respectively.

Even though copper nanoparticles' superior physical, chemical, and biological qualities have been studied, further research is still needed to promote a safer and more effective use of the nanoparticles due to certain concerns with synthesis techniques, possible health and environmental hazards, and scale-up production.

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