Content available at: https://www.ipinnovative.com/open-access-journals

Current Trends in Pharmacy and Pharmaceutical Chemistry

Journal homepage: https://www.ctppc.org/

Original Research Article

Formulation and evaluation of herbal microsphere gel

Ankit Agrawal[1]*, Parool Jadhav[1], Honey Shukla[1], Sourabh D Jain[1], Arun Kumar Gupta[1]

[1] *Chameli Devi Institute of Pharmacy, Indore, Madhya Pradesh, India*

ARTICLE INFO

Article history:
Received 02-06-2024
Accepted 28-06-2024
Available online 07-09-2024

Keywords:
Herbal gel
Tamarind
Microspheres
Transdermal

ABSTRACT

Formulation and evaluation of herbal microsphere gel involves designing a gel-based delivery system for herbal active ingredients encapsulated within microspheres. The process typically includes selecting suitable herbal extracts, encapsulating them into microspheres using techniques like solvent evaporation or emulsion-solvent evaporation, and then incorporating these microspheres into a gel base. Evaluation criteria may include physical characteristics (particle size, morphology), drug release kinetics, rheological properties, stability, and efficacy of the herbal ingredients. This approach aims to enhance the stability, controlled release, and therapeutic efficacy of herbal compounds, offering potential applications in various fields including pharmaceuticals, cosmetics, and personal care products. This present study demonstrated the effectiveness of carbopol based herbal gel containing extracts of tamarind possessing antibacterial activity. Thus, the formulated herbal gel incorporated with tamarind extracts show great promises in the management of antibacterial activity. Gel loaded with microspheres of tamarind was prepared with aim to deliver the drug which passes through transdermal route as it provides quick onset of action when compared to oral route. This gel loaded with microspheres of tamarind was successfully prepared using solvent evaporation method.

1. Introduction

Herbal Formulation: Herbal Formulation means a dosage form consisting of one or more herbs or processed herbs in specified quantities to provide specific nutritional, cosmetic benefits meant for use to diagnose, treat, mitigate diseases of human beings or animals, alter the structure or physiology of human beings or animals. [1]

Herbal Formulation are available as tablets, capsules, powders, extracts, teas and soon.

The main use of herbal medicines is for health promotion and therapy for chronic, as opposed to life - threatening conditions.

Consuming herbs may help to prevent and manage heart diseases, cancer, and diabetes. It may also help to reduce blood clots and provide anti-inflammatory and anti-tumor properties. [2]

2. Microspheres

These are small, spherical particles usually made up of biodegradable and biocompatible polymers having a size ranging from 1 to 1000 μm and incorporating drugs and other bioactive within their core. Microspheres may provide more prolonged contact with the nasal mucosa, which enhances rate and extent of drug absorption. Microspheres for intranasal applications are usually prepared using biocompatible materials, such as starch, albumin, dextran, and gelatin. The major advantage of microspheres is

* *Corresponding author*.
E-mail address: agrawalankit.ash@gmail.com (A. Agrawal).

https://doi.org/10.18231/j.ctppc.2024.026

their provision of stability for labile compounds that are easily degraded in the intestinal epithelium. Eudragit S100 microspheres have the potential to act as an oral carrier for peptide drugs, like insulin. Microspheres are various types like Bioadhesive microspheres, Magnetic microspheres, Floating microspheres, radioactive microspheres, Polymeric microspheres, Biodegradable polymeric microspheres, Synthetic polymeric microspheres and are prepared by methods like Spray Drying, Solvent Evaporation, Single emulsion. site and lead to potential risk, embolism and further organ damage. The microspheres are formed by polymeric crosslinking, with multiple interconnecting spaces. These porous microspheres are loaded with the drug by diffusion, acting similarly to a sponge, and are able to entrap a wide range of active ingredients such as emollients, essential oils, and sunscreens. The size of the microspheres was influenced by the stirring speed, organic solvent and molecular weight of polymers. The microspheres were spherical in shape with a smooth and non porous surface. The water miscibility of organic solvents plays a role in successful entrapment of proteins. Biodegradable polymers are frequently used for the development of microsphere matrixes such as polylactic acid and copolymer of lactic acid and glycolic acid. Apart from them, there is an extensive range of microspheres prepared from albumin, albumin dextran sulfate, and fibrinogen. Microspheres are supplied as a dry powder. Density: 0.985g/cc - 1.005g/cc (Designed for Water Suspension); Daylight Color: Fluorescent Red (607nm Peak); Fluorescent Response: Fluorescent Red under 300-550nm wavelengths.[3]

3. Gel

Gel is defined as "semisolid system is consisting of dispersion made up of either small in organic particles or large Organic molecules inclosing and interpenetrated by liquid." Gels are also defined as semirigid system in which the movement of dispersing medium is restricted by an interlacing three-dimensional network of particles or solvated macromolecules of dispersed phase.[4]

Herbal gel: It is drug or a preparation made from a plant or plants and used for any search purpose herbal medicines are the oldest form of health care know to mankind. Hydrogels are widely used in everyday products such as nappies, hair gels, and contact lenses, wound dressings and controlled release drug delivery systems. Hydrogels similar to those in nappies are used in soil to absorb large amounts of water and the release it slowly to plants. Viscosity of polyherbal gels were determined by using Brookfield viscometer and were ranging between 4500 to 4900 centipoise.[5] There are six different types of gel or acrylic manicures that are most popular: soft gel, hard gel, gradient gel, vinylux, acrylic or dip powder. The gel manicure process starts with the application of a simple base coat.

4. Antibacterial

Antibacterial are the subclass of antibiotics, which can be naturally obtained from fungal sources, semi-synthetic members which are chemically altered natural product and or synthetic. Cephalosporins, cefamycins, benzylpenicillin, and gentamicin are well- known examples of natural antibiotics/antibacterials.[6]

Uses: Antibiotics are medicines that fight bacterial infections in people and animals. They work by killing the bacteria or by making it hard for the bacteria to grow and multiply. Antibiotics can be taken in different ways: Orally (by mouth): This could be pills, capsules, or liquids. Topically: This might be a cream, spray, or ointment that you put on your skin. It could also be eye ointment, eye drops, or ear drops. Through an injection or intravenously (IV): This is usually for more serious infections.

5. Tamarind

Tamarind (Tamarindus indica) is a leguminous tree bearing edible fruit that is indigenous to tropical Africa and naturalized in Asia. The genus Tamarindus is monotypic, meaning that it contains only this species. It belongs to the family Fabaceae. The tamarind tree produces brown, pod-like fruits that contain a sweet, tangy pulp, which is used in cuisines around the world. The pulp is also used in traditional medicine and as a metal polish. The tree's wood can be used for woodworking and tamarind seed oil can be extracted from the seeds. Tamarind's tender young leaves are used in South Indian and Filipino cuisine. Because tamarind has multiple uses, it is cultivated around the world in tropical and subtropical zones. Tamarind extract was active against all the test Gram-positive bacteria isolates but was highly effective against Staphylococcus aureus, Staphylococcus epidermidis, Bacillus subtilis and Listeria monocytogenes with an inhibition zone of 18 mm, 19 mm, 16 mm and 16 mm, respectively. Tamarind extract contains natural compounds that have antimicrobial effects. In fact, studies show that this plant may have antifungal, antiviral, and antibacterial activity. It has also been used in traditional medicine to treat diseases like malaria. The antioxidant and anti-inflammatory effects of tamarind protect the skin's natural barrier and slow down signs of aging. Tamarind contains hyaluronic acid, a naturally occurring polysaccharide, which is a fantastic skin care ingredient due to its immense anti-aging benefits which is used in cuisines around the world. The pulp is also used in traditional medicine and as a metal polish. The tree's wood can be used for woodworking and tamarind seed oil can be extracted from the seeds. Tamarind's tender young leaves are used in South Indian and Filipino cuisine. Because tamarind has multiple uses, it is cultivated around the world in tropical and subtropical zones. Tamarind extract was active against all the test Gram-positive bacteria isolates

but was highly effective against Staphylococcus aureus, Staphylococcus epidermidis, Bacillus subtilis and Listeria monocytogenes with an inhibition zone of 18 mm, 19 mm, 16 mm and 16 mm, respectively. Tamarind extract contains natural compounds that have antimicrobial effects. In fact, studies show that this plant may have antifungal, antiviral, and antibacterial activity. It has also been used in traditional medicine to treat diseases like malaria. The antioxidant and anti-inflammatory effects of tamarind protect the skin's natural barrier and slow down signs of aging. Tamarind contains hyaluronic acid, a naturally occurring polysaccharide, which is a fantastic skin care ingredient due to its immense anti-aging benefits.[7]

6. Experimental Work

6.1. Extraction of tamarind pulp

1. 250 gm of tamarind was taken in beaker.
2. Added 3/4 cup of water into it.
3. Boiled it for 30 minutes.
4. Kept it aside for some time to cool.
5. Filtered the extract.

Figure 1

Figure 2: Concentrated tamarind pulp

Figure 3: Tamarind microspheres

6.2. Preparation of microspheres

1. Extract was concentrated and added required amount of sodium alginate.
2. Made 1% solution of calcium carbonate in 100 ml of beaker.
3. Filled the mixture of extract and alginate in syringe and through needle.
4. Microspheres were formed in beaker.
5. Allowed the microspheres to dry for 3 days on Whatman Filter Paper

6.3. Preparation of microsphere gel[8]

1. Accurately weighed carbopol 934 was taken in a beaker and dispersed in 50ml of distilled water.
2. Kept the beaker aside to swell the carbopol for half an hour and then stirring was done using mechanical/ lab stirrer at 1200 rpm for 30 min.
3. Taken 5ml of propylene glycol and required quantity of extract.
4. Taken 5ml propylene glycol in another beaker and added weighed quantity of propyl paraben and methyl parabento it and stirrered properly.

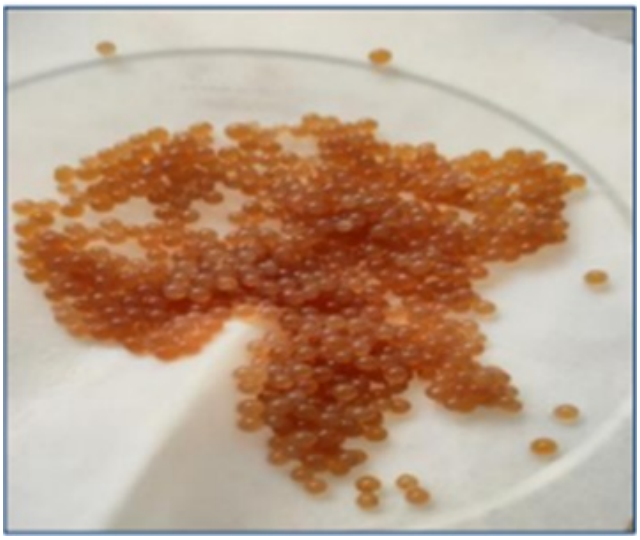

Figure 4: Tamarind microspheres

5. After all carbopol dispersed, 1gm extract and preservatives solutions were added with constant stirring.
6. Finally, volume made up to 100ml by adding remaining distilled water and triethanolamine was added drop wise to the formulation for adjustment of required skin p.H. (6.8-7) and to obtain the gel at required consistency.

Figure 5: Tamarind microspheres gel

7. Evaluation Tests

1. *Physical appearance:* The prepared gel formulation was inspected visually for its colour, homogenecity and condsistency.
2. *Measurement of pH:* Herbal gel formulation was diluted with distilled water (1:10) and pH was measured using pH meter.
3. *Viscosity:* The viscosity of developed gel formulation was determined by using Brookfield Viscometer with spindle no. 7.
4. *Spreadability:* Spreadability is expressed in terms of time taken in seconds by two slides to slip off from the gel placed between them, under certain load. The standardized weight tied on the upper plate was 20gm and length of the glass slide was 6cm. The lesser the time taken for separation of the two slides, the better is the Spreadability. The Spreadability was calculated by using the following:

Spreadability = Weight length/Time

Figure 6: Spreadibility test

5. *Extrudability*: The gel formulation were filled in standard capped collapsible aluminum tubes and sealed by crimping to the ends. Weights of the tubes were recorded. The tubes were placed between two glass slides and were clamped. 500gm was placed over the slides and then the cap was removed. The amount of the extruded gel was collected and weighed. The percentage of extruded gel was calculated.

8. Result and Discussion

1. *Physical evaluation:* The description of the various formulated gel with regards to their organoleptic description and physical features are presented in table no. 1.
2. *Determination of pH:* The pH of the formulated herbal gel is presented in table no.2.
3. *Spreadability:* The Spreadability of the formulated herbal gel is presented in table no.2.

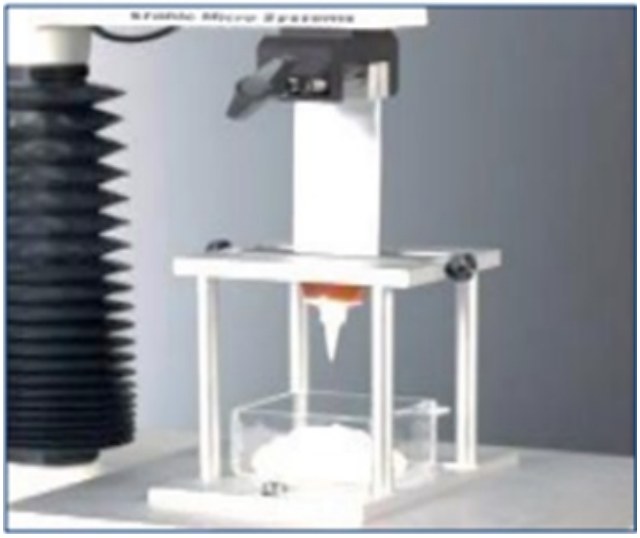

Figure 7: Extrubility test

4. *Extrudability:* The tube Extrudability of the herbal gel is presented in table no.2.
5. *Determination of viscosity:* The viscosity of the formulated herbal gel is presented in table no.2.

Table 1: Physical evaluation

Color	White
Odour	Characteristic smell
Texture	Smooth
Appearance	Thick, smooth
Ease of application	Easy to apply
Ease of removal	Easy to remove
Feel on skin	Spreads on skin, smooth

Table 2: Evaluation test

Evaluation parameters	**Readings**
pH	6.8
Spreadability (mm)	16.0 ± 0.5
Extrudability (g/cm^2)	1086.95
Viscosity	4.7 ± 0.4

8.1. Benefits of microsphere in drug delivery system

Microspheres are used as controlled drug delivery systems for a variety of applications including chemotherapy, cardiovascular disease, hormone therapy, therapeutic protein delivery, and vaccine development. Delivery of drugs through biodegradable microspheres has numerous applications compared to conventional delivery systems. While in conventional systems the drug is usually released shortly after delivery of drug and stops the working after brief period of time, biodegradable polymer offers away to provide sustained release over a longer time, thus eliminating the need for multiple doses and ensuring sustained and controlled drug delivery over weeks or months. Use of biodegradable polymers minimizes the possibility of toxicity problems, but does produce by-products that must be tolerated without adverse reactions.

9. Summary

Formulation and evaluation of herbal microsphere gel involves designing a gel-based delivery system for herbal active ingredients encapsulated within microspheres. The process typically includes selecting suitable herbal extracts, encapsulating them into microspheres using techniques like solvent evaporation or emulsion-solvent evaporation, and then incorporating these microspheres into a gel base. Evaluation criteria may include physical characteristics (particle size, morphology), drug release kinetics, rheological properties, stability, and efficacy of the herbal ingredients. This approach aims to enhance the stability, controlled release, and therapeutic efficacy of herbal compounds, offering potential applications in various fields including pharmaceuticals, cosmetics, and personal care products.

10. Conclusion

This present study demonstrated the effectiveness of carbopol based herbal gel containing extracts of tamarind possessing antibacterial activity. Thus, the formulated herbal gel incorporated with tamarind extracts show great promises in the management of antibacterial activity. Gel loaded with microspheres of tamarind was prepared with aim to deliver the drug which passes through transdermal route as it provides quick onset of action when compared to oral route. This gel loaded with microspheres of tamarind was successfully prepared using solvent evaporation method.

11. Source of Funding

None.

12. Conflict of Interest

None.

References

1. Jose J, Raju D, Nayak P. Microspheres-novel drug delivery carrier for plant extracts for antibacterial activity. *Res J Pharm Technol*. 2018;11(4):1681.
2. Nayak AK, Pal D. Tamarind seed polysaccharide: An emerging excipient for pharmaceutical use. *Indian J Pharm Educ Res*. 2017;51(2).
3. Zhang J, Xu S, Zhang S, Du Z. Preparation and characterization of tamarind gum/ sodium alginate composite gel beads. *Iranian Polym J*. 2008;17(12).

4. Phetnin R, Rattanachan ST. Preparation and antibacterial property on silver incorporated mesoporous bioactive glass microspheres. *J Sol-Gel Sci Technol*. 2015;75:279–90.
5. Masuda N, Kawashita M, Kokubo T. Antibacterial activity of silver-doped silica glass microspheres prepared by a sol-gel method. *J Biomed Mater Res B Appl Biomater*. 2007;83:114–20.
6. Sharma M, Mondal D, Mukesh C, Prasad K. Preparation of tamarind gum based soft ion gels having thixotropic properties. *Carbohydr Polym*. 2014;102:467–71.
7. Hu C, Feng H, Zhu C. Preparation and characterization of rifampicin-PLGA microspheres/sodium alginate in situ gel combination delivery system. *Colloids Surf B Biointerfaces*. 2012;95:169–9.
8. Nouri-Felekori M, Khakbiz M, Nezafati N, Mohammadi J, Eslaminejad MB. Comparative analysis and properties evaluation of gelatin microspheres crosslinked with glutaraldehyde and 3-glycidoxypropyltrimethoxysilane as drug delivery systems for the antibiotic vancomycin. *Int J Pharm*. 2019;557:208–20.

Author biography

Ankit Agrawal, Associate Professor

Parool Jadhav, Student

Honey Shukla, Student

Sourabh D Jain, Associate Professor

Arun Kumar Gupta, Principal

Cite this article: Agrawal A, Jadhav P, Shukla H, Jain SD, Gupta AK. Formulation and evaluation of herbal microsphere gel. *Curr Trends Pharm Pharm Chem* 2024;6(3):122-127.