Open Access Review Article

Jan.-Feb.2026, Vol. 02 (1), 43-53

INTERNATIONAL JOURNAL OF PHARMACEUTICAL RESEARCH AND MEDICINAL PLANTS

(An International Peer Reviewed Journal)

Formulation and Evaluation of Pharmaceutical Microbeads

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ARTICLE INFO:

Received: 04th Jan. 2026; **Received** in revised form: 17th Jan. 2026; **Accepted:** 20th Feb. 2026; **Available online:** 27th Feb. 2026.

Keywords: Ionotropic, Gelation, Polyelectrolyte, Cross linking, Polyanion.

DOI:
https://doi.org/10.61280/9krxaw20

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ABSTRACT

Microbeads are tiny, spherical polymeric particles that are used extensively in the biomedical, cosmetic, and pharmaceutical industries. They range in size from 1 µm to 1000 µm. They are an effective carrier system for targeted and regulated drug delivery because of their special physicochemical characteristics, which include high surface area, biocompatibility, and the capacity to encapsulate both hydrophilic and hydrophobic medications. To obtain the necessary drug release profiles and stability, a variety of natural and synthetic polymers, including as alginate, chitosan, gelatine, pectin, and xanthan gum, are used in the manufacturing of microbeads. The type of medication, polymer, and intended release properties all influence the method choice. To guarantee optimal performance, the prepared microbeads are assessed for swelling index, drug entrapment efficiency, surface morphology (using SEM), particle size distribution, and in-vitro drug release behaviour. With benefits including longer therapeutic action, fewer doses, and better patient compliance, microbeads have found use in parenteral, topical, and oral drug delivery systems. The formulation strategies, characterisation methods, medicinal uses, and most current developments in microbeads technology are all covered in detail in this chapter. Additionally, it highlights how synthetic microbeads affect the environment and the necessity of sustainable materials and regulatory oversight to guarantee both environmental safety and therapeutic efficacy.

INTRODUCTION

Microbeads are nearly spherical in shape and range in diameter from 0.5 to 1000 µm. The solid and free-flowing particulate carriers that contain dispersed medication particles in crystalline or solution form allow for treatment with various active agents with a variety of release profiles or a sustained release with few side effects. Moreover, the microbeads continue to work in physiological conditions. Additionally, they can be

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altered to incorporate drugs and administer them locally at high concentrations, guaranteeing that therapeutic dosages are reached at the intended location and minimizing adverse effects by keeping systemic quantities low. The microbeads are made by combining a number of polymers in a certain ratio, such as binding agents like gelatin and chondroitin, cationic polymers like chitosan, and anionic polymers like sodium alginate.[1] When compared to non-disintegrating single unit dosage forms, multiple unit dosage forms, like microspheres or microbeads, have become more popular as oral drug delivery systems due to their more uniform drug distribution in the gastrointestinal tract, more uniform drug absorption, decreased local irritation, and removal of undesired intestinal retention of polymeric material.

A prolonged release or numerous release profiles of treatment with different active agents without significant side effects are made possible by microbeads, which are tiny, solid, and free-flowing particle carriers that contain dispersed drug particles in either crystalline or solution form.[2] The article highlights the fundamentals, benefits, and drawbacks of several microbeads manufacturing processes, including ionotropic gelation, emulsification, and spray drying. We also look at methods for improving release patterns, encapsulation effectiveness, and drug loading. Modern characterization techniques for assessing the characteristics of microbeads, including as size distribution, surface morphology, zeta potential, and in vitro drug release investigations, are also covered in the study. In addition, we discuss the difficulties in formulating microbeads, possible remedies, and regulatory issues related to their creation.[3] Antacid-loaded beads can be used orally to treat a variety of conditions, including peptic ulcers, ulcerative colitis, cancer, and intestinal infections. [4]A range of polymeric materials, such as proteins, polyacrylates, polyalkylcyanoacrylates, polysaccharides, and polyalphahydroxy acids, including polylactide and copolymers, have been used to create microbeads. Microbeads for controlled release have been prepared using a variety of natural and synthetic polymers.[5]Because of their superior qualities over synthetic polymers, including their capacity to thicken, emulsify, stabilize, encapsulate, swell, and form gels and films, as well as their biocompatibility and biodegradability, natural polysaccharide hydrogels have found extensive use as drug release modifiers in a number of controlled drug delivery systems. Alginic acid, a naturally occurring polymer present in all brown algae species and several bacterial species, is the salt of sodium alginate (SA).[6].

POLYMERS USED IN MICROBEADS:

Natural polymers are weaker, less thermally stable, and more soluble. Enhancing these qualities is therefore crucial for broad polymer applicability. These polymers are unquestionably improved by synthetic cross-link polymers. Cross-linking is divided into two categories based on the synthesis method: in-situ cross-linking and post-cross-linking polymers. While post-cross-linking is a technique of cross-linking after polymerization, in-situ cross-linking is a direct cross-linking of a functional monomer with a cross-linker to produce a macromolecular chain of polymer. Depending on its kind, polymer cross-linking can be either

irreversible or reversible. There are three primary cross-linking techniques that have been extensively researched. These cross-linking techniques include biological, physical, and chemical ones. [7]

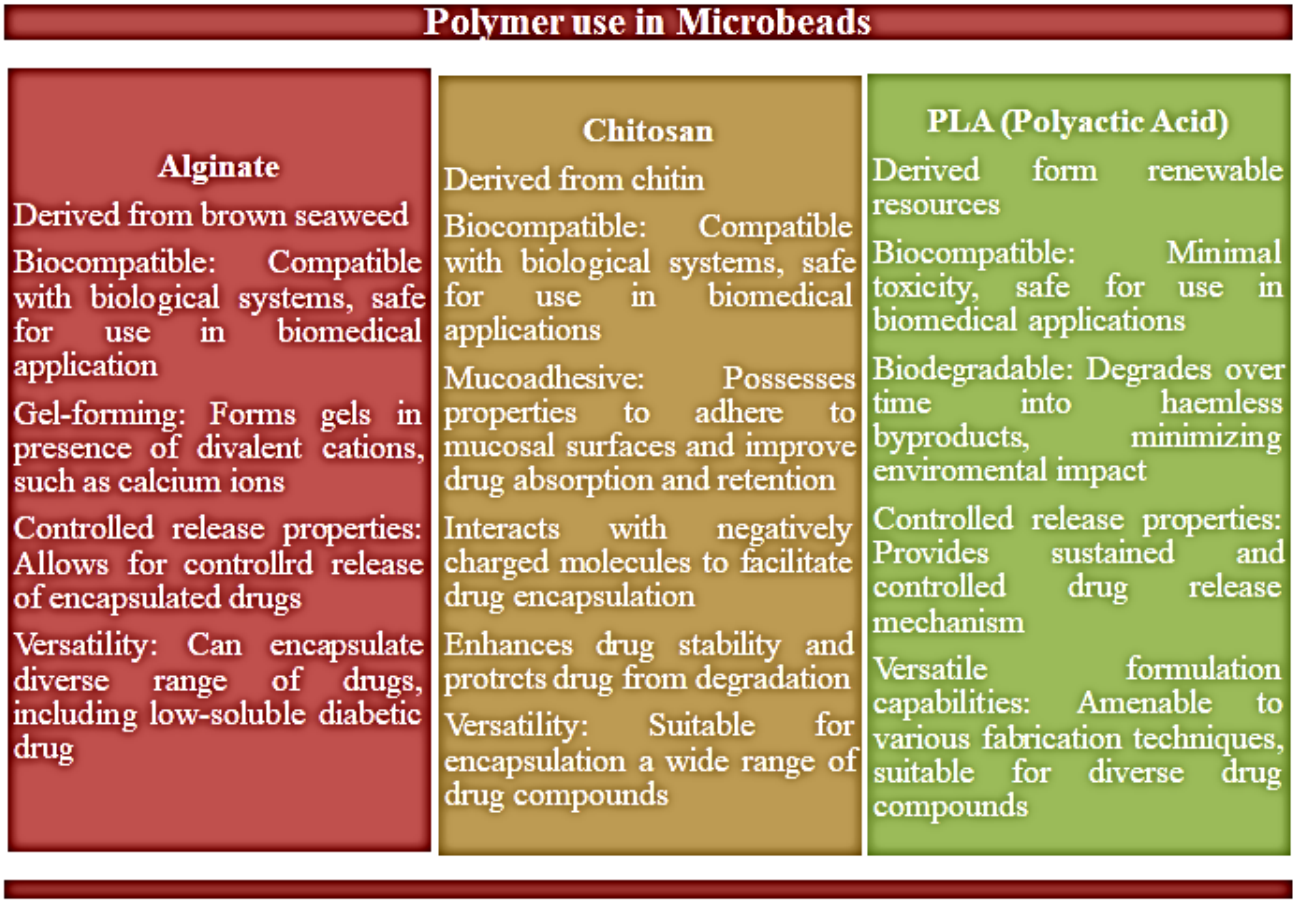


Fig. 1: Polymers in Mirobeads

Pectin:

Pectin are interesting since they are used extensively in many different industries. For example, pectin are utilized as thickening and gelling agents in food. Pectin' superior biocompatibility and specialized pH sensitivity allow for targeted distribution, including colon-specific, which is why the pharmaceutical industry uses them in drug delivery applications. Pectin can be given to humans without limiting their daily intake. Pectin are also believed to have anticancer properties, divalent metals with urine, facilitate the removal of harmful substances, slow down the absorption of glucose, and lower blood cholesterol levels. Pectin gel microbeads have the potential to serve as drug delivery vehicles. The temporal profile of material release from the beads can be changed by regulating the rate of gel decomposition. [8]

Xanthan Gum:

A natural, biosynthetic, edible gum made of extracellular polysaccharides is xanthan gum. Glucuronic acid, mannose, and glucose make up xanthan gum. The polyelectrolyte structure of the xanthan molecule accounts for its great solubility in both hot and cold water. Xanthan gum is used to increase viscosity and is primarily thought of as a nongelling agent. It provides a consistent viscosity by quickly hydrating in cold water without lumping. [9]

Equipment's used for Formulation of Microbeads:

1. Magnetic Stirrer: For combining and agitating the drug-polymer mixture.

2. Syringe and Needle: To inject the polymer solution into cross-linking agents under controlled conditions.
3. Drying Equipment: For drying microbeads, use a lyophilizer or tray drier.
4. Scanning Electron Microscope (SEM): To evaluate the shape of microbeads.
5. Analytical Instruments and Calibration Standards: For analytical techniques used in drug content analysis and other assessments, such as HPLC or UV-Vis spectrophotometry.
6. Safety Gear: To guarantee the security of researchers working with chemicals, personal protective equipment (PPE) such as lab coats and gloves is required. [10]

Drug Selection criteria for Formulation of Microbeads:

A careful assessment of a number of factors is necessary when choosing medications for microbeads formulation in order to guarantee peak performance and therapeutic efficacy. Drugs with issues like limited solubility or poor bioavailability benefit greatly from the use of microbeads as drug delivery vehicles. Customized release profiles are made possible by the selection procedure being guided by the drug's therapeutic aim and its unique release requirements. In order to maintain the drug's integrity throughout formulation and storage inside the microbeads, its chemical stability is also an important factor. Important elements affecting drug selection include loading capacity, biodegradability, release kinetics, and compatibility with selected polymers. In addition, the drug's target tissue or organ, biocompatibility with the microbeads components, and regulatory compliance are all crucial factors taken into account for a successful microbeads formulation. [10]

Microbeads Production:

The discovered technique serves as the basis for the production of EVA microbeads. As shown in, protein particles were suspended in an EVA-di-chloromethane solution before being transferred into a sealed flask that had been agitated. The agitated protein/dissolved EVA suspension was forced through glass tubing and then through a needle using air pressure. To maintain a consistent suspension flow rate (0.5 ml/min) throughout all experiments, the air pressure was controlled. Four centimetres below the needle, a ground was added to the collecting solution, and a positive electrode was attached to the needle. The results served as the basis for this applied charge arrangement. Three applied charges—0, 3, and 4 kV—were examined. [11]

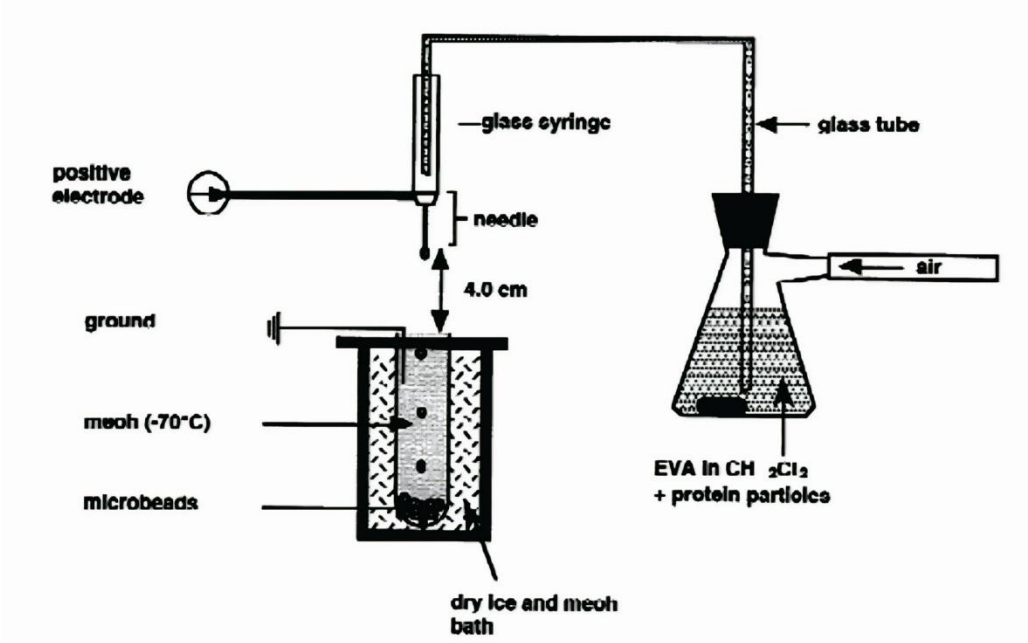


Fig. 2: Production of Microbeads

FORMULATION METHODS OF MICROBEADS:

1. Ionotropic Gelation Method
2. Emulsion Gelation Method
3. Polyelectrolyte Complexation Methods

1. Ionotropic Gelation Method:

To start cross linking, an ionic polymer must merely engage with an oppositely charged ion. The electro-neutrality principle cannot fully account for the interaction of polyanion with cations, in contrast to simple monomeric ions. The ability of cations to conjugate with anionic functions or vice versa is influenced by the present of other groups and the three-dimensional structure.[12]

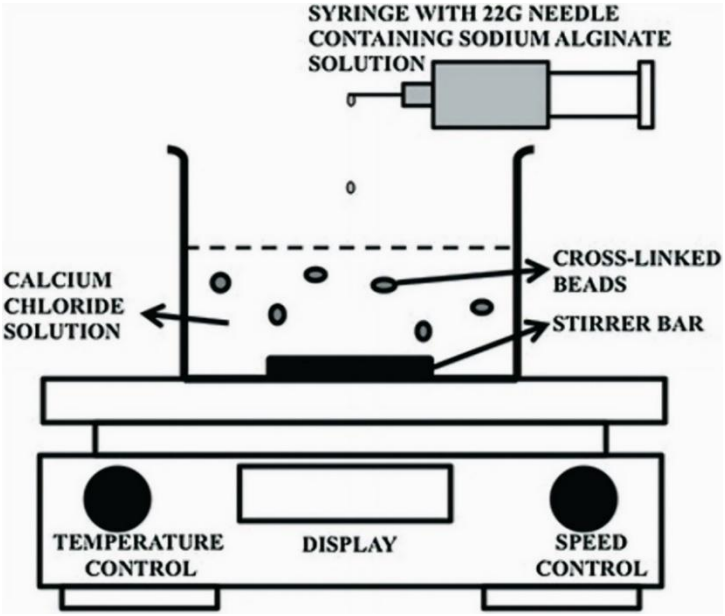


Fig. 3: Ionotropic Gelation Method

a) External Gelation Method:

In the external gelation procedure, crosslinking ions are obtained from a metal ion solution. The needle is used to gently press the drug-containing polymer solution into this solution. Self-charming beads are produced when the polymer droplet comes into touch with the metal ion solution and rapidly gels. The beads are removed and given time to dry after they have solidified in the gelling medium. External gelation results from the quick migration of crosslinking ions into partially gelled beads.

b) Internal Gelation Method:

When the internal gelation approach is used, the cross-linker ion is created “in situ”. An insoluble metal salt, like calcium or barium carbonate, is used in this process as a source of crosslinking cation. The cation is released in situ, dissolving the metallic salt and releasing the metallic ion with the aid of pH decrease.[13]

2. Emulsion Gelation Method:

Emulsion gelation techniques are yet another process of preparing beads. The polymer solution was prepared by dispersing the weighed quantity of polymer in deionized water

Further, the drug is dissolved or dispersed in the polymer solution yielding a homogenous drug-polymer mixture. A sufficient amount of cross-linking agent Is required to create a viscous dispersion, which is then extruded through a syringe with a flat-tipped syringe of size 23 into an organic phase with a span of 80 while magnetic stirring is kept at 1500 pm. The formed beads are retained in the oil for 30 min to

produce rigid discrete particles. Further collected by decantation and the products thus separated Were washed with chloroform to remove the traces of oil, dried at 400ºC for 12 h.[14]

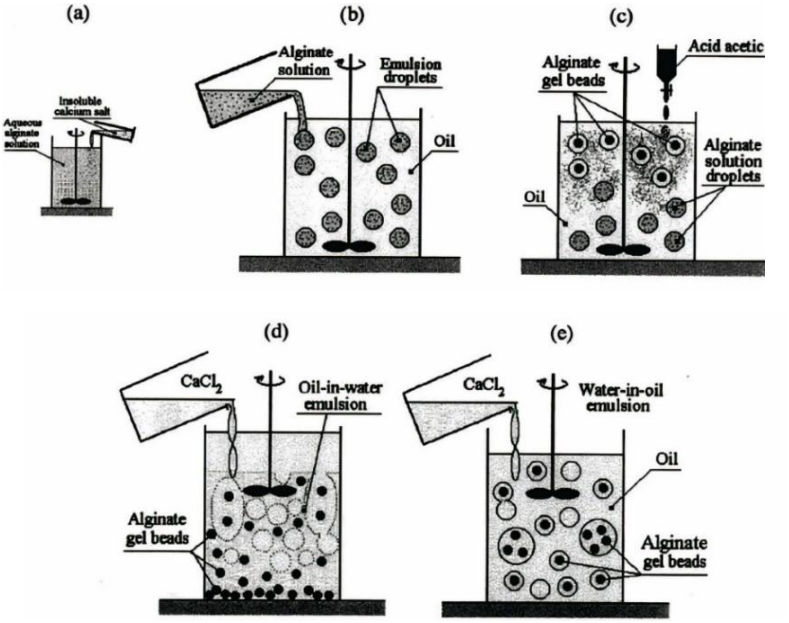


Fig. 4: Emulsion Gelation Method

3. Polyelectrolyte Complexation Method :

1. The complicated coacervation of oppositely charged poly-electrolytes, polycation, and polyanion materials is used in the manufacture of microbeads.
2. Mild conditions can be used to make alginate chitosan microcapsules that are both biodegradable and biocompatible.
3. Under physiological conditions, these are appropriate for use in biomedical disciplines. Protein and polypeptide drugs are delivered using alginate chitosan microcapsules.
4. Under particular polyion concentration, pH, and ionic strength conditions, the mixture will separate into a diluted equilibrium phase and a dense concretive phase that contains the microbeads. For instance, robust microbeads that are resilient at high pH were produced by spraying the sodium alginate solution into the chitosan solution, resulting in complicated coacervation between alginic acid and chitosan.[15]

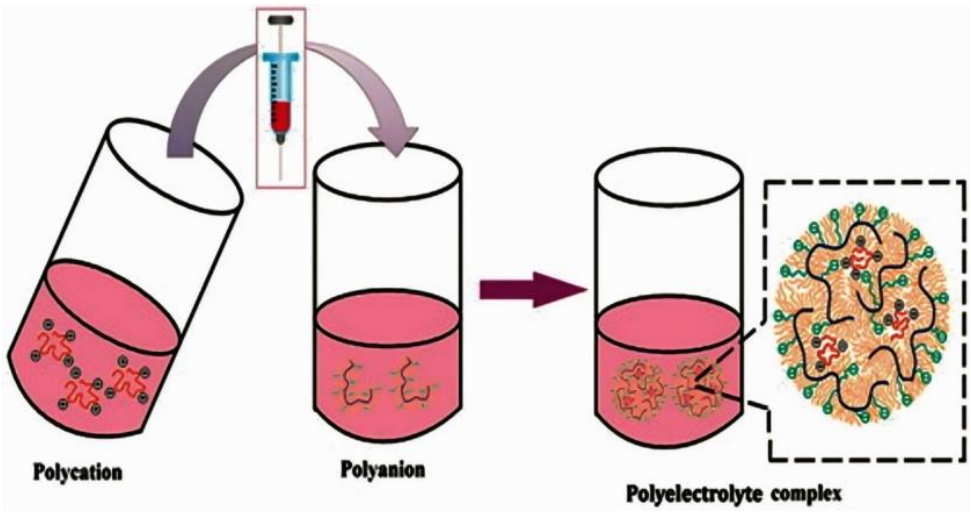


Fig. 5: Polyelectrolyte Complexation Method

EVALUATION OF MICROBEADS:

1. Particle Size Analysis:-

An optical microscope equipped with an ocular and stage micrometre was used to measure the particle sizes of drug-loaded formulations, and the particle size distribution was computed. At least fifty beads from five distinct fields were analysed for each measurement. Every experiment was conducted in triplicate.[4]

2. Drug Content (mg):

A 100 ml volumetric flask was filled with 100 mg of powdered microbeads, and the volume was adjusted with 7.4 pH phosphate buffer. The flask was then left for 12 hours, shaking occasionally, then filtered. The absorbance was then measured at 263 nm using spectrophotometry. For every formulation, three determinations were made.

Drug content = concentration × dil factor × conversion factor × amt. of stock sol was the formula used to determine the drug content. [16]

3. Drug Entrapment Efficiency:

A pestle and mortar were used to crush 100 mg of microbeads. The crushed drug-containing bead powders were put in a 250 ml volumetric flask, filled to the brim with phosphate buffer (pH 6.8), and then shaken periodically for 24 hours at 37 ± 0.5 ◦C. Following the allotted time, a magnetic stirrer (Remi Motors, India) was used to agitate the mixture for 20 minutes at 500 rpm. After the bead disintegrated, the polymer waste was eliminated by filtering through Whatman® filter paper (No. 40). A UV–vis spectrophotometer (Shimadzu, Japan) was used to measure the drug content in the filtrate at 269 nm in comparison to a suitable blank. Using the following formula, the DEE (%) of these produced beads was determined. [17]

$$\text{DEE \%} = \frac{\text{Actual drug contents in beads}}{\text{Theoretical drug Content in beads}} \times 100$$

4. Bulk Density and Tapped Density:

This is the ratio of the total mass of powder to the bulk volume of powder. Accurately weigh a portion of powdered mucilage (50 g) and was taken in a to a 100 ml graduated cylinder. The mixture was carefully levelled which is the initial apparent volume (Vo) of mucilage and expressed in g/ml. Loose bulk density can be calculated by using formula

$$\mathbf{P\ b = M / Vb}$$

Where,

ρb = bulk density,

M= bulk weight of blend,

Vb = Bulk volume of the blend.

Tapped Density:

This is the ratio of total mass of the powder to the tapped volume of the powder. Accurately weigh some quantity of powder mixture (40 g) and was taken in a 100 ml measuring cylinder. The cylinder containing the sample was manually tapped for three taps (1250, 750, 500) and the final tapped volume

(Vt) was then measured. Tapped bulk density can be calculated by using formula and expressed in g/ml.[18]

ρt = M / Vt

Where,

ρt = Tapped density,

M= weight of blend,

Vt = tapped volume of the blend

5. Swelling Index :

The swelling index was positively impacted by both sodium alginate and starch, suggesting that raising the concentrations of sodium bicarbonate and starch improved the microbeads' swelling characteristics while raising the sodium alginate concentration. This might be because of the microbeads' surface properties and the starch's high capacity for water sorption. The ion exchange phenomenon between the calcium ion of cross-linked microbeads and the sodium ions in phosphate buffer, mediated by calcium-sequestrate phosphate ions, may account for the swelling behaviour of optimized microbeads in alkaline pH. This disaggregation of the potato starch-alginate matrix structure causes matrix erosion and the dissolution of swollen microbeads.[19]

6. FT-IR Spectroscopy:

Pure ABH, drug-loaded beads, and pristine beads were all subjected to Fourier transform infrared spectroscopy (FTIR) spectrum measurements using a Perkin Elmer (model Impact 410, Wisconsin, MI, and USA) spectrophotometer. Spectra were scanned between 4000 and 500 cm-1 after the beads were finely processed with KBr to create the pellets at a hydraulic pressure of 600 dynes/m2. [20]

7. Angle of Repose:

Repose angle the powder's flow characteristics are gauged by its angle of repose. It is the greatest angle formed between the powder pile's surface and the horizontal plane. The formula was used to calculate the angle of repose. The finely ground mucilage was transferred to graph paper using a funnel, with the funnel's height kept constant. The height and base of the powder pile generated were then measured, and an equation was used to determine the angle of repose in accordance with the USP. [18]

Tan θ = tan-1 (h/r): θ = h/r

Where H is the height in centimetres and θ is the angle of repose. R is base/radius In centimetres.

8. In Vitro Dissolution Study :

All of the formulations underwent in-vitro dissolving tests using USP class II equipment. A precise weight of floating alginate beads was added to 900 millilitres of 0.1 N HCL buffer (pH 1.2). The temperature was kept at 37 „ ±0.5℃ while being agitated at 50 rpm. Five millilitres of the sample were taken out at predetermined intervals, and five millilitres of new dissolving medium were introduced concurrently to keep the sink state stable. After being filtered if required, the samples were measured at 234.8 nm using a UV spectrophotometer against a blank of 0.1 N HCL buffer (pH 1.2). [16]

9. Stability Study:

According to ICH guidelines, stability studies of the optimized formulation under accelerated storage conditions showed no drug degradation, and changes in the optimized formulation's in vitro release

profiles after six months of storage were statistically insignificant when compared to the refrigeration control sample (ANOVA, $p > 0.05$). [4]

Advantages of Microbeads:

- Drug therapy is controlled. It is possible to adjust the rate and quantity of drug absorption.
- Drug administration occurs less frequently.
- It is possible to increase patient compliance.
- It is possible to make drug administration convenient.
- High potency medications may have a wider safety margin.
- Reducing adverse effects.
- Limiting variation within the therapeutic range. Reduction in the frequency of dosing

Disadvantages of Microbeads:

- It may be challenging to release highly molecular weight chemicals due to their limited and constrained loading.
- Complex formation with blood constituents.
- The expense of manufacture is substantial.
- The capacity to modify the dosage is diminished.

It is an extremely complex technology that demands expertise to produce. [13]

Applications:

There are several therapeutic applications for alginate microbeads.

1. NSAIDs, such as Diclofenac micro-beads, exhibit decreased gastric release. It prevents the medicine from coming into direct contact with the stomach mucosa and lessens the negative effects
2. The oral administration of microbeads containing antibiotics, such as oxytetracycline, is beneficial for the treatment of intestinal and stomach disorders.
3. The synthetic nucleoside analog lamivudine is being utilized more and more as the mainstay of an antiretroviral regimen to treat HIV infection. It is encapsulated in alginate beads to allow for regulated release for a longer-lasting therapeutic impact.
4. The peptic ulcer medication ranitidine is made in the form of microbeads that are intended to stay in the stomach for an extended period of time. Thus, it may lead to new treatments for acidity and stomach ulcers.
5. Long-term release of Prednisolone from chitosan gel beads, which reduces adverse effects and increases therapeutic efficacy by limiting the drug's ability to enter the systemic circulation and fight inflammation.
6 Under physiologically mimicked pH circumstances (neutral and acidic), theophylline, a poorly water soluble bronchodilator and the targeted medication for controlled delivery, reduces drug release. Therefore, a modified dosage form could be created.[21]

CONCLUSION:

A flexible and effective drug delivery method, microbeads have a lot of promise for use in contemporary pharmaceutical formulations. They are useful for enhancing therapeutic efficacy and patient compliance because of their tiny, consistent size, controlled release characteristics, and capacity to encapsulate both hydrophilic and hydrophobic medications. Microbeads properties can be tailored to meet particular drug profiles and therapeutic requirements using a variety of production techniques, including ionotropic gelation, emulsion gelation, and polyelectrolyte complexation. But there are still issues that need to be resolved, like batch homogeneity, scaling up difficulty, and environmental issues with synthetic polymers. The creation of biodegradable and biocompatible materials, sophisticated fabrication techniques, and sustainable production methods ought to be the main areas of future study. All things considered, microbeads have the potential to completely transform controlled and targeted drug delivery systems, making them safer and more efficient Pharmaceutical therapies.

REFERENCES:

1. Moinuddin SK, Kumar P, Kumar S, Ramya P, Sree KS, Kavya K. A review on micro beads: Formulation, technological aspects, and extraction. GSC Biol Pharm Sci. 2024;26(2):059-66.
2. Menon TV, Sajeeth CI. Formulation and evaluation of sustained release sodium alginate microbeads of carvedilol. Int J Pharm Tech Res. 2013 Apr 1;5(2):746-53.
3. MICROBEADS – A PROMISING TECHNOLOGY FOR CONTROLLED DRUG DELIVERY: A REVIEW By Dr. ChristopherVimalson.,Dr.Alagarraja.M, Mrs.Mumtaj.J, Bavadharani.R, Gowrishankar. T,Jairthosh.S, Karthikeyan.R, Nigil.M
4. Kalbhare SB, Bhandwalkar MJ, Pawar RK, Sagre AR. Sodium Alginate cross-linked Polymeric Microbeads for oral Sustained drug delivery in Hypertension: Formulation and Evaluation. Asian Journal of Research in Pharmaceutical Science. 2020;10(3):153-7.
5. Odeku OA, Okunlola A, Lamprecht A. Microbead design for sustained drug release using four natural gums. International Journal of Biological Macromolecules. 2013 Jul 1;58:113-20.
6. Manjanna KM, Rajesh KS, Shivakumar B. Formulation and optimization of natural polysaccharide hydrogel microbeads of aceclofenac sodium for oral controlled drug delivery. Am. J. Med. Sci. Med. 2013;1(1):5-17.
7. Mane S, Ponrathnam S, Chavan N. Effect of chemical cross-linking on properties of polymer microbeads: A review. Can Chem Trans. 2015 Dec;3(4):473-85.
8. Khan Z, Abourehab MA, Parveen N, Kohli K, Kesharwani P. Recent advances in microbeads-based drug delivery system for achieving controlled drug release. Journal of Biomaterials Science, Polymer Edition. 2023 Mar 4;34(4):541-64.
9. FORMULATION OF MICRO BEADS: A REVIEWMullaicharam Bhupathyraaj , Alka Ahuja, Jayasekher and Sushama Pole et.al.
10. Revolutionizing Diabetes Management: Microbead Formulation f Low-Soluble Antidiabetic Drugs for Enhanced Therapeutic Efficacy. Rahul Ray1, Manoj Bhardwaj2*, Manoj Bisht2, Sanjeev Kumar3, Manoj Kumar4 et.al
11. Amsden BG, Goosen MF. An examination of factors affecting the size, distribution and release characteristics of polymer microbeads made using electrostatics. Journal of Controlled Release. 1997 Jan 18;43(2-3):183-96.
12. Shivhare UD, Vijay B, Mathur CG, Shrivastava VI. Preparation of Microbeads by different Techniques and Study of their influence on Evaluation Parameters. Journal of Advanced Pharmacy Education & Research Jul-Sept. 2013;3(3).
13. Gayathri BM, Vasanthi AV, Lalitha GS. A Comprehensive Review on Microbeads as a Targeted Drug Delivery system.

14. Gastroretentive Floating Beads – An Emerging Trend In Drug DeliveryD bhai Gajapathy, U Ubaidulla, Priyanka Sinha, Grace Rathnam. International Journal of Pharmaceutical Research and Applications vol 7, Issue 2 Mar-Apr 2022, pp: 1510-1520
15. MICRO-BEADS IN NOVEL DRUG DELIVERY SYSTEM: - A REVIEW Keerthana Devi and Gunamathi. WORLD JOURNAL OF PHARMACY AND PHARMACEUTICAL SCIENCESSJIF Volume 11, Issue 9, 741-750
16. Battu S, Prasanna RI, Devi KJ, Swamy N, Chetty CM, Purushothaman M, Gnanaprakash K. Preparation and characterization of cefadroxil loaded alginate microbeads. Int J Res Pharm Sci. 2010;1:386-90.
17. Das B, Dutta S, Nayak AK, Nanda U. Zinc alginate-carboxymethyl cashew gum microbeads for prolonged drug release: development and optimization. International journal of biological macromolecules. 2014 Sep 1;70:506-15.
18. Yashika Uniyal, Manoj Kumar Sarangi2 And Kriti Dabral3.FORMULATION AND EVALUATION OF MICROBEADS FOR COLON TARGETED DRUG DELIVERY USING NATURAL POLYMER,WORLD JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH. Wjpmr, 2019,5(7), 153-163
19. Tiwari R, Singh L, Sharma V. Performance optimization of sustained release arginine alginate microbeads with a natural polysaccharide. Journal of Pharmaceutical Research International. 2017 Jan 10;17(5):1-1.
20. Sudhakar P, Rao KM, Siraj S, Babu AC, Rao KC, Subha MC. Controlled release of hypertensive drug from pH/thermo responsive polymeric microbeads. Indian Journal of Advances in Chemical Science. 2013;2(1):50-6.
21. Tiwari RK, Singh L, Sharma V. Alginate micro-beads in novel drug delivery system: an overview. Int J Part Ther. 2013 Jan;5:1-3.

How to cite this article: Sagar Kulkarni, Dnayaneshwar Keskar, Shraddha Khandagle, Swati Malgunde, Madhvi Mehetre, Shivanjali Muluk, Anisha Nirgude Formulation and Evaluation of Pharmaceutical Microbeads. (2026). *International Journal of Pharmaceutical Research and Medicinal Plants*, *2*(1),43-53. https://doi.org/10.61280/9krxaw20

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