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Formulation and Characterization of Chamomile Oil Loaded Microsphere Face Cream

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Abstract

The present study focuses on the formulation and characterization of chamomile oil-loaded microsphere face cream, aiming to enhance the stability, controlled release, and skin benefits of chamomile oil. Microspheres were prepared using the ionotropic gelation method, where sodium alginate was used as a polymer and calcium chloride as a cross-linking agent. The prepared microspheres were then incorporated into a cream base containing green tea extract, jojoba oil, and other emollients. The formulation was evaluated for particle size, entrapment efficiency, pH, viscosity, spread ability, and stability. There results demonstrated that the microsphere-loaded cream exhibited smooth texture, stable pH, good spread ability, and no phase separation, making it a promising formulation for skin care applications

Key words: Chamomile oil, microspheres, ionotropic gelation, face cream, controlled release, stability.

1. Introduction

Chamomile (Matricaria chamomile) is one of the most widely used medicinal plants, known for its anti-inflammatory, antioxidant, antimicrobial, and soothing properties. It has been traditionally utilized in skincare and pharmaceutical applications due to its ability to calm skin irritation, reduce redness, promote wound healing, and provide relief for sensitive skin conditions such as eczema and dermatitis. The active constituents of chamomile oil, such as chamazulene, Bisabolol, and flavonoids, contribute to its potent therapeutic effects. Despite these benefits, cham omile oil is highly volatile, sensitive to oxidation, and prone to rapid degradation when exposed to air, light, or heat, which significantly limits its efficacy and stability in conventional formulations. To enhance the stability, bioavailability, and controlled release of chamomile oil, advanced drug delivery systems such as microsphere technology have been explored. Microspheres are small, spherical particles designed to encapsulate active ingredients, protecting them from environmental factors while allowing sustained and controlled release. This approach helps in preventing premature evaporation and degradation, thereby prolonging the therapeutic action of chamomile oil in topical applications.

Microsphere-Based Delivery System:

Microspheres serve as an ideal carrier for essential oils and bioactive compounds due to their ability to:

Enhance stability by preventing direct exposure to air and light.

Allow controlled and sustained release, ensuring prolonged therapeutic effects.

Improve penetration and absorption through the skin, enhancing efficacy.

Reduce potential skin irritation by regulating the release of active ingredients over time.

In this study, ionotropic gelation was used as the method for microsphere preparation. Sodium alginate, a natural polymer, was selected as the encapsulating agent, and calcium chloride was used as a cross-linking agent to form stable microspheres. This method is widely employed in pharmaceutical and cosmetic formulations due to its biodegradable, biocompatible, and non-toxic nature.

Green Tea Extract as an Additional Active Ingredient:

In addition to chamomile oil, green tea extract (Camelia sinensis) was incorporated into the formulation due to its high antioxidant content, particularly catechins and polyphenols, which offer anti-aging, anti-inflammatory, and UV-protective benefits. The combination of chamomile oil and green tea extract in a microsphere-based face cream enhances the overall formulation, making it suitable for sensitive, acne-prone, and aging skin.

Formulation of Microsphere-Based Face Cream:

After successful preparation of chamomile oil-loaded microspheres, they were incorporated into a face cream base to develop a stable and effective cosmetic formulation. The cream was designed to provide:

Enhanced hydration and nourishment with natural emollients such as jojoba oil and beeswax.

Improved texture and spreadability, ensuring a smooth and lightweight application.

Controlled release of chamomile oil, preventing rapid evaporation and maximizing skin benefits and Antioxidant protection from green tea extract, helping combat oxidative stress and skin aging.

Objectives of the Study:

The primary objective of this research is to develop and characterize a chamomile oil-loaded microsphere face cream, focusing on the following aspects:

1. Preparation of microspheres using ionotropic gelation and evaluation of encapsulation efficiency.

2. Incorporation of microspheres into a stable cream formulation with optimal physicochemical properties.

3. Characterization of the face cream, including particle size analysis, pH, viscosity, spreadability, stability, and irritancy tests.

4. Assessment of the formulations effectiveness in providing sustained release and enhanced skin benefits.

Scope of the Study:

This research contributes to the growing field of natural, plant-based cosmetic formulations, offering a novel approach for essential oil delivery in skincare. The study aims to demonstrate that microsphere technology can significantly enhance the efficacy, stability, and user acceptability of chamomile oil-based creams. The findings may serve

as a foundation for further advancements in herbal cosmeceutical formulations and open new possibilities for sustainable, natural skincare solutions.

2. Materials and Methods:

Materials:

Chamomile oil was used as an active ingredient in our formulation. The chamomile oil (Therapeutic grade) was purchased from the online. Green tea was purchased from the Ayurvedic medical Store, Kanchipuram. Sodium alginate used as a polymer, and calcium chloride used as cross-linking agent for preparation of microspheres. The chemicals used to prepare a cream formulations were purchased from the BRM Chemicals Pvt. Ltd. Essential oils were purchased from the cesaro organics company.

3. Methodology:

Preparation of green tea extract:

The extraction of green tea is done by microwave assisted extraction method (MAE). The green powder was obtained from the ayurvedic medical store. The extraction ratio (mass: volume) 1g: 20ml.So, 10g of green tea powder is dissolved in the 200ml of ethanol water mixture in a 500 ml beaker. Transfer the beaker into microwave Owen (Panasonic NN-SM25JB), set 500W in the microwave oven for 6mins at 80°C, this temperature is ideal for extracting the catechins and other polyphenolics compounds from the green tea extract. Then filter the extract with Whatman filter paper.

Test	Observation	Inference
Colour	Deep green colour	Chamomile present
Odour	Strong aromatic	Chamomile present
Solubility	Easily soluble in organic solvents	Chamomile present

Table 1: phytochemical screening test for chamomile oil

Test	Observation	Inference
Colour	Deep greenish black colour	Green tea present
Odour	Strong aromatic	Green tea present
Solubility	Easily soluble in water and organic solvents	Green tea present

Table 2: preliminary tests for green tea powder

SI.NO.	IDENTIFICATION TEST	OBSERVATION	INFERENCE
1.	**TEST FOR CARBHOHYDRATES**		
I.	2 drops of α-naphthol to an extract + molish reagent, shaking and then adding 1ml H_2SO_4	A violet colour ring at the junction of 2 layers	Presence of carbohydrates
2.	**TEST FOR ALKALOIDS**		
I.	Sample + Mayer's reagent	A white precipitate	Presence of alkaloids
II.	2 ml Sample + 2-3 drops of sodium hydroxide	A deep yellow colour	Presence of alkaloids
3.	**TEST FOR FLAVINOIDS**		
I.	Sample + 1-5 drops of H.cl	Immediate red colour	Presence of flavonoids
II.	Sample 1 ml + 10% lead acetate solution	Yellow precipitate	Presence of flavonoids
4.	**TEST FOR CATECHINS**		
I.	Few drops of sample + $FeCl_3$ solutions	Formation of blue or green colour	Presence of catechins
II.	Few drops of plant extract + vanillin H.Cl	Red or pink colour	Presence of catechins

Table 3: phytochemical screening of green tea extract

4. Formulation:

Preparation of microsphere:

Microspheres were formed by ionotropic gelation method, where sodium alginate was used as polymer and calcium chloride as cross-linking agent. 50 ml of 4% w/v Sodium alginate solution was prepared. Then the required quantity of Chamomile oil was added to the prepared sodium alginate solution and mixed by mechanical stirrer. The obtained solution was extruded drop wise into 100 ml of calcium chloride solution 10% w/v with the help of syringe (22 G) and needle of small size while stirring using a magnetic stirrer. The resulting microspheres were filtered and given a water wash after being stirred for 20 minutes.

FORMULATIOIN	CHAMOMILE OIL	SODIUM ALGINATE % (w/v)	CALCIUM CHLOORIDE %(w/v)
F1	1ml	2%	10%
F2	1ml	4%	10%
F3	1ml	3%	10%

Table 4: Different formulations of microspheres

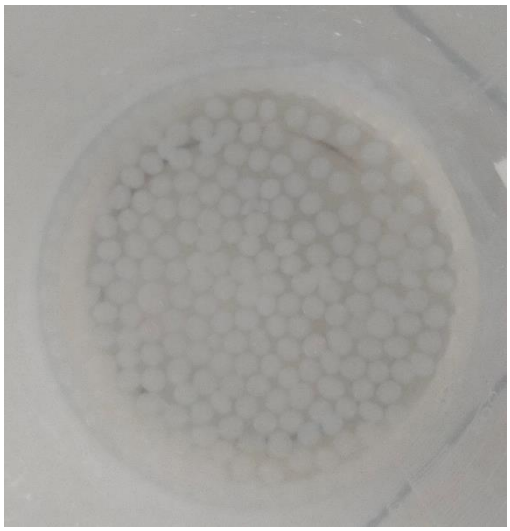

Fig 1: Microsphere without drug

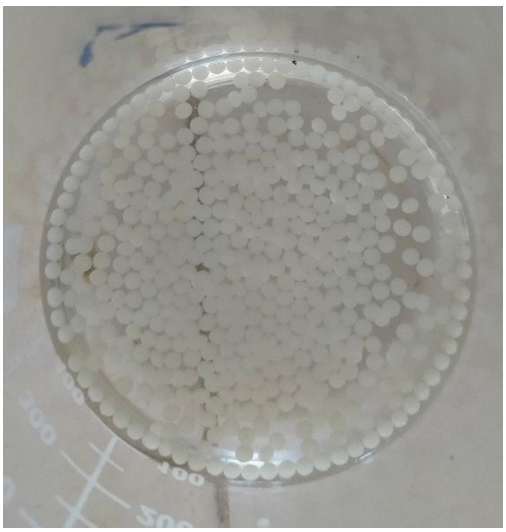

Fig 2: Microsphere with chamomile oil

Materials;

Preparation of cream base:

S.NO	INGREDIENTS	USES
1.	Green tea extract	Antioxidant
2.	Steric acid	Emollient
3.	Cetyl alcohol	Stabilizer and moisturizer
4.	Beeswax	Cream Base and protective barrier
5.	Borax	pH stabilizer
6.	Potassium sorbate	Preservative
7.	Liquid paraffin	Improves skin texture
8.	Glycerine	Exfoliator
9.	Petroleum jelly	Prevent dry skin
10.	Jojoba oil	Soothes sensitive skin
11.	Rose oil	Fragrance and Toning
12.	Distilled water	Hydration

Table 5: Ingredients for face cream formulation

Procedure for microsphere cream base:

The oil phase was prepared by heating the weighed amount of stearic acid, jojoba oil, bees wax, cetyl alcohol, petroleum jelly, liquid paraffin in a China dish and maintained at 65°C.

For aqueous phase, dissolve weighed quantity of borax, glycerine, potassium sorbate and distilled water in a 100ml beaker. Heat this mixture at 65°C to form a homogenous solution.

Then slowly add this oily phase to the aqueous phase in a China dish and mix until the temperature drops to room temperature.

Incorporation of Chamomile Oil Loaded Microsphere into The Cream Base:

Add the 50% Ethanolic extract of green tea to the cream base and mix well. The mixture was cooled to room temperature to get smooth cream. Then add 2g of formulated microspheres to the cream base. Add few drops of rose oil as a fragrance to impart aroma. Finally, chamomile oil loaded microsphere face cream was prepared.

Fig 3: Microsphere face cream

S.NO	COMPOSITION	F1	F2	F3
1.	Microsphere	2g	2g	2g
2.	Green tea extract	1ml	2ml	3ml
3.	Steric acid	5g	5g	5g
4.	Cetyl alcohol	3g	3g	3g
5.	Beeswax	1.5g	2g	2.5g
6.	Borax	2.9g	2.9g	2.9g
7.	Potassium sorbate	0.5g	0.5g	0.5g
8.	Liquid paraffin	10g	10g	10g
9.	Glycerine	12.5ml	12.5ml	12.5ml
10.	Petroleum jelly	7.5g	7.5g	7.5g
11.	Jojoba oil	6 drops	6 drops	6 drops
12.	Rose oil	0.2ml	0.2ml	0.2ml
13.	Distilled water	10ml	10ml	10ml

Table 6: Different formulations of chamomile oil loaded microsphere face cream

5. Evaluation:

Evaluation of chamomile oil microsphere:

Particle size analysis:

Stero zoom microscopy method was used for the determination of the particle size and morphology of the chamomile microsphere.

FITR Analysis:

FTIR Analysis for green tea extract, to determine the catechins, polyphenolics and other compounds present the green tea extract.

Entrapment efficiency:

50 mg of microsphere were appropriately weighed and crushed, then crushed microspheres are transferred into beaker containing 100 ml phosphate buffer pH 6.8. It was stirred by magnetic stirrer for few minutes. Then 1ml od sample was withdrawn and make up to 10ml using a phosphate buffer pH 6.8. Absorbance was taken at 210 nm, and the concentration was calculated.

% entrapment efficiency = (practical drug content / theoretical drug content) × 100

6. Evaluation of Chamomile Oil Microsphere Face Cream:

Physical appearance:

The physical appearance such as, color, odour, state and texture of the formulated microsphere loaded face cream were evaluated.

Determination of pH:

The pH measurement was conducted by utilizing a digital pH meter. Firstly, calibrate the pH meter by using different buffer solutions 4, 7, and 9. Then pH of then formulated cream was measured by using pH meter.

Spreadability:

Spreadability was determined by placing a required amount of sample between the glass slides, then apply a definite amount of weight on a glass slides for a definite. The spreadability was calculated by the following formula,

$$S=M\times L/T$$

$$\text{Spreadability (S)} = \frac{\text{weight tide to upper slide (W)} \times \text{length of the glass slide (L)}}{\text{Time taken to separate (T)}}$$

Viscosity:

Viscosity of cream was done by using Brooke field viscometer at the temperature of 25℃. Using LV spindle #7 at 1000 rpm.

Non-irritancy test

To perform a non-irritancy test for a face cream, apply a small amount of microsphere face cream to a clean, patch of skin to the forearm and monitor for 24-72 hrs.

Phase separation:

The prepared microsphere face cream was transferred in a suitable wide mouth container. Set aside for the oil phase and aqueous phase separation were visualizing after 24hrs.

7. Result and Discussion:

Particle size analysis:

The Particle size was found within the desired range 271 µm to 473 µm.

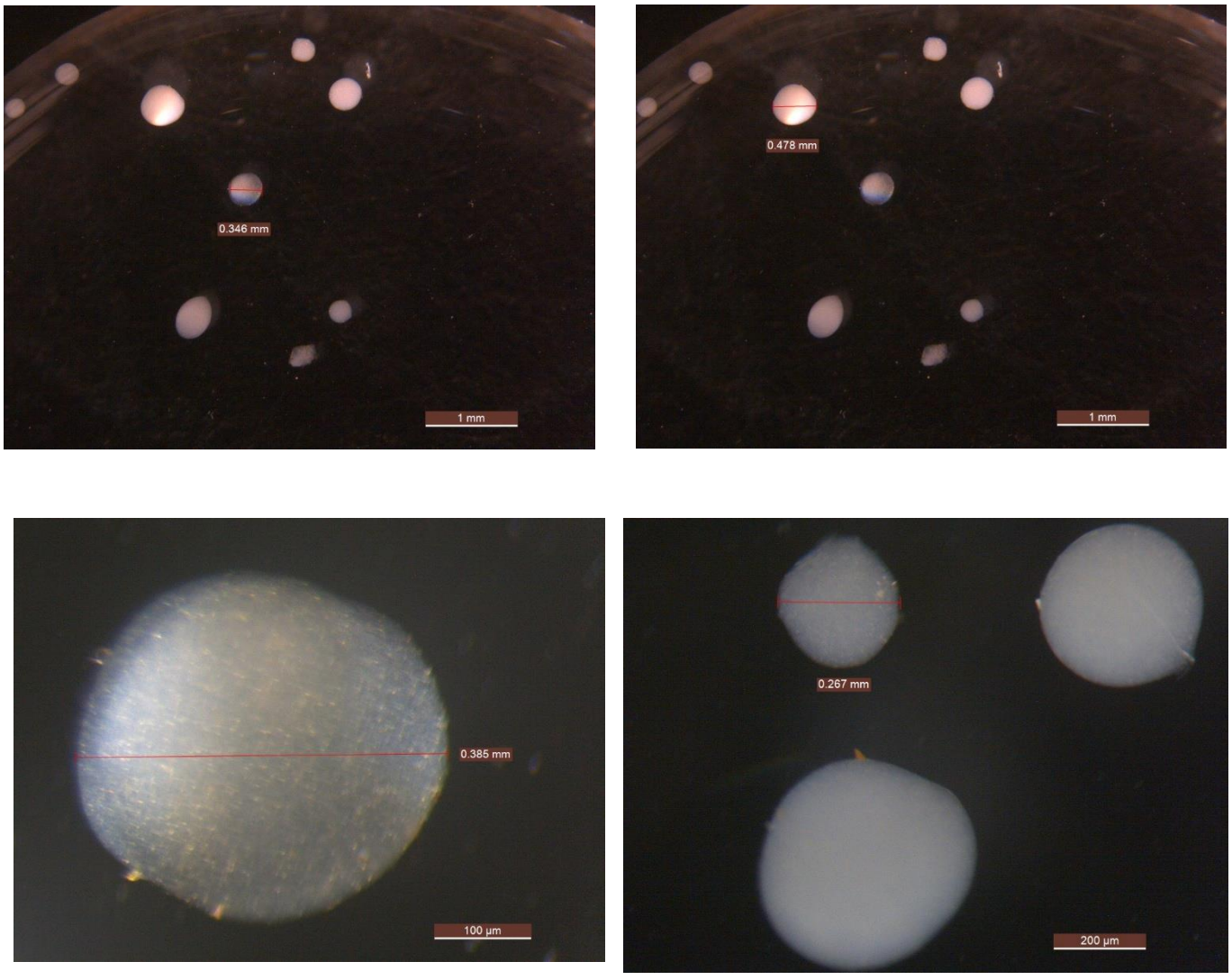

Fig 4: Stereo zoom microscopy images

8. FITR Analysis:

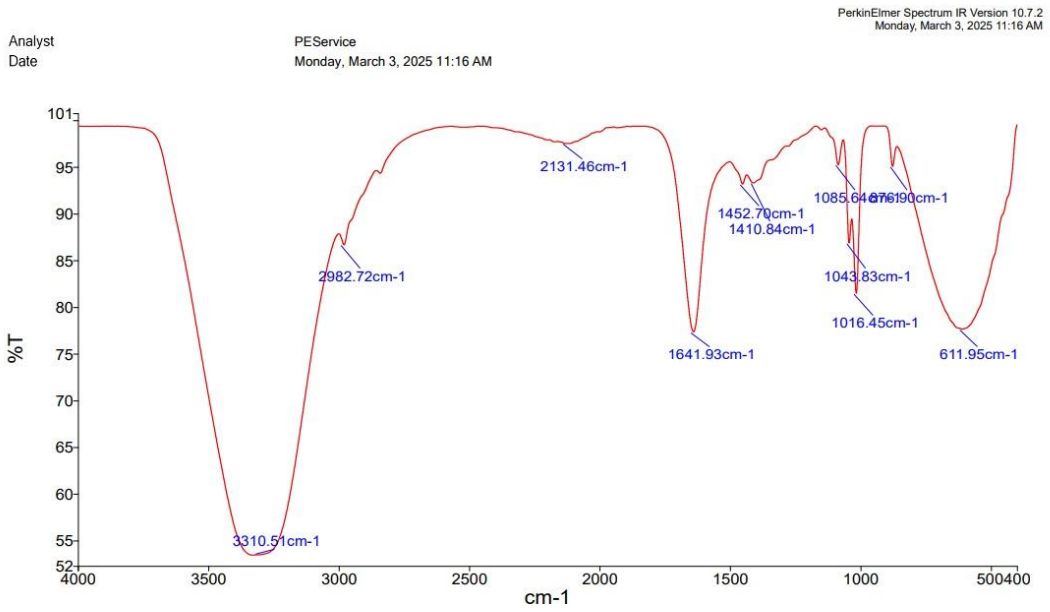

Fig 5: FITR graph for green tea extract.

FTIR Interpretation Table

Wavenumber (cm^{-1})	Functional Group	Types of vibrations
3310.51	Alcohols, Phenols	O-H Stretch (Hydrogen-bonded)
2982.72	Alkanes	C-H Stretch
2131.46	Alkynes	C≡C Stretch
1641.93	Carbonyl Compounds (Ketones, Aldehydes, Amides)	C=O Stretch
1452.70	Alkanes	C-H Bending
1410.84	Aromatics	C=C Stretch
1085.61	Alcohols, Ethers	C-O Stretch
1043.83	Alcohols, Ethers	C-O Stretch
1016.45	Esters, Carboxylic Acids	C-O Stretch
819.90	Aromatics	C-H Out-of-plane Bending
611.95	Halogen Compounds	C-Cl or C-Br Stretch

Table 7: FTIR interpretation table

9. Conclusion:

The FTIR spectral analysis confirms the presence of key functional groups, including hydroxyl (O-H), carbonyl (C=O), ether (C-O), and amine (N-H), indicating a complex organic structure. The similarity of

these functional groups to catechins, the bioactive compounds in green tea, suggests potential antioxidant properties. This study provides valuable chemical insights, supporting further exploration of the sample's pharmacological significance.

10. Entrapment Efficiency:

The entrapment efficiency of the microsphere formulations was found to be in the range of 74.6% to 89.43%. From the obtained entrapment efficiency results, maximum entrapment efficiency was found in F2. i.e., amount of polymer increases entrapment efficiency of drug within the microsphere also increases.

S. NO	ENTRAPPMENT EFFECIENCY
F1	74.6%
F2	89.43%
F3	78.37%

Table 8: Entrapment Efficiency

Evaluation of chamomile oil microsphere face cream:

Physical appearance:

The formulated microsphere was found to be milky white in colour with pleasant odour and have a smooth texture.

CHARACTERISTICS	F1	F2	F3
COLOR	Milky white	Milky white	Milky white
ODOUR	Pleasant	Pleasant	Pleasant
STATE	Semisolid	Semisolid	Semisolid
TEXTURE	Smooth	Smooth	Smooth

Table 8: physical appearance

Determination of pH:

The pH of formulated microsphere face cream was found with in the range of 5.5- 6.5 pH. The F2 formulation shows desired pH (6.05) when compared to F1 & F3.

S.NO	FORMULATION	pH
1.	F1	5.87
2.	F2	6.05
3.	F3	6.17

Table 9: pH test

Spread ability:

The spreadability of formulated microsphere face cream was found with in the range of 9.0 to 31. 02g.cm/s. The F2 formulation shows desired viscosity (16. 22g.cm/s) when compared to F1 & F3.

S.NO	FORMULATION	SPREDABILITY
1.	F1	21.56g.cm/s
2.	F2	16.22g.cm/s
3.	F3	29.43g.cm/s

Table 10: Spread ability

Viscosity:

The viscosity of formulated microsphere face cream was found with in the range of 2000 to 50000 cps. The F2 formulation shows desired viscosity (16. 22g.cm/s) when compared to F1 & F3.

S.NO	FORMULATION	VISCOSITY(Cps)
	F1	**26456**
	F2	**24275**
	F3	**32557**

Table11: viscosity

Phase separation:

The all three formulations shown desired results. There is no phase separation occurs.

S.NO	**FORMULATION**	**PHASE SEPARATION**
1.	F1	No phase separation
2.	F2	No phase separation
3.	F3	No phase separation

Table 12: Phase separation

Irritancy test;

The all three formulations shown desired results. It doesn't cause any irritation.

S.NO	FORMULATION	IRRITANCY
1.	F1	Non-irritancy
2.	F2	Non-irritancy
3.	F3	Non-irritancy

Table 13: irritancy test

Conclusion:

The present study successfully formulated and characterized chamomile oil-loaded microsphere face cream using ionotropic gelation as an encapsulation technique. The use of sodium alginate as a polymer and calcium chloride as a cross-linking agent resulted in stable microspheres that effectively encapsulated chamomile oil, enhancing its stability, controlled release, and bioavailability. The incorporation of green tea extracts further enriched the formulation by providing antioxidant protection, anti-aging benefits, and additional skin-soothing properties. The formulated face cream demonstrated favourable physicochemical characteristics, including optimal pH, spreadability, viscosity, and non-irritancy, making it suitable for sensitive and general skin types. Overall, this study highlights the potential of microsphere technology in herbal cosmeceuticals, offering an innovative approach to delivering essential oils in a sustained and effective manner. Future research could explore long-term stability, in-vivo skin absorption studies, and consumer acceptability trials to further validate the commercial viability of this formulation in the natural skincare industry. Future studies can focus on enhancing microsphere stability and controlled release for prolonged skin benefits. In-vivo and clinical evaluations will help confirm safety, efficacy, and consumer acceptability. Expanding the formulation into other skincare products like serums and lotions can increase its commercial potential.

Three formulations of Chamomile oil microspheres loaded face cream were formulated.

Selection of best formulation based on the evaluation parameter was done.

Comparing these three formulations, F2 formulations gives better results.

Reference

1. Rutika Rane, Neha Rai et.al., Formulation and Evaluation of Chamomile Microspheres Loaded Cream for Enhanced Topical Delivery in Acne Treatment, IJCRT, Volume 12, Issue 4 April 2024 | ISSN: 2320-2882.
2. S. J. Jawale, P. M. Deshmukhe et.al., Formulation and evaluation of microsphere loaded antifungal cream Volume 10, Issue 1 January 2022 | ISSN: 2320-2882.

3. LEON H. KIRCIK Microsphere Technology: Hype or Help? The journal of clinical and aesthetics dermatology, Volume 4, May 2011.
4. Tusharkumar Gautam Ingle, Shrikant D. Pande, The Current Trends in Microspheres: A Review Volume 13, Issue 1, January 2023
5. Sharadha M, Gowda D V An overview on topical drug delivery system – Updated review vol 11 no 1, ISSN: 0975-7538, 2020
6. Husna N. K., Nishad K.M; Design and evaluation of azelaic acid microspheres-based cream for topical treatment of acne, IJMPR,6(4), 2022.
7. Varade NK, Pack DW. Microspheres for controlled release drug delivery. Expert opinion on biological therapy, Jan 1; 4(1) 2004.
8. Sachin Aglawe, Amol Gayke et.al., Chamomile: A Review. Research journal of Pharmacology and Pharmacodynamics.2020; 12(1):12- 14.
9. Foziyah Zakir, Geeta Aggarwal, et. al; A comprehensive Study of Therapeutic applications of Chamomile, Pharmaceuticals, 15(10),2022.
10. Ananda T. Nóbrega1, Tais A. L. Wagemaker Antioxidant activity of Matricaria chamomilla L. extract and clinical efficacy of cosmetic formulations containing this extract and its isolated compounds Biomed Bio pharm Res.;(10) 2 2013DOI10.19277/bbr.10.2.6
11. Khomendra Kumar Sarwa.et, al, Extraction of Green Tea Leaves: The use of Different Methods, their Optimization and Comparative Evaluation Vol. 10(1) 2013
12. Muhammad Saleem [a], Mohib Ullah [b] et.al Microwave-assisted extraction of green tea catechins and antioxidant activity of tea extracts: The role of solvents, microwave power, and contact time Volume 203 August 2024.
13. Muggu SankaraBhavani, CH. Naveena, P. Nagamani, B. Sowmya Formulation and Evaluation of Herbal Face Cream Int. J. Pharm. Sci. Rev. Res., ISSN: 0976 – 044X, 83(2), November – December 2023; DOI: 10.47583/ijpsrr. 2023.v83i02.011
14. Nishant kumar, et.al A breif evaluation of microsphere. An update; international journal of recent scientific research, 9(5): 2018.
15. S. Y. Rai and Padmini Ravikumar, Development and Evaluation of Microsphere Based Topical Formulation using Design of Experiments, Indian Journal of Pharmaceutical Science, 78(2), 2016.
16. Thakur D, M.pharm, presentation on introduction, advantage, disadvantage, and ideal properties of microsphere, slideshare. Published on Oct 17, 2016.
17. Illium Lisbeth, Ping and Davis S. S., “In vitro evaluation of the Mucoadhesive properties of chitosan microspheres”, International Journal of pharmaceutics, , vol 166, 1998.
18. Munday D.L., Thompson C. J., Hansford D. and Higgins S., “Evaluation of ibuprofen loaded microspheres containing antimicrobial agnets for eradication of H. Pylori”, International Jouranl of Pharmceutics, 397 2007.