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Review

Design and Characterization of Herbal Nanogel: A Feasible Use

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Abstract:
The newest advances in drug delivery and nanogel formation have been examined in this study. The field of chemistry known as phytochemistry has been devoted to the study of botanical materials. Herbal materials have led to the development of novel therapies for an assortment of ailments. In order to supply herbal products that have more cellular penetration than presently feasible, nanogel has proved to be an innovative solution to oral and transdermal medicine delivery for a number of medical ailments, including diabetes, cancer, and chronic illnesses. By the way, herbal medications with the latest technical components can have great bioavailability, low toxicity, and improved sustained release mechanisms when given the right ways of administration.

Keywords: Nanotechnology, preparation method, parameters

Introduction

Cross-linked hydrogel nanoparticles made of hydrophilic or amphiphilic polymers are known as nanogels, and they offer prolonged and regulated drug delivery. Their high drug-loading capacity, improved permeability, and biocompatibility make them superior to other nanocarriers. Although herbal remedies are frequently used to treat inflammatory and skin problems, their high dosage requirements, low absorption, and poor solubility limit their clinical usage. These restrictions can be circumvented and treatment efficacy increased via nanogel technology. The goal of this research is to create a novel herbal nanogel that will effectively manage pain and inflammation by enhancing skin penetration with ginger (gingerol) and black cumin oil.[1-7]

Material and Methodology

Material Required

S.no.	Material	Category	Place from where we taken
1.	GINGER POWDER	Used as an API	JBIT COLLEGE OF PHARMACY
2.	CARBOPOL 940	Used as a gelling agent	PURCHASE FROM ONLINE
3.	CITRIC ACID	Used as a preservative	JBIT COLLEGE OF PHARMACY
4.	MENTHOL	Used as penetration enhancer	JBIT COLLEGE OF PHARMACY
5.	DISTTILED WATER	Used as base	JBIT COLLEGE OF PHARMACY
6	HPMC	Used as polymer	JBIT COLLEGE OF PHARMACY

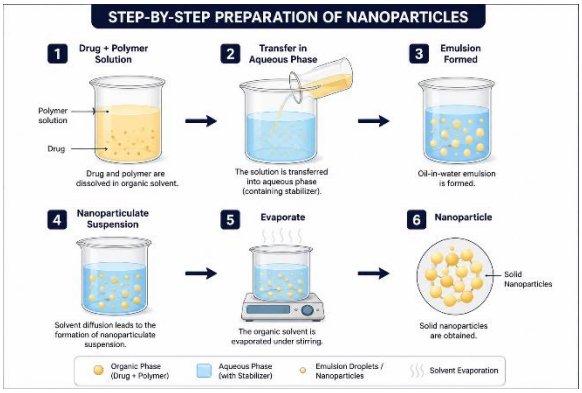
Composition table of Nanogel

S.no.	Ingredients	F1	F2	F3	F4
1	Nanoparticle	0.2	0.2	0.1	0.1
2	Carbopol 940	0.5	1	0.5	1

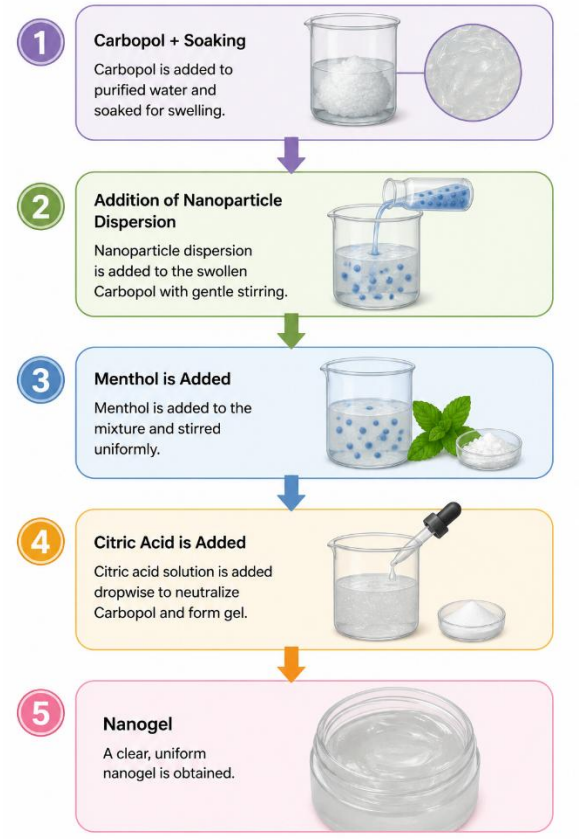
3	HPMC K4 M	2	1.5	1	0.5
4	Menthol	1	1	1	1
5	Citric Acid	0.2	0.2	0.2	0.2
6	Distilled Water	q.s	q.s	q.s	q.s

Method of Preparation

1. **For Nanoparticles : By Nanoprecipitation Method**

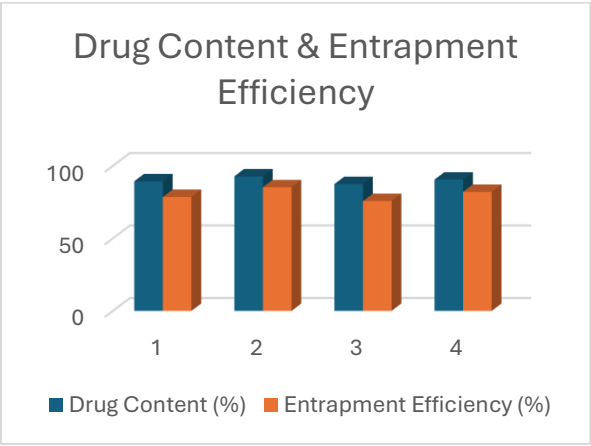


2. **For Nanogel**



Result and Discussion

Parameter	F1	F2	F3	F4
Appearance	Smooth, homogeneous	Smooth, homogeneous	Smooth, homogeneous	Smooth, homogeneous
pH	6.2 ± 0.03	6.4 ± 0.05	6.1 ± 0.04	6.3 ± 0.02
Viscosity (CP)	4150 ± 25	4850 ± 30	3900 ± 20	4550 ± 28
Spreadability (g·cm/sec)	6.8 ± 0.15	5.9 ± 0.12	7.2 ± 0.18	6.3 ± 0.14
Drug Content (%)	89.4 ± 1.2	92.8 ± 1.1	87.5 ± 1.3	90.6 ± 1.0
Extrudability (g)	165 ± 5	182 ± 6	158 ± 4	175 ± 5
Entrapment Efficiency (%)	78.6 ± 1.4	85.3 ± 1.2	75.8 ± 1.6	82.1 ± 1.3



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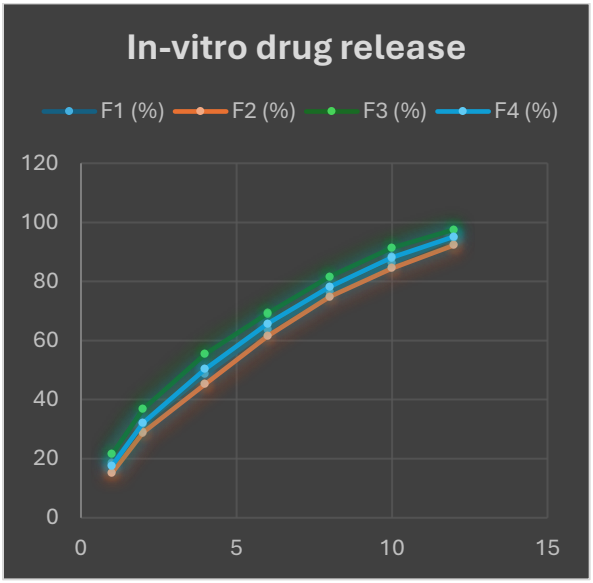
In-Vitro drug release from Nanogel

Time (hr)	F1 (%)	F2 (%)	F3 (%)	F4 (%)
1	18.4	15.2	21.5	17.6
2	31.7	28.9	36.8	32.1
4	48.6	45.2	55.4	50.3
6	63.8	61.5	69.2	65.7
8	76.4	74.8	81.6	78.2
10	86.2	84.5	91.4	88.1
12	94.8	92.3	97.6	95.2



Therefore, F2 was selected as the optimized formulation because of its balanced viscosity, drug content (92.8%), entrapment efficiency (85.3%), and controlled drug release characteristics.

Discussion

The prepared herbal nanogels loaded with gingerol demonstrated adequate physicochemical characteristics appropriate for topical use. There was little chance of discomfort because the pH values (6.4) were within the approved skin-compatible range. The concentration of Carbopol 940 and HPMC had a substantial impact on viscosity and spreadability, higher polymer content led to increased viscosity and prolonged drug release. Gingerol was effectively incorporated into the nanogel matrix, as evidenced by the high drug content and entrapment efficiency. Studies on drug release in vitro showed that the medication was released over a 12-hour period in a regulated and extended manner. F2 is the best formulation for effectively managing inflammation and pain because it exhibited the best balance of viscosity, entrapment efficiency, drug content, and sustained-release behavior among all the formulations.

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