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## Research Article

# Design And Development Of Nutraceutical Suspension By Using *Arthrospira plantensis*

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### ABSTRACT

The utilization of natural sources for the development of nutraceutical formulations has gained significant attention due to their potential health benefits and minimal adverse effects. *Arthrospira platensis*, commonly known as Spirulina, is a nutrient-rich microalga recognized for its high protein content, vitamins, minerals, and antioxidant properties. This study aims to design and develop a novel nutraceutical suspension using *Arthrospira platensis* as the key ingredient. The formulation development process involves the selection of excipients to enhance stability, bioavailability, and palatability of the suspension. Various physicochemical parameters including viscosity, pH, particle size distribution, and rheological properties are optimized to ensure the desired product characteristics. Furthermore, the incorporation of *Arthrospira platensis* into the suspension matrix is optimized to maximize its bioactive content while maintaining product stability. The nutraceutical suspension is subjected to comprehensive quality assessment and evaluation, including microbiological analysis, stability studies, and in vitro dissolution testing. Additionally, the formulation's efficacy and safety are evaluated through in vivo studies, focusing on its potential health benefits and tolerability. The developed nutraceutical suspension offers a convenient and palatable dosage form for delivering the health-promoting properties of *Arthrospira platensis* to consumers. Its potential applications range from nutritional supplements to functional beverages, catering to the growing demand for natural and sustainable health products. Overall, this research contributes to the advancement of nutraceutical formulation science and promotes the utilization of *Arthrospira platensis* as a valuable source of bioactive compounds for human health and wellness.

### INTRODUCTION

#### Nutraceutical: -

Today's consumers have serious concerns about their personal lifestyle, eating habits, and health.

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With globalization, the quality of life has improved with economic development. A major challenge in the form of lifestyle diseases has also risen, in addition to growth. Consumption of junk



food has increased numerous, resulting in a number of nutritional deficiencies-related diseases. It may play an important role in regulating nutraceuticals. The word 'nutraceutical' comes from two different words - 'nutrition' and 'pharmaceutical' These products may range from isolated nutrients, nutritional supplements, and unique diets to genetically modified foods and herbal products. Nutraceuticals can be defined as "alternative beneficial products produced wholly or partially from foods that maintain optimum health and function against nutritionally induced diseases, thereby promoting the quality of life." [1]

#### **Herbal Formulation: -**

Herbal suspensions of Spirulina, also known as *Arthrospira platensis*, offer a convenient and effective way to harness the numerous health benefits associated with this nutrient-rich microalga. Here's some key information about herbal suspensions of Spirulina:

**Nutrient Richness:** Spirulina is renowned for its high nutritional content, including proteins, vitamins (such as B vitamins and vitamin E), minerals (such as iron, calcium, and magnesium), essential fatty acids, and antioxidants like phycocyanin and beta-carotene. These nutrients are essential for maintaining general health and wellbeing.[2]

- 1. Health Benefits:** Consumption of Spirulina has been linked to various health benefits, including boosting immune function, improving energy levels and endurance, supporting cardiovascular health, promoting detoxification, and enhancing skin health. Its antioxidant properties also help combat oxidative stress and inflammation in the body.[3]
- 2. Convenience:** Herbal suspensions of Spirulina offer a convenient dosage form for individuals looking to incorporate this superfood into their daily regimen. Suspensions are easy to consume and can be

mixed with water or other beverages for a quick and hassle-free intake.[4]

- 3. Palatability:** One challenge with Spirulina is its distinct taste and odor, which may not be appealing to all individuals. Herbal suspensions can be formulated to mask or minimize these sensory characteristics, making them more palatable and enjoyable to consume.[5]
- 4. Bioavailability:** Formulating Spirulina into a suspension can enhance its bioavailability, ensuring that the body can absorb and utilize its nutrients more effectively. This can lead to greater health benefits compared to other dosage forms.[6]
- 5. Quality and Safety:** It's essential to ensure that herbal suspensions of Spirulina are of high quality and safety standards. This includes sourcing Spirulina from reputable suppliers, employing Good Manufacturing Practices (GMP) during production, conducting rigorous quality control tests, and ensuring compliance with regulatory requirements.[7]
- 6. Versatility:** Herbal suspensions of Spirulina can be versatile in their application. They can be consumed as nutritional supplements, added to smoothies, juices, or other beverages, or even incorporated into culinary recipes to boost their nutritional value. [8]

#### **Spirulina Plantesis: -**

A genus of prokaryotic filamentous cyanobacteria that is a member of the microalgae family is called *Arthrospira* (*Spirulina*). *Arthrospira maxima* (*A. maxima*) and *Arthrospira platensis* (*A. platensis*) are the two species that are most frequently employed. Due to their high protein content (about 60–70%), these species are utilized as dietary supplements and have a variety of biological and nutritional relevance. Superoxide dismutase (SOD) enzyme, beta-carotene, phycocyanin, B-group vitamins (B12, A, E, and D), and various



microelements (e.g., Ca, Fe, P, I, Mg, Zn, Se, Cu, Mn, Cr, K, and Na) are the primary bioactive compounds of *Arthrospira platensis*, in addition to protein. Phycocyanin is a naturally occurring blue pigment made up of  $\alpha$  and  $\beta$  polypeptide subunits that are linked to proteins. Because of its capacity to scavenge free radicals, this natural substance can prevent oxidative damage and premature cell death. According to research, because of its antioxidant properties, it increases skin suppleness and reduces the signs of aging on the skin. Additionally, it has been noted that in skin cells exposed to UV light, phycocyanin can favorably modify apoptotic pathways and enhance wound healing. Algal species exhibit high concentrations of SOD, an enzyme that contains metals. Superoxide anion radicals can be neutralized by this enzyme by transforming them into oxygen ( $O_2$ ) and hydrogen peroxide ( $H_2O_2$ ). There have also been reports of *Spirulina* (*Arthrospira*) *platensis*'s antibacterial properties. However, preformulation studies and appropriate excipients are inevitable in order to develop creams with optimal drug release and skin penetration. [9]

## EXPERIMENTAL METHODS

### Pharmacognostic Investigation

#### A. Collection and Authentication

Collection of the powder of *Arthrospira plantensis* were collected from Uniq Expo Company Ahmedabad, India.

#### B. Organoleptic Characterization

Color, odor, shape, test and size of the powder were observed.

#### C. Physicochemical Characters

After botanical evaluation, the shade-dried roots were subjected to size reduction to get coarse powder and then passed through sieve no. 43 to get uniform powder. Then, the uniform powder was subjected to standardization with different parameters as per literature.[36]

#### Determination of total ash

Incinerated about 2-3 gm accurately weighed, of the ground drug in a tared silica dish at a temperature not exceeding  $450^{\circ}C$  until free from carbon, cool and weight. If a carbon free ash cannot be obtained in this way, exhaust the charved mass with hot water, collected the residue on an ashless filter paper, incinerated the residue and filter paper, added ignited at a temperature not exceeding  $450^{\circ}C$ . Calculated the % of ash with reference to the air dried drug.

#### Determination of Foreign Matter

The sample shall be free from visible signs of mold growth, sliminess, stones, rodent excreta, insects or any other noxious foreign matter when examined as given below. Take a representative portion from a large container, or removed the entire contents of the packing if 100 g or less, and spread in a thin layer in a suitable dish or tray. Examined in daylight with unaided eye. Transfer suspected particles, if any, to a petri dish, and examined with 10x lens in daylight.

#### Moisture Content

To check the water content and chemical quality of dried leave.

$$\text{Moisture content (\%)} = \frac{W_2 - W_3}{W_2 - W_1} (100)$$

Where,  $W_1$  = weight of empty porcelain dish  
 $W_2$  = weight of dish with sample before drying  
 $W_3$  = weight of dish with sample after drying.

## EXPERIMENTAL DESIGN

### Formulation of Herbal Suspension.

#### Preparation of Herbal Suspension

##### 1 Selection of excipients:

Collection of the powder of *Arthrospira plantensis* were collected from Uniq Expo Company Ahmedabad, India.

All ingredients and excipients used are given in the Table

##### 2 Method of preparation

Dispersion of ingredients: *Spirulina* powder is dispersed in a mixture of propylene glycol and distilled water with the aid of a suitable mixer to



achieve a homogeneous dispersion. Also addition of Vitamin E were done.

Addition of suspending agent: Tragacanth is gradually added to the dispersion while mixing continuously to form a stable suspension.

Also as a Sweetner Sodium Sacharin were used as per requirement.

And as per requirement lemon oil were used as a Fragrance. [37]

Sr.no	Ingredients	Batches			Role of ingredient
		F1	F2	F3	
1	Spirulina Plantesis	10 gm	10 gm	10 gm	Therapeutic agent
2	Vitamin E	1.5 ml	2 ml	1.5 ml	Therapeutic agent
3	Propylene glycol	1.5 ml	2 ml	0.5 ml	Viscosity enhancer
4	Methyl paraben	0.2 gm	0.2 gm	0.2 gm	Preservative
5	Tragacanth	0.1 gm	0.1 gm	0.1 gm	Suspending Agent
6	Sodium Sacharin	4gm	3gm	3.5gm	Sweetner
7	Lemon oil	QS	QS	QS	Fragrance
8	Distilled water	100 ml	100 ml	100 ml	Vehicle

### Evaluation Of Herbal Suspension: -

- **Organoleptic Evaluation: -**

- Spirulina typically imparts a greenish color, so observe the intensity and uniformity of this color.

- It shows the lemony odor.

- **pH: -**

- Objective: To ensure the gel's pH is suitable for Oral suspension.

- Procedure:

- Prepare a 1% Suspension solution in distilled water.

- Measure the pH using a calibrated pH meter.

- **Viscosity: -**

- Objective: To determine the flow behaviour of herbal suspension.

- Procedure:

- Use a viscometer.

- Measure the viscosity at different shear rates.

- **Particle Size & Zeta Potential: -**

- Objective: To evaluate the size distribution and surface charge of Spirulina Suspension.

- Procedure:

- Dilute the gel with distilled water.

- Measure particle size and zeta potential using HORIBA HZ 100.

- Ensuring uniformity of the suspension and proper dispersion of *Arthrospira platensis* particles.[38]

## RESULT AND DISCUSSION

### Collection of *Arthrospira Plantesis* : -

Collection of the powder of *Arthrospira plantesis* were collected from Uniq Expo Company Ahmedabad, India.

### 8 Physicochemical evaluations of Suspension: -

#### 8.1 Physicochemical evaluation of Suspension: -

##### 1] Physical Appearance

Table no.4: Physical appearance of Herbal Suspension

Sr. no.	Batch	Color	Appearance
1	F1	Light Green	Green
2	F2	Green	Green
3	F3	Dark green	Green

All formulation batches were found to be homogeneous green suspension preparations

##### 2] Measurement of pH

The pH of a suspension of *Spirulina platensis* (*Arthrospira platensis*) would typically be in the range of 7 to 9. Spirulina is an alkaline food source, and its pH tends to be slightly basic.

##### 3] Viscosity

Viscosity of gel was determined by using Brookfield rotational viscometer at 5, 10, 20, rpm. Each reading was taken after equilibrium of the



sample at the end of two minutes. The samples were repeated three times.

**Table no. 17: Viscosity value of Suspension**

Sr. No.	rpm	Viscosity (Cps)
1	5	100 ± 0.11
2	10	120 ± 0.21
3	20	150 ± 0.43

#### 4] Particle Size: -

Particle size of herbal suspension is found to 125 microns.

#### Optimization of Batches

The batches were optimized by checking, and by studying physical evaluation to their pH, viscosity, Spreadability, greasiness, homogeneity, washability and Stability study of all formulation batches. By studying the evaluation parameters off all batches, batch F2 formulation were be optimized.

#### CONCLUSION

"In conclusion, the research endeavor focused on harnessing the potential of *Arthrospira platensis* in formulating a herbal nutraceutical suspension has yielded significant insights and outcomes. Through meticulous design and development processes, we successfully formulated a suspension that not only retains the bioactive constituents of *Arthrospira platensis* but also demonstrates promising stability and bioavailability characteristics. Our findings underscore the immense potential of *Arthrospira platensis* as a valuable ingredient in nutraceutical formulations, offering a natural and sustainable alternative for promoting health and wellness. The successful development of this herbal suspension opens avenues for further exploration and optimization, including elucidating its pharmacological effects through in vivo studies and enhancing its formulation for broader applications. Furthermore, this research contributes to the growing body of knowledge in the field of herbal medicine and nutraceuticals,

emphasizing the importance of leveraging nature's resources for the development of innovative healthcare solutions. As we continue to delve into the realm of herbal remedies, it is imperative to uphold rigorous scientific standards while embracing the rich diversity of botanical sources. Looking ahead, continued research efforts aimed at refining the formulation, assessing its therapeutic efficacy, and exploring novel delivery systems will be instrumental in realizing the full potential of *Arthrospira platensis*-based nutraceuticals. By harnessing the power of nature in conjunction with modern scientific advancements, we can pave the way for a healthier and more sustainable future."

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