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(REVIEW ARTICLE)

SPIRULINA-LOADED ORALLY DISINTEGRATING TABLETS: FORMULATION CHALLENGES, CRITICAL QUALITY ATTRIBUTES, AND EMERGING DEVELOPMENT STRATEGIES

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ABSTRACT

Spirulina (*Arthrospira/Limnospira platensis*) biomass has been extensively investigated in nutraceutical research due to its composition of proteins, phycocyanins and other bioactive compounds. The orally disintegrating tablets (ODTs) represent an attractive dosage form for patients suffering from swallowing difficulties while consuming traditional tablets or powder forms. But Spirulina biomass represents a high dosage amount, cohesive nature, bulkiness and moisture-sensitive powder form having strong color, odor and taste characteristics, thus causing complications during formulation into ODTs that are rarely discussed in literature related to ODTs. Previously published articles have reviewed Spirulina tablets and ODT technologies individually but very little is known about the combination of Spirulina with rapid disintegration property. The current narrative review focuses on key properties of Spirulina relevant for ODT formulation, potential strategies that may be employed for preparation of Spirulina-based ODTs, including superdisintegrants, diluents and carrier agents, taste masking agents, direct compression methods, along with the important quality characteristics and stability aspects. Additionally, safety and quality aspects including microorganism control will be highlighted in this article. Relevant studies will be classified based on the type of evidence i.e., Spirulina, Spirulina constituents, or drug loaded ODTs.

From this review of literature, the methods described for Spirulina ODTs are assumptions that require further experimentation for validation.

Keywords: Spirulina, *Arthrospira Platensis, Limnospira Platensis,* Phycocyanin, Bioactive Compounds, Pharmacological Activities, Nutraceuticals, Orally Disintegrating Tablets, Oral Drug Delivery.

1 INTRODUCTION

Spirulina is a naturally occurring filamentous cyanobacterium it has been present on Earth biosphere for a long period of time. The term Spirulina has been applied to cyanobacteria characterized by a spiral or helical filamentous form .the commercially cultivated Spirulina belongs to the genus *Arthrospira*, specific *Arthrospira platensis* and *Arthrospira maxima.* Traditionally microorganism has been referred to as blue-green algae, while the cyanobacteria belong to prokaryotes and not to algae which are eukaryotes. As all other cyanobacteria, *Arthrospira* does not have a membrane-enclosed nucleus. Its DNA is located in the nucleoid area of the cytoplasm and is organized in a circular chromosome. The microorganism does not contain any membrane-enclosed organelles such as mitochondria and does not have a typical endoplasmic reticulum either. However, it contains a specialized internal photosynthetic membrane system containing the photosynthetic pigments that enable light energy uptake. The cells are surrounded by envelope structures, and the organism usually occurs as a multicellular filamentous trichome consisting of cell chains.[1-6]



Figure 1: Spirulina Plant

Spirulina is categorized as photoautotroph organisms since the utilization of light energy to synthesize carbohydrates through inorganic carbon sources is possible in this organism. Photosynthetic machinery includes chlorophyll a, carotenoids and phycobiliproteins including phycocyanin pigment which gives bluishgreen appearance to the organism. Spirulina can flourish in aquatic environment via photosynthesis; therefore, its value for nutritional and biotechnological application appears evident. As regards the use of Spirulina, the following points may be considered: Nutritionally/pharmaceutical uses include consideration of Spirulina as the organism which contains multiple quantities of proteins, amino acids, coloring matters, vitamins, minerals, essential fatty acids, polysaccharides and biological active substances. Protein rich nature is one characteristic feature of the species, whereas the biological activity of phycocyanin, carotenoids, phenolics and biologically active peptides has been studied by various researchers. Biological activity profile of Spirulina includes antioxidant, immunomodulatory, antiinflammatory, antimicrobial and antiviral properties. But biological activity levels may vary depending on Spirulina strain, cultivation process, method, composition, dose level, and experimental study.[1-6]

1.1 Relevance of Spirulina in Development of ODT

Spirulina is considered as a natural bioactive substance (nutraceutical) rather than pharmaceutical substance with specified molecules. The importance of Spirulina in ODT development is associated with fast dissolving property of ODTs, where it can demonstrate advantages over traditional tablets or even consumption of Spirulina powder directly. It is noteworthy that incorporation of Spirulina into ODTs requires particular attention since Spirulina powder possesses certain characteristics such as characteristic green color, marine odor and flavor, aggregation and agglomeration tendency of powder and considerable bulk volume.[7-10]



Figure 2: ODT Formulation

The high active content could possibly have an effect on the properties of powder flow, mixing, compressibility, tableting, strength, disintegration, mouthfeel, and patient acceptability of the product. The process of developing formulations involves proper selection and optimization of diluents, binders/dry binders, superdisintegrants, masking agents, flavors, sweeteners, and other excipients. [5] Possible superdisintegrants are crospovidone, croscarmellose sodium, and sodium starch glycolate. Moreover, the formulation needs to take into account the sensory aspects of Spirulina because the rapid disintegration of the tablets will make the drug compound come into contact with the taste buds.

The development of an ODT from Spirulina is a kind of formulation engineering in which naturally occurring and bioactive compounds are formulated into rapidly disintegrating forms of oral solid dosage form. The optimization of Spirulina ODT must achieve a reasonable compromise between loading of active and critical quality attributes including flowability, weight variation, hardness, friability, wetting time, disintegration time, active content uniformity, dissolution, dispersion behavior, and sensory acceptability.[10-13]

1.2 Features of Spirulina

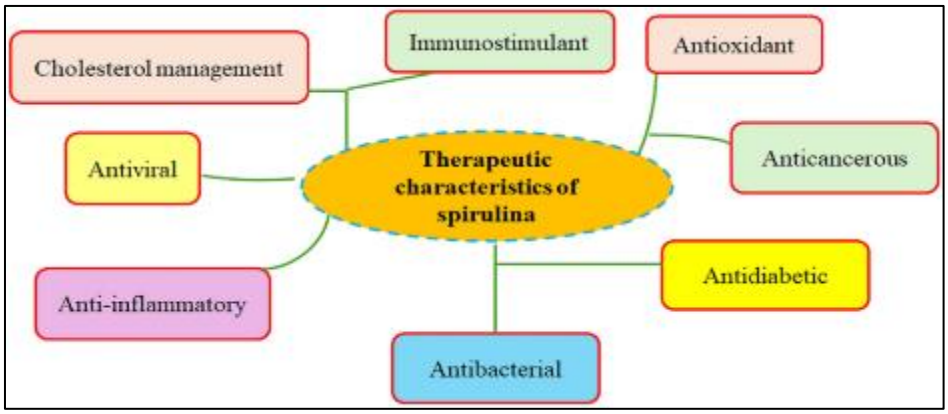


Figure 3: Therapeutic characteristics of Spirulina.

Table 1: Properties and Therapeutic Activity of Spirulina

Properties	Therapeutic Activity
Probiotic properties	It has been found that the presence of oligosaccharides from Spirulina can influence the quantity, diversity, and composition of the gut microbiota. It can help in promoting the growth of bacteria including Bacteroides, Escherichia-Shigella, Megamonas, Megasphaera, Blautia, Bifid bacterium, and Lactobacillus.
Anticancer potential	The effects of spirulina and some of its constituents have also been studied for their effects on the cell cycle in cancerous cells and for inducing cell death through modification of the cell's environment. Some of the constituents may even affect the body's antioxidant defenses and DNA repair process.
Antithrombotic properties	Inhibition activity of polysaccharides, proteins, especially protein phycocyanin derivatives and lipids derived from Spirulina against platelet-activating factor (PAF)-like actions and thrombin-like mechanisms was also investigated.

Neuroprotective effects	Spirulina was found to exhibit neuroprotective potential in laboratory models. Its antioxidative and neuromodulatory actions were investigated for their role in lowering oxidative stress and behavioural/motor dysfunction..
Enhancement of humoral immune responses	Use of Spirulina for Immunomodulatory purposes has been studied. In vitro studies suggest that Spirulina and Selenium-enriched Spirulina can have effects on the humoral immune response. This has been done under physiological stress conditions.

2 UNIQUE PROPERTIES OF SPIRULINA

Spirulina is a living thing that belongs to the category of blue-green filamentous cyanobacterium. Majority of the species belonging to this group belong to genus *Arthrospira*. There are plenty of studies related to this organism as a nutraceutical, functional food ingredient or even pharmaceutical excipient/bioactive compound.

2.1 Taxonomic and Morphological Properties

Two most famous species belonging to this organism include *Arthrospira platensis* and *Arthrospira maxima*. The morphological features of this organism include trichomes or long multicellular filaments. The trichomes have a tendency to coil into spirals. Photosynthetic pigments of this organism give it a blue-green color. In contrast to higher plants, Spirulina lacks a typical cellulose cell wall.

2.2 Macronutrients

Table 2: Macronutrient in Spirulina

Nutrient	**Per 100g**
Protein	51 -72 g
Carbohydrates	16 - 25 g
Total Fats	7.2 -7.72 g
Dietary Fibre	8 -10 g
Lipids (Fats)	6 - 9 g
Potassium	1,300-1,363 mg
Iron	25.10-28.50 mg
Energy (Calories)	270-290 kcal

2.3 Important Bioactive Constituents

Table 3: Bioactive Constituents in Spirulina

Constituent	**Importance**
C phycocyanin	Antioxidant and anti-inflammatory activity
Carotenoids	Antioxidant and cellular protective effect
Chlorophyll	Photosynthetic pigment of biological significance
Polysaccharide	Immunomodulatory and other biological activities
Phenolic compounds	Antioxidant potential
γ Linolenic acid (GLA)	polyunsaturated fatty acid
Proteins/peptides	Nutritional and potential bioactive functions
Tocopherols	Antioxidant activity

2.4 Nature rich in pigments

Another important distinguishing property of Spirulina is the presence of abundant phycobiliproteins, namely C-phycocyanin. The color of Spirulina largely depends on this pigment which is one of the most studied bioactive ingredients.

2.5 Features of antioxidants

Several substances in Spirulina have been identified as having antioxidant activity and might be able to counteract reactive oxygen species formation. These include phycocyanin, carotenoids, tocopherols and phenolic compounds.

2.6 Inflammatory effect

Some bioactive substances of Spirulina, such as phycocyanin, were studied for their ability to affect inflammatory messengers and pathways. That made Spirulina an interesting subject in the study of inflammatory diseases.

2.7 Features as immunomodulatory agent

Some bioactive substances of Spirulina have been studied for their possible effect on various aspects of immune response. These include polysaccharides, proteins and pigments of Spirulina.

2.8 Metabolic health features

There have been conducted studies on the potential influence of Spirulina on the following metabolic aspects: Regulation of blood glucose Lipid metabolism Cholesterol level of triglycerides Oxidative stress Cardio metabolic risk factors.

2.9 Applications in Pharmaceutical and Nutraceutical Areas

In view of the nutritional and bioactive aspects, the applications of Spirulina can include:

- Tablets
- Capsules
- Powders
- Granules
- Functional foods
- Nutraceutical products

2.10 Advantages in cultivation

It is possible to cultivate Spirulina relatively economically in proper conditions. It grows in alkaline water and can be grown on an industrial scale.

2.11 Considerations about stability and formulation

Important parameters for the formulation of the pharmaceutical product include:

- Water content
- Particle size
- Flow properties
- Compressibility
- Bulk and tapped density
- Microbiological purity
- Pigment/bioactive compound stability
- Storage conditions

3 FORMULATION CHALLENGES: PROPERTIES OF SPIRULINA RELEVANT TO ODT DEVELOPMENT

The features of Spirulina biomass that matter most for ODT design are summarised in Table 4. They are mainly physical and sensory rather than pharmacological, and they are the main reason why Spirulina cannot simply be treated as a conventional drug in an ODT platform. [12-14]

Table 4: Properties of Spirulina biomass relevant to ODT development

Property	Formulation consequence	Evidence basis
Strong green colour, algal odour and taste	Rapid disintegration exposes the taste buds to the biomass, so taste and odour masking is critical	Described for Spirulina tablets [10]; taste-masking principles come from general ODT work
Cohesive, bulky powder with poor flow	Poor flow, blending and compressibility at high loading; granulation or directly compressible carriers may be needed	Spirulina tablets similar loading problems in high-dose herbal extract tablets [12,13]
Moisture uptake	Affects flow, hardness, disintegration and stability; needs moisture control and suitable packaging	Spirulina tablets[12-14]
Pigment (phycocyanin) instability	Colour and bioactive content can be lost; protective measures are needed	Phycocyanin literature not studied in ODTs
Variable composition between batches	Strain, cultivation and processing influence composition, so active content needs standardisation	
High required dose per tablet	Tablet size and mouthfeel limit the load; a high load leaves less room for disintegrant and masking agents	Reasoned from high-dose herbal tablet work not tested for Spirulina ODTs[13]

3.1 Formulation and Manufacturing Strategies

Table 5 compares the strategies usually proposed for Spirulina ODTs with the evidence that supports them. Most come from general ODT research and until tested with Spirulina at realistic loadings, should be treated as hypotheses. [10-17]

Table 5: ODT formulation strategies and supporting evidence

Strategy	Intended purpose	Evidence basis	Status for Spirulina ODTs
Superdisintegrants (crospovidone, croscarmellose sodium, sodium starch glycolate)	Rapid disintegration while keeping tablet strength	General ODT reviews[10]	Extrapolated; needs testing at high Spirulina load
Directly compressible diluents and carriers; direct compression	Overcome poor flow and compressibility of the powder	General ODT reviews; Spirulina tablet review[11]	Partly addressed for Spirulina tablets, not shown for ODTs
Granulation of Spirulina biomass	Improve flow and density before compression	Spirulina tablet review[14]	Described for tablets; effect on ODT disintegration not shown
Taste and odour masking (sweeteners, flavours, polymer coating of granules)	Improve acceptability of the rapidly dispersing tablet	Bitter drug ODTs reviews[16]	Extrapolated; algal taste and odour not tested in these studies
Pigment protection (moisture control, light-protective packaging, encapsulation)	Retain phycocyanin and colour during storage	Phycocyanin reviews Spirulina tablet review[17]	Constituent-level or tablet data only; no ODT data

3.2 Critical quality attributes and stability

Table 6 lists the quality attributes that should be assessed for a Spirulina ODT and why each one is a particular concern for this ingredient. [18]

Table 6: Critical quality attributes and stability considerations

Attribute	Relevance for Spirulina ODTs
Hardness and friability	ODTs must withstand handling yet disintegrate quickly; a bulky biomass can make this balance difficult
Disintegration and wetting time	Defining ODT attributes; must be measured on the actual high-load formulation
Weight variation and content uniformity	Poor flow can cause variation; active content can be tracked through a suitable marker where justified
Sensory acceptability	Taste, odour, colour and mouthfeel determine acceptability and should be assessed rather than assumed
Moisture, pigment and storage stability	Moisture uptake and pigment degradation affect shelf life; packaging should follow stability data
Microbiological and contaminant quality	Biomass should be tested for microbial load, heavy metals and cyanotoxins
Regulatory and evaluation aspects	ODT evaluation and regulatory expectations are described for drug products; their use for a nutraceutical ODT depends on its regulatory category

3.3 Safety and Quality Aspects

Since spirulina is a biological source material, safety will depend on culture and processing. Cyanotoxins, heavy metals and microbes contamination studies were carried out on commercial microalgae dietary supplements. Also, multiclass cyanotoxin analysis techniques were reported for blue-green algae dietary supplements. Specifications on the raw material quality, testing for contaminants and consistency between batches should be established prior to interpreting results on any formulated orodispersible tablet. Conclusions on safety based on literature cannot be made for the specific dietary supplement under study. [19-20]

3.4 Spirulina Biological Activities: Background

The subsections highlight various biological activities associated with Spirulina and its components. These are the reasons why Spirulina formulations deserve attention. Most of the data presented here are based on pre-clinical investigations or pilot studies. The Spirulina is a unique strain of cyanobacterium consisting of filamentous and spiral-shaped blue-green algae called trichomes containing diverse nutritious components. These contain various proteins, vital amino acids, polyunsaturated fats, vitamins, minerals, and other bioactive ingredients. The Cphycocyanin, carotenoids, chlorophylls, polysaccharides, phenolics, and tocopherols can be listed among the major bioactive substances. Among these, the Cphycocyanin is distinguished as it exhibits specific structural pigments as well as biological activities, including antioxidant, anti-inflammatory, and immunomodulatory properties. Due to their high nutrition values, digestibility, and bioactivity, they have been extensively investigated for use in nutraceuticals and pharmaceutical formulations. Potential applications of Spirulina formulations as medicinal substance: The Spirulina refers to a type of filamentous cyanobacterium with distinctive spiral-shaped Trichomes. The size of the filamentous alga differs according to species, strains of the microalgae, environmental culture conditions, temperatures, and the physical properties of the growth medium. [21-22]

However, helical structure of *Arthrospira* is not always constant and sometimes affected by certain environmental conditions. Variations have been observed regarding various sizes of trichomes including diameter, pitch, and coil density. These parameters have significance when talking about biomass processing due to possible influence of mentioned characteristics on physical characteristics of resulting powder from biomass. The second product which gained popularity due to immunomodulating effects is called Spirulina. A number of experiments aimed at investigating the effect of this substance on innate and adaptive immunity including modulating activities of T and B lymphocytes, NK cells, monocytes, and macrophages as well as cytokine and antibody production. Phycocyanin is another interesting compound which attracted scientist's attention among substances contained in Spirulina. This is the substance responsible for photosynthesis and found in Spirulina in large quantities. Experimental evidence exists about possible influence of Spirulina and Spirulina components on inflammation process and immunity system. Additionally, the experiments conducted during investigations on effects of Spirulina supplementation on gut immunity showed alteration of intraepithelial lymphocyte populations and cell markers.

Research performed in humans and experimental animals suggests that there is alteration in certain factors involved with immunomodulatory functions in response to the consumption of Spirulina. Those include Interferon-gamma (IFN-γ), Interleukin-12 (IL-12), natural killer cells, and phagocytosis. It has been observed that consumption of Spirulina exhibits significant immunomodulatory effects despite the variation in strain of Spirulina, composition, dosages, and processing. Anticancer Properties of Spirulina Scientific literature indicates that Spirulina, especially *Arthrospira platensis*, has gained immense attention because of the presence of various bioactive compounds and their potential biological properties. Investigations carried out by means of Spirulina biomass and isolated extracts have demonstrated various biological properties such as anticancer, antioxidant, anti-inflammatory, and antiproliferation properties. Experimental research studies indicate that Spirulina supplementation may lead to alteration in carcinogenic cellular mechanisms. Specifically, Spirulina and isolated bioactive fractions of Spirulina have been reported to cause alteration in proliferation, apoptosis, and regulation of proteins like p53, p21, Rb, and Bcl-2 protein families.

Spirulina has been tested in animal models of chemical carcinogenesis, showing reduction in tumor growth and precancerous conditions after its consumption. Such findings are preclinical, nonetheless, and cannot be taken as proof that Spirulina prevents or treats cancers in humans. [21-23]

4 SPIRULINA PLAY IMPORTANT ROLE IN VARIOUS DISEASES

4.1 Spirulina's Antiviral Potential

In addition, the antiviral effects of Spirulina and its isolated bioactive fractions have been studied experimentally. Hot-water extracts, sulfated polysaccharide fractions, and phycocyanin fractions have been tested against viruses.

Selected Spirulina-derived polysaccharide fractions have inhibited viral replication in in-vitro experimental systems. Sulfated polysaccharide fractions have been tested specifically against enveloped viruses such as herpesviruses and other viral models. Therefore, there is growing interest in Spirulina-derived polysaccharides as a source of antiviral bioactive substances.

Antimicrobial and antiviral effects have been observed in Spirulina C-phycocyanin and other fractions in experiments. Antiviral effects have been observed in Spirulina-derived fractions with selected microorganisms and herpes simplex virus models. The strength of these effects, however, is highly dependent on the extract, purification process, concentration, experimental system, and biological model.

Thus, the antiviral effects that have been described for Spirulina can be considered investigational and preclinical at this point and not clinical antiviral effects at all. Controlled studies should be performed to determine whether there are clinically relevant antiviral effects.[21-24]

4.2 Potential Anti-Inflammatory Actions of Spirulina

There has been research done on the potential anti-inflammatory actions of Spirulina and some of its compounds, especially C-phycocyanin. Reduced inflammatory reactions have been observed in various animal models through experiments, which have been attributed to the regulation of the inflammatory mediators and oxidative stress-related pathways.

Some parameters, such as edema and the inflammatory mediator levels, such as prostaglandin and leukotriene-related responses, have been reduced using preparations from Spirulina in inflammation experiments. C-phycocyanin has drawn more interest due to its potential to regulate inflammatory signalling and oxidative processes.

From these experiments, it is clear that there is a potential for anti-inflammatory action from Spirulina. However, the magnitude of the action depends on the preparation used, the dosage, the mode of delivery and the experimental model used. There is a need for more clinical studies to confirm these findings. [21-24]

4.3 Spirulina as an Antioxidant Source

Oxidative stress occurs due to increased production of reactive oxygen and nitrogen species that may lead to oxidative damages to the cells and tissues. There are multiple constituents found in Spirulina, which may possess antioxidant activity, like C-phycocyanin, carotenoids and others.

According to the data obtained in experiments, the supplementation of animals with Spirulina extract may result in decreased oxidative-stress-induced markers and lipid peroxidation. The Spirulina extract has demonstrated free-radical scavenging activity in experiments.

One of the constituents found in Spirulina, which has been the most researched as an antioxidant, is C-phycocyanin. In accordance with the available experimental data, it is able to participate in antioxidant protection by its scavenging activity and/or influence on endogenous antioxidant systems such as superoxide dismutase (SOD), catalase and glutathione peroxidase.

These data confirm the antioxidant potential of Spirulina. Nevertheless, the obtained results depend on the composition and treatment of the Spirulina product and cannot be regarded as equivalent to clinical therapeutic effects.

Antioxidant property makes Spirulina suitable for selection as bioactive natural product in development of formulations. The ODT formulation needs to be assessed in terms of its physical quality, active content standardization, disintegration, dissolution and stability aspects. [21-24]

4.4 Antidiabetic and Metabolic Potential

The antidiabetic properties of Spirulina have been investigated due to the effect of this microalga on carbohydrate and lipid metabolism. Experiments involving animal models have noted a change in levels of glucose and lipids in blood and associated metabolic processes following the consumption of Spirulina. Spirulina is believed to affect carbohydrate and lipid metabolism due to its antioxidant, anti-inflammatory and metabolic activity. Some experiments in animal models of diabetes or metabolic disease have observed an improvement in certain biochemical parameters. [21-24]

4.5 Possible Anti-hypertensive Properties

The possible effects of peptides obtained from Spirulina and protein hydrolysates on cardiovascular physiology have been tested in various experiments. The use of hydrolysates of *Arthrospira platensis* and selected peptides resulted in reduced blood pressure in animal models of hypertension.

Possible ways the effects are achieved involve regulation of renin-angiotensin system, including pathways connected with angiotensin-converting enzyme (ACE), angiotensin receptors, and vasodilation.

Spirulina-derived peptides were also tested for their potential vasodilation-promoting properties related to endothelial cells. It was discovered that certain peptides might affect PI3K/AKT pathways, leading to nitric oxide-mediated vasodilation.

From these results, one can conclude about possible cardiovascular effects of Spirulina-derived peptides. However, since all the results are experimental, Spirulina cannot be claimed to be an antihypertensive agent. [21-24]

5 FUTURE PROSPECTS OF SPIRULINA ODT FORMULATION

There are plenty of applications for Spirulina as a nutritional supplement, which is characterized by high protein content (about 60–70% of the dry weight), vitamins, minerals, and bioactive ingredients, such as phycocyanin and carotenoids. The preparation of Spirulina is currently available in powder form, capsules, and conventional tablets. Spirulina ODT formulation might become an alternative solution for those patients that find it difficult to swallow conventional tablets. Further research and evaluation of formulation properties, palatability, disintegration, mechanical strength, and stability are required.

Spirulina was also evaluated as a potential remedy for hypertension, diabetes mellitus, and oxidative stress related disorders more clinical trials are required in order to prove its efficacy. The future development of Spirulina ODTs will require further formulation optimization, biomass standardization, and contamination reduction (heavy metals and cyanotoxins). It is also necessary to evaluate such parameters as hardness, friability, disintegration time, and content uniformity. Additionally, controlled cultivation technologies, including photobioreactor technology, can help to provide greater biomass consistency and production control. Production process also has to be taken into account. In order to guarantee the uniform quality of biomass and avoid any contamination, the production process of Spirulina has to be properly controlled. Controlled cultivation techniques such as photobioreactors could help monitor the production process better. However, the efficiency of these systems depends on many factors.[24-27]

6 FUTURE WORK PRIORITIES

- **Tablet formulation of Spirulina:** Explore different loading amounts of Spirulina, superdisintegrants, diluents, binders and manufacturing techniques for optimal tablet strength and quick disintegration.
- **Sensory characteristics and taste masking:** Evaluate the sensory attributes of Spirulina ODTs in terms of taste, aroma, color, and texture as well as possible taste masking methods.

- **Stability of phycocyanin**: Measure the stability of phycocyanin in the process of manufacturing, packing, and storing at appropriate temperatures, humidity, and light.
- **Quality and standardization:** Define the proper criteria for Spirulina biomass and Spirulina ODTs for their composition, microbiological quality, heavy metal contamination, and other potential toxic substances.
- **Evaluation of ODTs:** Measure the disintegration time, hardness, friability, uniformity of content, moisture sensitivity, and stability.[24-27]

7 CONCLUSION

Spirulina (*Arthrospira/Limnospira platensis*) an algae is rich with nutrients such as proteins, phycocyanin, and carotenoids along with several others. Application of Spirulina in oral disintegrating tablets (ODTs) is suggested as one potential method to develop an appropriate dosage form for patients suffering from problems with swallowing of regular tablets.

However, the formulation challenges including poor powder flow properties, low compressibility capacity, bitter taste and smell of the ingredients, and instability due to storage conditions can be overcome with correct excipients and formulation procedures. Evaluation for various parameters such as mechanical strength, disintegration time and homogeneity of contents, organoleptic qualities, and stability are required to be carried out on developed tablets. It is also vital to analyze quality and safety aspects of the ingredients in terms of microbiological contamination, heavy metals contamination, and cyanotoxins.

Spirulina loaded ODTs have been shown promise as a potential alternative dosage form but require further research for the development of a suitable formulation.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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No Conflicts of interest to be disclosed.

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