A Review on Extraction of Chia Seeds Mucilage & Its Potential Properties.

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Abstract

Chia seeds (Salvia hispanica L.) are rich in natural polysaccharides known as mucilage, which possess excellent hydration, gelling, and stabilising properties. These characteristics make chia seed mucilage a promising natural alternative to synthetic stabilisers commonly used in pharmaceutical gel formulations. The present review focuses on the extraction methods, characteristics, and functional applications of chia seed mucilage.This review highlights the growing interest in natural excipients and supports the potential of chia seed mucilage as an effective stabiliser in pharmaceutical gels. Its accessibility, safety profile, and functional performance make it a valuable candidate for future formulation development in pharmaceutics.

Keywords

Chia Seed Mucilage, Extraction Methods, Gel Formulation, Stabiliser

1. Introduction

Fig no. 1 Salvia hispanica L. plant

Gels are semisolid systems in which a liquid phase is constrained within a three dimensional polymeric matrix of natural or synthetic gums. The U.S.P. defines gels as a semisolid system consisting of dispersion made up of either small inorganic particle or large organic molecule enclosing and interpenetrated by liquid. Most topical gels are prepared with organic polymers, such as Chia seed Mucilage that impart an aesthetically pleasing, clear, sparkling appearance to the products and are easily washed off from the skin with water. The type of base used in formulating a topical dermatological product greatly influences its effectiveness.

Properties of gel:

i. For pharmaceutical or cosmetic application the gelling agent should be safe, inert and it should not react with other formulation components.

ii. The topical gel must not be sticky.

Types of Gel :

I. Hydrogels: Hydrogel is a system of polymer chains that are hydrophilic, once in a while found as a colloidal gel in which water is the scattering medium. Hydrogels are exceedingly absorbent.

II.Organogel: An organogel is a non-crystalline,non smooth thermoreversible (thermoplastic) strong material made out of a liquid

organic stage captured in a three dimensionally cross-connected system.

Sr.no	Particulars	Description
1	Plant	1m long
2	Leaves	4-8 cm long and 3-5cm wide
3	Leaves Shape	oval-elliptical shape with acute apex.
4	Seeds	1-2 mm long and 0.8 - 1.4 mm wide
5	Seeds Color	Black, brown, gray, black spotted, or white.

III.Xerogel : A xerogel is a solid structure from a gel by drying with unhindered shrinkage.

The exploitation of plants by human beings for the treatment of various diseases has been in practice for a very long time. Herbal source of drugs constitutes a major part in all the traditional system of medicines. The integration into modern agriculture of chia is ongoing and considering that in the next years their demand will continue increasing. Chia (*Salvia hispanica L.)* is a well-known plant containing the very high nutritional and therapeutic value. In spite of having a small size, it is very beneficial for the health, as it is a high source of omega - 3 ALA with a high amount of fiber, iron content, and rich in antioxidants.

2. Biological Classification:

I. Kingdom: Plantae
II. Division: Magnoliophyta
III. Class: Magnoliopsida
IV. Order: Lamiales
V. Family: Lamiaceae (Mint family)
VI. Genus: *Salvia*
VII. Species*: Salvia hispanica L*
VIII. Common name: Chia seeds

3. Morphological characteristics of S. Hispanica l. Plant

Table no.1

4. Phytochemicals in Chia Seeds:

1.Caffeic Acid : Caffeic Acid present in Chia seeds induce hypoglycemic activity and is effective against epilepsy.

2.Rosmarinic Acid : Rosmarinic acid present in Chia seeds gives Immunoregulatory, Anti-microbial, antioxidant and anti-inflammatory activities.

3. Protocatechinic acids : The Protocatechinic acids present in the Chia seeds induce the antioxidant activities.

4. Salicylic acid : Salicylic acid present in the Chia seeds is used as peeling agent. The peels have the therapeutic effect.

Fig no.2 Chia Seeds

5. Active Constituents in Chia Seeds:

Active Compounds in *Salvia hispanica L.* Seeds	**Biological Activity**
Quercetin	Anti-Oxidant Anti-Carcinogenic Anti Hypertensive
Vitamins (A,B1,B2,B3)	Heathy skin benefits Normal red blood cells working
Caffeic acid	Anti-Oxidant Anti-Carcinogenic Anti Hypertensive
Mycertin	Anti-oxidant
Omega-3-fatty acid	-Anti-Inflammatory - Anti-Diabetic

Table no:2

6. Nutritional Composition :

The primary fatty acids present in Chia seeds are ALA, linoleic acid, oleic acid, palmitic acid, stearic acid. Chia seeds have been reported to be among the richest sources of high-quality vegetative proteins and dietary fibers. The protein content was reported as 18.9–23% with the presence of many peptides of bioactive potentials. A and various forms of antioxidants like flavonoids and cinnamic acid. Moreover, chia seeds are a rich source of polyphenols and antioxidants including caffeic acid, rosmarinic acid, myricetin, and quercetin, etc.They are rich in crucial fatty acids, particularly with a high omega-6 which reduces the BP and lowers risk of Cardiovascular Diseases.

I. DIETARY FIBRE :

Efficient use of fibers decreases heart diseases, diabetes mellitus type 2, kidney stones, metabolic disorders. Total fiber content in chia makes up 23–41%. This fibre content is higher than quinoa, flax seeds even greater compared with other dried products. Chia seeds accelerate intestinal movement due to high quantity of insoluble fiber that increase volume of faecal mass and provide satiety, thus preventing obesity and insoluble dietary fibre content in chia seeds increased gastro intestinal time and it gradually increase post-prandial glucose levels and decrease insulin resistance over a period of time.

II. Fatty Acids :

Chia seeds contained α-linolenic acid (ALA). Due to their excellent fatty acid concentration of chia seed is known as power house of omega fatty acids. Eicosapentaenoic acid and docosahexaenoic acid have cardio protective effects. The fatty acids improve the parasympathetic tone, heart rate variability and protect ventricular arrhythmia. A little ratio of omega- 3 fatty acid is linked with a decreased chance of many long- lasting diseases like heart problem, cancer, inflammation, and premature deaths.

III. Protein Content :

With 20 % protein content, chia possesses a massive potential to correct and prevent protein energy malnutrition. Protein content of the seed greatly depends upon environmental and agronomic factors. The protein content of chia seed is greater than protein content of all the cereals. The absence of gluten in chia is another unique feature of chia that it can be digested by the patients suffering from celiac disease. The presence of 9 essential amino acids in chia in appreciable amount. Foods rich in protein had a great deal of effect on weight loss due to the loss of fats in the body.

IV. Lipid Content :

Chia seeds are being extensively studied as an alternative to current sources of long-chain fatty acids. These seeds have shown promising results in reducing the levels of triglycerides in human blood, which in turn improves cardiovascular and cognitive functions.

7. POTENTIAL ACTIVITIES OF CHIA SEEDS :

I. Cardioprotective Potential:

Chia seeds include the reduction of cholesterol, inhibition of blood clotting, prevent stresses and epilepsy, improvement of the immune system, eating chia in pregnancy helps in the development of retina and brain of foetus.[20] Hydrolysates of chia seed proteins show an activity inhibiting angiotensin convertase (ACE). They observed that the inhibition of activity of the enzyme converting angiotensin is dependent on the duration of hydrolysis.[18] Chia seed were useful for prevention and management of allergies, angina, coronary heart disease, heart attack, hyperlipidaemia, hypertension, stroke and vasodilatation.[11]

II. Anti-Oxidant Potential :

Ingestion of chia seeds extract decreased oxidative stress that was manifested in reducing MDA (malondialdehyde) levels and increasing GSH (glutathione) levels indicating a potent antioxidant ability.

This is linked to the presence of high levels of antioxidant nutrients such as chlorogenic acid, caffeic acid, myricetin, quercetin, kaempferol and omega-3.These nutrients aid in decreasing the oxidative stress and activating hepatic antioxidant enzymes leading to reduction of lipid peroxidation. Chia seeds are considered to be one of the most important antioxidant herbal nutraceuticals, since they represent a very good source of polyphenols and antioxidants such as caffeic acid, rosmarinic acid, myricetin and quercetin. The advantages of chia seeds being a potent antioxidant. They have shown a great help in decreasing and delaying the onset of many diseases including obesity and related health disorder, aging and inflammatory diseases.

8. Market Demand and Commercial use of Chia Seed:

Today, the demand for functional foods has increased a lot; this is happening due to the increasing number of people suffering from many diseases like CVS, diabetes, obesity, etc. These conditions have been arising due to bad day to day routine and inappropriate balanced diet. People are consuming saturated fatty acids in a very high amount, which is not very beneficial for health. The main reason why chia is gaining popularity in the market is because of its high content of omega-3-apha linolenic acid and anti-oxidative properties.

9. Uses :

1.Cardioprotective and helps control diabetes

2.Controls dyslipidemia

3.Beneficial for celiac disorders, joint pain and kidney disorders

4.Anti-inflammatory

5. Antioxidant

10. Topical Application Benefits :

1. Hydration : This are hydrophilic which helps keep the skin plump, dewy and soft without sticky residue.

2. Anti-Inflammatory: The omega-3-fatty acids show anti-inflammatory activity that help calm redness, puffiness and irritation from conditions like acne.
3. Skin barrier support: It contains alpha-linoleic acid (ALA) which help strengthen the skin's natural barrier and improve ability to retain moisture.
4. Oil control: Help balancing oil production (for oily and combination skin).
5. Brightening: Can help with uneven skin tone (has niacin).
6. Soothing and Healing: Has antibacterial properties can help with acne and wound healing.
7. Can be used as moisturizer.

11. Extraction Methods For Gel/Mucilage Extraction:

A. Soxhlet Extraction Method:

Firstly weight and clean the chia seeds after that chia seeds Were grinded for the extraction process, Chia Seed powder was weighed, and the weight recorded. The weighed sample was dropped in the Soxhlet extractor apparatus The extraction was carried out using normal Ethanol In the Soxhlet apparatus, the solvent in the round bottom flask was heated from the heating mantle to become evaporated and got condensed down through the sample where it was able to extract the oil along thereby, giving a mixture of oil and solvent, which was later separated filtered through Whatman No.1.Alcohol was evaporated under pressure by rotary evaporator to leave Chia Seed oil behind.

Carbopol 934 was dissolved slowly with stirring of demineralized water for 1hr to avoid agglomeration, then Methyl paraben & triethanolamine were dissolved in 10ml of demineralized water separately & stirred for 10 min .mixed propylene glycol in a water for 10 min. Methyl paraben and triethanolamine Solution were added to carbopol Solution and the PH was then adjusted to 4.7 by stirring the solution for 10min. then

propylene glycol solution was added with stirring for 10 min. until a clear Consistent gel was obtained. Finally the required quantity of chia seed extract was added at room temperature and Formulation were evaluated.

B. Cold Extraction :

The samples of 100 g of whole seeds were added to a container containing distilled water with seed:water ratio of 1:10,1:20, 1:30 and 1:40 with pH maintained at 8 and temperature at 27 °C using temperature controller. The mixtures were magnetically stirred and hydrated for 2 hrs and separation was done by pressing in ultrafreezer. Then dried in freeze dryer at -50°C.

12. Evaluation Parameters For Gel :

A. Physical Appearance: Organoleptic properties(colour, odour texture,consistency)

B. Measurement of pH

C. Washability

D. Skin irritation test

E. Homogenesity

F. Spreadability

13. Conclusion

Peptides identified from chia seeds have the active potential against various disease like antioxidative, hypoglycemic, immune-modulatory, anti-inflammatory and antihypertensive potential.The study gives the overview of the nutraceutical benefits of the chia seeds.Chia seeds contain a dietary fiber, proteins, vitamins (A, B1, B2, and B3), minerals, and antioxidants.Chia seeds were found to be a good source of minerals.Study of antioxidant properties and benefits of gel of Chia Seeds giving hydrating effects to skin, beneficiary for acne, reduce irritation, redness of skin and dark circles.Chia seed mucilage is polysaccharide rich hydrocolloid with exceptional gel-forming, thickening and stabilizing properties.This review summarises the key physiochemical and functional properties of chia mucilage which makes it significant in the therapeutic and biological perspectives.The Chia seed mucilage holds significant

potential as an eco-friendly versatile ingredient in therapeutic formulations and sustainable biomaterials. It also gives an overview on the extraction by various conventional as well as modern techniques.

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