

# Quinoa a Potential Ingredient in Cosmetics: A Review

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**Abstract:** According to FDA Guidelines, “Cosmetics” are the articles with mild action on human body, which are intended for dermal application through rubbing, sprinkling, or other methods, aiming to clean, beautify and to increase the attractiveness, and alter the appearance or to keep the skin in a good condition. Due to an increasing demand of natural cosmeceuticals various herbal ingredients are now added in modern cosmetic formulations. One such ingredient i.e., “Quinoa” (*Chenopodium quinoa* Willd.) is highly rich in vitamins, minerals, proteins, carbohydrates, amino acids, saponins, phytosterols, phytoecysteroids. As it is rich in many bioactive compounds it can be used as a potential ingredient in many cosmeceuticals. The present review gathers information on “Quinoa” and its amazing benefits.

**Keywords:** Quinoa (*Chenopodium quinoa* Willd.), Potential ingredient, Natural herb, Amazing benefits.

## I. Introduction:

Quinoa: Quinoa is a plant which is having a very high nutritional value.

It is rich in micronutrients and also macronutrients and contains a valuable source of digestible protein. Due to its high protein and amino acid content, it is being consumed by people. The grains of quinoa are gluten-free and also rich in nutrients so it can be used in food products. <sup>[1]</sup>

- Biological source: Quinoa (*Chenopodium quinoa* Willd.) is a plant belonging to family Amaranthaceae, is a food plant. <sup>[2]</sup>
- Geographical source: It is indigenous to Andean region of South America. <sup>[3]</sup>

➤ Botanical Description of *Chenopodium Quinoa*:



Figure: *Chenopodium Quinoa* Willd. <sup>[4]</sup>

- Synonyms: Supha, suba, jupha, dahue, quinoa. <sup>[3]</sup>
- Taxonomy: <sup>[5]</sup>

Kingdom- Plantae

Subkingdom- Dicotyledoneae

Group- Thalamiflorae

Order- Caryophyllales

Family- Chenopodiaceae

Genus- *Chenopodium*

Species- quinoa.

- Morphology: It is pseudo-cereal grain and cultivated by people living in Andes and is the oldest plant (5000 B.C). The plant is about 1mm thick, 1mm- 2.5mm in diameter. <sup>[3]</sup>

The review focuses on the phytochemical activity of quinoa and as quinoa is highly rich in many bioactive compounds it can be used in various cosmetic formulations.

## II. Indian History:

This herb was introduced at Shimla, Himachal Pradesh and by IARI in New Delhi. It was also cultivated well as a winter crop in New Delhi.

- Cultivation of Quinoa herb:

The herb favours soils which are rich in calcium, potassium and magnesium. This crop matures within 165-175 days. Then it is harvested, roll-up, dried and bashed and then the chaff of the grain is removed. The yield may vary from various region to region which generally depends on the type of cultivation.

- Description:

It has shallow roots, annual hollow stems up to 2m height. Leaves are wavy- rounded, but in some form it is marginally lobed.

The flowers are small, green, and are usually clustered in axillary and terminal panicles.

The seeds are small, 1.4-2.0mm in diameter, which may be of white-ivory, cream, yellow, red or black, striped. This grain is mainly used as nutritional food in many parts of the world.<sup>[6]</sup>



Figure: Seeds of quinoa.<sup>[7]</sup>

It consists of 93.2% flour and 6.8% bran and higher amounts of protein content.

The grains may contain bitter and toxic saponins. So, to remove the bitterness it is often washed with alkaline water.<sup>[6]</sup> The Saponins should be eliminated or reduced before cooking or industrial processing as the structure of saponins may negatively impact on animals and humans.<sup>[8]</sup> 'Sweet Rose' and 'Sweet White' are the varieties which are free from toxic saponins.<sup>[6]</sup>

### III. Indian species of Chenopodium:

Botanical species	General description
a. <b>C. amaranticolor</b> Coste & Reyn. Syn. <b>C. album</b> Linn	It is an erect annual, 2.5cm height. This plant is usually found in Himachal Pradesh, Aligarh, Delhi and sometimes in Indonesia. The leaves are rich in oxalates. <sup>[9]</sup>
b. <b>C. capitatum</b> (Linn) [Indian-Paint strawberry-Blite]	It is an erect annual, up to 45cm in height. Usually found in Shimla. <sup>[10]</sup>
c. <b>C. foliosum</b> (Moench) Aschers syn. <b>C. blitum</b> Hook.f. (Strawberry Goosefoot)	It is a glabrous, erect or ascending herb. The height is 30-90cm. Usually found from Kashmir to Kumaun. This herb is excellent vegetable. <sup>[11]</sup>
d. <b>C. glaucum</b> Linn. ( Oak-Leaved Goosefoot)	It is a succulent herb, decumbent or prostrate. The herb is found at higher altitudes 3,150-5,400m. It is usually found in Ladakh and Kashmir. <sup>[12]</sup>
e. <b>C.nuttalliae</b> Saff.syn. <b>C.pueblense</b> Reed	It is an annual herb. The seed is great source of food. It is rich in tryptophan. It was introduced in India from Mexico. <sup>[13]</sup>

### IV. Extraction Techniques:

A] Soxhlet Extraction: 10g of samples of ground quinoa seeds weighed to the nearest 0.0001g and then mix with 10g of sand for determining the oil content by soxhlet extraction using n-hexane at 60degree C for 16 hours. After extraction, n-hexane is evaporated under vacuum at 40 degree C and nitrogen steam is used subsequently. The solvent is totally removed. After solvent evaporation, the oil content should be gravimetrically determined. The mass of extracted oil is assumed to be 100% of the extractable matter.<sup>[2]</sup>

B] Super Critical fluid extraction: For study, a laboratory-scale SFE system Lizard 2001 SEKO-K s.r.o [Czech Republic] is used. The ground seeds of Quinoa are loaded into the extractor cell of 1.2ml capacity; 0.5cm internal diameter (i.d.) and 6.1cm of effective height. About 0.4g of sand and 0.6g of ground seeds (weighed to the nearest 0.0001g) are located into the cell and the content of the cell is stirred for 5minutes using a rotary stirrer. For all the modifiers (co-solvents) study, the modifier spiked directly into the sample in the extraction of vessel before the extraction cell is attached to the SFE system. The extract is collected into 12ml vials.

At a temperature of 40-80 degree C, and at a pressure from 18 to 30 MPa the experiment is carried out for a time of 40-140 minutes. It is not possible to adjust the CO<sub>2</sub> flow in this SFE system. CO<sub>2</sub> flow rate measurements are performed at the end of the capillary (restrictor) with diameter of 45µm and length of 7cm. The SC-Co<sub>2</sub> flows is based on extraction conditions and are within the range from 10.5 to 27.01/hr.

Determination of the extraction yield is compared by the weight of oil obtained by SFE with the weight of oil obtained by Soxhlet extraction.<sup>[2]</sup>

#### V. Chemical Composition of Chenopodium Quinoa:

Chemical Composition	Concentration
1. Saponins	0.1-5% <sup>[14]</sup>
2. Phytic acid	10.5- 13.5 mg/g <sup>[15]</sup>
3. Phytosterols	100g of Quinoa seeds contains 118mg phytosterols. <sup>[16]</sup>
4. Phytoecdysteroids	138-570µg/g <sup>[17]</sup>
5. Proteins	13.8% - 16.5% <sup>[18]</sup>
6. Carbohydrates	64-72% <sup>[19]</sup>
7. Lipid	2.0-9.5% <sup>[20]</sup>
8. Vitamins(ascorbic acid)	0-63.0 mg/100g <sup>[21]</sup>
9. Ash content	Its ash content is 3.4% <sup>[22]</sup>
10. Betanins	1.5-61mg/kg <sup>[23]</sup>
11. Quinoa oil	1.8- 9.5% <sup>[2]</sup>
12. Tannins	0.5% <sup>[24]</sup>

The essential Amino acids composition:<sup>[6]</sup>

Amino Acid	Composition:
1. Arginine	7.4
2. Histidine	2.7
3. Leucine	7.1
4. Isoleucine	6.4
5. Lysine	6.6
6. Methionine	2.4
7. Phenylalanine	3.5
8. Tryptophan	1.1
9. Threonine	4.8
10. Valine	4.0/16gN

#### VI. Effective concentration:

As stated by Xiaoyan Sun et al, they performed antibacterial assay of different saponin fractions of quinoa husk against halitosis, in which quinoa saponin(QS) and alkali transformed saponin(ATS) were separated by AB-2 resin so as to get QS-30, QS-80, ATS-30, ATS-80 as sub fractions. The bacteria's which were responsible to cause halitosis includes *P. gingivalis*, *C. perfringes*, *F.nucleatum*. So, the Minimum inhibitory concentration (MIC) and Minimum bactericidal concentration (MBC) were determined by gradient dilutions in 96- well plates, by High Performance Chromatography (HPLC) & Mass Spectrometry & thus the saponins were identified. The results indicates that QS-80 & ATS-80 were having inhibitory activity & also it was reported that ATS-80 showed stronger inhibitory activity than that of QS-80 especially more for *F. nucleatum* with a lower Minimum inhibitory concentration (MIC) of 31.3µg/ml and lower Minimum bactericidal concentration (MBC) of 125µg/ml. ATS-80 reported to destroy the membrane structure leading to the death of bacteria. So, ATS-80 should be used as an antibacterial agent to treat halitosis, but the antibacterial effects of quinoa saponin against halitosis are still unclear.<sup>[25]</sup>

#### VII. Toxicity of Quinoa saponin fractions:

An Acute Toxicity study done by Simone G. Verza et al on quinoa saponin fraction which was tested by subcutaneous inoculation of 300µg FQ70 and FQ90, both the saponin fraction was inoculated in the dorsal region in Mice, which showed no sign of local toxicity containing 300µg of saponin fraction of quinoa. Another study of Acute Toxicity against *Artemia salina* (brine shrimp) was also evaluated for the toxicity of quinoa saponin fraction, in which saline encysted eggs were incubated and after 48hr. quinoa saponin fraction 50µg aliquots at concentration of 4mg/ml were placed in the plate. In which 10 larvae was added to each well containing microlitres of a suspension, plates were then incubated at room temperature and examined after 24hours. Result indicates

that FQ70 and FQ90 behaved differently. Brine shrimp assay FQ70 found to be atoxic but FQ90 the LC50 value showed 138.0µg/mL. This indicates that the different fraction of quinoa shows different toxicity result and thus the use of quinoa should be restricted on the quantity and the type of fraction used in the product.<sup>[26]</sup>

#### VIII. Antioxidant Activity of Quinoa:

As reported by Semra Navruz- Varli et al, the antioxidant & immunoregulatory activity of quinoa polysaccharides were studied, in which the polysaccharides were extracted from quinoa through water i.e. (QWP) and alkali (QAP) using their four fractions as QWP-1, QWP-2, QAP-1, QAP-2 which was purified by isolation, anion exchange & gel filtration chromatography. Results showed essential antioxidant & immunoregulatory effects of all the fractions. Fractions QWP-1, QWP-2, QAP-1, QAP-2 were reported to be used as potential antioxidant & immunoregulators.<sup>[27]</sup>

#### IX. Quinoa as natural cosmetic ingredient:

As discussed, the quinoa is highly rich in many bioactive components it can be used as a natural cosmetic ingredient.

- Uses of quinoa in different cosmetic preparations:-

##### 1. Hair Care Products:

Due to the presence of bioactives such as proteins and 9 essential amino acids it can be used to give nourishment to hair. It will make hair soft, silky and shiny. It will also repair breakage and damage to hair and also it will revitalize and hydrate hair. Due to the presence of saponins it can be used as a mild detergent or cleansing agent in hair care preparations.

##### 2. Skin Care Products:

The presence of bioactives such as proteins and amino acids will give skin conditioning effects, boosts collagen, emolliency, and seals essential moisture. Due to the presence of vitamins it will improve complexion (suppression of skin pigmentation), anti-aging, anti-wrinkle and anti-oxidant effects.

##### 3. Oral Care Products:

As discussed, the quinoa saponins can be used to treat halitosis (bad breath), it can be incorporated in mouthwashes as well as in toothpastes. Further investigations are needed to study the antibacterial activity against halitosis.

#### X. Cosmeceuticals available using Quinoa as an active herbal ingredient:-

- Paul Mitchell ultimate color repair triple rescue.
- Glam glow Mud youth cleanse daily exfoliating cleanser.
- Cowshed Quinoa hydrating daily moisturizer.
- Bare minerals lash domination volumizing mascara.
- Briogco Be Gentle, Be kind Avocado+ quinoa co-wash.
- Phytospecific moisturizing styling cream.
- Rahua shampoo and conditioner.
- Verb Sea spray.
- Honest company conditioning detangler.<sup>[28]</sup>

These are the products which are marketed by many foreign companies.

#### XI. Conclusion and Future perspective:

As reported, the herb quinoa has so many wonderful and amazing uses. Due to the presence of many bioactive components it can be better option against synthetic chemicals as the popularity of naturals in cosmetics is increased in last few years. Many foreign companies have marketed quinoa as an active herbal ingredient in many cosmetic formulations. So, it is necessary to create awareness about this herb "Quinoa" in India, as it is safe to use and no toxicity makes it a great choice to be use in cosmetics. By cultivation of this herb in rural areas it will give employment to the people and also by creating awareness about this herb the demand will also be increased. So, further investigation and research on using quinoa in cosmetics should be done for its wonderful uses and a natural potential ingredient to cosmetic industry.

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