International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: 6.614
Available Online at www.journalijcar.org
Volume 11; Issue 04 (A); April 2022; Page No.595-598
DOI: http://dx.doi.org/10.24327/ijcar.2022.598.0131

Review Article

RED ALGAE

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A R T I C L E I N F O

Article History:
Received 24th January, 2022
Received in revised form 19th February, 2022
Accepted 25th March, 2022
Published online 28th April, 2022

Key words:

Red algae, Carotenoids, Peptides,Phycoerythrin, Rhodophyceae.

A B S T R A C T

Algae belongs to the group of photosynthetic organisms exists both in marine and fresh water habitats, commonly known for their uses in food and fuel. Macroalgae popularly called as seaweeds are eukaryotic, macroscopic and multicellular in nature. Macroalgae can be further divided in to three groups depending on their pigmentation like Chlorophyceae (green algae, Phaeophyceae (brown algae), Rhodophyceae (Red algae). Rhodophyceae called as red algae because it impart red color to the thallus. Rhodophyta are cosmopolitan in nature exist from artic to the tropic region. Red algae uniqueness is it can survive deep in sea and absorb blue light, and the red color is due to phycoerythrin pigment which reflects red light. Red algae is a aquatic photoautotrophic plants adds countless benefits to skin since it is a rich source of amino acids, vitamins, minerals. It exerts good antioxidant property by the presence of carotenoids and peptides. It is a natural source for polysaccharides and very effective in skin replenishment and increase in moisture retention efficiency of the skin. Red algae also rich in vitamin C causing skin rejuvenation and used to treat skin blemishes and stabilizing unequal skin tone and complexion. This review gives a detailed description about the use of Red algae in cosmetics.

INTRODUCTION

Red algae are widespread in marine habitats but negligibly rare in fresh waters. Red algae widely used as rich source of nutritional, functional food ingredients and pharmaceutical substances.[1]Red algae scientifically known as Rhodophyta belong to the class Rhodophyceae. Floridophyceae and Bangiophyceae are the the two classes of Red algae and encompass 99% of red algal diversity in marine and fresh water habitat. It has eukaryotic cells without flagella and centrioles, chloroplasts that lack external endoplasmic reticulum and contain untacked (stroma) thylakoids and use phycobiliproteins as accessory pigments. Distinctive redcolour is due to pigment chlorophyll A, phycocyanin and phycoerythrin, α and β – carotene, lutein and zeaxanthin.[2,3]

Morphology: Red algae owes a wide range of morphologies and it can be unicellular or multicellular. Unicellular forms exist like solitarily or as colonies whereas multicellular forms can be filamentous, leafy sheet like coralloid or crust like. Red algae contains double cell walls with polysaccharides agarose and agaropectin in outer layer and cellulose in inner layer. [4]

Red algae as cosmeceuticals*:* Cosmeceuticals are the cosmetic products with bioactive ingredients. Undeniably Cosmeceuticals overtaken the personal care industry beyond global benefits. Recently the passion towards red algae as cosmeceuticals is increasing owing to its beneficial properties.

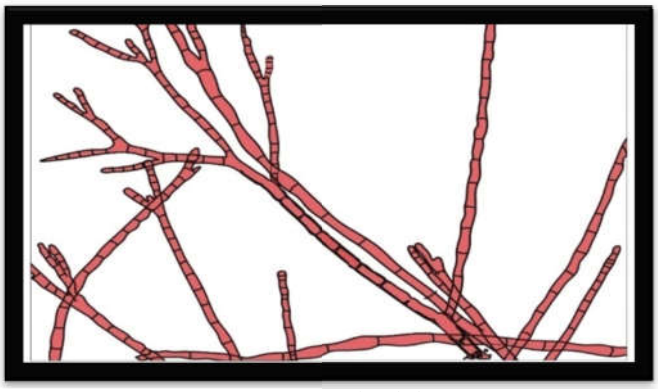

Fig 1 Structure of Red algae

Porphyridium cruentum: It is an unicellular red algae containing omega 3 fatty acid eicosapentaenoic acid, the omega 6 fatty acid arachidonic acid and contains abundant polysaccharides, enables skin to retain moisture and skin hydration. It has skin smoothening effect, enhances skin elasticity, moisturizing agent, self tanning agent, anti acne agent. It plays major role as antioxidant by combating the damage caused by free radicals.[5] Potential benefits include water retention property and this water can be used by the skin to attenuate excessive dryness. It has excellent anti-aging property and makes skin brighter and healthier. Hence it is widely in formulations of creams, lotion, gels, sun care product and skin care products[6].

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***Irish moss**:* It is also known as Sea moss or *Chondrus crispus*, which is a spiny edible plant grows naturally in waters and tide pools beside rocky coastal regions. Carrageenan is a gum that is extracted from Irish moss. Citrulline – arginine is a stable dipeptide, component of red algae, Irish moss plays major role in cellular growth, metabolism and skin protection. Citrulline – arginine aminoacids stimulates collagen synthesis and acts as a skin protector in cool and dry climate. Irish moss is rich in minerals and vitamins can be used for skin inflammatory conditions like eczema, psoriasis etc. Due to the presence of high sulfur content it decrease the excess sebum production in skin, reduces skin wrinkles, severity of acne and hydrates the skin. Irish moss is a non comedogenic containing calcium, vitamin A, vitamin K and omega 3 fatty acid. It is widely used in body lotions and powders[7]. It forms a viscous gel in water so it soothe the scalp, and acts as hair conditioner, imparts shininess to hair. Irish moss used in face care products such as moisturizers's, SPF's and masks.[8]

***Hawaiian Red Algae**:* It is a marine red algae mostly found in Hawaiian islands consists of polysaccharides with vitamins and minerals. It is also known as *Ahnfeltia concinna* extract, naturally builds collagen and hydrates rapidly and reverse the damage caused by oxidative stress and UV exposure. It contains an antioxidant Astaxanthin used for moisture retention, improve skin elasticity and reduces wrinkles. As it has good UV blocking property protects the skin against sun damage.It is rich in sulfated polysaccharides (carrageenan), peptides, carotenoids and fatty acids imparts firmness as well as rejuvenation effect to epidermis of skin.[9]

***Kappaphycus alvarezhii:** Kappaphycus alvarezhii*, is an edible red seaweed grown in Malaysia, Kenya, China and India.[10]It is also known as Elkhorn sea moss, a species of red algae which has gel forming property ows to carageenan's presence and viscosifying natural linear sullfatedpolysaccharides[11] It inhibits melanin, reduce wrinkles and dark spots and moisture the skin effectively. Elkhorn sea moss extract contains natural antioxidant and acts as UV rays blocker. The extract forms hydrogel with a glycosaminoglycan like (GAG-like) structure similar to skin extracellular matrix enables fast wound healing.[12,13]Cream prepared with *Kappaphycus alvarezhii* consists of proteins, polysaccharides, carotenoids and other vitamins played vital role in cell proliferation and tyrosinase inhibitory properties. Seaweed cream has effective antiaging and moisturizing effect.[14,15]

Corallina officinalis: It is a calcareous red seaweed, commonly known as coral weed particularly found in the lower and mid littoral zones on rocky shores of Great Britain and Ireland[16]. Reddish tinge of *Corallina officinalis* is due to the deposition of calcium carbonate within the cell wall and regulates the lipid barrier process. By crushing in to powder form when applied in skin, calcium regulates skin's oil production It has marine enzyme with epidermal growth factor and trace elements and rich in polysaccharide, amino acids, lipids, mineral, vitamins, phycobilins and carotenoids. *Corallina officinalis* has excellent good exfoliating property and making skin moist to anti-aging benefits. It acts as sunscreen by protecting the skin from photo damage and acts as anticellulite. Role of calcium is to control the cell division rate in the epidermis. Due to high concentration of upper epidermal calcium makes fast turn over of cells leading to flawless skin with less imperfections and controls age spots. Major chemical components are aliphatic hydrocarbons, cyclic hydrocarbons, monoterpenes, diterpenes, aldehydes, phenols, alcohols, ketones and esters.[17-19]

Jania rubens: It is a calcified slender beaded coral weed grows 15 to 40 mm high with rose-red colour tingeness belongs to Corollinaceae family. It grows in Mediterranean coast in well lit, sub tidal rocky surfaces from 8 – 10 meters deep in sandy sea floors. This algae is heavily infused with biochemically precipitated calcium carbonate as calcite form by the process of biomineralization. It is widely used in skin whitening and hydrating products. *Jania rubens* is abundantly rich in several bioactive compounds like flavonoids, vitamins and fatty acid. It is used in cosmetic industry for slimness as it apparently promotes fat elimination and collagen synthesis for smoothing out cellulite. Hence *Jania rubens* with its micro-minerals, natural antioxidants and bioactive metabolites widely used for formulations like skin conditioning, skin polishing, anti-ageing and skin whitening property.[20-22]

Gelidium cartilagineum extract: It is an extract of the Algae *Gelidium cartilagineum* belongs to the family Gelidiaceae. Lipolysis process is stimulated by *Gelidium cartilagineum* algae and cause break down of fats. It has the ability to use its stock of lipids and sugars to produce energy in case of reduced photosynthesis. It has very good moisturizing effect on skin and hair. It makes the skin to be form and reduction in the appearance of cellulite. It has excellent gel forming substance due to the presence of unusual length of its carbohydrate molecules [23,24]

***Asparagopsi armata**:* It is a species of marine red algae belongs to the family Bonnemaisoniaceae which are multicellular eukaryotic organisms. Mostly it grows in southern Australia and New Zealand.[25]It contains mycosporine like aminoacids (MAA) which mainly acts as antioxidants and also helps to absorb solar energy thus impart skin protection against UV rays. Hence red algae is highly recommended in cosmetics to support SPF functions. Vitamin C present in *Asparagopsi armata* finctions as a whitening agent, smoothing the skin tone. This red algae is rich in nutrients like polysaccharides, proteins, lipids which are easily absorbed in to skin and acts as effective moisturizer. *Asparagopsi armata* particularly rich in bromoform and dibromoacetic acid and acts as natural anti-acne agent [26,27]

Palmaria palamata: It is also called as dulse, dillisk, red dulse, sea lettuce flakes or creathnach of Palmariaceae family which grows extensively on northern coasts of Atlantic and Pacific ocenas.[28] It is rich in vitamin B, pantothenic acids, magnesium, calcium, iron and aminoacids. Hence these nutrients nourishes the skin and promotes healthy cell growth, improve skin texture and imparts glowness in skin. It also acts as film former, when formulated as lotions or creams it promotes smooth texture and unbreakable film to get nutrients properly absorbed and processed. It acts as emollient and protects the skin against environmental damage. *Palmaria palamata* at cellular level limits melanogenesis, decrease the production of melanin pigment and acts as skin whitening agent.[29,30]

CONCLUSION

Globally the growth of cosmeceutical industry is tremendous each year due to adoption of trendy modern lifestyle. More recently cosmeceutical industry is progressively shifting to marine active ingredients since it is abundant in various

nutrients. Red algae has notable skin brightening properties and protects the skin from free radical damage. Red algae contains rich source of vitamin C, which inhibits tyrosinase and prevents from skin darkening improves skin elasticity. Due to high proteins, vitamins and antioxidants red algae find vast applications in skin care.[31] Red alage adds multitudinous benefits for skin due to high level of beta carotene which the body convert to vitamin A, reduces skin discoloration and uneven skin tones due to hyperpigmentation. Red algae for skin care cosmetics is one of the modern approach nowadays and the concept of clean skin care is preferred by everyone. Red algae extracts usage offers an organic approach since it is rich in polysaccharides, sterols, peptides, amino acids imparts skin protection against environmental pollutants and improve hydration and skin texture.

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How to cite this article:

Gowri R *et al* (2022) 'Red Algae', *International Journal of Current Advanced Research,* 11(04), pp. 595-598.
DOI: http://dx.doi.org/10.24327/ijcar.2022.598.0131

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