International Journal of Pharmaceutical Research and Applications
Volume 7, Issue 6 Nov-Dec 2022, pp: 52-63 www.ijprajournal.com ISSN: 2456-4494

Applicationof marine macroalgaein dermocosmetic

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Submitted: 25-10-2022 Accepted: 05-11-2022

ABSTRACT: Macroalgae are photosynthetic, nonflowering plant, macroscopic,and benthic which belongs to the Plantae Kingdom. Commonly found in shallow water, on rocks, and attached to aquatic plants. Due to the increased demand fornatural products in cosmetics, natural compounds are extracted from seaweeds because of their bioactive compounds like phlorotannins, sulfated polysaccharides, and tyrosinase inhibitors.It can fight against aging,dullnessand wrinkle. It is used in textile industries,pharmaceutical industries, etc. Their high content incarbohydrates, protein,and vitamins,but also in secondary metabolites such as phenolic compounds, terpenoidsand pigments, make them great candidates for industrial applications. The cosmetic industry is one of the hugeindustriesin the world, which is in the search for new ingredients and is constantly growing as the consumer's demand now is going back to those classical cosmetics with a more natural composite Algal-derived polysaccharides are found the food products as a counterbalance, thickening agents and emulsifiers. In the cosmetic industry, algae are used in sunscreen, anti-aging, moisturizing,and skin whitening products. These products can be used to develop cosmeceuticals that contain algal derivative bioactive compounds and can exert a pharmaceutical therapeutic benefit.

KEYWORDS: Macroalgae, Cosmetics, Chemicals, Phycocompounds,health benefits

I. INTRODUCTION:

Macroalgae or seaweeds are autotropic, multicellular, eukaryotic, and macroscopic organisms. Like other terrestrial plants, seaweeds also have ecological importance in the aquatic territory [1]. According to taxonomic classification Marine macroalgae are comes under algae and Algae are subdivided into four major classes that are a) **Rhodophyceae** (red algae), b) **Phaeophyceae** (brown algae), c) **Chlorophyceae** (green algae), d) **Cyanophyceae** (blue-green algae). Some examples of algae are Chondrus crispus, Ascophyllum nodosum, Chlorella vulgaris etc. [2]. There are a variety of macroalgae and have huge diversity in the composition of seaweeds because its diversity provides an excellent source of bioactive components in their structural composition with a wide range of biochemical characteristics and physiological characteristics [3]. Algae are photosynthetic organisms that are found in freshwater and marine water. These algae possess pigment by which they can make their food. Algae are of two types 1) **Microalgae** and 2) **Macroalgae**.

Macroalgae are also widely known as seaweeds.Seaweeds belongto the Plantae Kingdom;they are multicellular and Eukaryotic. These are macroscopic, found in the benthic region and their length is up to 50 meters [4]. Algae can be found in surface water, stream water,tidal water, and the intertidal water zone. Algae are attachedto rocks, corals, pebbles, sand,plant, and freely float form [5].Algae producedifferent kinds of pigments. They are 1) Red algae contain **chlorophyll a**, **chlorophyll b**, **r-phycocyanin**, **r-phycoerythrin**, **phycobilins**, **carotenoid**, **B-carotene**, **andlutein**. 2) Brown algae contain **chlorophyll a**, **fucoxanthin, chlorophyll c,** and **carotenoid**. 3) Green algae contain **chlorophyll a**, **chlorophyll b,** and **carotenoid** [6]. Marine Macroalgae are distributed in various regions of India like **Mandapam**, **Vishakhapatnam**, **Kerala**, **Thiruvananthapuram**, **Ramnathpuram,**etc. In Gujarat,the **gulf of Kachchi** and the **gulf of Khambhat**showed the various types of marine algae in the various regions like **Okha**, **Veraval**, **Mandavi**,**andBhavnagar,**etc. Marine macroalgae possess primary metabolites as well as secondary metabolites. This hasa high source of carbohydrates, minerals, vitamins and pigments, sterols, proteins, lipids amino acids, phenolic compounds, fatty acids,and cyclosporin amino acids(MAAs) [4].There isa total of 271 and 1153 genera and species of the marine area found in Indian water respectively. There are 184 species

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of green algae found, 166 species of brown algae, and 420 species of red algae found [7].These algae are used in various fields like pharmaceutical, cosmeceutical, dairy, textile,chemical industries, bioremediation, medicines, fertilizers, biofuels, food ingredients, Sewage treatment, wastewater treatment, production of biofuels, CO_2 secludedness and it plays a vital role in reducing the greenhouse effect [8][9][10].For many years macroalgae are used as an ingredient in cosmetic productssuch as soaps, lotion, shampoos, moisturizers, powders, creams, lipsticks, andsprays [11]. Phycocompounds or algal componentsend to do an effect on enzyme Tyrosinaseinhibition, inhibition of matrix metalloprotein complex, radical scavenging activity, lower ultraviolet-induced damage, light absorption,and anti-elastase activity [9]. Aging is a spontaneous and continuous physiological process influenced by many factors that influence an individual'shealth in many ways. Oxidative stress has an essential role in aging and by different studies and from different mechanisms free radicals can damage biological systems and it leads to chronic diseases like diabetes, cognitive decline, neurodegenerative disease, heart-related disease andinjuries, skin damage, and certain types of cancer[12].In themarket, there is a huge demand for beauty products that delay the signs of skin aging and it is the primary characteristic ofthe formation of wrinkles and skin losing which is responsible for skin aging [13].Here cosmetic industries playan important role and it grows quickly day by day and spreadstheir business in the worldwide economy and more importantly buyer demand for new products with protective and therapeutic benefits [14].

Skin is made up of three layers that is **epidermis**, **dermis,**and **subcutaneous tissue**, here **keratin** is the main component of the skin and it is the first line of defense of the body against any inconvenience, skin acts as a shield [15][16].Skin aging is linked with loss of skin hydration, in which hyaluronic acid plays an important role. Hyaluronic acid is a glycosaminoglycan because of its polarity it can hold on to water molecules and maintain skin hydration and also do skin repair and give protectionagainst UV damage [17]. Continuous disclosure to ultraviolet radiation will increase reactive oxygen species levels which enhance the production of elastase, collagenase,and hyaluronidase which act on elastin, collagen, and hyaluronic acid degradation, which lead to wrinkles, thinning of the skin, and sagging [16].By consumingrich diet sources in which antioxidants and vitamins are stored in enough amounts which are beneficial for skincare and decreases aging signs [15][18].For decreasing skin problems like wrinkles, aging pigmentation,etc. cosmetic industries use synthetic ingredients which are made up of many chemicals which are formulated by using Polyhydroxy acids (PHA), Polyhydroxy butyrate (PHB), Oxybenzone, Beta hydroxy acids (BHA), Butylated hydroxytoluene (BHT), Diethanolamine (DEA), Monoethanolamine (MEA). This chemical substance damagesthe skin layer by accumulating on the skin which causes some damage like dermatitis, dryness, skin blotches, white patches, cancer, etc. For fighting these problems marine algae are used as a natural source of bioactive compounds. An algal component such as carbohydrates, sulfated polysaccharides, fucoidan, carrageenan, oligosaccharides, terpenoids, carotenoids, phenolic compounds, tocopherol, phlorotannins, crude polysaccharides,etc. [4].

II. HEALTH BENEFITS OF MACROALGAE:

1) Monostroma sp. Use in skin care products such as anti-cellulitis formulation [1].
2) Solieria chordalis species have sulphated oligosaccharides as a bioactive compound, which is a good antiherpetic agent [4].
3) Durvillea species is used as a skin moisturizing agent [4].
4) Dunaliella salina is act in the improvement of skin roughness [4].
5) Chaetomorpha antennina has a phenolic compound as a bioactive compound thatacts as an antiviral, antibacterial, antifungal, and anticancer agent [19].

III. HARMFUL CHEMICALS THAT ARE USED IN COSMETICS [20].

Table No.:1List of hazardous chemicals that are used in cosmetics.

Cosmetics	**Hazardous Chemicals**
Lipstick	Artificial colorants,Chlorphenesin
Liquid Soaps	Artificial colorants, Dimethylol dimethyl hydantoin

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Multipurpose cleaner	Formalin
Body lotion and fake tan	Artificial fragrance, ethyl benzoate, methylchloroisothiazolinone
Moisturizers	Artificial fragrance, formaldehyde
Shampoo and conditioners	Artificial fragrance, parabens,Iodopropynylbutycarbamate
Shower gel	Artificial color, artificial fragrance, isobutylparaben
Makeup	Artificial colorants, mercury, heavy metals, Ethylparaben
Deodorants	Bronopol
Ointments	Glutaral
Wet tissue	Methylparaben
Water based lotions	Methyloldimethlyhydantoin
Skim milk	Methamine
Skin cream	Kathon CG
Products for babies	Imidazolidinyl urea
Oil based lotions	Formic acid
Liquid formulation	Dehydroacetic acid

IV. HARMFUL EFFECT OF THE CHEMICALS ON THE SKIN[21].

Table No.: 2List ofhazardouschemicals thatare affecting the skin.

Chemicals	**Effects**
Coal tar	It is carcinogenic to humans. It is found in anti-dandruff shampoo.
Artificial fragrance	Leading causes of skin reaction and allergies.
Diethanolamine (DEA)	It is a hormone disruptor.
1,4-Dioxane	Carcinogenic chemicals to humans.
Formaldehyde	It affectsthe immune system, respiratory system, and cause cancer in human.
Fragrance	It disturbsthe endocrine gland.
Lead and mercury	It is toxic to the neural system.

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Hydroquinone	Neurotoxic and allergic to the human body.
Parabens	some have been shown to have weak oestrogenic
Nanoparticles	Nanoparticles absorb by the skin and damage the brain cells.
Petroleum distillates	It is carcinogenic to the human being.
p-Phenylenediamine	It affectsthe nervous system and causeslung irritation.

V. MARINE ALGAE AND ITS PHYCOCOMPOUNDS:

Marine macroalgae are used in various fields one of them is cosmetics. The definition of a cosmetic product, according to the European Commission is: "any substance or mixture intended to be placed in contact with the extrinsic part of the humanbody (epidermis, hair system, nails, lips, and external genital organs) or with the teeth and the mucous membranes of the oral cavity with a view exclusively or mainly to cleaning them, perfuming them, changing their appearance, protecting them in good condition or correcting body odor" [1].Those cosmetic products formed from the algal component that product is labeleda"marine extract", "extract of alga", "seaweeds extract "[22]. That means algal components like hydrocolloids extracted from seaweeds are used in products. Alginate or carrageenan are water-binding agents, which means they can able to hold water on skin and hair and maintain moisture [23].Alginate and carrageenan are both used in lotions, creams, shampoos, conditioners, etc. Macroalgae can be used in two ways in cosmetics: they can be a vehicle as a stabilizer, emulsifiers, or another type of agent which helps in making cosmetic product preparation or as an active therapeutic ingredient. Algae are a rich source of unsaturated and saturated fatty acids found in bioactive compounds [24]. The popular seaweeds product in the market is fatty acids and pigments. About 1200 tons of β-carotene were generated in 2010, those pigment was extracted by Dunaliella salina. Carotenoid, and astaxanthin were obtained from Haematococcus pluvialis[25].

Algae have different bioactive compounds like **polysaccharides (**chitin, fucoidans, agar, carrageenan, alginates, terpenoids, tocopherol**), proteins, peptides, amino acids, lipids, vitamins and minerals, pigment, phenolic compounds, sporopollenin, MAAs, Stoneman, collagen-like protein.**

Polysaccharides: Few bioactive componentsare obtained from macroalgae–drivensulfatedpolysaccharides. The chemical structure of these macromolecules differs as the species differ: brown species possess mainly laminarans (up to 32% - 35% dw) and fucoidans, red algae rich in carrageenans, and porphyrins, and green algae are rich in Evans [12].A remarkable amount of carbohydrate is noticed in many macroalgae species likeKappaphycusAlvarez(Rhodophyta), Sargassum polycystin(Phaeophyceae), Padina boryana (Phaeophyceae), Fucus vesiculosus (Phaeophyceae), Porphyra umbilicalis (Rhodophyta), etc. Application of polysaccharides is photoprotection, moisturizers, wound-healing agents, preservatives, thickening agents, and emulsifiers [19].

Chitin: Ithas physiological and biological properties by which it can be used in various fields like wastewater treatment, agrochemical, etc. Chitin is also used in hydrating agents like moisturizers, bath lotion, body creams, skin and hair products, oral care, and fragrances [2].

Fucoidans: These are also called fucan, it is highly branched and have a considerable amount of L-fucose. It is generally acetylated and sulfated and is mainly obtained from brown algae. It is used in cosmetics as skin-protecting, antiviral, antioxidant, antiaging, antitumor, anticoagulant, and anti-inflammatory. Fucus vesiculitis produces fucoidan, from this fucoidan extract and is used in creams and lotions, and the industry state that this cream and lotion is having antiaging and antiwrinkle benefits. Fucoidan inhibits matrix enzymes against hyaluronidase, heparanase,

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collagenase, etc. Undaria pinnatifida contains 85% fucoidan, F. vesiculosus have 60% fucoidan and 30% polyphenol [2].

Fig: 1 Structure of chitin [26].

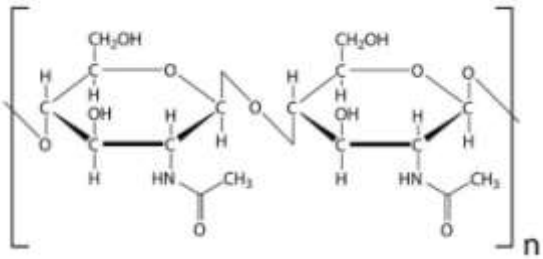
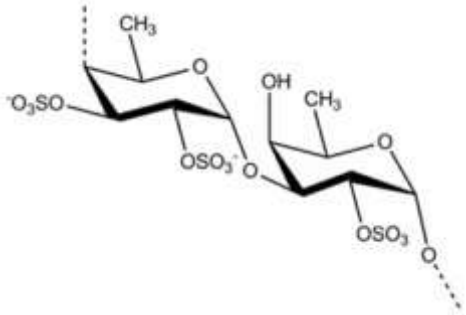
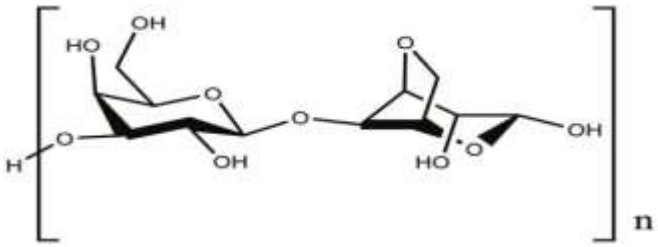


Fig: 2 Structure of fucoidan [27].



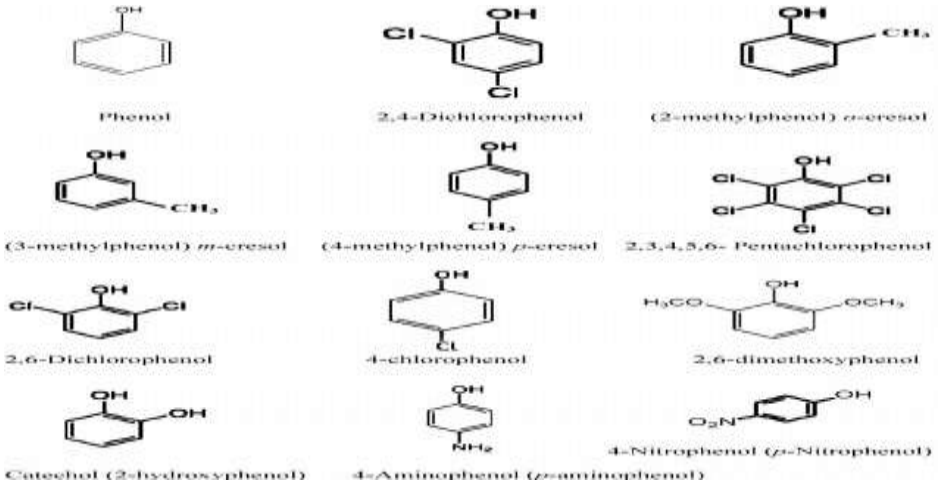
Agar: Agar and alginic acid is obtained from brown algae like Ascophyllum sp., Durvillaea sp., and Laminaria sp. Etc. It can be used in skin protective creams, beauty marks, and facial packs [19].

Fig:3 Structure of agar [28].



Phenolic compounds: These can be extractedfrom marine macroalgae. These are aromatic rings having one or more hydroxyl groups. Phlorotannincomes under the phenoliccompounds. Phlorotannin is a polymer of 1,3,5-trihydroxy benzene(phloroglucinol). This can be found in Alariaceae, Fucaceae and Saragassaceace [2]. It can be usedas an antioxidant effect, free radical scavenging, and anti-inflammatory activities, it can chelate metal ions [13].

Fig: 4 Structure of phenolic compounds [29].



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Protein: It is also an important parameter that is present in marine macroalgae or seaweeds. Protein is high in Rhodophyceae(8% - 50% dw) as compare to Chlorophyceae and Phaeophyceae(7% - 32% and 6% - 24% dw respectively). Protein content varies as the atmosphere fluctuates like temperature, salt concentration, light, wave force, nutrient supplyetc. [13].Its application is antioxidant activity, anti-skin cancer, anti-skin aging, anti-UVA,moisturizer, natural sunscreen, inhibition of MMPetc. [19].

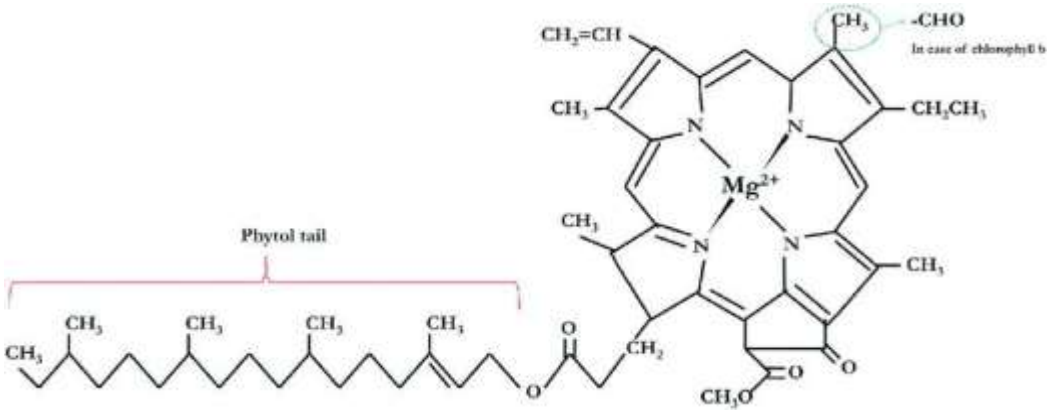
Peptide: It formsa short chain of 2 to 20 amino acids. Its bio function is dependenton the amino acid composition and sequence of the protein. It resembles hormone or drug-likeactivities peptide is considered as a capable of attracting topic in cosmetics and skin application [12].

Amino acid: Seaweeds are a good source of amino acidderivativesthat have natural moisturizing factors in the stratum corneum and promote collagen production in the skin. Red macroalgae like palmoria and Porphyra have a high content of arginine in their composition. It is the component of the naturalmoisturizing factor. Mycosporine-like amino acids protect macroalgae from UV radiation, which can be used in skin protection [30].

Pigments: Macroalgae contain various types of pigments that absorb light for photosynthetic. There are three classes of photosynthetic pigments are found in algae that is chlorophylls, carotenoids (carotene and xanthophyll), and phycobiliprotein [12].

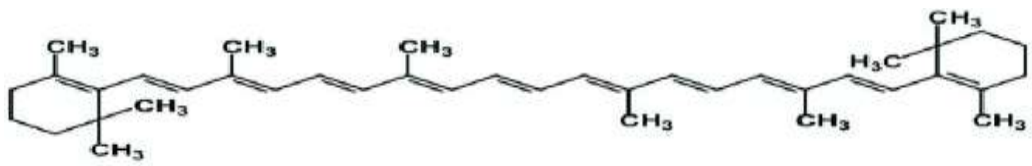
Chlorophyll: Chlorophylls are liquid soluble molecules. It is a greenish pigment, a group of cyclic tetrapyrrole pigments, and a hydrophobic chain it has. chlorophyll is the major pigment found in any algae and others are accessory pigments [12]. Red algae possess chlorophyll, phycobilin, carotenoids, beta-carotene, lutein, phycocyanin, and phycoerythrin. Brown algae have chlorophyll a, c, and another pigment. Chlorophyta have chlorophyll a,b,c, and carotenoids [19].

Fig: 5 Structure of chlorophyll [31].



Carotenoid: Carotenoids are considered themost important pigment because they can use in pharmaceutical and cosmetic industries due to their nutraceutical activity. It can be used as a stabilizer in cosmetics. It is also used as a preservative in cosmetics [2]. It protects against UV light. It is used in natural dyes and as an antioxidant with antitumor [19]. It is a lipid-soluble molecule. Dunaliella hasthe highestamount of beta-carotene and Haemayococcus Pluvialishave a high level of xanthophylls (also known as astaxanthin). Beta-carotene is also used in UVA-induced gene expression in human keratinocytes [13].

Fig: 6 Structure of carotenoid [32].



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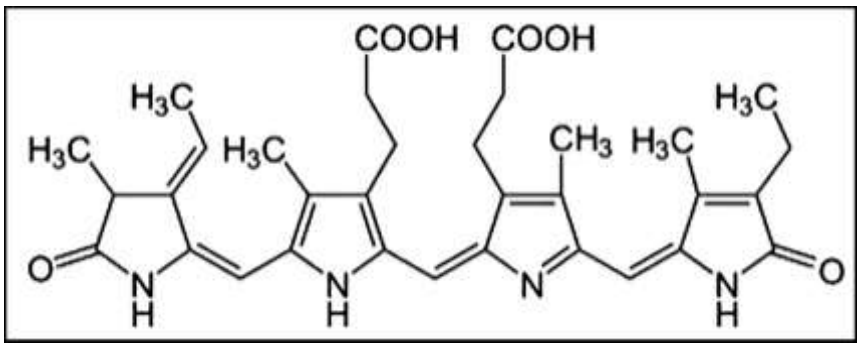
Phycobiliproteins: It is a water-soluble pigment having different compounds like phycoerythrin and phycocyanin. It is used as Natural food color in lipsticks, eyelineretc. [12].Phycocyanin is extracted from Spirulina platensis. It is insoluble in acidic solution (pH-3) and gets degrade at 45°c or above the temperature at pH between 5 to 7 [2].

Fig: 7 Structure of phycobiliprotein [33].



Sporopollenin: It is a bioactive compound derived from an algal source. It is a safe and natural compound thatacts against UVB radiation and binds with heavy metals. It protects the skin against the sun and acts against age-relatedwrinkles [2].

Lipids: Lipids are made up of heterogeneouscompounds. It is soluble in non-polar solvent but insoluble in water. Lipids play a very important role in food for humans and animals. It is also an important source of biofuels, lubricants, inks, and phytochemical compounds.Various types of lipid derivatives are used in cosmetics like waxes, ceramides,glycophospholipid, oxidized lipids etc. Cosmetics like moisturizers contain fatty acids, triacylglycerols, and sterols.Emulsifier agents like phospholipids, glycolipids, and lipopeptides. The fragrance is generated by essential oils. In cosmetics, there are some activecompounds such as glycerolipids, sphingolipids, isoprenoids, and flavonoids. Lipids are also a skin-softening agent which is used for gaining smooth and soft skin.Lipids also act as texturizersthat provide jelly-like consistency, by this one can spread cosmetics in an even manner, and it also possesses some fragrance. Pigments are an example of lipids [34].

Astaxanthin:it is a strong ingredient in natural oxidants, it acts as a free radicle scavenger. In the metabolism process of humans, it protects against UV-induced photo-oxidation therefore it is used in sun protection creams [35].

VI. ROLE OF PHYCOCOMPOUND IN SKIN COSMETICS:

TableNo.:3Various marine macroalgae specieshave bioactive compounds, that are used in the application of cosmetic products.

Sr. No.	Species	Bioactive compound	Technological function	Application	Reference
1	Chondrus crispus	Gelcarin PC 379	Emulsifier and thickener	Lipstick and deodorants	12
2	Undararia pinnatifida	Wakame 1% (peptidic extract)	Whitening/ lightening agent	Skincare product	12
3	Fucus vesiculosus	Akomarine fucus	Skin softness and elasticity	Formulation	12
4	Gracilaria conferta	Gracilaria hydrogel	Humectant, nourishing and conditioning agent	Skincare product	12

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5	Hizikia fusiform	Hijiki extract	Whitening agent	Whitening preparation	12
6	Caulerpa lentillifera	Rich in unsaturated fatty acids and vitamin c and a	Moisturizing, antiaging	Shampoo, shower gel, soap, lotions	1
7	Codium tomentosum	Extract codiavelane	Antiaging, moisturizing	Creams, lotions	1
8	Halopteris scoparia	Extract rich in antioxidant polyphenols. Cytokines and betaines	Skin softness and elasticity restoring	Creams, lotions	1
9	Saccharina latissima	Hyaluronic acid, polysaccharides, phlorotannins	Antioxidant, antiaging, anti blemishes	Skincare products	1
10	Sargassum muticum	Extract rich in proteins	Anti-wrinkle, collagen stimulation, reduce skin damage	Creams, lotions	1
11	Gelidium corneum	Extract rich in minerals and amino acids	Skin softness and elasticity restoring	Skincare products	1

TableNo.:4Various marine macroalgae and microalgae tend to produce bioactive compounds that areused in cosmetics.

Sr.no.	**Species**	**Bioactive compound**	**Application**	**Reference**
1	Microalgae	Carotenoid	Skin whitening serum	2
2	Microalgae	Chitin	Haircare, skin care, oral care products	2
3	Seaweeds	Collagen	Antiaging beverages, eye gel, retinol facial moisturizer	2
4	Cyanobacteria, macroalgae	MAAs	Sunscreen body lotion	2
5	Porphyra sp., Chlamydomonas hedlegi,Padinacrassa.	MAA, aminocyclohexanone imine-type	Antioxidant, anti-inflammatory, photoprotection, antiaging	13, 36
6	Porphyridium sp.,Costaria crostata, Ulva Lactuca.	Sulfate exopolysaccharide, fucoidans, fucans, sulfated galactan	Antioxidant, anti-inflammatory, antiaging	1

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TableNo.:5Various species of seaweeds use for making cosmetic products.

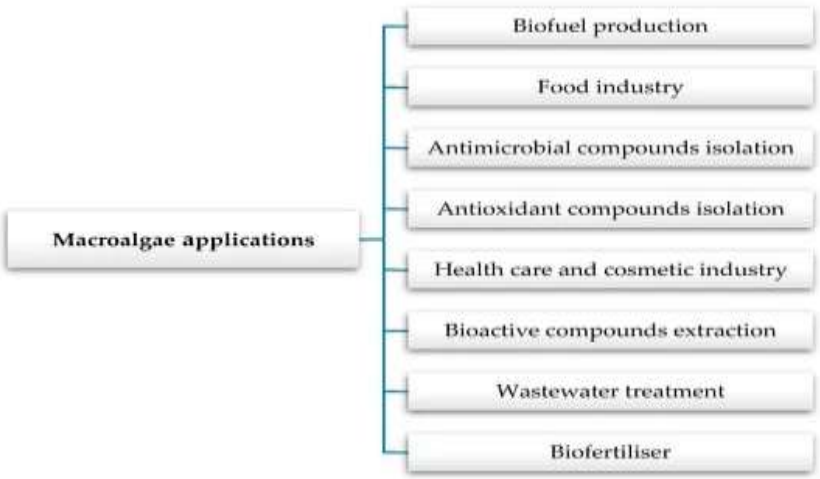
Sr. No.	Species	Application	Reference
1	Sargassum siliquastrum	Sunscreen	37
2	Ecklonia cava	Skin whitening	38
3	C. tomentosum	Skin moisturizing	4
4	Porphyra sp.	Photoprotection	4
5	Porphyrayezoensis	UV protection	4
6	Sargassum fusiforme	Collagenase and elastase inhibition	19

VII. APPLICATION OF MACROALGAE IN SKIN BENEFIT:

Moisturization is very important for skin and very essential to maintaininga healthy appearance, about 60% of the skin is contain water that can be known as a natural moisturizing factor. Amino acid, serin, lactic acid, pyrrolidone carboxylic acid, urea, sugar, and minerals. They all have natural moisturizing factors. Laminaria japonicaextract has5 to 10% skin moisture. Collagen-containing bioactive compound can reduce wrinkle and fine line and it is used in skin whitening. Antioxidantswhich is found in bioactive compounds can be safe and more effective because of natural component extracted from macroalgae. Those macroalgae can absorb ultraviolet rays [9]. Macroalgae can use in the treatment of aging, sun tanning, roughness, wrinkle, fine lines, etc. It plays a major role in hydrating skin and protecting against sun rays. Brown algae tend to inhibit UV radiation [4]. Some phenolic compoundswork to inhibit melanogenesis. Algol, a compound is produced by Fucus vesiculosusand is usedin perfume. Seaweeds also help against sunburn, photoaging, photodermatoses, and skin cancer [7].

Current application of macroalgae like (1) Phycocyanin which is found in red algae and blue-green algae, is used as a natural color in food. It is non-toxic and has lots of natural benefits with biodegradable properties [38]. (2) Carotenoidsplayan important role in scavenging free radicals in the human being's body, they act as a strong anti-oxidant [39].(3) Phlorotannin work for anti-melanogenic, and anti-aging. (4) Fucoidan contributesto anti-cancer, and anti-inflammation. (5) Fucoxanthin played a major role in anti-melanogenic and anti-oxidants. Macroalgae also possess antimicrobial activities in impurities of micro-organisms to cause infection to users and damage the cosmetic's properties such as a change in body odor, change in the texture of cosmetics, change in its effect by which side-effect, pimples can occur on the skin, so to overcome this problem macroalgae were used as a preservative via derived natural components [40].

Figure:9 [41]



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VIII. DISCUSSION:

Cosmetic use is increasing day by day for skincare, hence requirementsfor synthetic compounds like PHA, PHB, DEA, etc. were also increased which will lead to the toxic effect on the skin. Thus, an alternative to synthetic compounds for cosmetic is required which is contributed by algal sources. Phycocompound are derived from Macroalgae, which is used in cosmetics, which is effective and least harmful for the skin. It is also used in pharmaceutical, food, dairy and polymer industries. The cosmetic produced from bioactive compounds from algae nontoxic as well as cost-effective. It also provides additional properties like light antioxidant, anti-inflammation, skin whitening, slimming properties that is making macroalgae as potential source for cosmetic industries.

IX. CONCLUSION:

In conclusion, with the increment in the demand for natural products for skin and hair macroalgae and microalgae are used in a huge range. Cosmeceutical products like algae are the new way for the marine environment due to their novel properties because of their active ingredients. Macroalgae is used in the field of cosmetic industries, pharmaceutical industries, dietary products, and agrochemical industries. Due to overexposure of the human body to various kinds of a chemical and physical thing or due to environmental stress like pollution, sun radiation. This leads to the production of reactive oxygen species which cause skin problems, carcinogenesis, wrinkles, age spots, etc to resolve this problem algal compound is used. Cosmetics are used which is made up of natural product that is safe for the skin. The natural constituent is used in cosmetics. By using fully natural products,the skin will remain healthy for the long term. these compounds also have the potential for being isolated and used for the development of novel or innovative drugs against diseases, such as cancer, neurodegenerative disorders, and diabetes.

X. FUTURE PERSPECTIVE:

Today cosmetic industries explore many compounds for their appearance and to do their skin healthy or for skincare. So,these cosmetic itemsplay a very vital role as people use synthetic cosmetics which leads to adverse effects onthe skin. But today many algal componentsuseto serve as an antioxidant, anti-melanogenic, anticancer, anti-aging, anti-microbial, and anti-inflammation. Algae have many bioactive compounds which can use as active ingredients in the cosmetic formulation because it is natural and less harmful. Therefore, more studies can suggest the cell-signalingpathways and their proper mechanisms of componentsin our skin. It is also used as biofuels, biofertilizers, supplements, pharmaceutical industries, livestock, for medicinal purposes. Recent such products which use algal products are Gallinees face Vinegar, Algeternal technologies, etc.Microalgae are used for biodiesel production in the third generation,wastewater treatment, food industries, and agricultural sector. Cosmetics made from microalgae are an intriguing technique for increasing the search for new natural components from environmentally sustainable biomass.Lipid products are an excellent source of inspiration for cosmetic compositions. Microalgae could be utilized for the production of various bioactive molecules. Thecosmetic sector is always in search of new ingredients for innovative product formulations.Peptides are used in a wide range and to maintain their activity stores in the form of microencapsulation, nanoencapsulation, or by modification of their chemicals.

Phycoremediation is also done by using macroalgae. Seaweeds are usedto remediate contamination of heavy metals, it also treats wastewater, and it contributestothe reduction of the level of carbon dioxide in the atmosphere via photosynthesis. Sargassum spp. hasgood biosorption of copper metal.Dunaliella did biosorption of mercury,lead, and cadmium. Polyunsaturated fatty acids such as omega-3 eicosapentaenoic acid and docosahexaenoic acid are sourcedfrom marine microalgae. This EPA and DHA are used as a tablet for the reduction of heart-related disease, rheumatoid arthritis, alzheimer's disease etc. These macroalgae used as biofertilizerssuch as Ascophyllum, Ecklonia and Fucus are used as natural biofertilizers, by these fertilizers soil is nourished with high content of nitrogen, high amount of potassium, it has good moisture retention properties and improves soil aeration and structure. Plastics are a threat tothe natural environment instead of bioplastics are used which are derived from potatoes, corn, etc, but recently bioplasticsare derived from marine algae. Various type of marine algae-based bioplastic is derived like hybrid plastics, petroleum-based plastics, and cellulose-based plastics.

ACKNOWLEDGEMENT:
I would like to thank the Institute Bhagwan Mahavir College of Basic and Applied Sciencefor its support.

International Journal of Pharmaceutical Research and Applications
Volume 7, Issue 6 Nov-Dec 2022, pp: 52-63 www.ijprajournal.com ISSN: 2456-4494

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