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MARINE CONSTITUENTS AS POTENTIAL COSMECEUTICALS

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ABSTRACT

Cosmeceuticals are the advanced addition to the pharmaceutical industry; they are cosmetic products with drug-like activities. The word cosmeceuticals was coined by Klingman. Marine resources exist in vast numbers and they show enormous diversity. As a result, there are lots of possible applications for marine constituents of interest in the cosmetic industry, whether as active ingredients, excipients or additives. The active agents from the marine source used for the preparation of cosmeceuticals are sea weeds, marine fishes, phytoplanktons, sponges, corals, sea mammals, fungi and bacteria and molluscs. Marine ingredients used for the preparation of cosmetics having various properties such as anti aging, skin whitening, moisturizing, de-pigmentation and antioxidant activity etc. Lot of cosmeceuticals which contains marine ingredients is available in the market also. The potential of marine ingredients is a fascination of study by researchers for the last years.

KEYWORDS

Cosmeceuticals, Marine, Seaweeds, Corals and Phytoplankton.

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INTRODUCTION

Cosmetics are products that are used to cleanse and beautify the skin. The first usage of this cosmetics is attributed to Egyptians in 4000 B.C. Pharmaceuticals are the drug products and are defined as the products that will prevent, mitigate, treat or cure the disease and affect the structure or function of our entire body. Cosmetics are products aimed at improving the structure, morphology and appearance of the skin, with the assistance of excipients and active ingredients which are adapted to different types of skin (normal, oily, combination, sensitive, etc). Cosmeceuticals is a deliberate combination of these two terms and is

intended to produce drug like benefits from the cosmetic product. Klingman may be described as the Father of Cosmeceuticals, the product that first appeared in the world market was in 1996¹. The potential of the marine natural products has studied by many of the researchers over the last years. Inspired by the vastness of our oceans, and almost incomprehensible level of biodiversity in the marine environment, researchers have pursued the pharmacological potential of secondary metabolites obtained from the marine organisms². Various compounds can be obtained from the marine source which is having the anti-inflammatory, anti allergic, anti bacterial, anti aging, and anti wrinkle activities. In cosmeceuticals from marine source, the extract or constituents from marine sponges, seaweed, fishes, marine turtles, corals, phytoplankton, sea fennel etc are used³. There are so many marketed formulations are also available which will contain marine ingredients and will produce promising action.

Active agents from the marine source used for the preparation of cosmeceuticals

Sea weed (EEB extract)

Marine sponges

Marine fishes (shark, jelly fish etc.)

Corals

Phytoplankton

Crab

Sea mammals

Marine fungi and bacteria

Molluscs (pearl oyster)

Sea weed

Combination of invasive species will contribute to the creation of natural and eco-friendly ingredients for the cosmetic industry⁴. The sea weed/ algae which is of three types named Red algae, Green algae and Brown algae. The use of seaweed-derived ingredients in cosmeceuticals has increased in the recent years as a result of the vast scientific studies that are promising the potential skincare properties of the bioactives from seaweeds^{5,6}. Among these seaweeds carotenoids, fatty acids, polysaccharides, phlorotannins, vitamins, sterols, tocopherol, phycobilins, and phycocyanins have got attention due to their wide range of activities^{4,6-10}.

The following are some examples:

Agar having Thickening and antioxidant properties which is obtained from the sea weed species *Pterocladia*, *Pterocradiella*, *Gelidium amansii* and *Gracilaria*⁹.

Alginate which is obtained from Brown seaweeds act as highly stable, thickening agent and gelling agent¹¹⁻¹³.

Carrageenans which is having Antioxidant, antitumor, antiaging, thickeners properties and also act as radiation protectors obtained from Red seaweeds, *Porphyra haitanensis*, *Gracilaria chouae* and *Gracilaria blodgettii*.

Fucoidans obtained from Fucoidan (Sigma), *Ascophyllum nodosum*, *Chnoospora minima*, *Ecklonia maxima*, *Hizikia fusiforme*, *Saccharina japonica*, *Sargassum hemiphyllum*, *Sargassum horneri*, *Sargassum polycystum* and *Sargassum vachellianum* had Photoaging inhibition, minimized elastase activity, antioxidant, anti-inflammatory and skin-whitening properties¹⁴.

Marine sponges

The bioactive metabolites from sponges constitute a wide range of active ingredients for the preparation of cosmeceutical products. There are mainly four categories of marine sponges and are Calcarea (calcareous), Hexactinellida (horn sponges), Demospongiae (coralline), and the Sclerospongiae (glass sponges).

Various marine active compounds used are:

Collagen obtained from *C. reniformis* is used for wound healing¹⁵.

Ethyl acetate extracts obtained from *R. globostellata* and *S. inconstans* having Anti-oxidant properties¹⁶.

Geoditin A obtained from *G. japonica* had Skin whitening activities¹⁷.

Methanol, ethanol and hexane extracts obtained from *A. cavernosa* used to treat acne¹⁸.

Osirisynes A, B, E, G, H and I obtained from *Haliclona* species had Anti-aging property¹⁹.

Gagunin D obtained from *Phorbas* species had skin whitening property²⁰.

Some other examples of marine sponges are *Fascaplysinopsis reticulate*, *Niphates furcata*, *Callyspongia siphonella*, *Callyspongia sp.*,

Callyspongia clavata, and *Pseudosaberites clavatus* etc²¹.

Marine fishes

Marine fishes are rich source of biologically active compounds such as proteins and peptides. Collagen is the major structural protein that is present in the connective tissues and bones of fishes. Collagen derived from the Marine sources has ability to free radical scavenging, and thus they can be used for the preparation of skin care products²²⁻²⁴. The collagen derived from the marine fish has low odor and improved mechanical strength, and are used in cosmetic products²⁵. Skin-hydrating and skin-firming effects of these formulations were also evaluated²⁶. The result suggested that serum formulations displayed a better moisturizing effect within a short duration^{25,26}. Examples of some marine fishes used for the extraction of collagen are *Paralichthys olivaceus*, *Sebastes schlegeli*, *Lateolabrax maculatus*, *Pagrus major*²⁷ Jelly fish²⁸ *Mystus macropterus*, *Saurida* spp, *Trachurus japonicus*, *Mugil cephalis*, *Cypselurus melanurus*, *Dentex tumifron*²⁹ etc.

The mucus formed from jellyfish is a compound that is essential for some cosmetics. According to Cosmetic Design, the cosmetic industry can step in and help to increase the fish stock by using jellyfish in the manufacture of anti-aging beauty products as it is having powerful anti-aging activities. Scientist have replicated the cells from the jelly fish within the peptide and combined within skincare creams, to treat and prevent DNA damage and persuade our skin cells to act young again and regenerate³.

Corals

Corals are marine invertebrates within the class Anthozoa of the phylum Cnidaria. They typically form compact colonies of many identical individual polyps. Corals are used in various skin care products such as scrubbing agents by supplying some minerals to it, to protect from UV radiation sand acts as anti oxidant, anti ageing and anti acne and also smoothen the skin, in lipstick preparations, powders and deodorants³. The ethanolic extracts separated from soft corals that are abundantly growing along the seawaters can be used to inhibit the melanin content and is not cytotoxic³⁰.

Phytoplankton

Phytoplankton, also known as microalgae, are similar to terrestrial plants in that they contain chlorophyll and require sunlight in order to live and grow. The important categories of this phytoplankton include cyanobacterias, dianoflagellates and diatoms³¹. Microalgae extract which combats skin aging, de-pigmentation and anti-microbial activity. They will be functional antioxidants, polysaccharides, alginates and carotenoids which contribute skin health and beauty in cosmetics³². Some of the examples are *plastids*, *carotenoids*, *cyanobacteria*, *microalgae*, polyunsaturated fatty acids and tetrapyrrole³³. 27% of the cosmetic products for sensitive skin were prepared using marine ingredients and included the species *Laminaria ochroleuca*, *Ascophyllum nodosum* (brown macroalgae), *Asparagopsis armata* (red macroalgae), and *Chlorella vulgaris* (microalgae)³⁴.

Sea mammals

Marine mammals like dolphins are rich source of parabens which are commonly used as preservatives in food, cosmetics and pharmaceuticals³⁵. Turtle oil is extracted by heating the fat and it is used in the preparation of cosmetics as it is rich in Vit-E. In England it is being used in cosmetic preparations like in bathing soaps, lotions, skins creams and nail creams, etc³.

Marine fungi and bacteria

A number of compounds from marine bacteria and fungi such as polyketides, alkaloids, peptides, proteins, lipids, mycosporines and mycosporine-like amino acids, glycosides, isoprenoids and hybrids have great potential in cosmeceutical and cosmetics since they have photo-protective, anti-aging, anti-microbial, anti-oxidant and moisturizing properties³⁶. Marine bacteria have still not been widely studied as a source of skin-whitening compounds. Marine bacterias like *Pseudomonas* was found to produce the tyrosinase inhibitor methylene chloride, which reduce the pigmentation by melanocytes³⁶. One third of the total marine fungi are seen in association with algae³⁷.

Mollusces

Molluscs which contains lot of secondary metabolites which is having wide range of activities and are used to treat various diseases. Also they had antioxidant, anti inflammatory and antiviral activity and are used in cosmetics preparation too³⁸.

Advantages of Marine Cosmeceuticals

Provide scientific and eco-friendly ingredients which can be used for the preparation of skin care items.

Provides vitamins, minerals and UV protection to skin.

Act as antioxidant, moisturizing, cleansing agents and can be used in beauty products.

Active principles from marine source play roles in hydration, firming, slimming, shine and protection.

Collagen and gelatin obtained from marine sources have less adverse effects and greater health benefits.

Superior source of secondary metabolites which can be used to treat and cure so many diseases^{3,10,36}.

Table No.1: Examples of some marketed cosmetics which contains marine ingredients

S.No	Product name	Brand name	Marine ingredient used	Properties
1	Eternal Cream	Skeyndor	Oil soluble marine fennel extract	Nourishes skin Compensate the loss of skin volume Fights early signs of aging
2	Collagen Nutrition Cream	It's skin	Marine collagen from scales of fish living in deep sea	Firms skin Reduces wrinkles Balances oil and moisture
3	Skin Fuel Skin Elixir	Wellbeing nutrition	Japanese marine collagen peptides	Fortifies hair and nails Reduces signs of aging
4	Algae Vitalizer Ampoule Concentrate	Babor	Planton extract	Moisturizer
5	Souttle Marine Cleansing Foaming Cream	Phytomer	Algae extract	Brighten skin tone Detoxifies skin Protects skin from contaminants
6	Translucent Powder	Stay quickry	Pearl, Pearl powder and Pearl Protien	Easy application Easy layering Fade proof Hides imperfection
7	Pearl Whitening Face Cream	Jovees	Pearl powder	Face whitening
8	Biomarine Seaweed Skin Correctening Moisturizing Fluid	Nuxe	Seaweed Extract	Moisturizer
9	Algo Mist Hydrating Seaweed Facial Spray	Recepechage	Laminaria Digitata seaweed extract	Moisturizer Cell renewal
10	Matte Liquid Lipstick	Brenntag	Jelly Fish Extract	Long lasting, Lubrication Mattifying Protects and soothers lip Waterproof

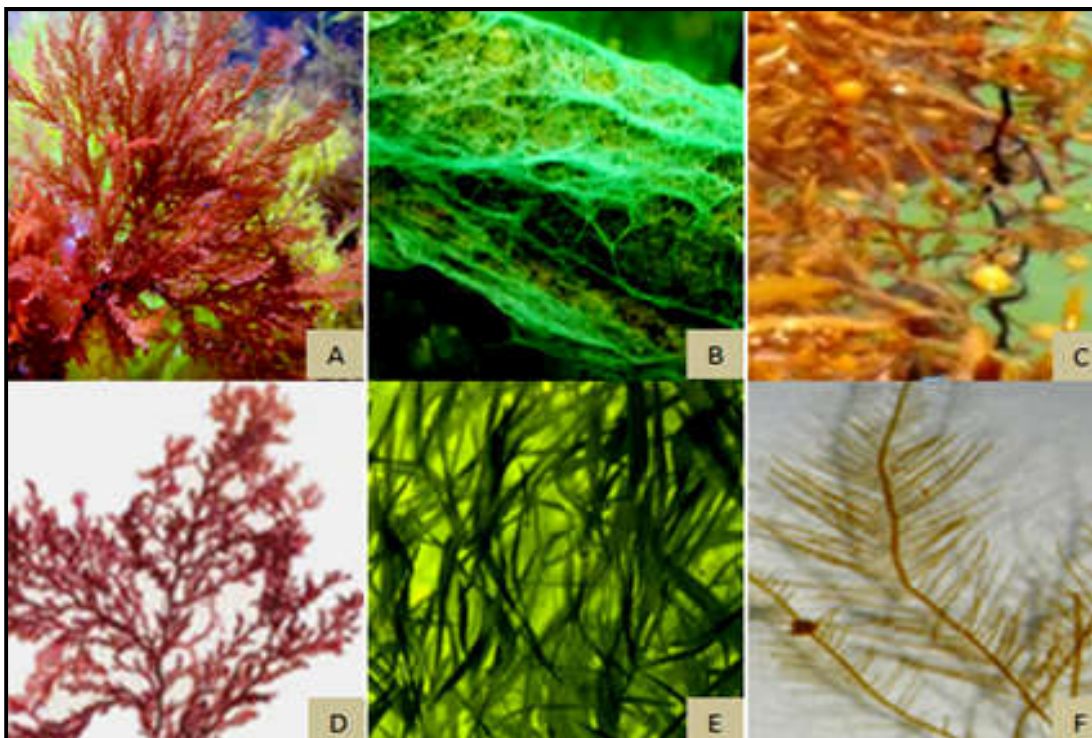


Figure No.1 Different types of seaweed/micro algae; A and D represents Red algae, B and E represents Green algae and C and F represents Brown algae



Figure No.2: Different types of Sponges; A-Calcareous (calcareous), B-Hexametallida (horn sponges), C-Demospongiae (coralline), and D-Sclerospongiae (glass sponges)



Figure No.3: Few examples of marine fishes: A- *Paralichthys olivaceus*, B- *Lateolabrax maculatus*, C- Jelly fish and D- *Dentex tumifrons*



Figure No.4: Few examples of corals: A- Brain coral, B- Mushroom coral, C- Star coral and D- Staghorn coral

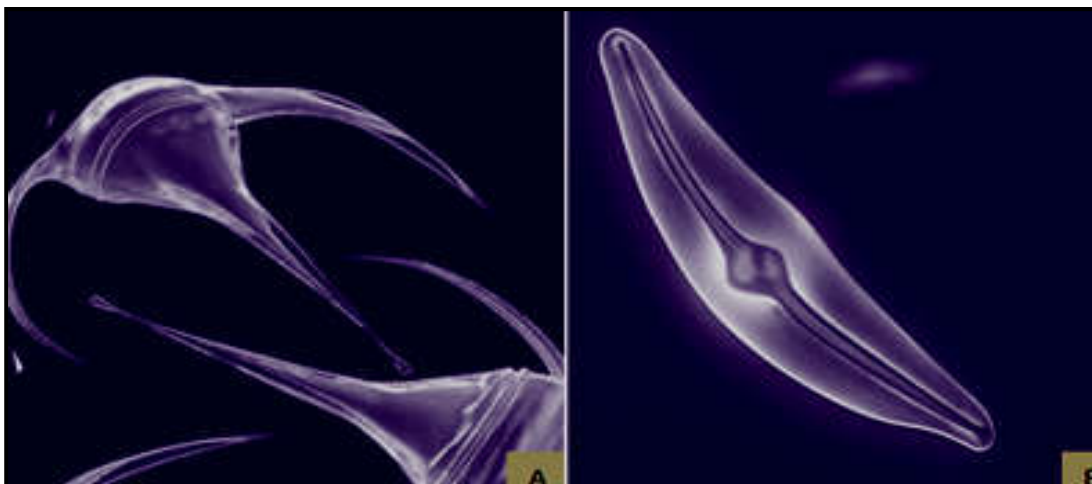


Figure No.5: Examples of phytoplankton: A- Dinoflagellates and B- Diatoms

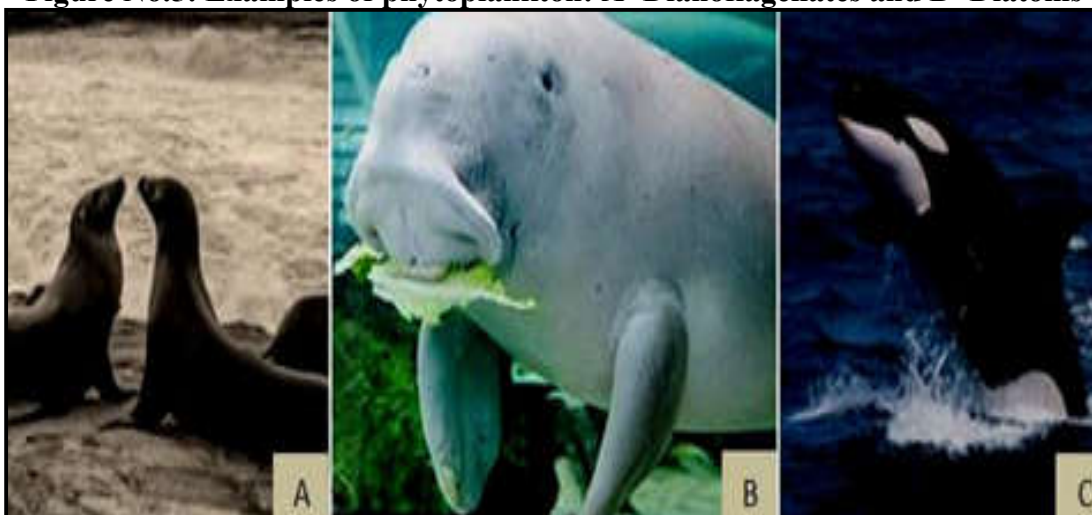


Figure No.6: Few examples of Sea Mammals: A- Sea lions, B- Dugongs and C- Whale

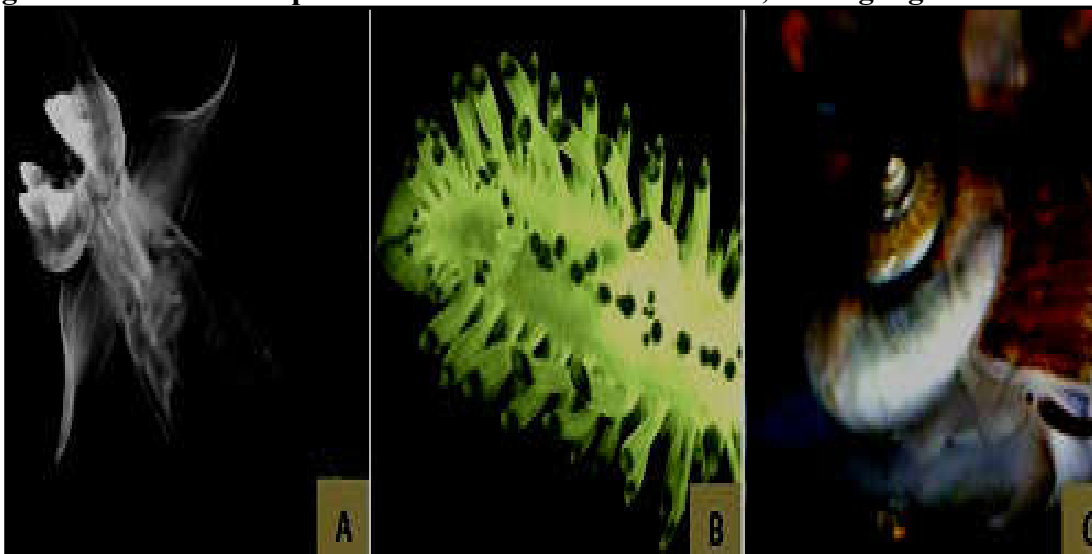


Figure No.7: Examples of molluscs: A-Sea Butterflies, B-Slugs and C-Snails

CONCLUSION

Marine organisms can able to produce unique compounds. Cosmetics which can be derived from the marine sources have various health benefits. Marine source consists of large number of components which is having potential cosmetic properties. Now a day, marine-based ingredients have been inevitable sources for cosmetic based companies. Marine diversity is a fascination for the researchers and cosmetic industries for the last years since it is an area for exploration.

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CONFLICT OF INTEREST

We declare that we have no conflict of interest.

BIBLIOGRAPHY

1. Oricha B S. Cosmeceuticals: A review, *African Journal of Pharmacy and Pharmacology*, 4(4), 2010, 127-129.
2. Alparslan L, Sekeroglu N. The potential of marine resources in cosmetics, *Current Perspectives on Medicinal and Aromatic Plants (CUPMAP)*, 1(2), 2018, 53-66.
3. Uppala L. A review on active ingredients from marine sources used in cosmetics, *SOJ Pharm Pharm Sci*, 2(3), 2015, 1-3.
4. Querellou J, Børresen T, Boyen C, Dobson A, Hofle M, Ianora A, Jaspars M, Kijjoa A, Olafsen J, Rigos G. Marine biotechnology: Realising the full potential of Europe, *VLIZ Special Publication*, 47, 2010, 21.
5. Jesumani V, Du H, Aslam M. Potential use of seaweed bioactive compounds in skincare-A review, *Mar Dru*, 17(12), 2019, 688.
6. Jesumani V, Du H, Pei P, Zheng C. Unravelling property of polysaccharides from *Sargassum* sp. as an anti-wrinkle and skin whitening property, *Inter Jour of Biol Macro*, 140, 2019, 216-224.
7. Gellenbeck K W. Utilization of algal materials for nutraceutical and cosmeceutical applications-what do manufacturers need to know? *Journal of Applied Phycology*, 24(3), 2012, 309-313.
8. Thomas N V, Kim S K. Beneficial effects of marine algal compounds in cosmeceuticals, *Marine drugs*, 11(1), 2013, 146-164.
9. Wang H M, Chen C C, Huynh P, Chang J S. Exploring the potential of using algae in cosmetics, *Bioresource Technology*, 184, 2015, 355-362.
10. Couteau C, Coiffard L. Phycocosmetics and other marine cosmetics, specific cosmetics formulated using marine resources, *Marine Drugs*, 18(6), 2020, 322.
11. Morais T, Cotas J, Pacheco D, Pereira L. Seaweeds compounds: An ecosustainable source of cosmetic ingredients? *Cosmetics*, 8(1), 2021, 8.
12. Sachan N K, Pushkar S, Jha A, Bhattcharya A. Sodium alginate: the wonder polymer for controlled drug delivery, *J Pharm Res*, 2(8), 2009, 1191-1199.
13. Priyadarshani I, Rath B. Commercial and industrial applications of micro algae-A review, *Journal of Algal Biomass Utilization*, 3(4), 2012, 89-100.
14. Lopez-Hortas L, Florez-Fernandez N, Torres M D, Ferreira-Anta T, Casas M P, Balboa E M, Falque E, Domínguez H. Applying seaweed compounds in cosmetics, cosmeceuticals and nutricosmetics, *Marine Drugs*, 19(10), 2021, 552.
15. Swatschek D, Schatton W, Kellermann J, Muller W E, Kreuter J. Marine sponge collagen: Isolation, characterization and effects on the skin parameters surface-pH, moisture and sebum, *European Journal of Pharmaceutics and Biopharmaceutics*, 53(1), 2002, 107-113.
16. Chairman K, Singh A R, Alagumuthu G. Cytotoxic and antioxidant activity of selected marine sponges, *Asian Pacific Journal of Tropical Disease*, 2(3), 2012, 234-238.

17. Cheung F W, Guo J, Ling Y H, Che C T, Liu W K. Anti-melanogenic property of geoditin A in murine B16 melanoma cells, *Marine Drugs*, 10(2), 2012, 465-476.
18. Yanti C, Vendy V, Hwang JK. *In vitro* antiacne activity of marine sponge *Acanthella cavernosa* extracts, *Int. J. Biol. Pharm. Res.*, 6(5), 2015, 388-392.
19. Campos P E, Herbette G, Chendo C, Clerc P, Tintillier F, de Voogd N J, Papanagnou E D, Trougakos I P, Jerabek M, Bignon J, Le Goff G, Osirisynes G I. New long-chain highly oxygenated polyacetylenes from the mayotte marine sponge *haliclona* sp, *Marine Drugs*, 18(7), 2020, 350.
20. Lee H Y, Jang E J, Bae S Y, Jeon J E, Park H J, Shin J, Lee S K. Anti-melanogenic activity of gagunin D, a highly oxygenated diterpenoid from the marine sponge *Phorbas* sp., via modulating tyrosinase expression and degradation, *Marine Drugs*, 14(11), 2016, 212.
21. Seradj H, Moein M, Eskandari M, Maaref F. Antioxidant activity of six marine sponges collected from the Persian Gulf, *Iranian Journal of Pharmaceutical Sciences*, 8(4), 2012, 249-255.
22. Senaratne L S, Park P J, Kim S K. Isolation and characterization of collagen from brown backed toadfish (*Lagocephalus gloveri*) skin, *Bioresource Tech*, 97(2), 2006, 191-197.
23. Xu Y, Han X, Li Y. Effect of marine collagen peptides on long bone development in growing rats, *Journal of the Science of Food and Agriculture*, 90(9), 2010, 1485-1491.
24. Swatschek D, Schatton W, Kellermann J, Muller W E, Kreuter J. Marine sponge collagen: isolation, characterization and effects on the skin parameters surface-pH, moisture and sebum, *European Journal of Pharmaceutics and Biopharmaceutics*, 53(1), 2002, 107-113.
25. Allard R, Malak N A, Huc A, inventors; Coletica S A. Collagen product containing collagen of marine origin with a low odor and preferably with improved mechanical properties and its use in the form of cosmetic or pharmaceutical compositions or products, *United States patent US 6,660,280*, 2003.
26. Xhaufaire-Uhoda E, Fontaine K, Pierard G E. Kinetics of moisturizing and firming effects of cosmetic formulations, *International Journal of Cosmetic Science*, 30(2), 2008, 131-138.
27. Cho J K, Jin Y G, Rha S J, Kim S J, Hwang J H. Biochemical characteristics of four marine fish skins in Korea, *Food Chemistry*, 159, 2014, 200-207.
28. Nagai T, Ogawa T, Nakamura T, Ito T, Nakagawa H, Fujiki K, Nakao M, Yano T. Collagen of edible jellyfish *exumbrella*, *Journal of the Science of Food and Agriculture*, 79(6), 1999, 855-858.
29. Okazaki E. Isolation and characterization of acid-soluble collagen from the scales of marine fishes from Japan and Vietnam, *Food Chemistry*, 149, 2014, 264-270.
30. Sanjewa K A, Park Y J, Fernando I S, Ann Y S, Ko CI, Wang L, Jeon Y J, Lee W. Soft corals collected from Jeju Island inhibits the α -MSH-induced melanogenesis in B16F10 cells through activation of ERK, *Fisheries and Aquatic Sciences*, 21(1), 2018, 1-8.
31. Santhanam R, Ramesh S, Sunilson A J. Biology and ecology of pharmaceutical marine sponges, *CRC Press*, 1st Edition, 2018, 342.
32. Wang H M, Chen C C, Huynh P, Chang J S. Exploring the potential of using algae in cosmetics, *Bioresource Technology*, 184, 2015, 355-362.
33. Heydarizadeh P, Poirier I, Loizeau D, Ulmann L, Mimouni V, Schoefs B, Bertrand M. Plastids of marine phytoplankton produce bioactive pigments and lipids, *Marine Drugs*, 11(9), 2013, 3425-3471.
34. Ferreira M S, Resende D I, Lobo J M, Sousa E, Almeida I F. Marine ingredients for sensitive skin: Market overview, *Marine Drugs*, 19(8), 2021, 464.
35. Xue J, Sasaki N, Elangovan M, Diamond G, Kannan K. Elevated accumulation of parabens

and their metabolites in marine mammals from the United States coastal waters, *Environmental Science and Technology*, 49(20), 2015, 12071-12079.

36. Corinaldesi C, Barone G, Marcellini F, Dell'Anno A, Danovaro R. Marine microbial-derived molecules and their potential use in cosmeceutical and cosmetic products, *Marine Drugs*, 15(4), 2017, 118.
37. Balabanova L, Slepchenko L, Son O, Tekutyeva L. Biotechnology potential of marine fungi degrading plant and algae polymeric substrates, *Front. Microbiol*, 9, Article No: 1527, 2018, 1-15.
38. Pati P, Sahu B K, Panigrahy R C. Marine molluscs as a potential drug cabinet: An overview, *Indian Journal of Geo-Marine Sciences*, 44(7), 2015, 961-970.

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