Use Of Marine Ingredients In Anti-Aging Cosmetics

Papiha Raut*1, Vishal Gaikwad*2

*1student At Pratibhatai Pawar College Of Pharmacy
*2assistant Professor At Pratibhatai Pawar College Of Pharm**acy**

ABSTRACT:The skin is the largest organ in the body and has many purposes, the most crucial of which is defence against different damaging stressors.Normal (left) and compromised skin barriers (right). Water loss occurs and environmental c ontaminants can enter the skin when the skin barrier is damaged, causing irritation, allergic reactions, inflammation, or a n aggravation of a particular kind of eczema.Marine ingredients have become more important in the cosmeticbusiness sin ce they are a source of novel chemical entities with biological action. The most important category in this market is facial care.Although plant-derived extracts are typically among the primary ingredients in cosmetic formulations made with natural ingredients, an increase in the use of marine ingredients for this purpose has been observed over the past year due to the marine industry's observation of biotechnological advanc ements. The trends in the usage of marine components in a panel of anti-aging products were examined in this study. Due to their diversity, ease of cultivation, and ability to control growth, algae were without a doubt the most popular mari ne element in these antiaging compositions; red algae weremost frequently utilized during this time. On the other hand, from 2011 to 2018, there was a decline in the utilisation of marine microbes. This study examines the rising usage of marine ingredients in anti-aging products in order to give academics and the cosmetic industry a perspective on the trends in marine components and to help them create new and improved formulations to combat the issues associated with skin ageing.

Keywords: -marine ingredients, anti-aging, algae, sensitive skin, UV radiation, damaging stressors, human skin, pollution, air contaminates

Introduction

The skin is heavily exposed to the environment outside and ages both internally and externally. Extrinsic skin ageing primarily results from exposure to heat, smoking, pollution, or UV radiation, whereas intrinsic skin ageing results from the passage of time and is impacted by genetic factors. Due to the loss of collagen, elastic fibres, and hyaluronic acid, chronic exposure to these factors frequently causes wrinkles, skin dryness, loss of elasticity, laxity, and a rough-textured look. Reactive oxygen species (ROS), which are produced by cellular oxidative metabolism and damage DNA, proteins, and lipids, are the main way that UV radiation triggers molecular reactions in human skin. This process also lowers antioxidant levels in the skin. [1] Human skin thins with age and loses its natural suppleness and capacity to moisturise. Aged skin becomes more brittle, flabby, dry, and wrinkled [3] Algae are one of the richest sources of novel bioactive chemicals among marine organisms. As evidenced by the emergence of various cosmetic products derived from these compounds in the market, the distinctive diversity of bioactive compounds found in algae, such as vitamins, minerals, amino acids, sugars, lipids, and other biologically active compounds, translates into numerous appealing properties for various industries, including the food, pharmaceutical, and cosmetic industries [4] Cells experience oxidative stress and lose their capacity to control ROS as a result of skin ageing. Fortunately, a variety of compounds from marine species successfully fend off oxidative cell damage and delay skin ageing. It has been demonstrated that fucoxanthin isolated from brown seaweed can shield keratinocytes from oxidative damage. The deepsea bacteria Vibrio diabolicus produces a glycosaminoglycan extracellular polymer that can aid in skin healing. Extremophiles found in deep-sea hydrothermal vents produce Alteromonas fermentation extract, an EPS. The fermentation extracts of Alteromonas can chelate cadmium and lead, decrease MDA (the byproduct of lipid peroxidation), and create a protective coating on the surface of the body. In order to produce a novel beauty cream, it was mixed with carnosine, a sodium hyaluronate crosspolymer, and a tripeptideand research on the product's efficacy in improving skin quality and facial shapes. This composition is a top-notch anti-aging product with good tolerance. Numerous functional proteins of the highest quality and bioactive natural peptides with a variety of molecular structures are found in marine microorganisms. For instance, gammaglutamate transferase (GGT) activity is inhibited by marine peptides produced from Navicula salinicola microalgae proteolytic products, which reduce oxidative damage and delay cell senescence. Similar to this, chlorella peptides can inhibit matrix metalloproteinase-1 (MMP1) production in human skin fibroblasts, preventing collagen degradation and slowing the ageing process. [3] As a result of ageing, matrix metalloproteinases (MMPs), which can be generated by UV radiation, infrared radiation, and possibly even visible light, break down collagen fibres as a result of ageing. Reactive oxygen species (ROS) buildup and activation of MMPs are the two main causes of skin ageing. This ultimately results in the buildup of fragmented collagen fibres that inhibit regular collagen synthesis [5].

Figure 1 enables analysis of the specific marine ingredients utilised in the examined anti-aging cosmetics sold over this seven-year period. The "top 3 marine ingredients" are extracts from Laminaria digitata, Kappaphycus alvarezii, and Chondrus crispus. It is possible to draw the conclusion that all of the marine ingredients used in 2011 were still used in 2018. Chondrus crispus was already in use in 2011 (with an increase in use from 1.05 to 4.85% in 2018), whereas Laminaria digitata (used in 6.8%) and Kappaphycus alvarezii (used in 4.8%) are new species. Although producers often list the species of the marine ingredient, occasionally a combination of extracts is listed. For example, "algal extracts" are frequently used in a variety of cosmetic compositions, and their usage dropped over this time

period (from 2.63 to 1.94%).
This component is described as "an extract of numerous species of algae; an extract of the seaweed, Fucus vesiculosus, Fucaceae" in the database maintained by the European Commission with information on cosmetic ingredients used in cosmetics. [1]

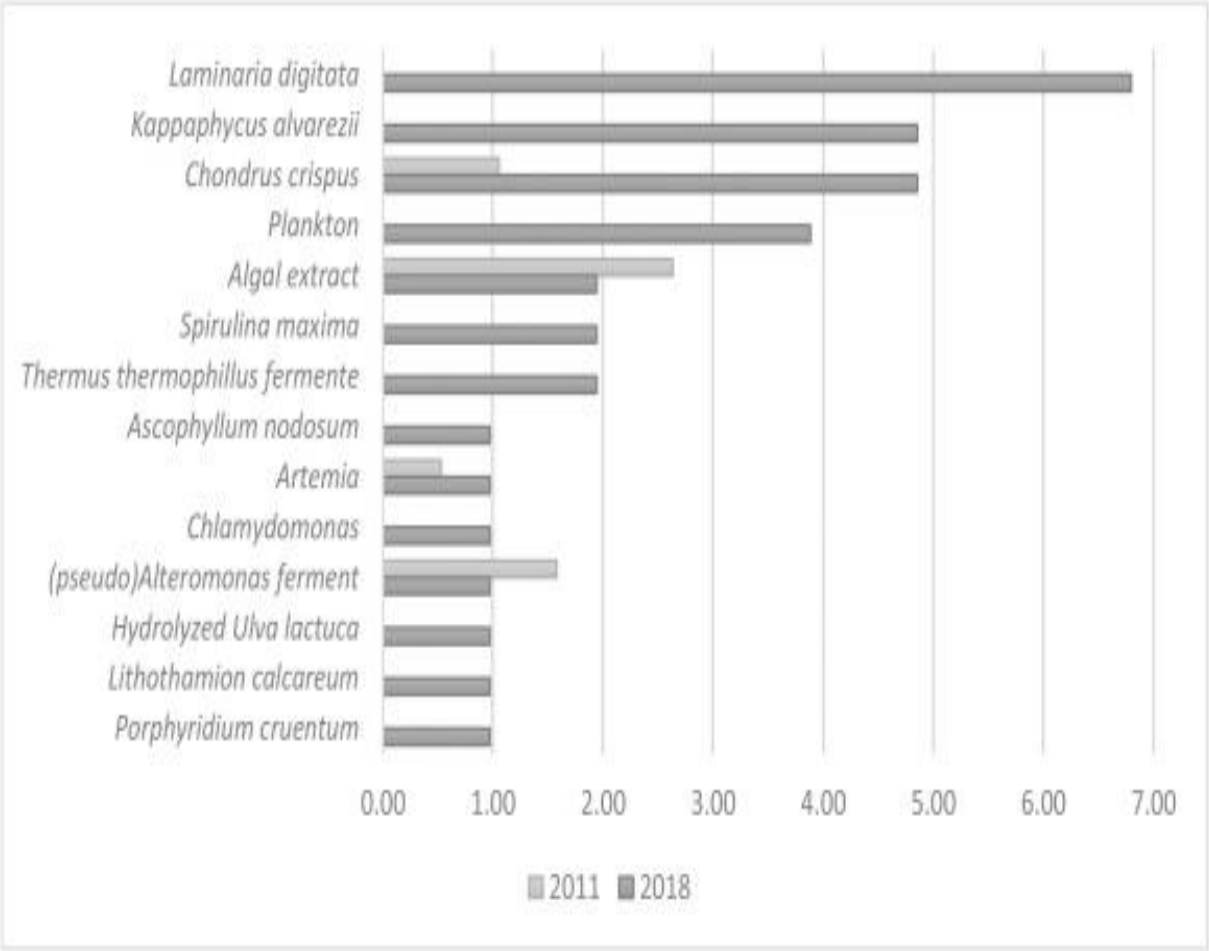


Fig. 1. Occurrence of marine ingredients in anti-aging cosmetics commercialized in the Portuguese market. A comparison between 2018 and 2011 (%).

A breakdown of the marine ingredients' sources (Fig. 2) reveals that the vast majority of them are algae (64% in 2011 vs. 76% in 2018), with other marine species and bacteria being the least frequently employed as ingredients in the anti-aging cosmetics under study.

This classification took into account bacteria (Thermus thermophiles and Alteromonas), other marine species (plankton and artemia/brine shrimp), and algae (macroalgae (green, brown, and red) and microalgae). Algae are among the best maritime resources due to their richness, ease of cultivation, and ability to control development, which puts them ahead of other marine species and bacteria, which are more difficult to collect. There has been a clear evolution in the way various forms of algae are used.

While only the most prevalent (red algae, 18%) were present in 2011 (Fig. 2) A classification of the marine ingredients used in Portuguese anti-aging cosmetics for sale. An analysis of 2011 and 2018.

In 2018, several types of algae [red (32%), brown (23%), and green (6%)] were used as ingredients in addition to the "algae extract," which is listed in Fig. 2 as "undefined." [1]

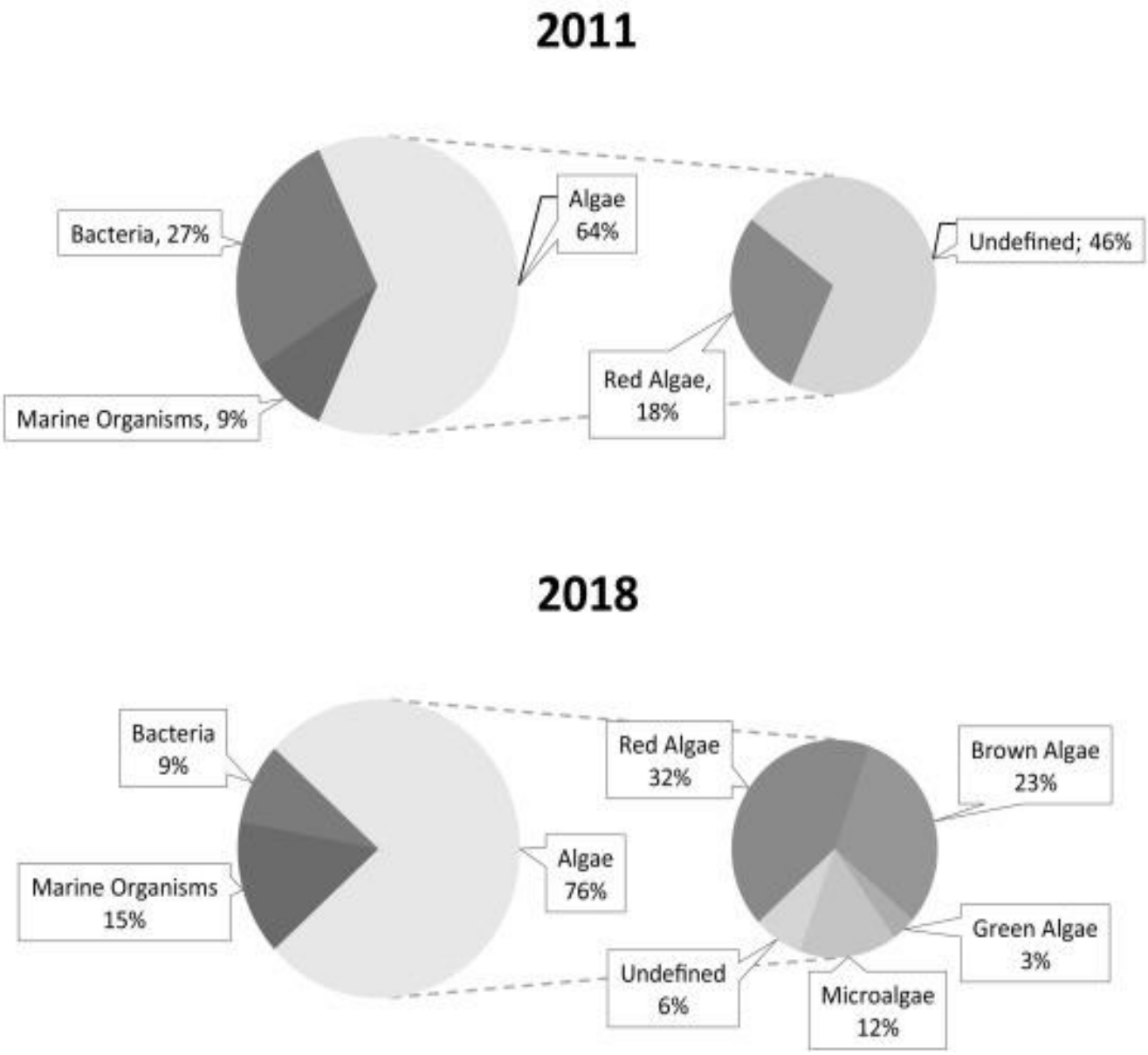


Fig. 2. Categorization of the marine ingredients present in anti-aging cosmetics commercialized in the Portuguese market. A comparison between 2011 and 2018

- **FACTORS THAT EFFECT SKIN AGEING**

Skin aging and ROS

Photoageing of the skin is mainly due to pollution and UVR:

- **UVR: -**

UVR also causes the induction of proinflammatory genes, and inflammation is a major mediator of photoaging. Keratinocytes, fib roblasts, leucocytes, and the endothelial lining of blood vessels release inflammatory mediators such as fibrin, prostaglandins, cyt okines (interleukin-1 (IL-1)), IL-6, and tumour necrosis factor (TNF-a). COX-2, a cyclooxygenase, and
ROS also activate prostaglandin E2 (PGE2). The inflammatory cascade starts the production of ROS. [2]

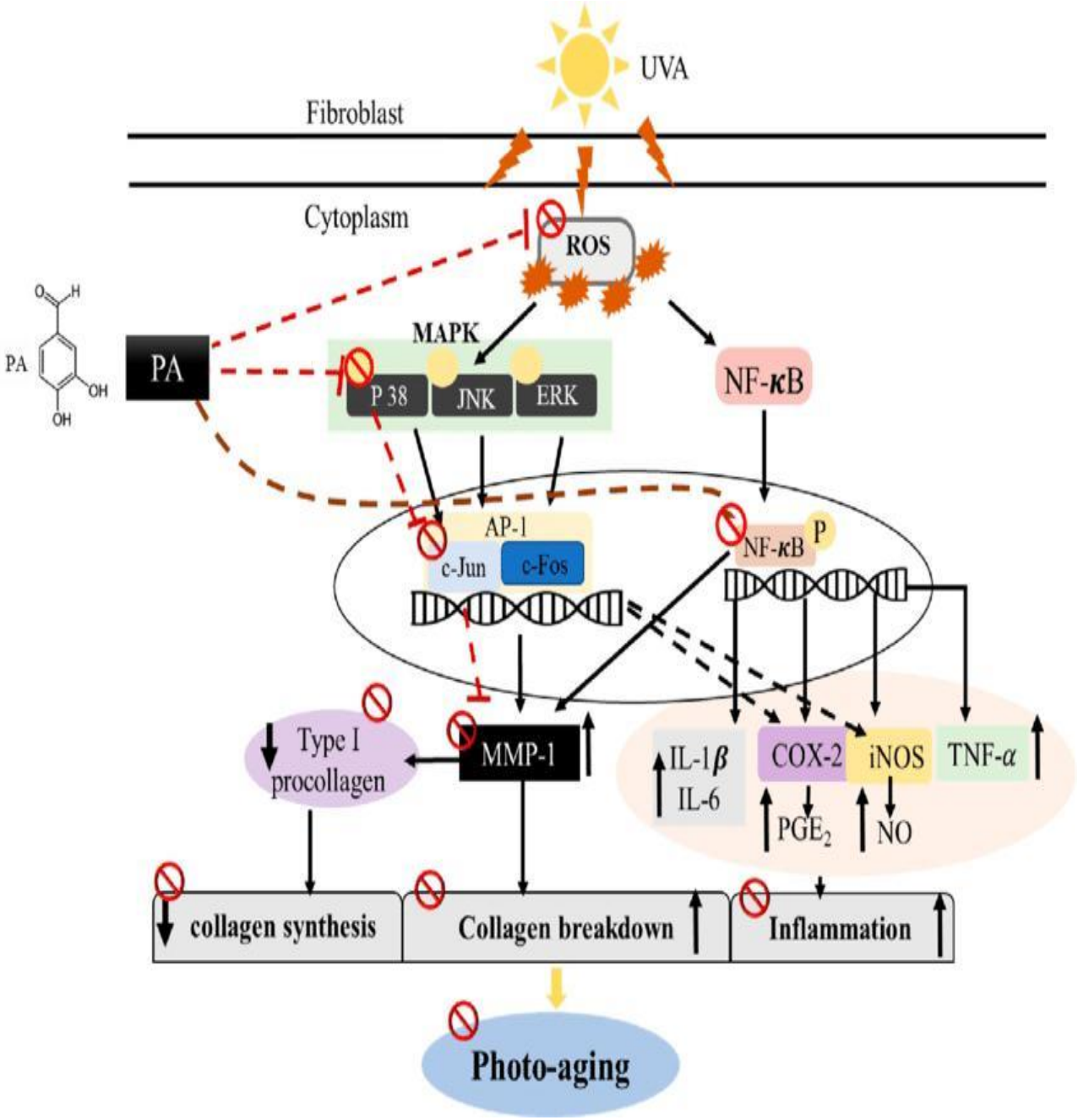


Fig 3: -photo-ageing caused by UVR [7]

➢ **Increase in skin temperature**: -

Skin temperatures are raised by the heat energy that solar infrared radiation (IR) conveys. Increased MMP expression, especially MMP1, MMP-3, and MMP-12, which leads to the breakdown of collagen and elastin, is a hallmark of heat-related skin injury. Additionally, heat increases tropoelastin dermal expression while lowering fibrillin1 levels, which causes a buildup of elastotic material. The main causes of protein and DNA oxidation caused by heat are the activation of NADPH oxidase, xanthine oxidase, and the mitochondrial electron transport system. The transient receptor potential vanilloid1 (TRPV1) has been demonstrated to mediate the expression of MMP-1 when activated by heat, suggesting a possible role for TRPV-1 inhibitors in the treatment of heat-induced skin ageing. [2]

➢ **Pollution**: -

Another significant environmental factor that produces ROS is air pollution. [2] Because the skin serves as a peripheral barrier and is constantly exposed to various air contaminants, there is a connection between air pollution and skin-damaging effects that contribute to skin ageing[8] Due to its unusual location, the human skin is one of the first and primary targets of air contaminants. Air pollution mainly refers to particulate matter (PM), which contains the dangerous suspended pollutants in the air. PM tends to influence the growth and aggravate existing skin pathologies. The term "PM" refers to the airborne contaminants that are suspended and include biological contaminants (pollen), gaseous contaminants, various types of dust, and particle contaminants (tobacco smoke, soot, etc.) (exhaust gas from traffic). Sulfates, nitrates, and polycyclic aromatic hydrocarbons are other components of PM (PAHs). The increased production of oxidative stress is one of the mechanisms connected to the negative impact of PM on skin conditions. The primary sources of PAHs in mixes are coal tar, diesel exhaust, and cigarette smoke. [2]

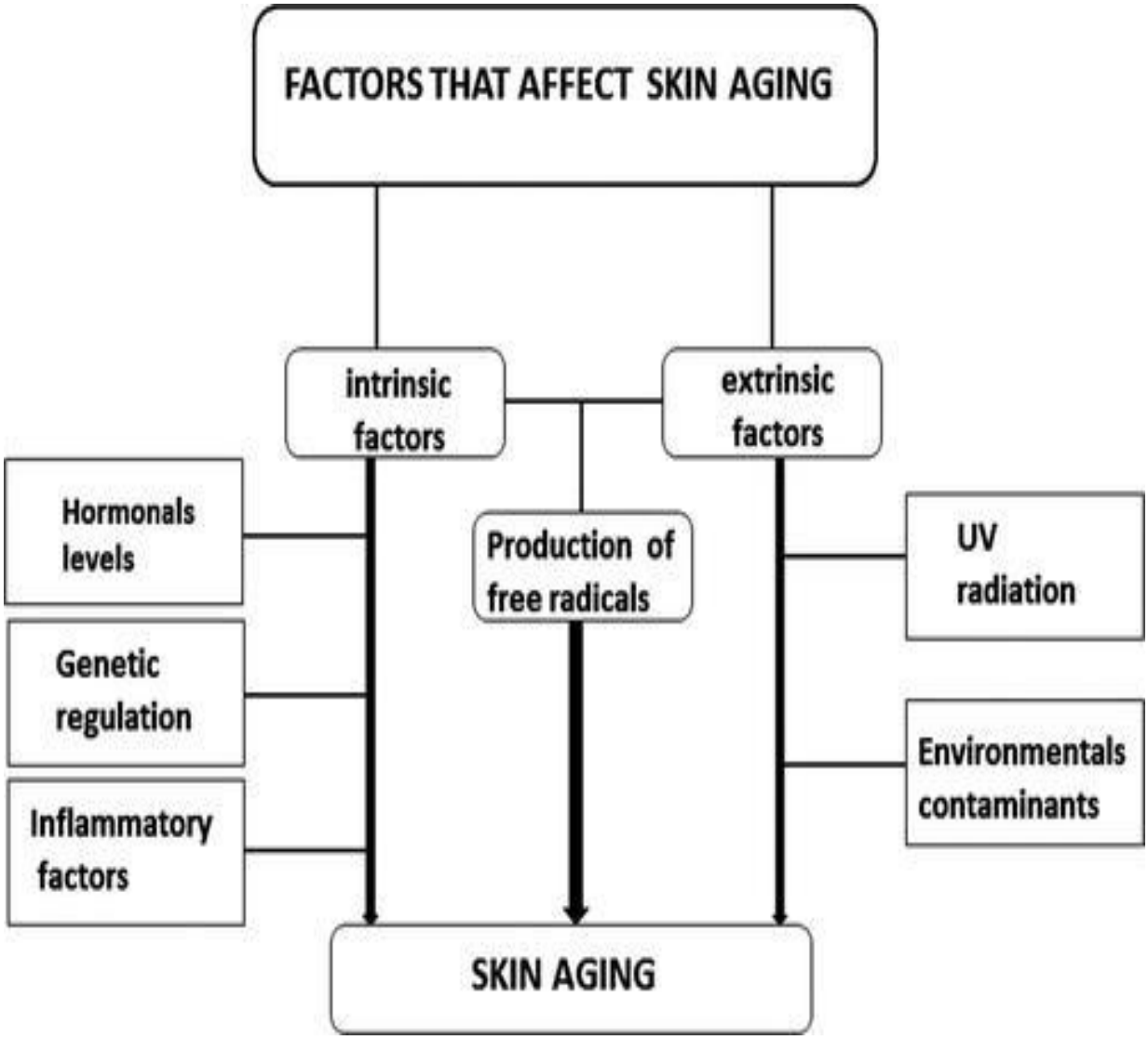
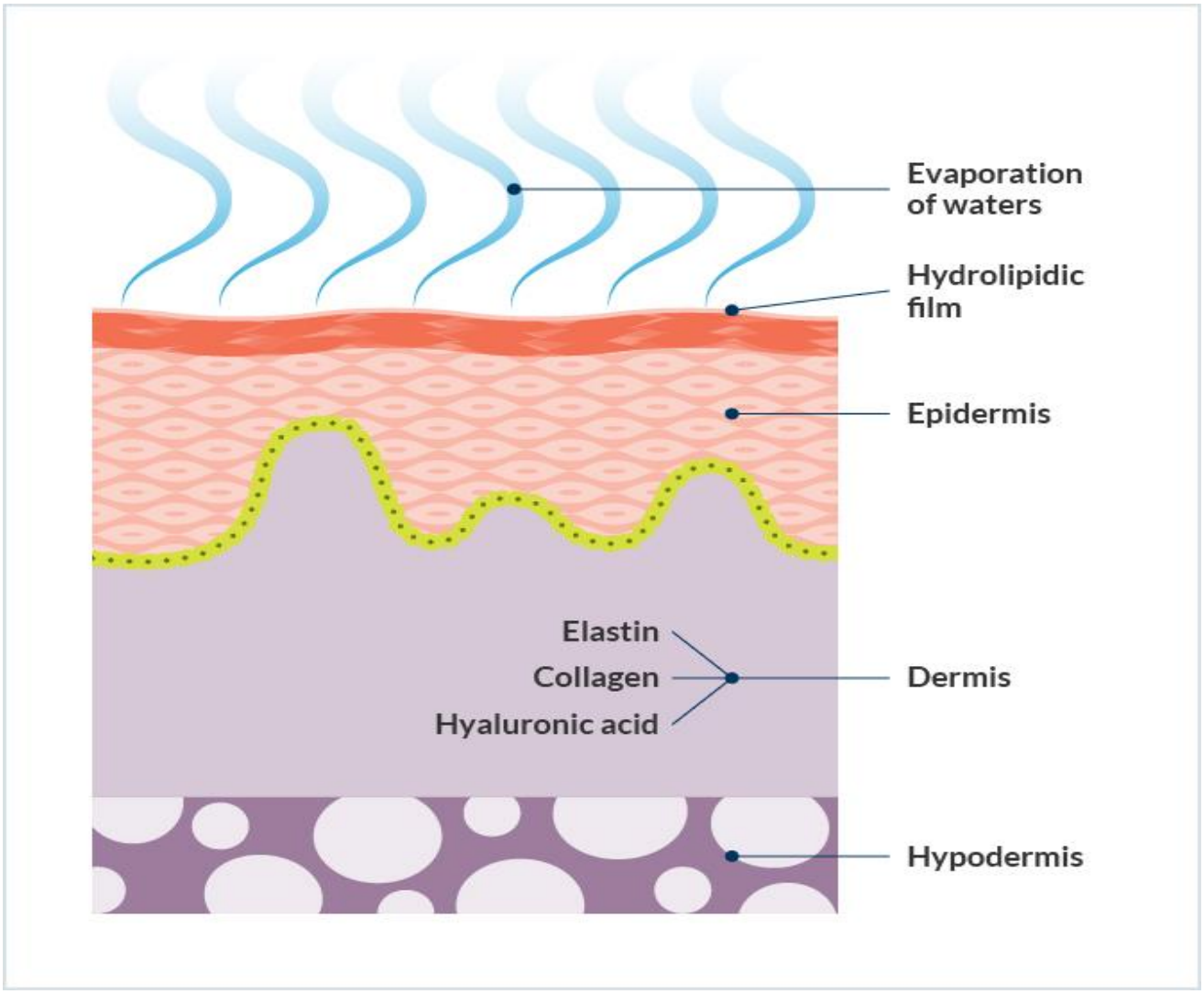


Fig 4:-Factors that effect skin ageing [9]

- **MOISTURISING EFFECT**

The fibroblast is the primary kind of cell in the dermis, and it is embedded in collagen, elastic fibres, and an extracellular matrix that is made of glycoprotein, hyaluronic acid, glycosaminoglycan, and other compounds that combine to form a gel, including water and salts. A proteoglycan called glycosaminoglycan (GAG) is what stores the majority of the water in the skin. For the skin to operate correctly, water is necessary. External influences may hasten skin ageing, as aged skin breaks down the barrier function of the skin. As a result, it becomes more delicate and progressively loses its inherent suppleness and moisturising capabilities. Natural hygroscopic substances such as urea, polysaccharides, amino acids, and minerals are found in the keratinocytes of the skin's epidermis and are known as natural moisturising factors (NMF). The lipids in the skin's cuticle, which line up to form a barrier to stop water loss, are also hydrating. Moisturizing compounds like fatty acids and polysaccharides, which are frequently used in cosmetics, are produced by marine species. To hydrate the skin, oil in water emulsions can be supplemented with omega6 polyunsaturated fatty acids obtained from algae, particularly C-18 linoleic acid and gammalinolenic acid, which are present in marine microalgae. Dermatitis and skin dryness have been linked to a deficiency in unsaturated fatty acids. Unsaturated fatty acids are mostly produced by marine microbes. [3]

[6]



- **ANTI-AGING EFFECT**

Both internal elements and the outside environment have an impact on the skin's ageing process. Age-related changes in internal factors are predominant, although environmental stressors such as high temperatures, smoke, pollution, and UV radiation are external. Wrinkles, dryness, loss of elasticity, sagging, and a rough look are signs of aged skin and are mostly caused by a decrease in collagen, elastic fibres, and hyaluronic acid. Cells experience oxidative stress and lose their capacity to control ROS as a result of skin aging. ([3] Matrix metalloproteinases (MMPs), which can be triggered by UV radiation, infrared radiation, and possibly even visible light, break down collagen fibres as we age. ([5] Fortunately, several components found in marine species efficiently prevent oxidative cell damage and skin ageing. It has been demonstrated that fucoxanthin isolated from brown seaweed can shield keratinocytes from oxidative damage. [3]

- **REPAIR FUNCTION**

The primary job of the skin, the immune system's first barrier, is to keep the inside of the body separate from the outside. The skin barrier stops hazardous substances from entering and reduces water loss. The cuticle, which has keratinocytes, lipid-rich cells, and protein-rich cells, makes up the majority of the skin barrier. Ceramides, free fatty acids, and cholesterol are some of these lipids. As a result, foreign bacteria and irritants can more easily infiltrate it, leading to inflammatory reactions and other symptoms. Skin restoration is therefore a crucial component of beauty care. In order to address these issues, we can first encourage wound healing, or more specifically, the proliferation or protection of skin fibrocytes. It was shown that sea bacteria can boost fibrocyte production, speed up mouse skin wound healing, and lessen the damage low temperatures cause to the skin. [3]

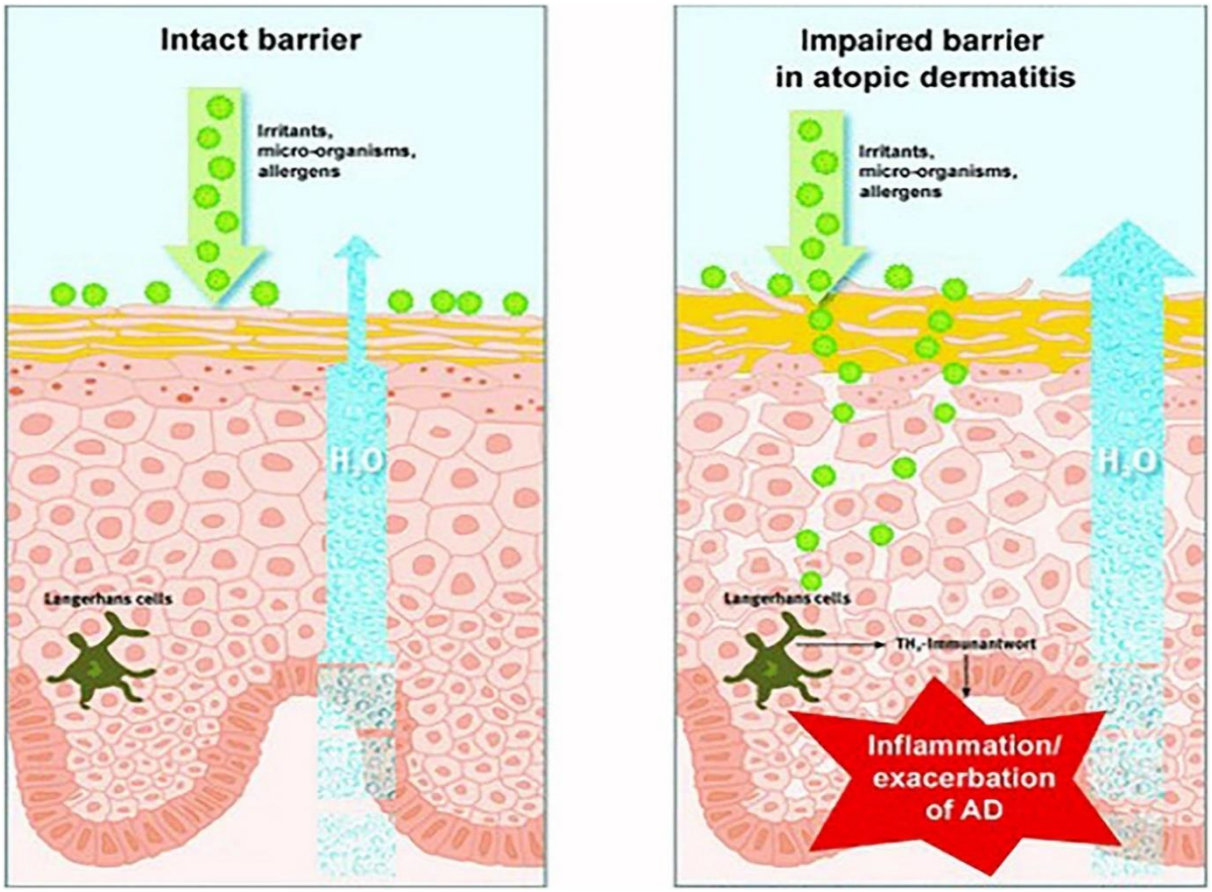


Fig 5:The skin barrier is normal (left) and impaired (right). When the skin barrier is compromised, water loss increases, and environmental toxins can penetrate the skin, triggering irritation, allergic reactions, inflammation, or exacerbation of specific eczema.[3]

- **Marine ingredients used as anti-aging cosmetics**

Marine bacteria: -

Of all the marine environments, bacteria often have the most abundance and diversity of biota. Several species are used in biotechnological applications, and some of them have properties that make them attractive to the cosmetics sector, including photoprotective, antiaging, antibacterial, antioxidant, and moisturising properties. Alkaloids, pepti des, proteins, lipids, mycosporines and amino acids with mycosporine like properties, glycosides, and isoprenoids are a few of the primary components of marine bacteria [1].

Different marine sources that are used as anti-aging cosmetics are:-

1.seaweed
2.coral
3.jellyfish
4.phytoplankton
5.sea fennel

- **Seaweed**: -

The term "seaweeds" refers to a vast array of marine plant and algae species that can be found in rivers, lakes, and other bodies of water in addition to the ocean. In addition to these names, seaweed is also known as algae, kelp, egg wrack, wakame, nori, dulse/dillisk, sea lettuce, sea grass, carrageenins, and Irish moss. Since ancient times, seaweed has been used to balance natural moisture levels and enhance circulation in bath, body, and skincare products. This can lessen the appearance of cellulite and restore the texture and tone of the skin. Seaweed has traditionally been used to help the skin heal and for its purifying effects. Mineral salts, amino acids, and vitamins A, C, B1, B12, E, K, and D are all abundant in seaweed. The easy-to-absorb lipid, protein, mineral, and vitamin composition offers a deeply moisturising and skin-promoting treatment. The primary application of seaweed extract is for skin and body care; it has anti-aging, anti-acne, and skin-protective properties. Skin cell renewal may be stimulated by it. It can tone the skin, cleanse, detoxify, and moisturise. Proteins, amino acids, carbohydrates, vitamins (A, B, and C), and oligo-elements including copper, iron, and zinc are abundant in algae (both macro and micro) [10].

Fig 6:-Seaweed[11]

- **Coral**: -

Many cosmetic products include coral powder. It has been applied to the skin as a scrub and a source of trace minerals. Due to its physical, chemical, and textural properties as well as its trace mineral concentration, fossilised coral powder has the potential to b ecome a new sustainable material for cosmetic applications. Coral powder is a pure substance with a high calcium carbonate cont ent. With no heavy metals present, this natural sea coral powder could also contain 74 other trace minerals. This coral powder fun ctions as an antioxidant, anti-aging, and anti-acne treatment in addition to UV radiation protection. It is used to smooth the skin and is found in deodorants, powders, and lipstick preparations [10].

Fig 7: - coral [12]

- **Jellyfish**: -

Jellyfish mucus contains a lot of a substance that is essential for some medications and cosmetics. Cosmetic Design claims that by incorporating jellyfish into the production of anti-
aging beauty products, the cosmetics sector can get involved in helping to increase the fish population. Jellyfish possess potent ant i-aging qualities. [5].
Scientists created the peptide juvefoxo using jellyfish cell replication; when mixed with beauty products, it works to repair and pr event DNA damage as well as convince our skin cells to act young and regenerate. [10]

Fig 8:-Jellyfish[13]

- **Phytoplankton**: -

The two primary types of phytoplankton are the single-celled algae that drift in the sunny upper layers of the ocean and photosynthetic cyanobacteria. The cerebrosides (proceramides) produced by the cells are stimulated by phytoplankton extract, which is high in lipids and omega-3 fatty acids. This strengthens cellular cohesion and restores the skin's protective barrier. Skin toning, skin whitening, anti-aging, and wrinkle prevention are the most common applications [10].

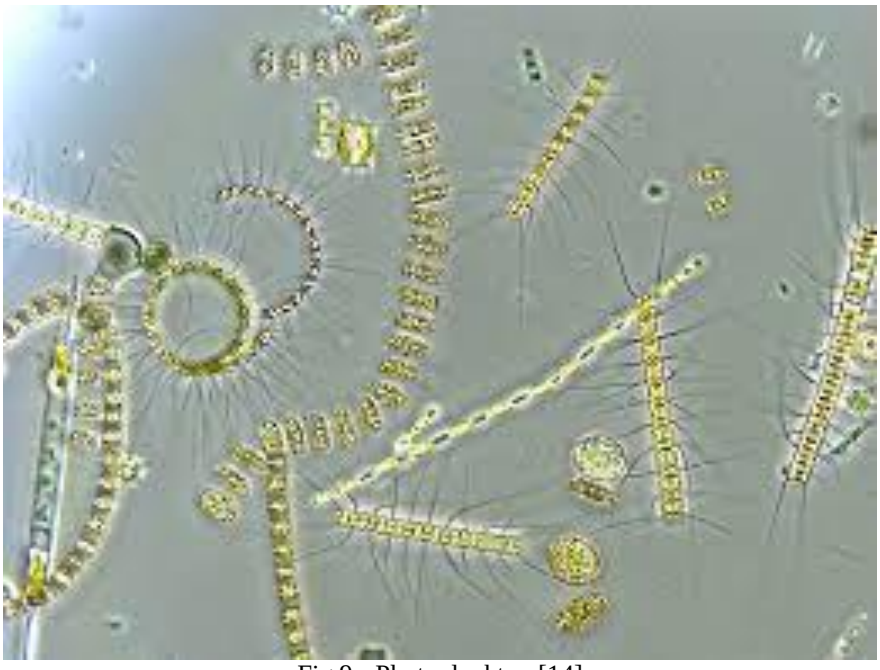


Fig 9: -Phytoplankton [14]

- **Sea Fennel**: -

Vitamins A, C, and E, the antioxidant and antiaging trifecta found in sea fennel, have been shown to counteract wrinkles and skin stresses associated with contemporary life (like UV light, alcohol pollution, and cigarette smoke). It also contains chlorogenic aci d, a strong antioxidant, making these understated beach plants a good skin defender. The powerful stem cells control keratin rene wal in your own skin, which will enhance skin tone[10].

Fig 10**:**-sea fennel[15]

CONCLUSION

This study presents an original and updated overview of the development of the usage of marine components in a panel of anti-aging formulations sold on the Portuguese market between 2011 and 2018.ROS generation and oxidative stress are greatly increased in human skin exposed to pollution and solar UV radiation, which sets off a chain reaction involving numerous cell/molecular signalling pathways. The impacts of oxidative stress on skin ageing result in DNA damage, decreased antioxidant production, and activation/inhibition of numerous signalling pathways, which in turn cause the creation of MMPs, which break down collagen and elastin in the dermal skin layer. Aging is the outcome of several molecular pathways that induce a direct or indirect rise in ROS depending on whether intrinsic or extrinsic factors are present. Wrinkles, altered skin texture, and elastosis are caused by decreased levels of dermal collagen and increasing levels of elastin in the dermis. Cell senescence, a sign of ageing, is caused by the protective process of chromosome telomeric length shortening during each cell division. To stop skin ageing, several therapies and treatments, both natural and artificial, are used.

Overall, marine elements are already utilised in anti-aging skin care products and have enormous growth potential. For formulators, cosmetic companies with R&D departments, and raw material suppliers from the cosmetic industry, their in-depth study and the further investigation of other organisms, such as fish, sponges, corals, mollusks, echinoderms, Artemia, plankton, and microorganisms, represent a significant opportunity. Unique chemicals are produced by marine creatures. cosmetics with positive effects on the body's health that come from marine sources. It is made up of numerous phytochemical components that have been isolated from different marine resources. The current development presents a chance to comprehend marine natural products and their potential for use in cosmetics. Marine-based compounds have captured the interest of cosmetic firms for a while now.

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