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What Is The Efficiency of Bioactive Compounds Derived From Marine Organisms in Developing Advanced Skincare Formulations With Enhanced Therapeutic Properties?

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ABSTRACT

The landscape of skincare has undergone a profound transition, evolving from mere cosmetic enhancements to embracing the therapeutic properties found in nature. This transformation has attracted the scientific community's interest in the immense and intricate realm of marine wild life. The driving force for this evolution lies in the burgeoning exploration of bioactive compounds derived from marine organisms—discoveries that have the power to revolutionize skincare formulas and their extraordinary curative capabilities. This study aims to investigate the effectiveness of bioactive substances produced from marine creatures in the development of innovative skincare formulations with increased therapeutic qualities. This work adds to the growth of skincare into a subject that not only beautifies but also nourishes and fortifies the skin by bridging the gap between traditional cosmetic improvements and scientific breakthroughs.

Keywords: Skincare, marine organisms, collagen, aging, carotenoids, terpnoids.

INTRODUCTION

Marine organisms that thrive in the world's most captivating ecosystems have evolved chemical defenses and adaptations to withstand the rigors of their environment. Within these adaptations lies the potential to redefine skincare products, offering profound therapeutic benefits that extend far beyond conventional cosmetic applications. As the largest organ in the human body, the skin not only serves a protective function but also plays a crucial role in overall health. However, contemporary skincare practices have predominantly focused on aesthetics, overlooking the broader spectrum of skin health.

While bioactive compounds from marine organisms have been explored to some extent, their full potential in promoting collagen synthesis, combating oxidative stress, regulating inflammatory processes, and accelerating tissue repair is still largely unexplored. This study aims to fill this void by elucidating the untapped potential of these compounds, bridging the gap between traditional cosmetic enhancements and scientific breakthroughs, and contributing to the holistic well-being of the skin.

MATERIALS AND METHODS

Data collection: The information for this research study was obtained from reputable online sources. Data was primarily collected from the following three sources, in addition to other sources to further complement the primary sources and inform the results and discussions of this study:

1. "Application of Marine Microbial Natural Products in Cosmetics" by Ding et al. (2022), published in *Frontiers in Microbiology,*
2. "Marine-Derived Compounds with Potential Use as Cosmeceuticals and Nutricosmetics" by Alves et al. (2020), published in *Molecules*
3. Applications for Marine Resources in Cosmetics by Guillerme et al. (2017), published in *Cosmetics*

RESULTS

Moisturization

Moisturizing is an integral step in a skin care routine. When one thinks of moisturizing, they often think of ingredients like hylauronic acid or ceremides; however, using elements derived from marine organisms can take this key step to the next level. Marine organisms produce several molecules with moisturizing properties, such as polysaccharides, fatty acids (sophorolipids, rhamnolipids, and mannosylerythritol), and proteins that are widely used in the skin [2]. In general, the ability to restore transepidermal water loss (TEWL) to normal relies on omega-6 polyunsaturated fatty acids, specifically the 18-carbon atom fatty acids linoleic acid and γ-linolenic acid [3, 4]. During a skin care routine, there are mainly two steps that provide moisture to the skin. This includes serum and cream. Serum has a much runnier consistency, whereas cream has a thicker consistency. Polysacchrides derived from marine organisms can be used in both serums and creams due to their anti-inflammatory and water-retention properties.

Anti-ageing

One of the most popular goals of skin care products is to slow down the aging process of the skin. Long-term exposure to pollution and the sun, often called ‘skin's worst enemies’, makes the skin more susceptible to sagging and wrinkles; anti-aging products can help prevent this. Carotenoids are one such ingredient that has enormous potential for anti-aging. Pagels et al. (2022) studied the cosmetic potential of Cyanobium sp. carotenoids that could be incorporated into anti-aging formulations due to their anti-hyaluronidase properties [6]. Additionally, β-carotene tops this pigment family and has an excellent capacity to prevent reactive oxygen species (ROS) formation [5].

Sun protection

Exposure to a reasonable amount of sunlight is crucial to maintaining healthy skin; however, over time, UV damage can take a toll on the skin and its underlying connective tissue. As a result, healthy skin may develop more wrinkles and lines. Too much sun exposure can also raise the risk of skin cancer, the most common type of cancer in the United States [7]. Several marine organisms, notably photosynthetic organisms, produce UV-absorbing compounds such as scytonemins (cyanobacteria), mycosporines, mycosporine-like amino acids (MAAs), and carotenoids to protect themselves from UV radiation [8-11]. Another such element is mycosporine; they are attached to the core through imine linkages, leading to a combination of resonating tautomers responsible for UV-absorption [12, 13]. MAAs absorb UV radiation ranging from 310–362 nm and dissipate this energy in the form of heat radiation to the surrounding environment [14].

MAJOR COMPOUNDS

Collagen

Collagen, the main structural protein of connective tissue, can be found in many cosmetic products due to its humectant, moisturizing, anti-aging, anti-wrinkling, and skin-repairing properties [15, 16]. Marine collagens can be used instead of bovine collagen because they come from fish and organisms in the Porifera, Echinodermata, Cnidaria, and Mollusca phylas. Some of these have higher biocompatibility and mechanical strength.

Polyphenolic Compounds

Polyphenols (i.e., phenolic acid, flavonoids, tannins, and phlorotannins) are secondary metabolites that are involved in many biological processes, such as reproduction, photosynthesis, and cell division, and present antioxidant and anti-melanogenesis properties [18, 19]. Polyphenolic compounds sourced from marine algae (i.e., dieckol, phloroglucinol, fucofuroeckol-A, and triphlorethol-A) also present photoprotective abilities, especially against UVB rays. This presents their potential to be included in sunscreens [20].

Fatty Acids

Among the different fatty acids, polyunsaturated fatty acids (PUFA), specifically the omega-3 fatty acids docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA), have been linked to several health benefits, such as healthy aging [21, 22]. Thus, this holds enormous potential for anti-aging products, along with carotenoids.

Terpnoids

Terpenes and terpenoids are aromatic hydrocarbon molecules found in most plants and can be used as replacements for artificial scents and flavors. This class of compounds presents many biological activities, such as antioxidant and anti-acne properties [23, 24, 25].

CONCLUSION

In conclusion, this research has illuminated the vast potential of bioactive compounds derived from marine organisms in the development of advanced skincare formulations with enhanced therapeutic properties. The

findings underscore the transformative capacity of these compounds to bridge the gap between traditional cosmetic enhancements and scientific breakthroughs, ushering in a new era where skincare not only beautifies but also nourishes and fortifies the skin. In summary, the efficiency of bioactive compounds derived from marine organisms in skincare formulations is undeniable. This research underscores their capacity to revolutionize the skincare industry by offering innovative, therapeutic, and holistic solutions that not only enhance beauty but also promote the overall well-being of the skin. As we move forward, further exploration and development of these marine-derived compounds hold the promise of even more advanced and effective skincare products, benefiting individuals seeking healthier and more vibrant skin.

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