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Gold nanoparticles in sunscreen formulations

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Abstract

These days, many sunscreens are being produced. According to each skin type, sunscreen, which contains different ingredients, has not only beneficial aspects but also harmful aspects. The treatment of these sunscreens is superficial and protects from UV-B rays but not from UV-A rays. These harmful rays that can reach us from the sun, invisible to the naked eye, may cause DNA damage, cancer formation, skin aging, genetic mutations such as photo allergy and phototoxicity. AuNPS that are ultra-small, stable, absorption as properties with biocompatiple particles are known to have qualifications such as stronger irradiance and benefits to the skin. Thanks to these features, they can assist us on this topic. Furthermore, as the zinc oxide in the content of sunscreen is not absorbed through the skin, it does not harm the skin. However, recently, zinc oxides with nanoparticles have been produced. It is aimed to eliminate the white effect of zinc oxide on the skin directly. Namely, since the nanomaterial is absorbed through the skin, it is likely to cause harm, and it has been shown in some studies that ZnO causes breast cancer. Therefore, it is thought that the use of AuNP instead of ZnO may be beneficial.

Introduction

The sun's rays emit UV rays that provide the most harmful wavelengths to the skin. UV light can provoke DNA damage and genetic mutations that lead to cancer [1]. UV radiation is divided into 3 wavelengths with regard to the biological effects of these wavelengths; UVA 400-320 nm, UVB 320-290 nm, and UVC 290-200 nm wavelengths.

Sunscreens help to reduce the radiation reaching the epidermis and dermis by covering the stratum corneum surface of the skin. They have been observed as organic or inorganic substances in the form of creams, lotions, gels, or sprays that prevent the penetration of UV rays reaching the skin by causing absorption, reflection, or scattering. While the first sunscreens produced in the 1930s were only effective against UVB, new products targeting the UVA spectrum have started to be produced in recent years, with the understanding that UVA can cause cancer formation, skin aging, photoallergy, and phototoxicity. Hence, preparations with UVA+UVB combined effect have come to the fore [2]. Nevertheless, these sunscreens do not show their full protective function. So, it shows a superficial protection function. Therefore, by using AuNP, we can provide both deep protection and benefit from the natural benefits of gold to the skin. In this way, we do not have to use separate products for both sunscreens and chemical-containing products for imperfect skin. This saves us in terms of the economy.

Results

In ancient times, gold was used in the treatment of diseases such as smallpox, skin wounds, syphilis, and measles in ancient Egypt, India, and China.

Melanin production in the skin may increase and stains may occur due to aging of the skin and excessive exposure to sunlight.

Gold balances the production of this pigment and corrects the unevenness in skin tone. Gold, which activates basal cells, increases the regeneration rate of the skin and supports the removal of details that impair the skin texture, such as fine wrinkles, lines and scars.

This ingredient, which stimulates the cells, nerves, and vessels in the skin, accelerates blood circulation and provides a healthier, quality, and brighter skin structure. Gold is also a powerful antioxidant. It strengthens the skin barrier and protects the skin against free radicals that damage the skin due to environmental factors such as UV rays and pollution.

After a certain age, sagging and wrinkles appear more easily as the rate of collagen and elastin production in the skin decreases. Gold delays the formation of signs of aging by reducing the breakdown of these building blocks in the skin. This gold, which triggers cell activity, accelerates blood circulation and allows more oxygen to go to the cells, thus ensures the removal of inflammation from the skin [3].

At the same time, this element, which has antibacterial properties, improves skin texture, eliminates acne and creates a healthier skin structure in general. Gold is a noble metal and shows non-toxic properties. Gold is insoluble in water but soluble in hydrochloric acid and other acids [4].

In this study, we will examine the gold nanostructure. In nanosystems, it is very important that the nanomaterial can be targeted to the diseased area and exhibit low toxicity in addition to its high biocirculation and pharmacokinetic properties. According to conventional methods, gold nanoparticles show chemical, mechanical, optical, and electronic properties in the early diagnosis, diagnosis, and treatment of diseases.

Although nanotechnology has been utilized extensively in drug targeting and controlled release, gold nanoparticles occupy a very special place [5].

Targeted nanoparticles release the drug loads they carry to the target tissues and cells with intracellular interaction (pH, glutathione) or external stimuli (radiation).

Researchers have given special attention to gold nanorods due to their ease of synthesis and larger surface area per unit volume that can interact with light compared to other AuNP types [6].

These structures, unlike other shapes, have superior absorption and stronger light scattering properties. Seed-mediated synthesis, which is a synthesis technique, is one of the best-known methods for preparing gold nanorods and can provide higher size ratios compared to particles synthesized by other methods.

Drug release from AuNPs is mediated by internal or external stimuli. In external stimulation (external stimulation), an active substance is released with the stimulation of external stimuli such as light and temperature.

Sreejivungsa et al. investigated AuNPs containing photosensitive ligands and non-covalently bound active substances as a potential drug delivery system that can be triggered by UV light [7]. It was found that the substance was released at a higher rate.

The optical properties of AuNPs are based on their SPR properties. SPR is the resonance process that allows gold electrons to both absorb and scatter light in response to incoming radiation. As a result, an electromagnetic field appears on the AuNP surface and optical properties develop on the nanoparticle surface.

Discussion

In summary, the use of AuNP in cosmetic products is very common. We can take advantage of these features to include them in the content of sunscreens. In terms of these studies, we can enrich the content of sunscreens.

Concurrently, we can prevent the formation of skin cancer, DNA damage, skin spot problems, and the increase in aging problems. Clinical studies should be managed to prevent surface protection by using AuNP instead of ZnO (Zinc Oxide) [8].

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