UV-induced skin damage with bacterial cellulose.

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Bacterial cellulose (BC) is a biopolymer that has excellent water retention, skin permeability, and biocompatibility, making it one of the best delivery methods for plant phenolic chemicals. Some of these chemicals are well-known antioxidants with photoprotective properties. As a result, the link between BC and plant phenolics could be a novel way to prevent skin damage induced by UV exposure. Despite this promising application, the research and dermatological use of BC-loaded with plant phenolics face numerous hurdles. The current study looks at the parameters that determine BC's biosorption of plant phenolic compounds as well as the role of phenolic compounds in UV-induced skin damage prevention. This review goes into greater detail about the BC-phenolics complex's delivery mechanisms and additional effects (antioxidant, antibacterial, healing, and anti-aging). Overall, a better understanding of the intrinsic mechanisms of plant phenolics biosorption and release by BC, combined with advances in the use of new cellulose sources complexed with phenolics, may improve dermatological product formulations and stimulate the development of high-activity biopolymers [1].

The main reason of the high incidence of skin cancer is exposure to ultraviolet (UV) sun radiation. UV radiation can cause acute damage such as burns and skin discoloration in the short term. Long-term exposure can have serious clinical consequences, including the development of melanoma, accelerated ageing, solar elastosis, and hyperpigmentation (Box et al., 2016); inflammation and immunological suppression; solar lentigines, ephelides (freckles), telangiectasias, and melasma (Box et al., 2016). As a result, one of the most important tactics for reducing UV damage to the skin is the use of transdermal delivery of molecules of interest, such as phytochemicals.The transport of active chemicals through the skin is known as transdermal administration. This method involves the entry of synthetic or natural compounds, such as phenolics and carotenoids, into one layer of the epidermis, followed by permeation, in which the compound reaches a functionally and histologically different layer. Finally, absorption takes place, which involves the uptake of the substance into the circulatory system, which acts as a central reservoir compartment Plant phenolic compounds have anti-inflammatory, immunomodulatory, antioxidant, and DNA-repair activities, and they can be used to treat a variety of skin illnesses caused by UV exposure. Environmental parameters such as ionic strength, pH, and temperature have a substantial impact on phenolic compound adsorption into cellulose, resulting in structural alteration and chemical degradation of phenolic compounds. Drying treatments such as lyophilization, in addition to these parameters, have an impact on the binding ability of phenolic compounds-cellulose. As a result, lyophilized BC must be rehydrated before being immersed in phenolic compound solutions.[2].

At various scales, water retained inside the cellulose tape structure plays a key role in the binding of phenolic chemicals. This is owing to the fact that the polyphenol-binding capacity and water content have a positive association, indicating that the ability of cellulose networks to expand adds to the interactions between phenolic chemicals and cellulose. Bioactive-enhanced cosmetics (creams, lotions, serums, masks, and others) may help to slow down and/or prevent skin ageing. Vitamin C, carotenoids, tocopherols, and phenolic compounds, particularly the stilbene resveratrol, have anti-inflammatory, antibacterial, anti-aging, photoprotective, and antioxidant properties.The utilisation of these plant secondary metabolites in dermatological formulations has been linked to the creation of stable and bioactive products. BC membranes with plant phenolic compounds could be a biotechnological alternative to UV-induced skin damage prevention and treatment. However, more research is needed into the benefits and advantages of employing this BC-bioactive complex (as nanocellulose membranes, nanocapsules, nanoparticles, and nanoemulsions). In addition, kinetic and equilibrium studies of the biosorption process are critical for optimising BC-phenolics formulation and improving skin penetration, controlled release, and efficacy when used topically [3].

References

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