

Materials Science Challenges in Skin UV Protection: A Review

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Abstract:

UV radiation is one of the critical environmental stress factors for human skin, which can trigger various problems such as pruritus, burning, erythema, premature skin aging and skin cancer. Hence, UV protection has become an indispensable daily routine and the use of topical sunscreen products is rapidly increasing. However, there are emerging concerns over the efficiency and safety of existing chemical and physical UV filters used in consumer products. Furthermore, there is no universally approved method for assessing sun protection efficiency regardless of the immediate end user need to develop safer sunscreen products that afford broad-spectrum photoprotection. It is evident that the current organic and inorganic UV filters have significant unfavorable impacts on human, environmental, and marine safety. Therefore, effective alternative UV filters should be established. This article comprehensively reviews the properties, safety, health and ecological concerns of various UV filters including TiO₂ and ZnO nanoparticles as well as the limitations of the testing protocols and guidelines provided by major regulatory bodies. The photoreactivity of UV filters used in sunscreen remains a major challenge, and it is crucial to develop new sunscreen ingredients, which not only protect the consumer, but also the environment.