The Application of Photochromism in Sun Protection as an Indicator of Sunscreen Efficacy

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Skin cancer and sunburn are serious consequences of exposure to the ultraviolet spectrum of sunlight. Sunscreen is an effective public health intervention that protects by blocking these harmful rays. However, its effectiveness is time limited and reapplication is periodically necessary. This project aimed to develop a novel product that would indicate the decreased efficacy of sunscreen using the principle of photochromism. Upon exposure to ultraviolet radiation, the nontoxic photochromic compound (spiropyran) undergoes a reversible structural change that reflects as a transition from colorless to a brightly colored form. Micro-encapsulated spiropyran powder was suspended, at concentrations of 2.5%, 5% and 10%, in a medium of acetates and organic co-polymers to produce a liquid film application. The effect of light, temperature and ultraviolet intensity on the formulation was investigated. Results showed that only the ultraviolet spectrum of light induced a color change and that this color change was independent of temperature. The formulation was then covered with sunscreen which acted as a barrier between the radiation and spiropyran molecules thereby resulting in no color change. As sunscreen wears off, ultraviolet exposure increases. The decreasing efficacy of sunscreen was simulated by exposing the formulation to increasing intensities of ultraviolet radiation. As ultraviolet intensity increased, color intensity increased. The color change was visible at all the concentrations tested. This formulation is a reliable indicator of decreased efficacy of a sunscreen. Application of this formulation may protect individuals from the harmful consequences of excessive sun exposure by alerting them as the sunscreen wears off.

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