A Complete Approach to the Prevention & Treatment of Photo-Ageing

Authors: A. Jentzsch, Technical Manager, V. Andre, Strategic Marketing Manager, BASF AG, Germany;
P. Aikens, Technical Service Manager, BASF Corporation, NJ, USA

Abstract

Premature aging of the skin is a complex process; normal chronological aging is greatly accelerated by excess solar exposure. It has been shown that cosmetic products that provide photoprotection with UV filters for use on a daily wear basis in combination with antioxidants and skin reparative ingredients can counteract photodamage at three critical junctures: 1) prevention of excess photoexposure, 2) countering the production of oxidative species caused by it and 3) treatment of physiological damage caused by oxidative processes

Introduction

Excess photoexposure is the primary cause of premature aging of the skin. A major contributor is ultraviolet A radiation (UVA), the longer wavelength, lower energy portion of the ultraviolet solar spectrum. While the highly energetic UVB radiation causes more acute damage such as sunburn and can trigger skin cancer, it largely affects the upper epidermal layer of the skin. UVA can penetrate deeper into the dermis where the structural proteins collagen and elastin can be found[1]. Repeated damage in this layer of the skin leads to the formation of wrinkles[2].

The damage caused by excess UVA photoexposure is mainly a result of the generation of reactive oxygen species (ROS) from molecular oxygen[3, 5, 6]. While UVB radiation is powerful enough to chemically decompose molecules such as DNA, UVA causes them to enter a photoexcited state and then to transfer the energy to oxygen and/or water to generate very highly reactive species such as superoxide anion, hydrogen peroxide/ peroxide radical, and singlet oxygen known as ROS[3,4]. These can directly oxidize sensitive lipids and lipoproteins within the cell membranes of the skin and extracellular matrix. Another route of skin damage from ROS is that gene expression is modified in such a way that protein degrading enzymes that are normally present to eliminate damaged collagen and elastin so it can be replaced are elevated and break down healthy proteins. As these are replaced physiologically, they create tiny imperfections known as solar scars. An accumulation of these leads to uneven skin topography[2].

The "Three-Lines-of-Defense", proposed in 2001[7], includes 1) Broad spectrum UV protection for the skin on a daily basis, 2) Antioxidants to counteract free radical species, and 3) Anti-inflammatory and anti-aging ingredients to repair damaged skin and prevent further damage by normalizing perturbed physiological processes.

Two formulation breakthroughs have made this strategy eminently practical from a marketing, formulation, and production standpoint. First, cosmetically elegant daily-wear broad spectrum UV protective creams and lotions prepared with the non-irritating inorganic UV filters microfine zinc oxide and titanium dioxide with polyacrylate (carbomer) rheology modifiers are possible with the introduction of the T-Lite™ Max and Z-COTE®Max technology. It is no longer necessary to use hydrophilic gum thickeners for such formulations giving unprecedented elegance to effective gentle daily wear skin moisturizers. Second, anti-aging formulations containing the proven active retinol (Vitamin A) can be prepared with minimal manufacturing precautionary steps with RetiSTAR™. This is a stabilized form of retinol, resistant to oxidative degradation that can be formulated without an inert atmosphere. These two technologies are integrated into the Three-Lines-of-Defense strategy as described below.

The First Line of Defence: Daily use of broad-spectrum UV filters

The SPF of a sunscreen indicates its ability to filter the high-energy UVB radiation, a major contributor to sunburn and ultimately skin cancer. UVA radiation has lower energy, however it can penetrate deeper into the skin than UVB[2]. Ultimately, much of this radiation can reach into the dermis where the damage causing the visible signs of photo-aging takes place. Sunscreens commonly worn for the beach and prolonged outdoor activity generally give very good protection to the skin from damaging UVB through high SPF and varying degrees of protection from UVA. Photostability of organic UV filters can be an issue. These products are, however, unsuitable for daily wear facial products mainly because of their spreading and after-feel aesthetics. They tend to be oily