POLY-WHAT?

The importance of polyphenols for skin care and cosmetics.


Polyphenols protect skin from free-radical damage

KALAMAZOO, MI, USA, April 12, 2019 /EINPresswire.com/ -- Polyphenols are molecules found in plants. The beneficial properties of polyphenolic extracts, such as fulvic acid concentrates, demonstrate an enormous potential in topically applied products for the prevention and therapy of UV damage, skin ageing and cancerous conditions of the skin, as well as providing anti-microbial activity, and anti-carcinogenic properties.

In the white paper Dr. William's analyzed numerous studies on the benefits of plant compounds for skin care applications. Many of the studies are drawn from common plants you know, such as green tea or grapes. The fundamental active ingredient in these compounds are classified as polyphenols, which comprise antioxidants, organic acids, flavonoids and fulvic acids.

> The beneficial properties of polyphenolic extracts demonstrate an enormous potential in topically applied products for skin therapy and protection."
>
> *Dr. Mark K. Williams, PhD*
> *Biochemist*

Both plants and humans have a photo protective biochemical process that helps the cells cope with molecular damage caused by excessive sunlight. Under normal conditions, the natural endogenic antioxidant system of the skin is very effective against free-radicals produced by sun exposure.

Polyphenols
Numerous studies confirm the benefits of plant compounds for skin care applications. Many of the studies are drawn from common plants you know, such as green tea, grapes and strawberries. The fundamental active ingredient in these compounds are classified as polyphenols.

UV Irradiation and Oxidative Stress Explained
UV irradiation and oxidative stress are the main causes of extrinsic (premature) aging of the skin. UV radiation from the sun induces several harmful responses, including erythema (reddening of the skin, dilation of capillaries), immune-suppression, edema, hyperplasia (increased cell replication), hyper-pigmentation, premature aging and skin cancer.

UVA accounts for more than 90% of the total UV radiation reaching us and is constant throughout the year, but UVB photons are one thousand times more capable of causing sunburn than UVA and increase considerably in the summertime.

Leads to DNA Damage

The skin is often damaged by UV irradiation as DNA can directly absorb UVB light. Exposure to UV facilitates mutations and errors in DNA replication. Furthermore, UVA can also inhibit DNA repair, invoking an additional stress on DNA integrity [1].

Structure of Polyphenols

The term 'polyphenols' includes a large group of molecular compounds, which all have more than one phenolic hydroxyl group, bound to one or more benzene ring systems. Flavonoids, also known as fulvic acids, are the main group of polyphenols. Phenolic compounds are often esterified with sugars or organic acids resulting in a complex spectrum of over 5000 compounds naturally occurring in plants. These compounds act as antioxidants and free radical scavengers.

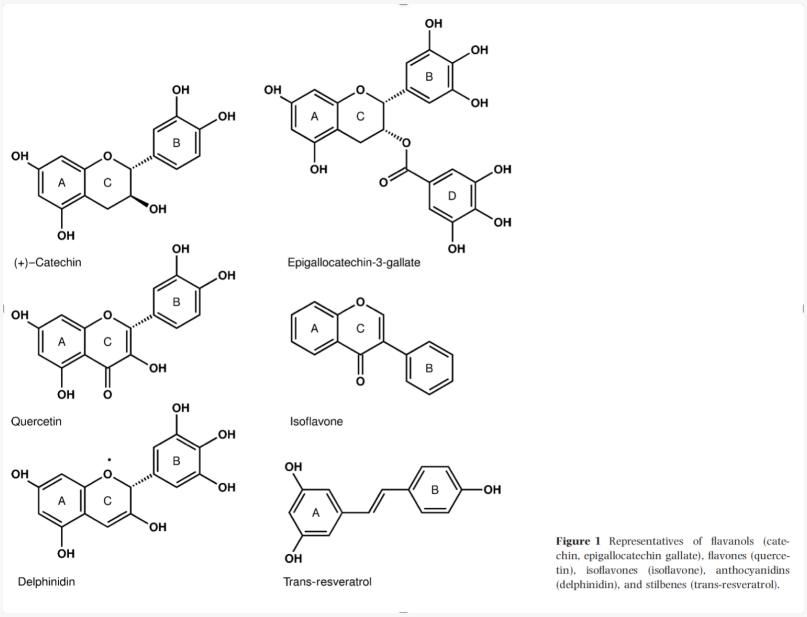

Figure 1 Representatives of flavanols (catechin, epigallocatechin gallate), flavones (quercetin), isoflavones (isoflavone), anthocyanidins (delphinidin), and stilbenes (trans-resveratrol).

Flavonoid molecular diagram

Table 1 *In vitro* activities of polyphenols

	Activity	Reference
Cell-free systems		
Antioxidant activity	Free radical scavenging capacity, measured by the inhibition of stable radicals: DPPH (2,2-diphenyl-1-picrylhydrazyl), ABTS (2,2′-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid)), peroxynitrite ($ONOO^-$), superoxide anion ($O^{-\bullet}_2$), hydroxyl radicals	[8, 9, 16, 25, 27–31]
	Oxygen radical absorbance capacity (ORAC) assay; superoxide dismutase (SOD) assay; ferric reducing antioxidant potential (FRAP) assay	[16]
	Inhibition of lipid oxidation (liposomes, thermal acceleration of oils)	[8, 27, 29, 30, 32]
Inhibition of skin's enzymes	Anti-elastase activity	[33–37]
	Anti-collagenase activity	[33, 34, 37]
	Anti-hyaluronidase activity	[35]
Cell cultures		
Prevention of oxidative DNA-damages, increasing cell viability, reduction of intracellular ROS	UVB-Irradiated human HaCaT keratinocytes, comet assay	[31, 38, 39]
	Fibroblasts stressed with H_2O_2	[40]
	UV-irradiated normal human epidermal keratinocytes (NHEK)	[41]
Anti-inflammatory activity	Inhibitory effects on the release of inflammatory mediators such as IL-6, IL-8, prostaglandin-E2 in HaCaT cells, NHEK, fibroblasts	[34, 39, 41, 42]
Inhibition of UV or heat-induced enzyme release	Activity of MMP1, MMP2, MMP3, hyaluronidase gene expression in human dermal fibroblasts	[36, 43, 44]
Anti-cancer activity	Reduced viability and increased cell death of human skin cancer cell lines	[45]
	Decreased melanoma cell viability	[46]
Anti-microbial activity	Anti-bacterial, anti-fungal, antiviral activity	[8, 28, 47, 48]

In Vitro Polyphenol Activities

Sources of Polyphenols

Fruits and berries, vegetables, spices, oil seeds and tea [2] are the major sources of polyphenols. Their function in plants are mainly protection against UV radiation, pathogens and the for production of color in fruits and flowers.

Antioxidant Defense System

The skin posses an elaborate antioxidant defense system to deal with UV-induced oxidative stress by utilizing antioxidants, vitamins and co-enzymes to protect and repair free radical damage throughout its layers. However excessive and chronic exposure to the sun can overwhelm our antioxidant capacity, leading to skin disorders, immunosuppression, premature aging and development of melanoma and non-melanoma skin cancers.

Topical Applications Help

The ability of polyphenols to act as photo protectors is of importance for cosmetic applications. Flavonoids, stilbene and hydroxycinnamic acid derivatives have been determined to have their own sun protection factors (SPF) ranging from 7-30, in a study performed by Nichols et al.[3].

Formulating Cosmetic Application of Polyphenols

Many skin care products have been developed in recent years based on polyphenol-enriched extracts, like green tea. To exert their designated biological activities, topically applied substances need to be released from the formulation to reach the skin and to overcome the Stratum Corneum -- the horny outer layer -- barrier and penetrate into the epidermis and dermis. The release of active substances and their absorption depends on the molecular properties such as molecular weight and lipophilicity, but also on the vehicle -- oil based, water based -- formulation [4,5]. The formulations must be chemically, physically and microbiologically stable to assure the stability and deliverability of active substances to the target skin layers.

The fulvic acids in MLG-50™ are derived from a natural source deposit in the United States. Through a clean extraction by purified water, a concentrated product is produced that is stable in a wide pH range. Fulvic acids are both hydrophilic (water-loving) and lipophilic (fat-loving) making them ideal for skin care products to aid in hydration and to remain homogenized in skin care formulations. Their wide pH and tiny molecular weight make them ideal for passing through cell membranes.

The Take-Away
Numerous studies suggest that polyphenolic extracts are very useful ingredients for both sunscreens -- as preventative -- and after-sun -- as therapeutic -- cosmetic products. Polyphenols have anti-carcinogenic effects as demonstrated in several skin tumor models [6,7]. They also support the skin's clarity, elasticity, smoothness, hydration and firmness.

We see clearly from studies done both in the laboratory and in human trials that antioxidant properties of polyphenols have been described extensively in the literature [8,9] including those comprising the organic acids which include gallic, caffeic, shikimic, fumaric, cinnamic, ferric, benzoic, protocatechuic, phenyl acetic, succinc, malic, acetic, and lactic acids [10-21].

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