

POLLUTION AS PREMATURE SKIN AGING CAUSE

Cutaneous aging is not only a manifestation of the time course, it is said that even 90% of aging is influenced by environmental factors.

This process of aging induced by environmental factors is called extrinsic aging and carries to premature skin aging.

There are morphological differences in aging between intrinsic and extrinsic aging: In the first case it can appear fine wrinkles, thin skin, firmness lost, xerosis and fatigue while in the second case appear deep wrinkles, irregular pigmentation, loss of elasticity, sagging skin, xerosis, fatigue and vascular lesions.

In general terms, extrinsic aging carries a prominent manifestation of natural aging signs.

Skin is the contact barrier with external agents.

Skin problems happen when we are exposed under excessive abnormal external factors so that decrease the skin's defensive potential.

One of the most representative factors of high aging incidence is pollution. It can cause cell damage, dryness, inflammation and pigmentation, which are obvious signs of premature aging.

It is also associated with inflammatory and allergic conditions such as atopic dermatitis, eczema, psoriasis or acne, even with cancer as one of the most serious factors.

We are overexposed to pollution. The increase of contaminated air over the years is alarming and it has important effects on the skin.

To protect the Public Health, in 1999 the EPA created the new Air Quality Index (AQI). In the [image 1](#) we can see the most polluted cities.

Pollution sources are diverse: Burning fuel, exhaust pipes, soot, etc.

Air pollutants have been classified as Criteria Air Contaminants (CAC) and Non Criteria Air Contaminants. CAC have been identified as detrimental to the health and well-being of humans. They were called Criteria Air Contaminants because they were object of published evaluations in air quality documents.

At the international level the CAC are:

1. Carbon monoxide (CO),
2. Sulfur Oxides (SO_x),
3. Nitrogen Oxides (NO_x),
4. Ozone (O₃),
5. Lead (Pb),
6. Particulate matter (PM).



Image 1 Most polluted cities. Source: waqi.info

Ground-level ozone is one of the major components of the smog. It is formed by the reaction of sunlight (photochemical) with pollutants such as Nitrogen Oxides (NO_x) and Volatile Organic Compounds from solvents or vehicle and industry emissions. Higher Ozone levels are recorded during periods of sunny weather. Several studies evidence that ozone acts as a strong oxidative agent capable of affecting the integrity of the skin. O₃ induces the expression of metalloproteinases leading to a celular matrix remodeling.

Contaminated air is composed of complex mixtures of different sizes and composition of particles suspended in the air. Particles of sizes between 2.5 and 10 microns seem to be one of the main threats to the skin. A recent study shows a direct link between PMs and the appearance of aging signs especially blemishes on the skin, but also wrinkles. These particles can serve as carriers of organic molecules and metals, able to enter to the mitochondria and generate ROS manifesting directly the premature damage of the skin through mitochondrial damage.

Skin pigmentation can occur in the absence of UV radiation, Polycyclic Aromatic Hydrocarbons (PAHs), a type of PM, induce the proliferation of melanocytes and consequently pigmentation.

In fact, people living in heavily populated cities have lower vitamin E and sebum squalane levels compared to people living in rural areas.

A third pathway suggested to induce aging may be through PAHs which are absorbed on airborne PMs surface in urban areas.

PAHs are among the most widespread organic pollutants. The main source of PAH is wood burning, also car exhaust fumes, especially in diesel cars, and all the smoke from organic combustion.

Prolonged exposure of the skin to PMs with adhesion of PAH, either through hair follicle or transepidermal absorption, leads to oxidative stress and skin aging.

PAH can induce acneiform eruptions. Chloracne (*image 2*) is a chronic skin disease of the acne type induced by overexposure to certain halogenated aromatic hydrocarbons. It is

characterized by the appearance of non-inflamed comedones, erythematous cysts and pustules. The lesions are most commonly located on cheek, behind the ears, neck, armpits and in groin area. PAHs are among the most widespread organic pollutants. The main source of PAH is wood burning, also exhaust fumes, especially diesel cars, and all the smoke from organic combustion.

The trend towards anti-pollution cosmetics began in Asia due to the dangerous levels of air pollution. As the increase of pollution levels is increasingly a global problem, anti-pollution products have become a global trend.

Western consumers are increasing the pursuit of cosmetics with benefits not only to fight against the signs of age, but also to protect against pollution.



Image 2 – Chloracne induced by herbicides. Source: Wikipedia

Initially the anti-pollution claim was applied only to facial treatment products, now the demand is affecting facial cleansers, sunscreens, shampoos and other hair products and decorative cosmetics.

Growing awareness of urban pollution will set up a new pattern of anti-pollution product purchasing in the next years. This translates into great opportunities for global leading brands and ingredients manufacturers. Some brands have already started to create complete anti-pollution lines, due to the increased demand of consumers.

Since anti-pollution cosmetics have been established in the industry, more research is needed to understand the effects of skin contamination over time, developing standardized tests required to validate the products efficacy. This will allow consumers to gain a better understanding of products that offer better protection

Therefore, the future antiage routine used to prevent effect of premature aging would be:

Morning: Use a daily moisturizing antiaging cream with the appropriate sun protection and anti-pollution for each specific area of the face. As well as protection for hands and hair that are also exposed areas

Night: Cleanse the skin of possible contaminants to which it has been exposed and give to the skin an extra cocktail of antioxidants to reduce the effects of oxidative stress produced by external factors and improve antioxidant defenses. With ingredients to repair and regenerate the cells of the dermis