

Pollution and the Skin

We have known for many years about the negative impact of pollution on our health and the environment. However, only more recently have we begun learning about pollution's impact on our skin.

What exactly is pollution?

Air is essential to life because it supplies us with oxygen. Air is a mixture of gases, 78% nitrogen and 21% oxygen, along with traces of water vapour, carbon dioxide, argon and various other components. Air pollution is the contamination of air with noxious gases and particles in concentrations that endanger the health of humans, animals or plants (NASA).

Pollution is present in different forms. **Particulate pollution** – also called particulate matter (PM) – is made up of tiny pieces of solids or liquids that are in the air. Some particles, such as dust, dirt, soot and smoke are large enough or appear dark enough to be seen with the naked eye in the air or on your washcloth after wiping your face. Others are too small to see in the air and can only be detected with an electron microscope (CDC [1]). Some particulates occur naturally, such as those originating from volcanoes, forest fires and dust storms. The burning of fossil fuels in motor vehicles, power plants and factories are also a significant source of particulates. PM is often described in terms on particle size; PM10 represents particulate matter that is 10 microns or less in diameter and PM2.5 represents particulate matter that is 2.5 micrometers or less in diameter. To illustrate how small 2.5 microns is, the average human hair is about 70 microns in diameter, making it 30 times larger [2].

There is also gas pollution such as nitrogen oxides, sulfur dioxide, carbon monoxide, ozone and VOCs (volatile organic compounds). The burning of fossil fuels for electricity, heat and transportation causes a significant amount of gas pollution [2].

All forms of pollution can collect on your skin and lead to negative sequelae.

Which areas of the world have the most pollution?

Pollution is particularly problematic in large cities worldwide and worsening over time. The pollution level in urban areas was 8 percent worse in 2013 than it was in 2008 (WHO). Approximately 80 percent of all urban areas have air pollution levels above what is considered healthy according to the World Health Organization's Air Quality Guidelines (AQGs), including London, Glasgow, Paris and Chicago.

The following is a list of the top 15 most polluted cities on earth according to the WHO: Kanpur, India; Shijiazhuang, China; Dammam, Saudi Arabia; Ludhiana, India; Delhi, India; Baoding, China; Xingtai, China; Bamenda, Cameroon; Raipur, India; Patna, India; Al Jubail, Saudi Arabia; Riyadh, Saudi Arabia; Allahabad, India; Gwalior, India; Zabol, Iran.

How does pollution affect the skin?

The skin acts as our first line of defense to the many environmental stressors it encounters daily. Along with ultraviolet light and harsh climates, pollution is another one of these stressors.

When pollution comes into contact with our skin, it unfortunately does not just sit on the surface. Some pollution particles are so tiny that they can easily penetrate through pores. This property allows them to infiltrate deeper layers of the epidermis, causing not only inflammation and dehydration but also a disruption of the skin's barrier and breakdown of collagen, which accelerates wrinkling and aging [3].

PM induces oxidative stress via production of reactive oxygen species (ROS) and secretion of pro-inflammatory cytokines such as TNF- α , IL-16 and IL-8. In addition, the increased production of ROS such as superoxide and hydroxyl radical by PM exposure increases matrix metalloproteinases (MMPs) including MMP-1, MMP-2, and MMP-9, resulting in the degradation of collagen. Overall, increased PM levels are associated with acne, skin sensitivity and visible signs of aging including hyperpigmentation via the regulation of oxidative stress and inflammatory cytokines [4].

A landmark study in the Journal of Investigative Dermatology in 2016 compared women living in urban and rural environments over 24 years and found that those exposed to increased pollution had more dark spots (lentigines) and wrinkling. No association was seen between levels of NO₂ and lentigines formation on the back of the hands or forearms; however, exposure to NO₂ was significantly associated with more lentigines on the cheeks in both German and Chinese women older than 50 years. Overall, an increase of 10 $\mu\text{g}/\text{m}^3$ in NO₂ concentration was associated with approximately 25% more dark spots [5].

According to a new study in 2017, the role of inflammation in the development and progression of acne is increasingly being recognized. This study revealed that while the prevalence of acne is similar between Asian and Caucasian women, Asian women experience inflammatory acne more frequently and report flare-ups during high-pollution periods [6].

A 2014 P&G study of 200 women aged between 30 and 45 compared the skin quality of inner-city dwellers with that of women living in rural areas. Both groups had similar lifestyles and were exposed to comparable amounts of ultraviolet radiation. After analyzing the data, researchers concluded that living in the city makes the skin age 10% faster than living in the countryside.

How can you protect skin from pollution?

- **Proper cleansing.** All the experts agree that properly cleansing your face and neck every night to remove dirt and environmental toxins from the skin's surface is the most important thing you can do to protect your skin from pollution.
- **Moisturize.** Use your favourite moisturizer to replenish the skin's lost moisture caused by pollution and to protect the skin's lipid barrier from pollution.
- **Use antioxidants.** Use a serum packed with antioxidants every day to neutralize harmful free radicals produced by pollution.

AlumierMD's Alumience A.G.E. is an exclusive formulation that reduces the visible signs of aging caused by free radicals, pollution and advanced glycation end products (AGEs). Using a unique blend of antioxidants, specialized peptides, antiglycation ingredients and a biomimetic pollution shield, Alumience A.G.E. provides the ultimate in daily protection.

Exo-P™ (Alteromonas Ferment Extract) is featured in Alumience A.G.E. Exo-P is a sustainable purified polysaccharide from a unique microorganism ecosystem in the French Polynesia that forms a biomimetic shield on the surface of the skin to protect against pollution and smog.

References:

- 1 Centres for Disease Control and Prevention (CDC)
https://www.cdc.gov/air/particulate_matter.html
- 2 United States Environmental Protection Agency
<https://www.epa.gov/pm-pollution/particulate-matter-pm-basics>
- 3 Zoe Draelos, M.D., consulting professor of dermatology at Duke University in Durham, North Carolina, and author of the Journal of Cosmetic Dermatology article "Aging in a Polluted World."
- 4 Kim KE, Cho D, Park HJ. Air pollution and skin diseases: Adverse effects of airborne particulate matter on various skin diseases. *Life Sci* May 2016;152:126-34.
- 5 Hüls, A., Vierkötter A. et al. Traffic related air pollution contributes to development of facial lentiginos: Further epidemiological evidence from Caucasians and Asians. *Journal of Investigative Dermatology* 2016;136(5):1053-6.
- 6 Krutmann J et al. Pollution and Acne: Is There a Link? *Clin Cosmet Investig Dermatol* May 2017;10:199-204