mibelle GROUP biochemistry

# Two lines of defense against urban pollution

**Depolluphane is a novel active ingredient developed by Mibelle Biochemistry to protect the skin from urban pollution. Depolluphane not only protects the skin against environmental aggressors, but it can strengthen the skin to easily face the daily stress of city life – two lines of defense to guard skin's youthfulness**

### Air Pollution – a Complex Toxic Mixture

The contribution of environmental pollution is one of the major areas of concern when it comes to skin ageing. Air pollution comes into direct contact with our skin, and contributes on a daily basis to skin ageing. The main sources of air pollution are industrial combustion (diesel exhaust fumes and coal), traffic, and construction works. Air pollution consists of gases such as ozone and very fine particles that are known as particulate matter (PM). These particles, which are between 0.1 µm – 10 µm in size, can remain in the atmosphere for weeks and contain toxic compounds such as heavy metals and allergens.

### Effects of Pollution on the Skin

Our skin is often the first organ to come into contact with air pollution. Particulate matter is especially dangerous for the skin, as it not only sits on the skin surface but can also penetrate into pores and therefore transport toxic substances into deeper skin layers. In combination with exposure to UV light, these particles cause oxidization reactions within the skin, which lead to the formation of reactive oxygen species (ROS), inflammation and the loss of collagen. ROS can cause protein carbonylation, and these damaged proteins contribute to accelerated skin ageing. Furthermore, lipid peroxidation caused by ROS leads to skin barrier dysfunction, which creates a vicious cycle as more PM can enter the skin. The result is irritated, uneven skin that will age more rapidly.

### Protecting our Skin Against Pollution

Pollution affects our skin on many levels and causes damage, inflammation and accelerated skin ageing. Therefore, a multi-level protection is needed to shield the skin from unwanted exposure to pollutants; to detoxify the skin by neutralizing dangerous chemicals that manage to enter the skin; and to prevent the cellular damage caused by free radicals formed in the skin.

### Expression of Detox and Antioxidant Enzymes in the Skin

It is obvious that our cells are in constant danger from toxic influences in the environment and thus need an efficient defense or detoxification system. Fortunately, our cells can produce enzymes that assist in the detoxification and removal of toxic substances. The genes encoding for detoxification and antioxidant enzymes, which are also called phase II enzymes, are activated by a specific mechanism. The transcription of these genes is regulated by a special control sequence in the promoter region.

To start the expression of detoxification and antioxidant enzymes, a specific protein interacts with this control sequence. This "switch-on-protein", which is called transcription factor Nrf2, is normally blocked by the repressor Keap1.

A stimulus such as oxidative stress can disrupt the Nrf2-Keap1 complex. The released Nrf2 then binds to the control sequence, and cells start to produce detoxification and antioxidant enzymes. In this way, cells can react to their environment by producing the correct response enzymes. Interestingly, a molecule found in plants of the *Brassicaceae* family, sulforaphane, has also been shown to disrupt the Nrf2-Keap1 complex and therefore activate the cellular detoxification system.

### Depolluphane – Organic Cress Sprouts and a Smart Polysaccharide Complex

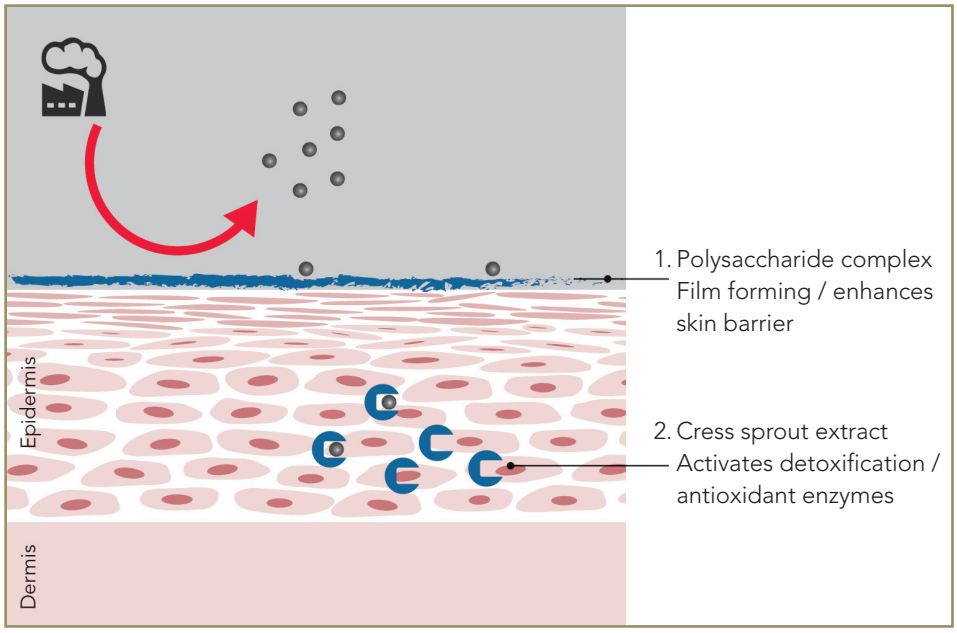
Depolluphane contains a purified extract of garden cress sprouts (*Lepidium sativum*, belonging to the *Brassicaceae* family). Sprouts have the highest concentration of phytonutrients, which are the compounds in plants that are known for their health promoting properties. Depolluphane contains sulforaphane, which is a well-known activator of the detoxification system of the cell. It therefore enhances the resistance of skin cells to environmental pollutants as well as intrinsic reactive molecules. Thus, Depolluphane protects our skin cells against dangerous molecules.

To produce Depolluphane, the organic cress spout extract is sprayed on a carrier that is based on a mixture of different polysaccharides. This smart polysaccharide complex performs various functions on the skin:

- the film forming capability of the complex shields the skin from unwanted exposure to pollutants
- the biochemical activity of the complex enhances the skin's immune function and helps to strengthen the skin barrier.

### Cress Sprout Extract Activates Detox Enzymes and Improves Cell Viability

It was demonstrated in *in vitro* studies that cress sprout extract is indeed able to activate the expression of detox enzymes in skin cells. For this, normal human epidermal keratinocytes were incubated with different concentrations of cress sprout extract, and the gene expression of three representative antioxidant enzymes was strongly stimulated by the cress sprout extract in a concentration-dependent manner. In a second study, the ability of the cress sprout extract to protect keratinocytes from oxidative stress was assessed. The keratinocytes were incubated with different concentrations of tert-butyl hydroperoxide (t-BH), which is a strong oxidizing organic peroxide. Higher concentrations of t-BH led to a reduced cell viability. The cell viability at higher t-BH concentrations was greatly increased when 0.05% cress sprout extract was present. This shows that the cress sprout extract, a component of Depolluphane can activate the detoxification machinery of skin cells and thus protect the cells from oxidative stress.




### Depolluphane Protects the Skin from Pollution

Particulate matter from air pollution can enter the skin and cause oxidization reactions within the skin through the formation of free radicals. These free radicals cause protein carbonylation which damages the proteins and leads to cell ageing. In an in vitro study, protein carbonylation was induced by the addition of particulate matter to normal human dermal fibroblasts. Pre-treatment with cress sprout extract significantly reduced the formation of protein carbonylation caused by particulate matter in these fibroblasts.

In a placebo-controlled, double-blind clinical study on twenty-one women, a single application of a cream containing 2% Depolluphane, and the corresponding placebo cream on the forearm, was followed by the application of microparticles that modelled atmospheric pollution (1 µm on average). Afterwards, the forearm was rinsed in a standardized manner. Results showed that a single treatment with 2% Depolluphane resulted in a lower quantity of microparticle adhesion and a significantly more efficient removal of microparticles compared to the non-treated zone and the placebo treated zone. Therefore, Depolluphane shields the skin from environmental pollutants and facilitates their removal when cleansing the skin.

To summarize, Depolluphane, with its combination of an organic cress sprout extract and a smart polysaccharide complex, provides the skin with two lines of defense against pollution: 1. It effectively shields the skin against particulate matter such as smoke and air pollution; and 2. It fortifies the skin's own defense mechanism by activating detoxification enzymes in the skin.

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