Ultraviolet radiation (hygiene)

Introduction

Ultraviolet radiation (UV) is electromagnetic waves beyond the violet – short-wavelength edge of the visible spectrum. The natural source of UV radiation is the Sun. In Earth's atmosphere, most UV radiation is absorbed, reducing its intensity to a level compatible with life. Most of the hard UV radiation is already scattered in the ionosphere; another part is then absorbed in the other layers of the atmosphere: exosphere, thermosphere, mesosphere, stratosphere, and troposphere. The stratosphere, which contains ozone, has the greatest influence on the passage of UV radiation and thus got the name ozone layer. The amount of UV radiation penetrating the atmosphere also significantly affects the current state of the lower layers of the atmosphere - the weather.

Types of UV radiation

UV radiation is an electromagnetic wave and its character is therefore determined by its wavelength. According to it, we divide UV radiation into **three basic groups**.

- **UVA** has a wavelength range of **315-400 nm**, penetrates deeply, and does not cause tanning.
- **UVB** has a wavelength in the range of **280–315 nm**. It is mostly absorbed by ozone in the stratosphere - that is, the so-called ozone layer. The harmful effects of exposure to UV radiation are mainly due to the action of UVB.
- **UVC** – its wavelength is **lower than 280 nm**. It has the highest energy from UV radiation and is therefore the most dangerous.

Ozone and ozone depletion

Ozone (trioxygen) is a poisonous gas with a typical odor arising from the dioxygen molecule, among other things, under the action of short-wave UV radiation (UVC). Dioxygen is hemolytically split into unstable oxygen atoms. These combine to a lesser extent with dioxygen molecules to form ozone, and most of them form dioxygen again. At the earth's surface, ozone, referred to as **ground-level ozone**, is considered a very undesirable component of the atmosphere. In large cities with concentrated car traffic, the air is polluted by nitrogen oxides. The photochemical decomposition of nitrogen dioxide into nitric oxide produces ozone, which is part of the so-called photochemical smog, which can have negative effects on the human body. In contrast, **stratospheric ozone** is essential to protect life on Earth, as it can absorb most of the sun's UV radiation of wavelengths **240–290 nm**.

In recent times, there is often mention of a violation of the ozone layer, which means a reduced local or temporal concentration of ozone in the atmosphere. Such a disorder is also referred to as an **ozone hole**. The decomposition of ozone is accelerated by chlorofluoroalkanes (freons) and nitrogen oxides. Freons entered the atmosphere mainly **30-40 years ago**, which is associated with their mass use (specifically dichlorodifluoromethane) as components of cooling devices or fillings for pressure sprays. The reaction of nitrogen oxides or chlorine with ozone creates dioxygen in a sequence of reactions and the active substance is released again. The whole process can be repeated again and the ozone concentration drops rapidly. It should be mentioned that CFCs are non-reactive in the troposphere, but if, due to their non-reactivity, they can diffuse into the stratosphere over a long period of time (15 years), their photolysis will occur and the formation of free chlorine, which through binding to dust particles is subject to the above-mentioned reaction.

Predictions of the development of ozone depletion

Ozone disturbances are most marked in the regions of t**he South and North Poles**. In some periods, however, these disturbances can extend over populated areas, e.g. Australia or Northern Europe. The increased permeability of such a disturbed atmosphere for UV radiation can mean a health risk primarily for children in the lowest age categories, whose skin is more sensitive to this exposure, or also for people who spend a lot of time in the sun for professional reasons. UVB radiation also penetrates water very easily within several meters, which results in the continuous destruction of plankton. This can have a huge effect on the concentration of carbon dioxide. Damage to plankton would significantly increase the risks associated with the so-called **greenhouse effect**.

Nowadays, the use of freon is abandoned. Thanks to the UN Environmental Protection Program, the Vienna Convention was signed in 1985, which obliges signatory countries to limit the use of CFCs. Two years later, the implementing Montreal Protocol was signed, and in 1990 and 1992, two more, tightening amendments. It should be mentioned that with the possible development of African industry in the future there is a risk of their massive use again, mainly due to their affordability. However, the fact remains that CFCs are stable substances and even if their use were to stop completely, it would still take a long time for them to disappear from the atmosphere.

Links

Related articles

- Ultraviolet radiation (biophysics)
- Biological effects of UV radiation, health protection
- Plankton

Sources

- BENCKO, Vladimír, et al. *Hygiena : Učební texty k seminářům a praktickým cvičením.* 2. přepracované a doplněné vydání edition. Karolinum, 2002. 205 pp. pp. 115 – 118. ISBN 80-7184-551-5.
- TÁBORSKÁ, Eva – SLÁMA,, et al. *Lékařská chemie I.* 1.. edition. Masarykova univerzita v Brně, 2001. 134 pp. pp. 94-95. ISBN 80-210-2534-4.