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EFFECTS OF UV RADIATION ON HUMAN HEALTH

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ABSTRACT

Ultraviolet (UV) light is an electromagnetic radiation with a wavelength from 400 nm to 10 nm, shorter than that of visible light but longer than X-rays. Near-UV is visible to some insects and birds. UV radiation is present in sunlight, and also produced by electric arcs and specialized lights such as mercury-vapor lamps, tanning lamps, and black lights. Although lacking the energy to ionize atoms, long-wavelength ultraviolet radiation can cause chemical reactions, and causes many substances to glow or fluoresce. Consequently, biological effects of UV are greater than simple heating effects, and many practical applications of UV radiation derive from its interactions with organic molecules. Here effects of UV on human and plants can be discussed.

Keywords: *UV, UVA, UVB, EM.*

1. INTRODUCTION

Ultraviolet (UV) light is part of a family of radiations called the electromagnetic (EM) spectrum. UV is just beyond the violet end of visible light and has smaller wavelengths and greater energy. As with all electromagnetic spectrum radiations, UV travels at the speed of light. Humans cannot see it, but some animals, especially some insects, can see UV light and have body markings that reflect UV light. UV is produced naturally by very hot objects such as our Sun. About 10 percent of the Sun's energy output is UV. UV shines on the Earth along with heat and visible light. Our atmosphere reflects much of the incoming UV back out to space and absorbs most of the rest. Overall, then, only a small proportion of the Sun's UV reaches us. The ozone layer at the top of the Earth's atmosphere and oxygen within the atmosphere absorbs the more energetic UV with shorter wavelengths. It is some of the longer wavelength UV that reaches the Earth's surface.

A nuclear reaction at the sun's core creates massive amounts of radiation, or energy. This energy (also known as the electromagnetic spectrum) includes radio waves, microwaves, infrared radiation, visible light, ultraviolet radiation, X-rays, and gamma rays shown in Fig. 1. The UV radiation is divided into three wavelength ranges which are:

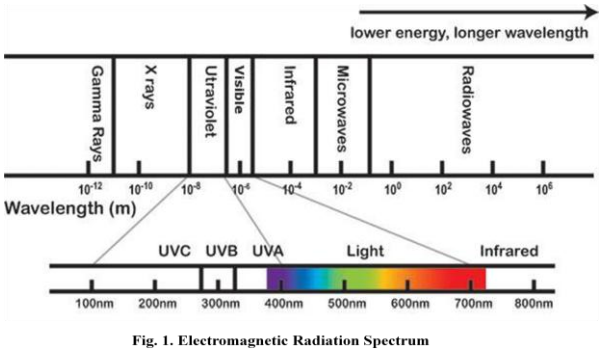

Fig. 1. Electromagnetic Radiation Spectrum

1. **UVA:** It is long range UV radiation between 320 and 400 nm. About 98% of UV that reaches us on the Earth's surface which affected little by ozone. These penetrates through windows and causes colours of dyes and paints to fade, also causes aging of the skin.

2. **UVB:** It is short wave UV radiation between 280 and 320 nm. About 1.3 % of UV that reaches us on the Earth's surface and highly affected by ozone. It is responsible for sunburn. It blocked by the glass in windows and doors.
3. **UVC :** This is in between 100 and 280 nm wavelengths and is very energetic. About 0 % of the UV that reaches us on the Earth's surface. Scattered and absorbed by atmospheric oxygen, nitrogen and ozone. It causes destructive offect on skin cells causes lesions on the skin.

Factors Affecting Ultraviolet Intensity

The intensity of UV radiation reaching our earth's surface depends on a number of factors:

Time of day - UV radiation from the sun reaches its peak at solar noon, which is between 12 and 1 p.m. At this time, the sun's rays have the least distance to travel through the atmosphere, increasing the intensity of UV.

Season - During the year, the sun's angle varies, which causes the intensity of UV rays to vary. UV intensity is highest during the spring and summer months. But the sun can still have an effect on skin and eyes in the fall and winter, especially when UV is reflected back by large surfaces of fresh snow.

Ozone layer thickness - A decrease in thickness of ozone layer results in an increase in UV intensity. This effect is greatest in the spring and can be traced back to greenhouse gases. Also, pollutants like the chlorine from chlorofluorocarbons destroy ozone molecules at a faster rate.

Weather conditions - Cloud cover can greatly affect the amount of UV radiation that reaches the earth's surface. Clouds that are dark and full of water can absorb up to 80% of the radiation. High thin clouds do not absorb much UV radiation. On the other hand, scattered clouds can actually increase the amount of UV radiation at the surface of the earth because of reflection. The intensity of UV radiation also depends on which pressure system is influencing the weather. A high-pressure area causes a thinner ozone layer, while a low-pressure area causes a thicker ozone layer.

Surface reflections - Fresh white snow reflects up to 85% of UV radiation. Other bright surfaces (like sand, concrete, and water) reflect less.

Altitude - UV radiation increases with altitude (height above sea level) because there is less atmosphere to absorb the damaging rays. At an altitude of around 2,000 metres, the amount of UV radiation can be up to 30% higher than at sea level.

Effects of UV Radiation - The Earth's atmosphere blocks about 98.7% of the Sun's UV radiation from penetrating through the atmosphere and remaining 2.3% that gets through has both positive and negative effects.

1) Positive effects of UV

Vitamin D – UV from the Sun is needed by our bodies to produce vitamin D. Vitamin D helps strengthen bones, muscles and the body's immune system. It may also lower the risk of getting some kinds of cancers such as colon cancer.

Skin Conditions – UV is used in the treatment of skin conditions such as psoriasis. This is a condition where the skin sheds its cells too quickly and develops itchy, scaly patches. Exposure to UV slows the growth of the skin cells and relieves the symptoms.

Helps Moods – The sunlight stimulates the pineal gland in the brain to produce certain chemicals called 'tryptamines'. These chemicals improve our mood.

Animals' Vision – Some animals (including birds, bees and reptiles) are able to see into the near UV light to locate many ripe fruits, flowers and seeds that stand out more strongly from the background. The fruits, flowers and seeds often appear quite different from how humans see them.

Aids Some Insects' Navigation – Many insects use UV emissions from celestial objects as references for navigating in flight. This is why a light sometimes attracts flying insects by disrupting their navigation process.

Disinfection and Sterilisation – UV has positive applications in the fields of disinfection and sterilisation. UV can effectively 'kill' (deactivate or destroy) microorganisms such as viruses and bacteria. To destroy the microorganisms, UV rays penetrate the cell's membrane, destroying

the DNA, and so stops its ability to reproduce and multiply.

2) Negative Effects of UV

Skin Cancer – UV is an environmental human carcinogen. It's the most prominent and universal cancer-causing agent in our environment. There is very strong evidence that each of the three main types of skin cancer (basal cell carcinoma, squamous cell carcinoma and melanoma) is caused by sun exposure.

Sunburn - Sunburn is redness of the skin, which is due to increased blood flow in the skin caused by dilatation of the superficial blood vessels in the dermis as a result of exposure to UV radiation. High UV doses may also results in edema, pain, blistering, and peeling of the skin a few days following exposure. UV-B radiation is believed to be mainly responsible for sunburn. UV-A contributes 15-20% to the sunburn reaction in the summer months. Risk factors for sunburn include fair skin, red or blond hair, blue eyes, and freckles. For people with fair skin, it takes only 15-30 minutes in midday sun to induce erythema. In terms of areas of the body that are more susceptible to sunburn, the face, neck, and trunk are two to four times more sensitive than the limbs. In addition, children and the elderly are believed to be more sensitive to UV radiation and may burn more easily. A sunburn reaches its maximum redness eight to 12 hours after exposure and fades within one to two days[1].

Damages Immune System – Over-exposure to UV radiation has a harmful suppressing effect on the immune system. Sunburn can change the distribution and function of disease-fighting white blood cells in humans for up to 24 hours after exposure to the sun. Repeated over-exposure to UV radiation can cause even more damage to the body's immune system. The immune system defends the body against bacteria, microbes, viruses, toxins and parasites (disease and infection).

Damages eyes – UV rays can also damage the eyes as more than 99% of UV radiation is absorbed by the front of the eyes. Corneal damage, cataracts, and macular degeneration are all possible chronic effects from UV exposure and can ultimately lead to blindness. Melanoma, a type of skin cancer, can also develop within the eye. . Intraocular melanomas are the most common ocular malignancy in whites. The risk of intraocular melanomas is 8-fold higher in whites than blacks [2].

Ages Skin – One of the chronic effects resulting from repeated exposure to UV radiation is premature aging of the skin, which encompasses a number of clinical signs that reflect structural changes in the dermis. These clinical signs include dryness, wrinkles, accentuated skin furrows, sagging, loss of elasticity, mottled pigmentation, and are the result of degenerative changes in elastin and collagen [1,2]. The degenerative changes accumulate over time and are largely irreversible [2]. It is believed that as much as 80% of premature aging of the skin may occur within the first 20 years of life. UV-A radiation has been found to be an important contributor to premature aging of the skin. Whereas UV-B is 1,000 to 10,000 times more efficient than UV-A in terms of induction of sunburn and nonmelanoma skin cancer, respectively.

Fades Colours – Many pigments (used for colouring food, cosmetics, fabric, plastic, paint, ink and other materials) and dyes absorb UV and change colour. Fabrics, furnishings and paintings need protection from to prevent colour change or loss.

Steps to Protect From Heat

Heat illnesses are preventable. During extreme heat, the most important is to protect from heat. Following are the few steps –

Prepare for the Heat

- Tune in regularly to local weather forecasts and alerts so know when to take extra care.
- Have cool drinks (usually water) in vehicle when going to outside.

Stay Hydrated

- Drink plenty of cool liquids (especially water) before feel thirsty to decrease risk of dehydration. Thirst is not a good indicator of dehydration.
- Flavouring water with natural fruit juice may make it more appealing.
- Eat more fruits and vegetables as they have high water content.

Drink water before, during and after physical activity.

Stay Cool

- Wear loose-fitting, light-coloured clothing and a wide-brimmed hat made of breathable fabric.
- Buy sunglasses which gives protection against both UVA and UVB rays.
- When doing physical activity in extreme heat, take extra breaks, remove gear to let your body cool off and drink lots of water.
- Don't expect usual performance in hot weather. Give time to body to recover after being in the heat.
- Block the sun by closing a windows, curtains or blinds during the day.

Avoid Exposure to Extreme Heat When Outdoors

- Plan strenuous outdoor activities for cooler days, or choose a cooler location like a place with air conditioning or with tree shade.

CONCLUSIONS

Human beings must need protection from UV rays on both sunny and cloudy days. Heat illnesses can affect on human body quickly, and can lead to long-term health problems and even death. In the extreme heat risk from heat illnesses, health risks are greatest for the older adults, young children, people with chronic illnesses, who work in the heat and homeless people. UV rays have been used to successfully treat number of diseases. Vitamin D plays big role in bone development.

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