Chapter one

Introduction

1.1 Introduction

The ultraviolet radiation is considered one of the parts of the electromagnetic spectrum, and its divided into three types such as UVA, UVB and UVC. The solar radiation coming from the sun contains the UV radiation which have been effects of the health, and causes the risk on the human skin cells like skin cancer, basal cell carcinoma, squamous cells carcinoma and malignant melanoma.

1.2 The problem of the thesis

The ultravoilet radiation of the sun is considered dangerous on the human health. Especially on the skin cells, and that is ability to ionize living cells to determine the type effect and seriousness of that must be investigated accurate and help the human to avoid exposed the sun.

1.3 Aims of the thesis

This thesis aims to study the electromagnetic spectrum regions, and ultravoilet radiation and its effects on the skin.

1.4 The importance of the thesis

The ultravoilet radiation is one of the part of the electromagnetic spectrum coming from the solar radiation to the ground, so that should be know their effect on the human skin cells.

1.5 Literature review

The previous studies which was related with this thesis. Exposure to artificial UV radiation and skin cancer. Reported by IARC working group that met in Lyon, France (2005), found that, the users of outdoor tanning and their age less than approximately 30 years causes melanoma risk.

UV radiation and the skin presented by John D' Orazio and et.al(2013) and they are found that the UV radiation has complex and mixed effects on the human health.

1.6 Outline of the thesis

This thesis contents four chapters

Chapter one the introduction.

Chapter two introduction of electromagnetic spectrum regions.

Chapter three introduction of ultraviolet radiation.

Chapter four effects of the ultraviolet radiation on the human skin cells.

CHAPTER TWO

Introduction of electromagnetic spectrum

2.1. Introduction:

The electromagnetic spectrum is the range of all possible frequencies of electromagnetic radiation. The "electromagnetic spectrum" of an object has a different meaning, and its instead of the characteristic distribution of electromagnetic radiation emitted or absorbed by that particular object[1].
The electromagnetic spectrum extends from below the low frequencies used for modern radio communication to gamma radiation at the short-wavelength (high-frequency)[2].

Most parts of the electromagnetic spectrum are used in science for characterize matter. In addition, radiation from various parts of the spectrum has found many other uses for communications and manufacturing[3].

2.2 Range of the spectrum

Electromagnetic waves are typically described by any of the following three physical properties: the frequency f, wavelength λ, or photon energy E.

Frequencies observed in range from 2.4×1023 Hz (1 GeV gamma rays) down to the local plasma frequency of the ionized interstellar medium (~1 kHz). Wavelength is inversely proportional to the wave frequency, so gamma rays have very short wavelengths that are fractions of the size of atoms, whereas wavelengths on the opposite end of the spectrum can be as long as the universe. Photon energy is directly proportional to the wave frequency. These relations are illustrated by the following equations:

$$f = \frac{c}{\lambda}, or\ f = \frac{E}{h}, or\ E = \frac{hc}{\lambda} \qquad (2.1)$$

Where c is speed of light, λ is wavelength, E is energy and h is Planck's constant[3].

2.3 **Region of electromagnetic spectrum:**

The electromagnetic spectrum is divided into many types as shown in figure 2.1 below.

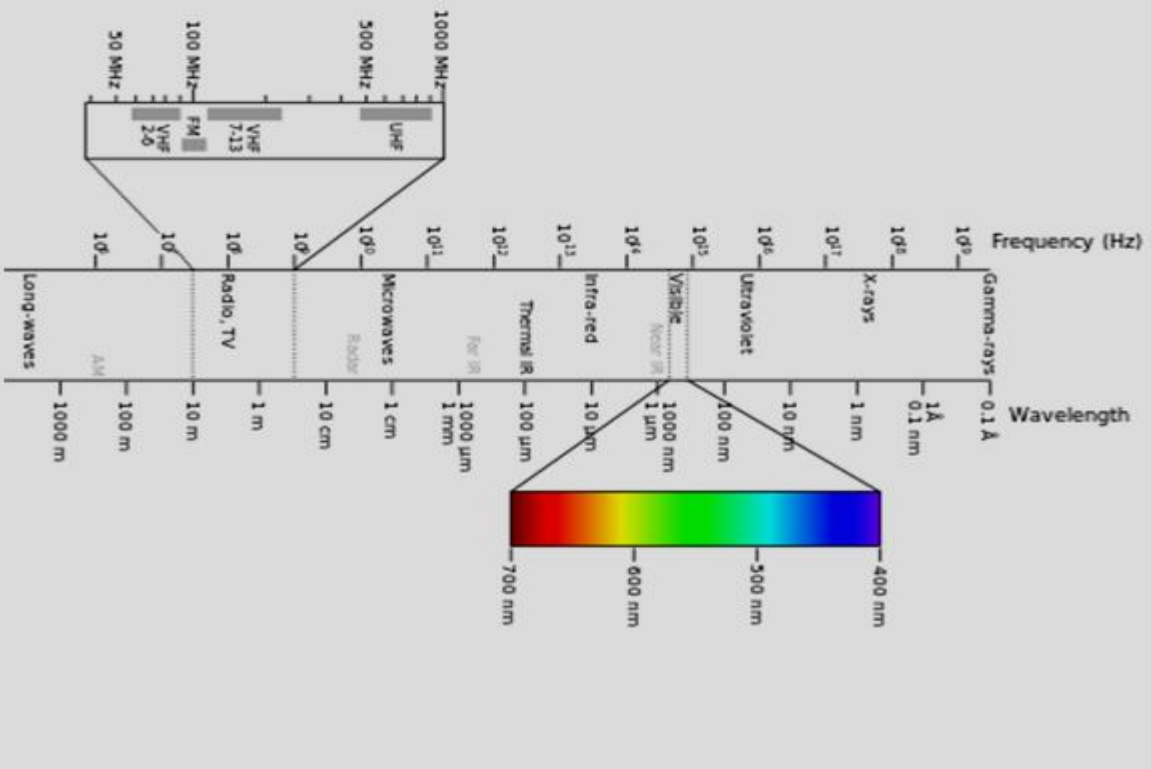

Fig. 2.1 show the electromagnetic spectrum region[3].

2.3.1 Gama radiation

Gamma rays, which were discovered by Paul Villard in 1900. These are the most energetic photons, having no defined lower limit to their wavelength. In astronomy they are valuable for studying high-energy objects or regions, however as with X-rays this can only be done with telescopes outside the Earth's

atmosphere. Gamma rays are used experimentally by physicists for their penetrating ability and are produced by a number of radioisotopes. They are used for irradiation of foods and seeds for sterilization, and in medicine they are occasionally used in radiation cancer therapy. More commonly, gamma rays are used for diagnostic imaging in nuclear medicine, an example being PET scans. The wavelength of gamma rays can be measured with high accuracy through the effects of Compton scattering[4].

2.3.2 X-ray radiation

X-rays, come after UV which, like the upper ranges of UV are also ionizing. However, due to their higher energies, X-rays can also interact with matter by means of the Compton effect. Hard X-rays have shorter wavelengths than soft X-rays and as they can pass through many substances with little absorption. X-rays are useful as probes in high-energy physics. In astronomy, the accretion disks around neutron stars and black holes emit X-rays, enabling studies of these phenomena. X-rays are also emitted by the coronas of stars and are strongly emitted by some types of nebulae[5].

2.3.3 Ultraviolet radiation

The wavelength of UV rays is shorter than the violet end of the visible spectrum but longer than the X-ray is capable of ionizing atoms, greatly changing their physical behavior. At the middle range of UV, UV rays cannot ionize but can break chemical bonds, making molecules unusually reactive. Sunburn, for example, is caused by the disruptive effects of middle range UV radiation on skin cells, which is the main cause of skin cancer. UV rays in the middle range can irreparably damage the complex DNA molecules in the cell producing thymine dimers .

The Sun emits significant UV radiation (about 10% of its total power), including extremely short wavelength UV that could potentially destroy most life on land (ocean water would provide some protection for life there). However, most of the Sun's damaging UV wavelengths are absorbed by the atmosphere and ozone layer before they reach the surface. The higher energy (shortest wavelength) ranges of UV (called "vacuum UV") are absorbed by nitrogen and, at longer wavelengths, by simple diatomic oxygen in the air. Most of the UV in the mid-range of energy is blocked by the ozone layer, which absorbs strongly in the important 200–315 nm range, the lower energy part of which is too long for ordinary dioxygen in air to absorb. The very lowest energy range of UV between 315 nm and visible light (called UV-A) is not blocked well by the atmosphere, but does not cause sunburn and does less biological damage. However, it is not harmless and does create oxygen radicals, mutations and skin damage[5] .

2.3.4 Visible radiation

Visible light is the part of the EM spectrum the human eye is the most sensitive to.Visible light (and near-infrared light) is typically absorbed and emitted by electrons in molecules and atoms that move from one energy level to another.

The light that excites the human visual system is a very small portion of the electromagnetic spectrum. A rainbow shows the optical (visible) part of the electromagnetic spectrum and it come above the infrared radiation and the wavelength between 380 nm and 760 nm (400–790 terahertz) is detected by the human eye and perceived as visible light. White light is a combination of lights of different wavelengths in the visible spectrum. Passing white light through a prism splits it up into the several colors of light observed in the visible spectrum between 400 nm and 780 nm[6].

2.3.5 Infrared radiation

The infrared part of the electromagnetic spectrum covers the range from roughly 300 GHz to 400 THz It can be divided into three parts:

2.3.5.1 Far-infrared:

from 300 GHz to 30 THz The lower part of this range may also b called microwaves or terahertz waves. This radiation is called rotational modes in gas-phase molecules. However, there are certain wavelength ranges within the range from approximately 200 μm up to a few mm is often referred to as "sub-millimeter" in astronomy, reserving far infrared for wavelengths below 200 μm.

2.3.5.2 Mid-infrared:

from 30 to 120 THz Hot objects (black-body radiators) can radiate strongly in this range, and human skin at normal body temperature radiates strongly at the lower end of this region. This radiation is absorbed by molecular vibrations, where the different atoms in a molecule vibrate around their equilibrium positions. This range is sometimes called the fingerprint region, since the mid-infrared absorption spectrum of a compound is very specific for that compound.

2.3.5.3Near-infrared:

from 120 to 400 THz Physical processes that are relevant for this range are similar to those for visible light. The highest frequencies in this region can be detected directly by some types of photographic film, and by many types of solid state image sensors for infrared photography and videograph [3].

2.3.6 Terahertz radiation

Terahertz radiation is a region of the spectrum between far infrared and microwaves. Until recently, the range was rarely studied and few sources existed for microwave energy at the high end of the band (sub-millimeter waves or so-called terahertz waves), but applications such as imaging and communications are now appearing. Scientists are also looking to apply terahertz technology in the armed forces, where high-frequency waves might be directed at enemy troops to incapacitate their electronic equipment[7].

2.3.7 Microwave radiation:

The super-high frequency (SHF) and extremely high frequency (EHF) of microwaves are on the short side of radio waves. Microwaves are waves that are typically short enough (measured in millimeters) to employ tubular metal waveguides of reasonable diameter.

Microwave energy is produced with klystron and magnetron tubes, and with solid state diodes such as Gunn and IMPATT devices. Microwaves are absorbed by molecules that have a dipole moment in liquids. In a microwave oven, this effect is used to heat food. Low-intensity microwave radiation is used in Wi-Fi, although this is at intensity levels unable to cause thermal heating.

Volumetric heating as used by microwave ovens, transfers energy through the material electromagnetically not as a thermal heat flux. The benefit of this is a more uniform heating and reduced heating time; microwaves heat material in less than 1% of the time of conventional heating methods. When active, the average microwave oven is powerful enough to cause interference at close range with poorly shielded electromagnetic fields such as those found in mobile medical devices and poorly made consumer electronics [8].

2.3.8 Radio waves radiation

Radio waves generally are utilized by antennas of appropriate size (according to the principle of resonance), with wavelengths ranging from hundreds of meters to about one millimeter. They are used for transmission of modulation. Television mobile, wireless networking, all use radio waves. Radio waves can be made to carry information by varying a combination of the amplitude, frequency, and phase of the wave within a frequency band[8].

Chapter three

Introduction of ultraviolet radiation

3.1Introduction

Radiation is the emission (sending out) of energy from any source. Ultraviolet (UV) radiation is a form of electromagnetic radiation. The main source of UV radiation (rays) is the sun, although it can also come from man-made sources such as tanning beds and welding torches. Radiation exists across a spectrum from very high-energy (high-frequency) radiation – like x-rays and gamma rays – to very low-energy (low-frequency) radiation – like radio waves. In terms of energy, UV rays have more energy than visible light, but not as much as x-rays. Higher energy UV rays often have enough energy to remove an electron from (ionize) an atom or molecule, making them a form of ionizing radiation. Ionizing radiation can damage the DNA in cells, which in turn may lead to cancer. But because UV rays don't have enough energy to penetrate deeply into the body, their main effect is on the skin. Scientists often divide UV radiation into 3 wavelength ranges:

• UVA rays are the weakest of the UV rays. They can cause skin cells to age and can cause some indirect damage to cells' DNA. UVA rays are mainly linked to long-term skin damage such as wrinkles, but are also thought to play a role in some skin cancer.

• UVB rays are slightly stronger. they are mainly responsible for direct damage to the DNA, and are the rays that cause sunburns. they are also thought to cause most skin cancers.

• UVC rays are the strongest UV rays.Fortunately, because of this, they react with ozone high in our atmosphere and do not reach the ground. Therefore UVC rays are not present in sunlight and are not normally a risk factor for skin cancer. But

they can be found in some man-made sources, such as arc welding torches and mercury lamps. In the past, sun beds were also a source of UVC rays.

Ultraviolet radiation and ozone depletion

Ultraviolet (UV) radiation is one component of solar radiation. It is progressively filtered as sunlight passes through the atmosphere, in particular by the ozone layer .As the ozone layer is depleted, the protective filter activity of the atmosphere is reduced and more UV radiation, in particular the more harmful UVB, reaches the Earthís surface.In the year 2000, the ozone hole over the Antarctic reached its biggest size ever covering 11.4 million square miles - an area more than three times the size of the United States. For the first time it also stretched over populated areas exposing local residents to extreme levels of solar UV radiation. Local authorities warned residents in Southern Chile that they could sunburn in less than seven minutes and should avoid spending time outdoors in the middle the day. Sustained ozone depletion and enhanced levels of UV radiation on Earth will aggravate UV effects on the human skin, eyes and immune system. Children are at especially high risk of suffering damage from exposure to UV radiation[9, 10 and 11].

3.2 Physical characteristics of UV radiation

UV radiation belongs to the non-ionized part of the electromagnetic spectrum and ranges between 100 nm and 400 nm; 100 nm has been chosen arbitrarily as the boundary between no ionizing and ionizing radiation. UV radiation is conventionally categorized into 3 regions:

UVA (>315–400 nm),UVB (>280–315 nm) and UVC(>100–280 nm) (Figure 1)

These categories have been confirmed by the Commission International de l’Eclairage (CIE, 1987), Although there is variation in usage In the medical and

biological fields for example 320 nm is used as the limit between UVA and UVB. More recently it was proposed to distinguish between UVA-1 (>340–400 nm) and UVA-2 (320–340 nm)[9].

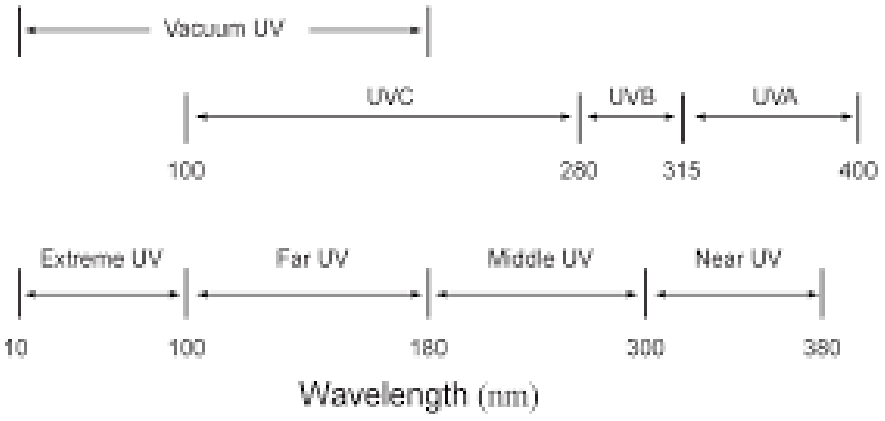

Figure 1: Ultraviolet (UV) region of the electromagnetic spectrum[9]

3.3 Units and measurements of UV radiation

Measurement of ambient solar UV radiation .Measurement of ambient solar UV radiation has been performed worldwide for many year.However, UV radiation detectors for research or individual use have been developed only recently .There are two principal types of instruments: steady spectroradiometers, which screen the entirety of the UV spectrum (100–400 nm) within a few minutes, and broad-spectrum dosimeters,which can measure solar irradiance within a few seconds. Individual dosimeters, which can easilybe placed at strategic places on individuals, are of the second type. Broad-spectrum instruments often include aweighting factor representative of a given biological spectrum (e.g. skin erythema). In current practice, the margin of error for the measurement is relatively high, around 30%. The biologically relevant UV radiation dose at a given

wavelength corresponds to the measured UV radiation multiplied by aweighting factor specific to the biological endpoint considered(e.g. erythema, pigmentation, carcinogenesis,etc.) at that wavelength. For the overall dose [9].

3.4 Sources of natural and artificial UV radiation

3.4.1 natural Sources UV radiation

• Solar radiation(sun light)

Sunlight is the main source of UV radiation, even though UV rays make up only a small portion of the sun's rays. About 95% of the UV radiation from the sun that reaches the earth is UVA, with the remaining 5% being UVB. The amount of UV radiation you may be exposed to at any point depends on a number of factors [9,10] , such as:

• Time of day**:** Almost a third of the day's UV rays from the sun comes down between 11AM and 1PM, with three-quarters between 9AM and 5PM.

• Season of the year**:** UV rays are strongest during summer months. This is less of a factor near the equator.

• Distance from the equator (latitude): The amount of UV exposure per year goes down as you get further from the equator.

• Altitude**:** People burn more easily at higher elevation because more UV rays get through.

• Clouds: The effect of clouds can vary – sometimes cloud cover blocks some UV from the sun and lowers UV exposure, while some types of clouds can reflect UV and so can increase UV exposure. What is important to know is that UV can get through, even on a cloudy day.

• Reflection off surfaces: UV rays can bounce off surfaces like water, sand, snow, or grass, leading to an increase in UV exposure.

• Contents of the air: Ozone in the upper atmosphere, for example, filters out some UV radiation[9].

3.4.2Artificial UV radiation

Artificial sources of UV radiation emit a spectrum of wavelengths specific to each source. Sources of artificial UV radiation include various lamps used in medicine, industry, business and research, and for domestic and cosmetic purpose . Exposure may occur from artificial sources of UV used, for example, in industry, for medical treatment or for cosmetic purposes (sunbeds). Important artificial sources of human exposure include[11].

• Sunbeds: These are intended to produce a tan by emitting UVA and some UVB. Regular use of a sunbed may contribute significantly to a person's annual UV skin exposure. The use of eye protection such as goggles or sunglasses should be mandatory. Staff working in tanning salons may also be exposed [10][11].

• Medical exposure: UV sources are used for a variety of diagnostic and therapeutic medical purpose. Exposures vary considerably according to the type of treatment.

• Welding and metal work**:** Studies have found that welders and sheet metal workers have a higher risk of melanoma of the eye[11].

• Phototherapy: People exposed to UVA as a treatment for skin conditions such as psoriasis (as a part of PUVA therapy) have an increased risk of squamous cell skin cancers. Treatment of skin conditions with UVB alone (not combined with PUVA) has not been linked to an increased risk of cancer[10,11].

• Industrial/commercial exposure : The most significant source of potential exposure is arc welding. The levels of UV around arc welding equipment are very high and the potential for acute injury to the eye and the skin is great. Eye and skin protection is mandatory for this work. Many industrial and commercial processes

involve the use of UV-emitting lamps. While the likelihood of harmful exposure is low because of shielding provided with the lamp, in some cases accidental exposure can occur[11].

• Lighting: Fluorescent lamps are common in the workplace and are often used in the home. These lamps emit small amounts of UV and typically contribute only a few percent to a person's annual UV exposure. Tungsten halogen lamps are increasingly used in the home and in the workplace for a variety of lighting and display purposes. Unshielded lamps can emit UV levels sufficient to cause acute injury at short distances. Filters over the lamps can significantly reduce these levels. Blacklights, which emit predominantly UVA, are often used for special effects, for example, in discothèques and also for the authentication of banknotes and documents. These lamps do not cause any significant UV exposure to humans[11].

Indoor tanning**:** Studies have found that people who use tanning beds (or booths) have a higher risk of skin cancer, including melanoma, and squamous and basal cell skin cancers. The risk of melanoma is higher if the person started indoor tanning before age 30 or 35 and the risk of basal and squamous cell skin cancer is higher if indoor tanning started before age 20 or 25. Some studies have also found a higher risk of melanoma of the eye in people who have used UV tanning [11].

3.5 Human exposure for radiations

The exposure of radiations for long time may be cause skin cancer for example UV radiation. most skin cancers are a direct result of exposure to the UV rays in sunlight. Both basal cell and squamous cell cancers (the most common types of skin cancer) tend to be found on sun-exposed parts of the body, and their occurrence is related to life time sun exposure. The risk of melanoma, a more serious but less common type of skin cancer, is also related to sun exposure,

although perhaps not as strongly. Skin cancer has also been linked to exposure to some artificial sources of UV.

3.6 Studies in people (Sun exposure)

squamous cell skin cancer:

Many observational studies have looked at the link between basal and squamous cell skin cancers and sun exposure. These studies have found that basal and squamous cell skin cancers are linked to certain behaviors that put people in the sun, as well as a number of markers of sun exposure, such as:

• Spending time in the sun for recreation (including going to the beach).

• Spending a lot of time in the sun in a swim suit.

• Living in an area with a high amount of sun.

• Serious sunburns in the past (with more sunburns linked to a higher risk) .

• Signs of sun damage to the skin, such as liver spots, actinic keratoses (rough skin patches that can be precancerous), and solar elastosis (thickened, dry, wrinkled skin caused by sun exposure) on the neck [11].

Chapter four

The effects of the UV radiation on the human skin cells

4.1. Introduction:

The skin is a large organ with an area of more than 1.5 m^2 in adults. It provides the first stage of protection against chemicals, radiation, and infection and it also prevents the evaporation of fluids from the body. The skin is composed of three very different parts: the epidermis (which includes the outer layer of dead cells called the stratum corneum), the dermis and subcutaneous tissue. The epidermis is the outermost layer of the skin and is continuously renewed The epidermis is separated from the dermis by a membrane made of permanently dividing cells (keratinocytes and melanocytes). Melanocytes, synthesize the pigment melanin and transfers this to the neighbouring keratinocytes. A third type of cell, called Langerhans cells, are present immediately under the stratum corneum. Langerhans cells are able to recognize foreign or abnormal substances and play a major role in immunological recognition. Their activity is very sensitive to UV. The dermis, which contains collagen fibres, gives the skin its elasticity and supportive strength. The collagen fibres break down on exposure to high levels of UV, reducing the elasticity of the skin and giving the appearance of mature aging[11].

4.2 Types of the skin

When human skin is exposed to UV it is absorbed, reflected, and scattered. Thus, the actual exposure received by the various layers of the skin will be lower than the incident exposure. For simplicity, skin sensitivity to UV can be divided into three general groups:

4.2.1 Lightly pigmented

The UV exposure causes sunburn but little tanning (e.g. Celtic populations). Characteristics of this group include fair or red hair, blue eyes and freckles. People in this group must take extra care in the sun as their skin is poorly protected and easily damaged.

4.2.2 Intermediately pigmented

The UV exposure results in little sunburn but tanning always occurs (e.g. southern Mediterranean and Asian populations). Characteristics of this group include darker hair and eyes. Although able to tan, people in this group can still burn and sustain significant skin damage from UV.

4.2.3Heavily pigmented

The UV exposure rarely causes sunburn (e.g. Aboriginal, African and American Negroid populations). These populations have very good natural protection and are at little risk of skin cancer, but are ,like all groups, subject to UV-induced eye damage and possibly reduced ability to combat infections when exposed to excessive UV levels [11].

4.3 Melanin

The amount and type of epidermal melanin is the main factor that determines skin complexion and UV sensitivity. Melanin is a large bio-aggregate composed of subunits of different pigment species formed by oxidation and cyclization of the amino acid tyrosine Intriguingly, the intermediates of melanogenesis may have important regulatory roles in the skin. Melanin exists in two main types:

• eumelanin, a dark pigment expressed abundantly in the skin of heavily pigmented individuals.

• pheomelanin, a light-colored sulfated pigment resulting from incorporation of cysteines into melanin precursors.

Eumelanin is much more efficient at blocking UV photons than pheomelanin, thus the more eumelanin in the skin, the less UV-permeable is the epidermis Fair-skinned people who are almost always UV-sensitive and have high risk of skin cancer have little epidermal eumelanin and therefore realize much more UV than darker-skinned individuals. Therefore, the fairer the skin, the more damaging UV exposure will be. In fact, pheomelanin levels are similar between dark-skinned and light-skinned individuals, and it is the amount of epidermal eumelanin that determines skin complexion, UV sensitivity and cancer risk. Data suggest that pheomelanin may promote oxidative DNA injury and melanoma genes by generating free radicals in melanocytes even in the absence of UV[12].

4.4 Skin Pigmentation

Skin complexion is among the most important determinants of UV sensitivity and skin cancer risk. The scale is a semi-quantitative scale made up of six phototypes that describe skin color by basal complexion, melanin level, inflammatory response to UV and cancer risk Minimal erythematous dose (MED) is a quantitative method to report the amount of UV (particularly UVB) needed to induce sunburn in the skin 24–48 h after exposure by determining erythema (redness) and edema (swelling) as endpoints. The fairer the skin, the easier it is for UV to cause inflammation (sunburn). MED, therefore is highest in dark-skinned persons since more UV radiation is needed to burn eumelanin-rich skin. In contrast, fair-skinned people whose skin expresses predominantly pheomelanin have low MEDs. Low Fitzpatrick photo type correlates with both MED and with melanoma and other skin cancer[12].

4.5 Health effects on the skin

The skin protects against UV exposure by increasing the amount of pigment (to produce skin darkening) and by increasing cell proliferation to produce thickening of the outer layer (stratum corneum). Health risks associated with exposure to UV include both acute and chronic effects and will vary according to the nature of the exposure .Factors important in assessing such risks include: the levels of UV impinging on the person exposed, she duration and frequency of occurrence of exposures and the individual sensitivity of the person to UV as determined, by their skin characteristics genetic and other factor [11].

4 .5.1Short-term effects

4.5.1.1 Sunburn:

In its mildest form, sunburn consists of a reddening of the skin (erythema) that appears a few hours after UV exposure and reaches a maximum intensity between 8 and 24 hours, then fades over a few days.

4.5.1.2Tanning:

When skin is exposed to UV, two distinct types of tanning reactions ensue. Firstly, immediate pigment darkening occurs, where melanin already in the skin darkens on exposure to UV and begins to fade within a few hours after cessation of exposure. Delayed tanning then occurs over about 3 days and can persist for several weeks .Exposure to UVB also results in an increase in the thickness of the epidermis. Because UVA does not produce thickening of the epidermis, the tan obtained from UV sunbeds, while perhaps cosmetically acceptable in the short term, is less effective in protecting against further exposure to solar UV.

4.5.1.3Photosensitivity:

A small percentage of people have a skin condition that makes them particularly sensitive to the sun's UV rays ;this is called photosensitivity. Photosensitivity disease (porphyria) and photo-aggravated disease (e.g. lupus erythematosus) are triggered by minimal UV exposures. In addition, some medications, foods and cosmeticscontain ingredients that may cause photosensitivity. This combination of chemicals or drugs with UV causes an adverse effect in the skin such as a rash or exaggerated sunburn.

4.5.2 Long-term effects

4.5.2.1 Effects other than cancer:

The most common long term effects of UV exposure on the skin are:
• Dryness: As the outer layers thicken to protect it from the sun, the skin loses moisture.
• Blemishes: Blotchy discolouration from breakage of small blood vessels can be an early sign of sun damage.
• Aging: UV damages the elastin and collagen fibres in the lower layers of the skin causing loss of the skin's natural elasticity (wrinkles), mainly from UVA exposure. Excessive wrinkling from sun exposure gives the appearance of skin aging.
• Freckles and solar brown spots (lentigines**)**: are flat pigmented areas (usually no larger than 0.5 cm) normally occurring on the sun-exposed skin of lightly pigmented people (e.g. Caucasians). Their prevalence is higher in those with highly sun-sensitive skin. Freckles occur most commonly in children, while the frequency of solar lentigines increases with age and is greatest in those over 60 years of age (estimated at 75% in the USA) [11].

4.6 dangerous effects on the skin

4.6.1 Skin cancer:

Skin cancer is the most common human cancer. About 95% of these are basal and squamous cell carcinomas (commonly referred to as "non-melanoma skin cancers"), the remaining 5% are malignant melanoma. The scientific evidence that sunlight is an important factor in the cause of skin cancers is convincing. While it is not unusual to have some moles kles, it is important to watch for any moles that change colour, become bigger, itchy or inflamed, or that weep or bleed. These may be symptoms of melanoma or other skin cancers[11, 13].

4.6.2 Non-melanoma skin cancer (NMSC):

NMSCs are not usually fatal but can be very disfiguring if left untreated. A number of facts have emerged from investigations of NMSCs

• The most common NMSCs are squamous and basal cell carcinomas. About 75% of basal cell carcinomas and more than one-half of all squamous cell carcinomas occur on the head and neck, which are the sites of highest sun exposure. They also occur on the forearms and hands, or on any part of the body commonly exposed to the sun.

• Lightly pigmented people (group 1 skin) are much more likely to develop NMSC than those with higher pigmentation

.• An increased risk of non-melanoma skin cancer has been observed in relation to both freckling and the prevalence of solar lentigines (brown spots) in childhood.

• Hereditary factors associated with a tendency to develop skin cancer are light-coloured eyes, fair complexion, light hair colour, tendency to sunburn and poor ability to tan

• Surveys of the incidence of skin cancer conducted in various countries yield ample evidence that the risk increases for people living closer to the equator. As a rough guide, the incidence doubles for every 10o decrease in latitude (about every 1000 km from the equator) provided that the population has the same hereditary factors.

• Studies have shown that people over 50 years of age who have worked outdoors for most of their lives are more likely to develop skin cancer than those working indoors [11].

4.6.3Melanoma:

Malignant melanoma is the least common but most dangerous type of skin cancer, with about 25% of diagnosed melanomas resulting in death. The number of cases of melanoma is rising at an alarming rate worldwide and at a much higher rate than other skin cancers. Studies have shown.

• While NMSCs occur predominantly on body sites of highest sun exposure (head, neck and hands), melanoma incidence on these sites is similar to that on partially sun-exposed sites, such as the lower legs (women) and the back (men). Thus UV exposure is thought to be only one of the factors that increase a person's risk of developing melanoma.

• Melanoma is much more common in lightly pigmented people than in heavily pigmented people despite the fact that the latter tend to live in sunnier climates. However, hereditary factors such as the number of naevi or moles are more associated with melanoma than pigmentation .An increased risk of melanoma has been observed in relation to freckling in childhood

• A tendency to sunburn is a risk factor in developing melanoma, as is a history of infrequent, intense exposure resulting in a painful, blistering sunburn, particularly during childhood

• In general, there is an inverse relationship between melanoma incidence and latitude of residence, although there are some inconsistencies. For example, in Europe the incidence is higher in Scandinavia than in Mediterranean countries. This apparent paradox may be explained by the obvious differences in skin sensitivity and by strong exposures to the sun during vacations in sunnier places.

• People who are born in Europe and migrate to sunnier countries after childhood have a risk of developing melanoma of about one-quarter that of people of European descent born in those countries. However, arrival during childhood results in a comparable risk[10,11].

4.6.4 Malignant Melanoma

Malignant melanoma is more destructive than either basal cell skin cancer or squamous cell skin cancer, and is the most severe and deadly of the three skin cancers. it has been estimated that forty-four thousand Americans develop this form annually .and about seventy-three hundred will die from melanoma. Melanoma is a disease in which malignant or cancerous cells form in the skin cells called melanocytes, which are the cells that are responsible for skin color. Melanocytes are found throughout the lower part of the epidermis. and give rise to the dark, protective pigment called melanin. Upon onset, melanocytes continue to make melanin, which explains the cancerous cells emerging in mixed shades of tan, brown, and black, although melanoma can also appear as red or white. This type of skin cancer spreads very quickly to other tissues or organs, a process referred to as metastasis, which is why treatment is essential. Melanoma can appear as a new lesion on skin without warning, or it may begin in or near a mole, or another dark spot in the skin. Most important, malignant melanoma can occur anywhere on the body[13].

4.7 Skin Cancer Prevention and Early Detection

Artificial sources of UV rays

Many people believe the UV rays of tanning beds are harmless. This is not true. The best thing to do is not use tanning beds (or booths). People who may be exposed to artificial sources of UV at their job should follow appropriate safety precautions, including protective clothing and the use of shields and filters[9].

4.8 Conclusions

In this work to study the effect of the ultraviolet radiation on the skin .when human exposure to the UV radiation becoming nature source and artificial it can causes to skin cancers , begging basal cell carcinoma , squamous cell carcinoma and malignant melanoma.

4.9 Recommendations

- Avoid getting sunburn ,More than 5sunborn risk of skin cancer.
- Use sunscreen with sun protection factor.
- Wear protective clothing ,and wear a hat protective head ,face ,ears ,and neck.
- Wear UV protective sunglasses.

References

1.Imagine the Universe Dictionary, NASA, 2015.

2. Bakshi, U. A. and Godse, A. P,Basic Electronics Engineering, Technical Publications. pp. 2009

3.Mehta and Akul, Introduction to the Electromagnetic Spectrum and Spectroscopy, Pharmaxchange.Info, 2011.

4. chelkunoff and Sergei Alexander, Electromagnetic waves, van Nostrand, 1943.

5 .Koontz and Steve, Designing Spacecraft and Mission Operations Plans to Meet Flight Crew Radiation Dose, NASA/MIT Workshop, 2012.

6 .Thuillier, G., et al. "The solar spectral irradiance from 200 to 2400 nm as measured by the SOLSPEC spectrometer from the ATLAS and EURECA missions." Solar Physics , 2003

7."Advanced weapon systems using lethal Short-pulse terahertz radiation from high-intensity-laser-produced plasmas". India Daily, 2005.

8 . Gamma-Rays". Hyperphysics.phy-astr.gsu.edu. 2010.

9. Exposure to artificial UV radiation and skin cancer reported by IARC Working Group that met in Lyon, France 2005.

10. review of Ultraviolet (UV) Radiation ,American cancer society,2013.

11.Belkin and et.al. ,Protection Against Exposure to Ultraviolet Radiation, World Health Organisation Genf, 1995.

12. John D'Orazio and at.el,Review UV Radiation and the Skin, International Journal of Molecular Sciences,2013.

13. Nikol Erin Hall, The Effect of Ultraviolet Radiation of the Sun on the Skin American Academy of Dermatology,2005.