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STERILIZATION BY ULTRAVIOLET RADIATIONS

In Partial Fulfillment of the Requirements for The Degree of Bachelor of Science in Biomedical engineering department

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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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ABSTRACT

Sterilization The removal or destruction of all microbes in the form of germs present from the medium to be sterilized, whether the environment, food environment or solutions or different places or areas limited in the distance or reluctance and usually sterilization methods are based on physical, chemical or mechanical.

Physical methods: like Radiation the effect of some radiation on bacteria in sterilization is practically exploited in some places, such as operating rooms, drug and sterilization containers, and vaccination rooms, usually associated with large bacteriological laboratories. UV rays are usually used more than other sterilization purposes and for the above purposes. In this case we working on the device who can sterilize anything according to its characteristics and show the ability of sterilize operation rooms and many things so in this report we will show everything related to sterilization by exposing UV radiations.

Keywords: UV, radiation, sterilization, microbes, and exposure

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CHAPTER 1

INTRODUCION

1.1 Introduction:

Visible light is an electromagnetic waves that can see the human vision range, the white color resulting from the combination of different colors are the colors of the spectrum, and the seven colors are red, orange, yellow, green, blue, Its speed is the electromagnetic wavesspeed, equal to 300,000 km / s. Ultraviolet rays are those that have wavelengths in visible light and are estimated at 290 nanometers. In studying the visible spectrum closely, scientists have discovered a wavelength shorter than ultraviolet radiation, and will publish it in detail by experimenting with chloride.

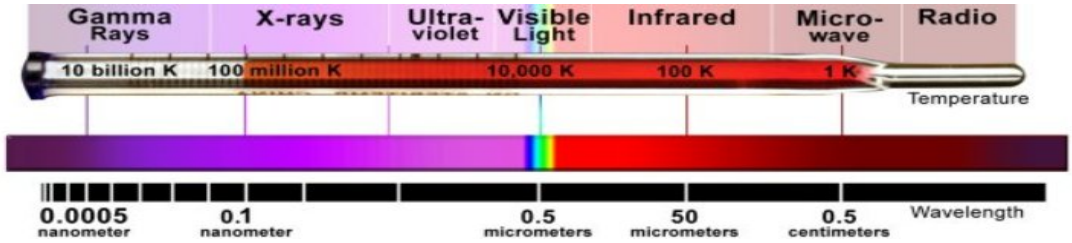

Figure1: Electromagnetic spectrum

The importance of ultraviolet rays in nature to long-wavelength UV radiation is important in human life and living organisms on the Earth's surface. UVB & UVC is an important source of ozone gas, a layer that protects the Earth from harmful radiation, Environment and weather on the planet. Human does not see UV rays, but many insects see them like bees.

How UV can help the human body? UV helps the human to absorb vitamin D that is very important in the absorption and storage of calcium in the bone. The deficiency and lack of this vitamin usually causes osteoporosis.

What UV can do in scientific fields? In modern scientific fields the scientists have been able to benefit from these rays throughmonitoring the spectrum of ultraviolet radiation from planets and galaxies, scientists have been able to estimate distances between them. What UV can do in medical fields? In medical science it is used to sterilize medical equipment using ultraviolet rays, which are generated from special lamps; they kill all kinds of bacteria and microbes. Also treat some skin diseases such as acne, vitiligo and psoriasis, by shedding rays. Also used in drying and hardening ceramic tooth fillings.What UV can do in industrial fields? Industrial fields used for production of semiconductors in electronic circuits. UVC is used by water, which destroys the DNA of

bacteria and fungi and eliminates them and prevents them from reproduction and is very famous in our time to kill worms and agricultural pests. Also used in studying energy levels in atoms, and the detection of fraud in passportsand money.

Figuer2: Detecting fraud of money by UV

1.2 Aim:

Our aim of our project is ease the sterilize the places by focusing light that have UV radiation that have short wavelength. As we all know UV have a lot of benefits so we can use it for sterilization and a lot of things.

1.3 Materials and Method:

1.3.1 Materials:

1 - Wire connecting: transfer of electricity

2 - Transformers: transform the current from 220 volts to currents used

3 - Ultraviolet light lamp has short wavelength: the emission of electromagnetic waves that have certain wavelength

4 - Switch: to operate the circuit

5. Broadband: to collect the parts of the circuit

6 - Reflector lighting: to reflect the light

7. Fan: Move the air inside the room into the device and sterilize it

1.3.2Method:

The current is fed into the main feeding circuit in the device and then the power supply distributes the appropriate currents on the rest of the device. After that, the fan is activated to pull the air out of the place and completely clean the air. Then the ultraviolet is issued with a short wave length to eliminate bacteria and viruses completely.

CHAPTER 2

STRELIZATION CONCEPT

2.1 Sterilization: It is the processes that kill or remove all microorganisms from the object to be sterilized, whether this object is, food object or solutions or places, and different methods of sterilization used depending on the nature of the material to be sterilized.

Figure3: A man sterilizes lane in hospital

2.2 Another way to understand sterilization accurately:

Sterilization The term sterilization in the language carries two different meanings. Some may use it to refer to the removal of germs. There are many confuse from sterilization and disinfection meanings. Disinfection means inhibiting or stopping the growth of germs and microbes, which may mean killing them but not getting rid of them. Sterilization is the complete removal of germs and the disposal of their bodies, also it is the process of removal or killing, such as bacteria and viruses on the surface, both in medicines or fluids and can be sterilized through a series of methods such as heating, chemicals, radiation and high pressure and filtration has developed to include the term disable or destroy Some microorganisms that are not alive

Figure4: Room sterilized by UV

2.3 Most common place that UV sterilization used:

Operations room department isolated from the rest of the hospital

The operating room must be of a high level of treatment and sterilization, and a specialized team of nurses and health care providers should work on surgical interventions in a safe. Although it is an basic part of any hospital, the operating room is very important, from the rest of the departments to consider before the hospital design to be in place of a little crowding, and must undergo a special ventilation system different from other sections to ensure a suitable and sterile environment to prevent infection and viruses And bacteria in the site of surgery by using UV machine.

2.4 Principle of sterilization devices:

The device works on the principle of UV sterilization where there is a lamp inside the device that emits these rays that penetrate the living organisms in the object and these rays affect the nucleic acids and the living components within the cell germs and viruses in the object, and destroys the cell's ability to reproduction and This makes these cells ineffective.

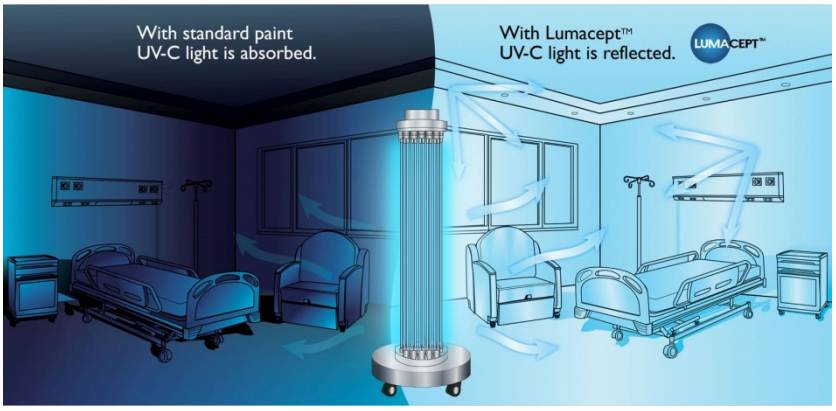

Figure5: This is how UV-C light reflected

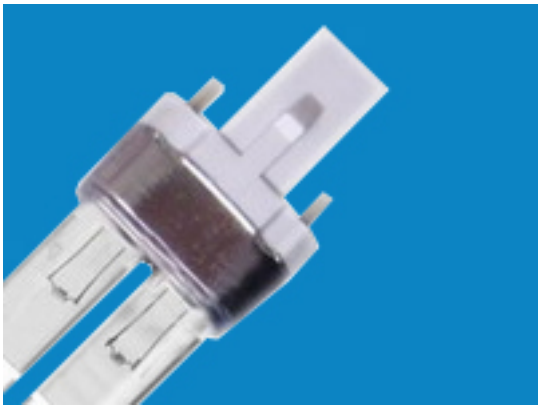

Figure6: Lamp of UV 290nm

2.5 The effectiveness of sterilization devices is based on several things, including:

1 - Specifications of the object that enter to the device.

2 - Intensity and strength of ultraviolet radiation.

3 - The exposure time of the object to radiation

2.6 Difference between cleaning, disinfection and sterilization:

Cleaning: removes bacteria, viruses and fungal infections on surfaces by 90%

Disinfection: removes bacteria, fungi and viruses that can cause infection up to 98%

Sterilization: It works through very high temperature and long periods, which ensures the complete removal of all types of bacteria, viruses and pathogens.

CHAPTER 3
RADIATIONS

3.1 Types of radiations:

Radiation is divided into two types:

1 - Ionic radiation:

Ionizing radiation is a type of energy that is emitted by certain atoms and transmitted in the form of electromagnetic waves (gamma rays or x-rays) or as particles (neutrons, beta or alpha). This is called the automatic decay of atoms of radioactivity, and the extra energy emitted during this decay is considered a form of ionizing radiation.

2. Non-ionic radiation:

Which have an electrical, magnetic, mechanical, thermal or light source, etc. These radiation are less dangerous than the first type radiation, for example magnetic field radiation and infrared radiation. This type we are using it in our device.

It is worth noting that all the materials are composed of atoms. Almost all of the mass of the atom is concentrated in the nucleus, which consists of positively charged protons and neutrons that are electrically neutral. The nucleus revolves around negatively charged molecules called electrons.

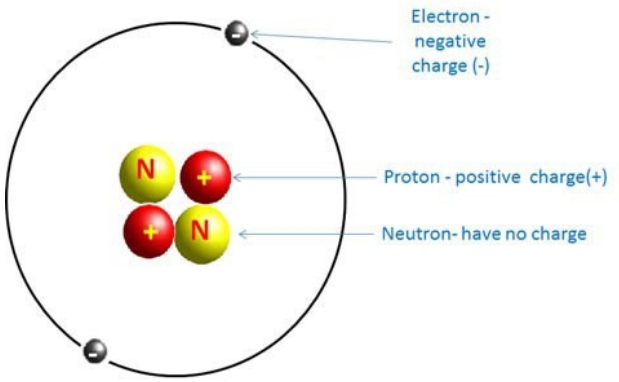

Figure7:The figure shows an example of the helium atom structure. The atoms have an equal number of protons and electrons and their electric charge is neutral. The total number of protons and neutrons is the mass of the atom, called mass number.

3.2 Three types of active radiation are as follows:

1-Alpha particle

A particle with a positive charge and a high energy released by a nucleus of radioactive atom when it undergoes a nuclear transformation. An alpha particle is identical to the

nucleus of the helium atom. It consists of two protons and two electrons that are closely interrelated. It weighs an alpha particle more than a beta particle 7,000 times, for a short distance due to its huge mass. For example, a typical alpha particle travels to a distance of no more than 5 cm in the air.

2- Beta particles:

They are electrons where some radionuclides emit ordinary electrons with negative electrical charges, but others emit positrons, that is positively charged electrons. Beta particles move at about the speed of light, some of which can be carried through 13 mm of wood.

A beta-electron particle is generated from the nucleus of a radioactive atom during a nuclear transformation. Most beta particles are negatively charged when a neutron turns into a proton, some positive positrons resulting from proton transformation, and tiny beta particles, only 1/1840 of the proton's body. Its energy enables it to get-away long distances and penetrate solids that are several millimeters thick. Scientists measure the energy of beta particles by calculating the range to which they penetrate certain substances.

3 - Gamma radiation:

Non-charged rays are electrically neutral, often with smaller wavelengths. These rays are photons (particles of electromagnetic radiation) and are transmitted at the speed of light as gamma rays can penetrate objects more than alpha or beta particles.

Gamma rays are a form of electromagnetic radiation, and gamma rays have a short wavelength.

Gamma rays may carry millions of volts of energy and can penetrate many kinds of materials, but some materials can absorb gamma rays. For example, a 1.3cm-thick iron slice can absorb 50 percent of the gamma rays of one million electrons.

Gamma rays that pass through the body produce ionization in the tissues, and if they are in large quantities they damage the cells of the body, and although dangerous, may be useful in detecting the crack of metals and food preservation. It is used in the treatment of benign and malignant tumors.

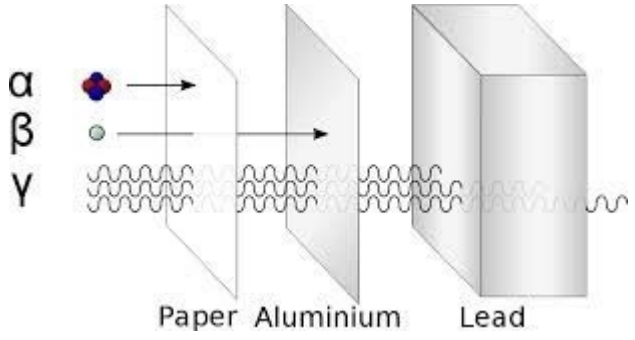

Figure8: Thefigure shows the ability of radiation to penetrate objects

3.3 Radiations related to our device:

It is known that some radiation has a harmful effect on cells of microorganisms, and exploits this harmful effect in sterilization surgical rooms, vaccination rooms usually attached to microbiological examination laboratories, and in quarantine stations to clean agricultural products that may contain pathogenic organisms that are feared to be transmitted from one place to another. The radiation used in this field is UV it is more commonly used in sterilization of the above mentioned applications.

CHAPTER 4
ULTRAVIOLET

4.1 Importance of Ultraviolet:

UV is particularly important in sterilization because of its deadly effect on microorganisms although the sun emits large amounts of ultraviolet radiation at different wavelengths; most of these rays are the short wavelength, which has the strongest effect in sterilization.

The purine and pyrimidine located in the nucleic acids of the cell absorb ultraviolet rays and the maximum absorption of these rays is at a wavelength of 260 nanometers. Proteins also absorb ultraviolet rays and maximum absorption at a wavelength of 280 nanometers where they are absorbed by ring amino acids. The deadly effect of ultraviolet radiation has been shown to be primarily due to the formation of thymine duplication. Two adjacent thymine bases bind together chemically to separate from the adenine-adenine bases in the second series of DNA

Many organisms contain systems to repair the damage caused by the formation of thymine duplication. These systems may take place in light. These systems are called light-activated or dark systems they are called dark-based systems of repair and light is not necessary to occur. Because of these repair systems, ultraviolet radiation kills microorganisms if damage to nucleic acids is greater than the efficiency of repair systems.

4.2 History and Discovery of ultraviolet radiation:

The discovery of ultraviolet radiation by the scientist Johann W. Ritter, who make a practical experiment to analyze the sunlight to the basic color, and the tools used in his experiment the spectral publication and he was doing the experiment by exposing each color on a sample of chloride ranging from red to violet, that Change the color of chloride to dark color The color after which the violet burned at the whole chloride sample so the light that after the violet rays is called ultraviolet rays.

4.3 The UV behavior:

Visible light exhibits the behavior of ultraviolet light in many of its manifestations, both of which result from the absorption of electronic excitation into molecules. Most of the devices used in spectroscopy methods in the field of visible rays are the same as those

used in UV spectroscopy. So they have studied together. These two spectra cover the range from 200 to 800 nm.

UV Band	Wavelength Range
UV-A	400nm - 320nm
UV-B	320nm - 280nm
UV-C	280nm - 180nm

Figure9: Bands of UV and ranges of them

4.4 How UV rays kill bacteria?

Ultraviolet rays are electromagnetic rays with shorter wavelengths than the visible spectrum. UV rays can be separated into different ranges, with ultraviolet (UV). UV rays considered "germicidal UV". In some bacterial wavelengths (254 nm) vector spectrum UV rays will break down the molecular bonds between the nucleic acids of the microorganisms, where the thyme dimers produce their DNA destroying them, making them harmless or inhibiting their growth and reproduction. The treatment is similar to the effect of ultraviolet wave (UVB) on humans, such as sun-burning or sun-glare. Microorganisms have less protection than long UV rays.

UVGA is a system designed to expose environments such as water tanks, enclosed rooms and air-borne systems to UV germs.

4.5 Important factor of UV rays that kills germs and viruses:

The effectiveness of UVB in such this environment depends on a number of factors:

1- The length of time in which microorganisms are exposed to ultraviolet radiation

2- The electrical fluctuations for the source of ultraviolet rays affecting the wavelength of EM

3- The presence of molecules that can protect microorganisms of ultraviolet radiation

4- The ability of microorganisms to tolerate ultraviolet radiation while exposed to it.

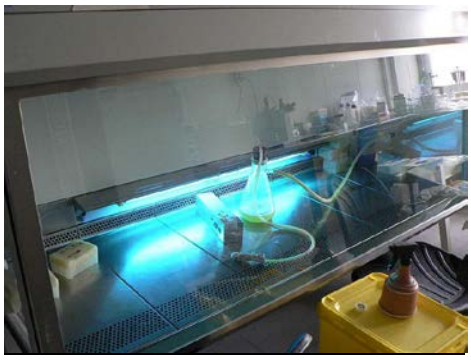

Figure10: Using of UV in laboratory

Table1: Specification of ultraviolet lamps

Lamp Wattage (W)	Diameter (mm)	Length (mm)	Cap	Lamp Voltage (V)	Lamp Current (mA)	Average Lifetime (hrs.)	UV Intensity (Distance=1 M) µW/cm2
5W	12	85	G23/2G7	30-40	180	8000	14
7W	12	115	G23/2G7	42-52	175	8000	16
9W	12	145	G23/2G7	54-66	170	8000	23
11W	12	215	G23/2G7	81-99	155	8000	38
13W	12	164	G23/2G7	48-62	300	8000	40
18W	17	217	2G11/G32q	52-64	375	8000	57
24W	17	317	2G11/G32q	77-97	345	8000	94
36W	17	411	2G11/G32q	98-118	435	8000	147
40W	17	544	2G11/G32q	130-150	385	8000	155
55W	17	533	2G11/G32q	110-130	550	8000	170

https://www.light-sources.com/solutions/germicidal-uvc-lamps/uv-germicidal-lamps/low-pressure-mercury-lamps/specialties/

Table2: Types of waves and specifications of each of them

Wave name	Symbol	Wave length	The amount of energy per photon charge
Long ultraviolet rays or black light	UVA	320-400nm	3.10–3.94 eV
Nearby wave	NUV	300-400nm	3.10–4.13 eV
Medium wave or B wave	UVB	280-320nm	3.94–4.43 eV
Middle	MUV	200-300nm	4.13–6.20 eV
Shortest wave or C wave	UVC	100-280nm	4.43–12.4 eV
Far	FUV	122-200nm	6.20–10.2 eV
Vacuum	VUV	10-200nm	6.20–124 eV
Extreme	EUV	100-121nm	10.2–124 eV

https://www.light-sources.com/solutions/germicidal-uvc-lamps/uv-germicidal-lamps/low-pressure-mercury-lamps/specialties/

CHAPTER 5
SPECTROSCOPY AND EXCITATION

5.1 Electronic spectroscopy:

Electronic spectroscopy is one type of spectroscopic study that relies on absorption of ultraviolet or visible radiation, and is named because the absorption of radiation in these regions leads to the stimulation of electrons in the molecule that absorbs those rays.

5.2 Electronic excitation:

As it is known, molecules consist of their atoms consisting of a nucleus and electrons orbiting at specific energy levels. If the molecules absorb certain energy, the electrons move from the lower energy level to a higher energy level. This is called electronic excitement. In order for an optical beam to cause electronic excitement, this beam should be in the field of visible or ultraviolet radiation,The absorbed beam frequency is energy related to the $E = h\upsilon$ relationship.

In organic molecules there are three types of electrons. The first electrons are common in a saturated bond such as the bond between hydrogen and carbon, carbon and carbon in saturated compounds. This is called σ bond and the amount of energy needed to excite electrons in σ is much greater than that of the rays so the saturated compounds are not absorbed in this area so they are usually used as good solvents. And the second type of electrons that share an unsaturated bond. These compounds typically contain σ and π bonding, as an example of compounds containing two alternating bonds such as benzene and alternating histastrines.The third type of electron is the one that does not share the bonds between the atoms. These are called free electrons (n). Saturated organic compounds do not contain n electrons because all electrons at the outer levels of carbon and hydrogen share chemical bonds. Organic compounds containing nitrogen, oxygen, sulfur and halogens contain n electrons and can absorb visible or ultraviolet rays because these rays can emit electrons. IN SUMMERY, UV or visible radiation can be absorbed by a compound containing a nitrogen, oxygen, and halogen or sulfur atom or containing an unsaturated bond called the group containing the absorbent group or chromophore.

The equation is the following equation: $A = \varepsilon cl$ this equation is sometimes known as the Lambert-Bier Law. It is clear that the absorption strength of the compound (or compound absorption) is directly proportional to both the molar concentration (C) and cell length (L), and that the molar absorption coefficient of a compound the absorption strength is equal to the solution of the compound of 1 mole / L subjected a cell length of 1 cm. Both max λ and ε are the physical constants that distinguish organic compounds.

CHAPTER 6
INFORMATION ABOUT OUR DEVICE

6.1 Pros and Cons:

6.1.1 Pros:

1 –Removal of the majority of viruses, germs and worms by high percentage.

2. Sterilization by radiation is a physical not chemical method. There is no need to use pumps to inject chemicals. We do not need to buy and store chemicals such as chlorine.

3 - UV sterilization does not affect the chemical object and therefore there are no side effects such as the effects of the addition of chlorine to the object

4. The operational cost is very low compared with the use of chemical sterilizers

5 - When using chemicals in sterilization there should be a time for the interaction of these materials with the object until sterilization becomes effective, but UV sterilization does not need this time

6. Easy to use

7 -The overall price of the device is low compared to other sterilization devices

8- Easy maintenance

9 -The device is used in several fields.

6.1.2 Cons:

1 - Damaged metal coated and easy to peel paint

2 - Large and wide areas of sterilization cannot be covered by one device requiring several devices

3 - Excessive handling of ultraviolet radiation leads to damage to the skin requires use very carefully

6.2 Prices:

Equipment prices vary between $ 250 to $ 400 depending on size and additional features. There is no operating cost for the device.

Note: in whole devices of sterilization depending on UV radiation, we cannot do the sterilization procedure if there is patient inside the room so, we developed our device to that we can do it if there is patient inside the room or not. I will show you all that thing during the discussion

CHAPTER7
GENERAL INFORMATION ABOUT ULTRAVOILET RADIATION

The literal translation of the word comes back to the original Latin (Ultra Violet). Since ultra violet radiation is shorter than UV, it is not visible.Because ultraviolet rays are not visible to the human eye, they are called dark or dark lights, and there are animals, birds, reptiles and insects, such as bees, which can see the ultraviolet spectrum called Near UV. There are also fruits, flowers and seeds growing strongly through a floor of ultraviolet color than other visible colors. Scorpions use their ultraviolet light. Birds have patterns in their arms not seen by the naked eye but can be observed through ultraviolet rays.

7.1 UV types:

UV rays are divided into several interwoven waves as shown below.

Wave name Symbol Length of wave in meter Power quantity per charge Photon
Near UV NUV 400 nm - 200 nm 3.10 - 6.20 eV
UVA, long wave 400 nm - 320 nm 3.10 - 3.87 eV
UVB, medium wave 320 nm - 280 nm 3.87 - 4.43 eV
UVC, short wave Below 280 nm 4.43 - 6.20 eV
Far or vacuum FUV, VUV 200 nm - 10 nm 6.20 - 124 eV
Extreme or deep EUV, XUV 31 nm - 1 nm 40 - 1240 eV

7.2 Natural resources:

Ultraviolet radiation from the sun emits long, medium and short wavelengths, but because ozone absorbs its upper atmosphere, 99% of the Earth's radiation is from the long beam. (For example, medium and short bands of ultraviolet waves have direct responsibility for the formation of the ozone layer).Ultraviolet rays start at 200 nm, because the normal air dimming waves with a length of less than 200 nm, due to the strong absorption of oxygen in the air for this length of waves. The pure nitrogen is transparent to the waves between 150-200 Nm. This method is industrially important because manufacturing processes for semiconductors use wavelengths less than 200 nm.

7.3 Effects of human health associated with ultraviolet radiation:

7.3.1 Benefits of ultra violet effect:

The positive effect of UVB exposure is that it helps to produce vitamin D in the skin. Statistics say there are tens of thousands of people who die of cancer every year in the United States and that is because of vitamin D deficiency in the body. This deficiency causes bone marrow disease (or rickets in adults), and causes bone weakness and ease of fracture. Generally this vitamin is obtained by food or exposure to the sun for specific periods. Many countries have fortified their diets with vitamin D to prevent deficiency, preferring to eat these foods or using dieting pills more than exposure to UVB for fear of increased risk of skin cancer due to ultraviolet light.

Ultraviolet rays have medical uses, such as skin diseases such as psoriasis and vitiligo. Ultraviolet (UVA) radiation is used with some medications. The UVB is rarely used in this area.

7.3.2 The bad effect of ultraviolet radiation:

Prolonged exposure to the sun and its ultraviolet rays may cause serious and chronic health effects on the skin, eye, and immune system of the body. UVC radiation is the highest energy of ultraviolet radiation and is also the most dangerous. Fortunately, it is filtered at the Earth's atmosphere. However, it can be used with special equipment such as swimming pool sterilization units if the lamp is lit outside the closed sterilizer basin.

The toxic effect of ultraviolet light from sunlight and artificial treatment lamps are worrisome to human health. The serious effects of radiation on the skin include inflammation of the burns, skin infections, sunburn and weakened body immune system. UVA, UVB and UVC all can destroy collagen protein fibers and thus accelerate skin aging. UVA and UVB can break down vitamin A in the skin.

We start with UVA, the least dangerous, which accelerates skin aging, DNA damage and accelerates skin cancer. It spreads deeply and does not cause sunburn or redness of the skin and there is no medical examination but the solar condenser intercepts and intercepts UVB with it.

CHAPTER 8
GENERAL INFORMATION ABOUT STERLIZATION

Sterilization is the process that kills or removes all microorganisms including bacterial spores. The meaning of the word sterilization is absolute, that is, there is nothing sterile in the sense that things are either sterile or not sterile. Sterilization can also be defined as the removal of transport agents (such as bacteria and viruses) from surfaces, equipment, and food and from the biological culture medium. Sterilization can be achieved by natural or chemical methods of killing microorganisms or by filtration in the case of liquids.

To understand the basis of sterilization, it is necessary to know the kinetics of death of microorganisms, which can be expressed by the irreversible loss of reproductive capacity. This can be used to evaluate sterilization since only living cells can form colonies.

For example, when a pure community of microorganisms is exposed to a lethal treatment such as high temperature treatment, the death motor is always logarithmic, meaning that the number of organisms decreases logarithmically over time. This means that all members of society are similarly sensitive and that only Determines the actual time of death of any individual cell. If the relationship draws the number of organisms and the time of exposure of a given microorganism to a lethal treatment, we are in a straight line with a negative inclination and the curve represents the death rate.The mortality rate and initial number can be used to calculate the remaining microorganisms after treating microorganisms with a fatal treatment for a given period of time. Since most societies in nature are mixed communities, they usually rely on the most heat-resistant microorganisms, which are often bacteria. Therefore, if you want to evaluate the method of sterilization (eg, heat), water suspension is used from high temperature resistant bacteria. If we want to sterilize any treatment or method of sterilization that takes into account the dynamics of microcellular mortality, we aim to have a very small possibility of even one cell in the sterile material. For example, if you want to sterilize 1 liter of liquid medium (liquid environment), we can reach the target in a practical way when the transaction results in the number of remaining microorganisms not exceeding one cell at 610 liters and then the probability of any microorganisms in that quantity Too small to be of any importance. Most sterilization methods in the industry take into account a high degree of safety.

CHAPTER 9
APPENDIX

9.1 Interview and Discussion:

We met Dr. Shadi Al Aufi, who works at the Saudi German Hospital in Saudi Arabia, Jeddah, to talk about UV-related devices in the hospital. He began to talk about the sterilization device in the operating room, which is a device depends entirely on ultraviolet radiation and says that there is no operation room without it because of the importance of sterilization, and that has a great impact in the sterilization of the hospital and also drew our attention that he told us that the radiation Ultraviolet uses many in the medical field in the treatment of some skin diseases such as vitiligo and others, so we got the admiration and decided to work on the device and facilitate its use and thus benefit the community.

9.2 Sub-increments:

- UV is an electromagnetic wave with a wavelength shorter than visible light, but longer than X-rays called ultraviolet because the length of the violet wave is the shortest between the colors of the spectrum. Its wavelength starts from 10 nm to 400 nm, and its energy starts from 3 to 124 electron volts.

- Ultraviolet rays with wavelengths shorter than 300 nm are effective in killing bacteria and viruses. Hospitals use microbial lamps that generate these short rays to sterilize surgical device, water, and air in operating rooms. Many food and pharmaceutical companies also use these lamps to sterilize various types of products and their package.

CHAPTER 10
CONCLUSION

UV is an electromagnetic wave with a wavelength shorter than visible light, but longer than X-rays called ultraviolet because the length of the violet wave is the shortest between the colors of the spectrum. Its wavelength starts from 10 nm to 400 nm, and its energy starts from 3 to 124 electron volts.

The term sterilization in the language carries two different meanings. Some may use it to refer to birth control or refer to the removal of germs. Many also confuse sterilization and disinfection. Disinfection means inhibiting or stopping the growth of germs and microbes, which may mean killing them but not getting rid of their kidneys. It is the process of removing or killing aspects of life, including bacteria and viruses on the surface, whether in medicines or liquids. Sterilization can be obtained through a combination of methods such as heating chemicals, radiation, high pressure and filtration. Or destroy some microorganisms that are not alive

Sterilization method that uses ultraviolet light at short wavelength enough to destroy microorganism this method is used in many applications, such as food purification, air and water. UVGI uses a short wavelength of ultraviolet radiation that harms microorganisms. It is effective in breaking down the nucleic acids in these living organisms so that their DNA is disrupted by ultraviolet radiation. This eliminates their productive capabilities and kills them.

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