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UV-C Radiation Therapy against Pandemic Covid-19 for Equipments in Dry Confined Atmosphere

Rohit Madhukar Nikam[1], Kailas Haribhau Kapadnis[2], Ratan Yadav Borse[3]
[1]*Assistant Professor Department of Chemistry, M. J. M. A.C.S College, Karanjali, Tal- Peth, Dist-Nashik-422 208,*
[2]*Professor Department of Chemistry, L. V. H. A.C.S College, Panchavati, Dist-Nashik-422 003,*
[3]*Principal Department of Physics, M. J. M. A.C.S College, Karanjali, Tal- Peth, Dist-Nashik-422 208.*

Abstract: ***It has been growing global alarm of corona disease Covid-19 and spreading everywhere in world pandemically around 215 countries. It is aroused in Wuhan at December 2019 and transmitted in human. Developed countries like Italy, America, Japan, Germany, France and China are much infected along with developing countries like India, Iran, Saudi, U.A.E and undeveloped countries. No vaccination is available for Covid-19. Efforts and clinical trials have been made in different countries for appropriate but uncertain route to cure patients affected from Covid-19 such as B. C. G vaccination or Hydroxyquinoline drug or alkaloid drugs or convalescent plasma therapy. Convalescent plasma therapy has been found much effective in America and Kerala in India. But still we should remind aphorism prevention is better than cure in our mind. Soaps and sanitizers are found to be more reliable in preventive measurements against covid-19. Flaviparavir heterocyclic drug compound is proven to useful for covid-19 patients into curable conditions. Multivitamins and vitamin C reached drug is also found to be sustainable for covid-19 and helpful to boost immune system among patients. This article imparts the contribution against covid-19 via dry route condition using ultraviolet radiations designed artificially at 100 nm to 280 nm for medical and household tools. This method of voltage gained in instruments using coils of wavelength in ultraviolet region are useful to protect against covid-19. It is necessary to kill covid-19 virus either in high temperature or using high voltage radiation therapy of UV-C so that the DNA material can be dry in dry conditions.***

Keywords: Vaccination, ultraviolet, Covid-19, UV-C, Soap and sanitizer etc.

I. INTRODUCTION

Sun is most intense source of energy in terms of nuclear fusion chain reaction. It imparts visible, I. R. and ultraviolet radiation with wavelength 100 nm to 800 nm to earth surface. Visible light is utilized in food preparation through photosynthesis by green leaves of plants containing chlorophyll in visible wavelength 400 nm to 800 nm. Infra-red radiation with longer wavelength reflected back from earth surface increases the concentration of greenhouse gases with the help of Infra-red active molecule and major contributor among greenhouse gases such as carbon dioxide (CO_2) thereby heating up earth's atmosphere give rise to global warming around surface of earth notably called greenhouse effect.

Ultra-violet radiation covers a range of 100 nm to 400 nm coming from sun is divided according to CIE classification into three types mainly UV-A long wave (315-400 nm), UV-B medium wave (280-315 nm) and UV-C short wave (100-280 nm) category. 90% of the UV-B (280-315 nm) and 100 % of the UV-C (100-280 nm) radiation is absorbed by the ozone.

The remainder part of UV-A (315-400 nm) and small percentage of UV-B (280-315 nm) are component of UV radiation reaching to surface of earth.

Light therapy treatment uses ultraviolet light UV-B type with narrowband wavelength of 311 nm-313 nm well within the range of light at which UV light generates vitamin D in the human body. Ordinary light in the form of light bulb is exposed to infant and new born babies for maintaining the warm conditions. UV light is a higher frequency but lower wavelength. Though UV radiation comes from the sun, it can be created by artificial sources used in industry, commerce and recreation [1]. This type of radiation based therapy equipped with instruments and a source of UV-C light arc or tube is useful not only to monitor but also to disinfect the tools employed against pandemic Covid-19.

Pandemic Covid-19 is dangerous to human being with respect to economic, cultural, environmental and medical parameters are concerned. In these situations patients affected from Covid-19 are increasing expontially day by day and masks, soaps, sanitizers and lockdown are not ways to be remaining to control Pandemic Covid-19. It is necessary to discover more sophisticated technologies to prevent and control Pandemic Covid-19.

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II. LITERATURE SURVEY

Nowadays Covid-19 is spreading everywhere and changing its stages from first to fourth. The infection growth rapidly increasing expontially. These can be prevented with good habits of cleanliness and use of some etiquette [2]. Soap and sanitizer is regarded as protective shield against bacteria and viruses. Further the advancement in good habits can be reformed with the use of soap and sanitizers. Applicability of soap and sanitizers toward Covid-19 is one step for prevention. In case of bathing soap, it finds its role in person to family. Use of soap generally attributes with price, role and fragrances [3]. Sanitizers are useful as it contains more than 70% alcohol such as ethanol or iso-propanol with color agents, perfumes and aqua. When Covid-19 virus comes in contact with soaps and sanitizer, the virus is killed and destroyed in the wet atmosphere. The protective battelshield of DNA present in Covid-19 is being broken by alcohol, as fatty acids are soluble in alcohols. Soaps and sanitizers contain stabilizers. But sanitizers are highly flammable and handled carefully. In high temperature conditions it is difficult for any virus to sustain on any surfaces. The sanitization method for disinfection of any metal, porous and non-porous surface are two 254-nm UV-C devices providing a dose of 60 mJ/cm^2, 70% ethanol spray that means alcohol based sanitizers, quaternary ammonium disinfectant spray, sodium hypochlorite solution in 5-6% and delicate-task wipes against aerobic bacterial counts[4].

III. ABOUT COVID-19

A. How Pandemic Covid-19 is Generated in Atmosphere Through affected Patient?

Study of NNK world in Japan revealed that Covod-19 is generated through sneezing from micro-droplets of the size of 10 µm patients affected with virus covid-19 and spreads dynamically when they generated a laser atmosphere with high magnification camera with powerful resolution and high sensitivity 0.1 micrometer particle size (Shin Nippon Air Technologies Co. LTD). The micro-droplets do not sink to ground directly. It remains in patient's atmosphere for some time and then sinks to ground or any surface. A study also revealed that a large talking and high breathing increases the risk of covid-19 into air. Masashi Yamakawa said and focused on simulation study that big droplets sinks to the bottom or surface within 60 seconds, but micro-droplets till sustain in air atmosphere parallel to approximately height of patient affected with Covid-19 more than 20 minutes. Micro-droplets does not travel directly, they need air medium to flow [5].

B. The life-time of Covid-19.

It is evident that the life time of corona virus ranges from 3 hours to 72 hours. It depends on the contact layer with which corona virus come in contact with hard, porous, non-porous, metallic, soft structure material.

Fig 1:- life span Covid-19 on different material surfaces (adopted from Business insider Newspaper/Magazine)

IV. UV-C DISINFECTANTS BASIC COMPONANTS AND APPLICATIONS

UV-C radiation is known to be disinfectant for air, water and mitigate surfaces of risk factors. In 2020, Szeto et al., suggested that vaccum-UV lamps with ozone production were found to be effective for inactivating various human pathogens. With the best tested criteria, 3-log10 inactivation of Escherichia coli, seasonal influenza viruses can be achieved with < 10 min of VUV treatment except Mycobacterium tuberculosis required about 20 minutes. They proved valid germicidal results reflected with 3-log10 inactivation for bacteria, 4-log10 inactivation virus and 5-log10 inactivation can be obtained with all tested pathogen for MTB suggesting VUV radiation is effective way against different environmental and pathogenic microorganisms for purification of affected surfaces[6]. UV-C can be used against covid-19 and other coronaviruses such as Sars. The radiation therapy warps the structure of their genetic material and prevents the viral particles from making more copies of them. A recent study finds depicted as far-UVC light safely kills airborne coronaviruses by Colombia University Irving Medical center has found that a type of ultraviolet light called far-UVC-which is safe to use around people kills more than 99.9 percent airborne coronaviruses[7].

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Ultraviolet light destroys DNA of viruses, bacteria and fungi [8]. A strong germicidal effect is provided by the light in the short-wave UV-C band, but a care should be taken to handle UV-C light and important to design systems for UV-C light to exclude leakage UV-C leakage [9]. It has been proven that UV-C disinfects the hospital surgical items, packed foods and bottles, groceries, metal, plastic, cotton, mobiles, watches, ornaments, all types of masks and clothes, banking notes and coins, office documents and special for children uniform and school bags. UV-C purification has a long and honorable history in cleaning room air, high-tech volume liquid, domestic ponds and surface treatment of food resulting in less waste food products. UV-C technology is often used in conjugation with other techniques such as reverse osmosis and ultra flurometry in tandem with water purification systems from small scale to large volume.

Here are some basic components of UV-C instruments are as under,

A. Filaments and Lamps

Germicidal UV-C lamps are of three types viz; cold cathode, slimline lamps, hot cathode. The inverse square law is useful to decide germicidal action since killing power decreases as the distance from the lamp decreases. The average bacterium will be killed in ten seconds at a distance of six inches from the lamp in an American UV germicidal fixture[10] Electronic preheat type of ballasts provide the best conditions for a long life, especially when lamps are switch frequently. Optimum UV efficiency of low pressure lamps is directly related the saturated mercury pressure. The pressure dependency on the lowest temperature spot is approximately 40^0C. The lamp life depends on electrode geometry, lamp current, noble-gas filling, switching frequency, ambient temperature and circuitry. The irradiance E on a small surface in point P on a distance from an ideal linear radiation source AB of length l amounts to:

$$E = \frac{\varphi}{2\pi^2 la}(2\alpha + sin2\alpha) \text{.....[11]}$$

Where, φ is total radiation flux (in Watts).

B. Volume of the standard Ultralyzer

The volume or space in UV-C instrument is enough to available things to be keep and to be disinfect. It is designed in such a manner so as to accommodate things. The instrument prepared in the Prism lab has volume 27-28 liter/dm^3. It has dimensions 1feet in height, 1 feet in breadth and 1 feet in length (1"×1"×1"). The volume or space available in this instrument is sufficient to place things like bottles, groceries, metal, plastic, cotton, mobiles, watches, ornaments, all types of masks, clothes, banking notes and coins and office documents [12].

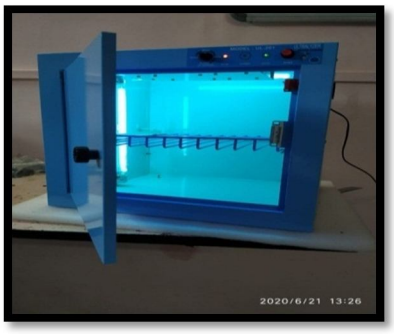

Fig 2: Ultralyzer manufactured in Prism lab:-Model: UL-201 range of 253.7 wavelengths [12]

C. Working Principal

The germicidal UV-C (100 nm-280 nm) has highest disinfectant capacity with a peak effect wavelength of 265 nm. The UV-C light is absorbed by RNA and DNA in cells and microbes which induces changes (apoptosis) in the DNA/RNA structures resulting into replication inability. Many microbes have proved to be susceptible to inactivation using UV-C light such as bacteria, viruses, fungi and spores. The shorter cycle has achieved for surface exposed to UV-C radiation but longer cycle has also been achieved for surface that has not been placed on front of UV-C radiation. The inverse square law is applicable to carry out sanitizing materials. Those surface is placed in front of UV-C radiation is disinfected with high intensity. So it is necessary to adjust light symmetry for irradiation on surface of object [13].

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D. Applications of UV-C Radiation as a Disinfectant are as Under

1) *Hospitals:* In hospital there are many instruments and surgical equipment's that needs to be sterilized and disinfect varying apparatus of steel, masks, PPE kits, surgical goggles and hand-gloves. The UV-C equipment's plays an important role in the decontamination of hospital rooms such as Spectra 254 LLC, XENEX™ and Tru™ [14]. UV-C provides better route to disinfect for above apparatus. The appropriate dose of UV-C light is useful to clean and give the way to reuse the hospital tools. It purify surface from different microbes such as bacteria, virus, pores and fungi.
2) *Banks:* Ultra-violet lamps are used in banks for currency and document verification [15]. In banks coins and bundles of bank-notes are needs to be disinfected. UV-C provides remarkable route to disinfect for tools in bank. It cleans surface from different microbes such as bacteria, virus, pores and fungi.
3) *Homes:* In house hold things to disinfect UV-C provides better option. Clothes, Glossaries and vegetables can be purified. Keys of vehicles, pens, daily usable and habitual things can be cleaned.
4) *Jewelry Shops:* The surface of precious ornaments can be cleaned by adopting UV-C radiation confined in instruments like Ultralyzer.
5) *Hotels:* In hotels UV-C radiation are useful to disinfect many items like money given by customers, vegetables, glossaries, laundry clothes.
6) *Schools:* School bags and school equipment's can be disinfected with the aid of UV-C light therapy.
7) *Beauty Saloons:* Beauty Saloons products such as saloon equipment's, creams are disinfected with the use of UV-C light during Covid-19 pandemic.

V. CONCLUSION

UV-C disinfectant is useful to kill micro-organisms, bacteria, yeast and viruses at wavelength of 253.7 nm. The innovative disinfectant technique is easy to construct, easy to handle and easy to adopt. The virus like Covid-19 can be killed with this disinfectant technique within 10-15 seconds and daily needy things can be purified easily. The technique is solution free and does not require any chemical solution to purify or sanitize substances; therefore it is chemical free technique. It is useful for and required in industries, hospitals, domestics and medical practitioners like dentist who are directly being exposed to breathe fumes of patients. The technique does not rely on high temperatures and free from liquid sanitizations. UV-C sterilization process has been effective to many viruses and bacterial infective substances. UV-C radiation therapy has been proven reforming tool in reprocessing and reutilizing many apparatus and equipment's. From above study and advantages of UV-C reveals that UV-C radiation therapy can be useful to surfaces affected from bacteria, spores, fungi and viruses such as Covid-19 in dry confined atmosphere for pandemic situation.

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Fig 3: Ultralyzer manufactured in Prism lab:-Model: UL-201 range of 253.7 wavelengths

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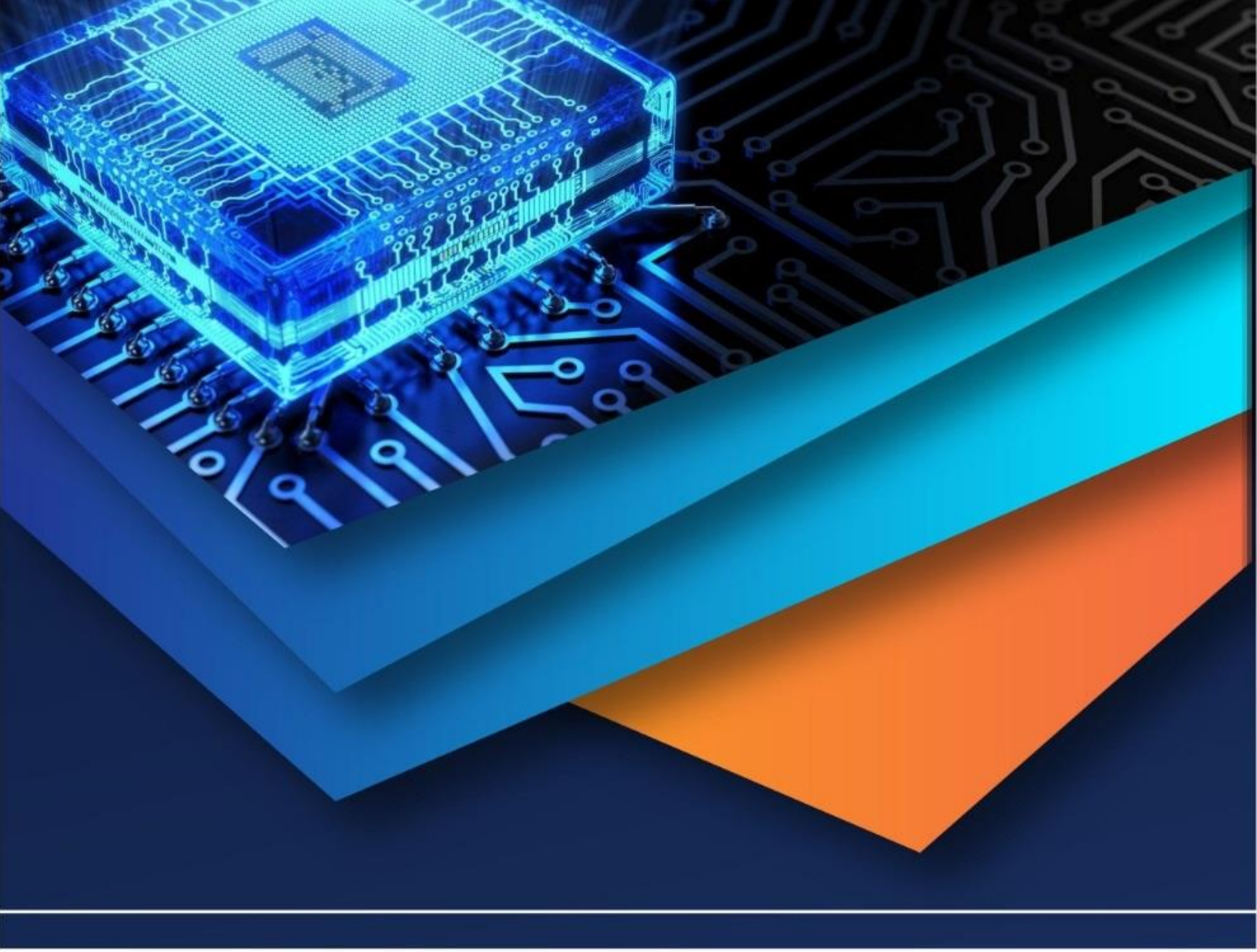

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