UV LIGHT STIRLIZER

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Abstract - Sterilizing equipment is a vital element of modern medical care since patients come in contact with surgical tools, syringes and bandages all the time. To ensure the medical safety of your patients, medical practitioners and the environment, you must use medical equipment safely — this includes keeping them clean and sterilized. Thorough and effective cleaning of these important equipment pieces is necessary to avoid the possibility of disease spreading from patient to patient. UV (Ultraviolet) light is a confirmed technology that can be infected and reducing bacteria, viruses, Coronavirus and other hurtful germs that can jeopardy human health.UV light kills or deactivates bacteria, viruses and Coronavirus by destroying nucleic acids and disrupting their DNA, leaving them unable to perform vital cellular functions.UV (Ultraviolet) Light have been used for disinfection of air and surfaces within hospitals, care homes, laboratories and many other organizations for many years.In light of the current outbreak, UV is just one of the many technologies available and being utilized to help reduce and control the spread. Ultraviolet C lights inside the cart disinfect the device cases. They emit 254nm UV light that kills any kind of bacteria and virus, by destroying the molecular bonds that hold their DNA together. Unlike chemical disinfectants, UVC leaves no residues on the objects, needs not maintenance, and is clean and cost effective.

Key Words: Micro-organism, UV light, UVC-decontamination, Efficacy, Dosimeter, Sterilization

1.INTRODUCTION

With invasive procedures, there's contact between a patient's mucous membranes or sterile tissue and a surgical instrument or medical device. A significant risk of these types of procedures is introducing pathogenic microbes, potentially resulting in infection. When you don't properly disinfect or sterilize medical equipment, it increases the risk of infection due to the breach of host barriers. For both hospital staff and patients alike, germs need to be destroyed to reduce the spread of infections. A prime example of this is fighting against healthcare-associated infections (HAIs), which are infections hospital patients get due to their hospital stay. Surgical instruments, contaminated equipment or improper staff hygiene can cause HAIs. Ultraviolet germicidal irradiation (UVGI) is a disinfection method that uses short-wavelength ultraviolet (UV-C) light to kill or inactivate microorganisms by destroying nucleic acids and disrupting their DNA, leaving them unable to perform vital cellular functions.[1] UVGI is used in a variety of applications, such as food, air, and water purification. UV light is electromagnetic radiation with wavelengths shorter than visible light but longer than X-rays. UV can be separated into various ranges, with short-wavelength UV (UVC) considered "germicidal UV". Wavelengths between about 200 nm and 300 nm are strongly absorbed by nucleic acids. The absorbed energy can result in defects including pyrimidine dimers. These dimers can prevent replication or can prevent the expression of necessary proteins, resulting in the death or inactivation of the organism.

- Mercury-based lamps operating at low vapor pressure emit UV light at the 253.7 nm line.
- Ultraviolet light-emitting diodes (UV-C LED) lamps emit UV light at selectable wavelengths between 255 and 280 nm.
- Pulsed-xenon lamps emit UV light across the entire UV spectrum with a peak emission near 230 nm.

This process is similar to the effect of longer wavelengths (UVB) producing sunburn in humans. Microorganisms have less protection against UV, and cannot survive prolonged exposure to it. A UVGI system is designed to expose environments such as water tanks, sealed rooms and forced air systems to germicidal UV. Exposure comes from germicidal lamps that emit germicidal UV at the correct wavelength, thus irradiating the environment. The forced flow of air or water through this environment ensures exposure. Here we are using Ultraviolet light. To power up and control the light we are designing the mono-stable. Mono-stable circuit will define thetime for which light will be on. And inverter circuit will produce the AC voltages from 12v DC to use light up the Ultraviolet light. We will use 12v DC power supply circuit to power up mono-stable . How does UV Light help us? When ultraviolet light has a C wavelength (specifically 254 nm), it breaks apart molecular bonds of DNA. So how can your everyday nurse or doctor take advantage of this technology? With the UV Flash. The UV Flash is an infection control

station that uses UVC lamps to eliminate potentially harmful pathogenic microorganisms from a variety of objects.

2. Body of Paper

We divided circuit diagram into three main parts. These are as follows.

Power supply.

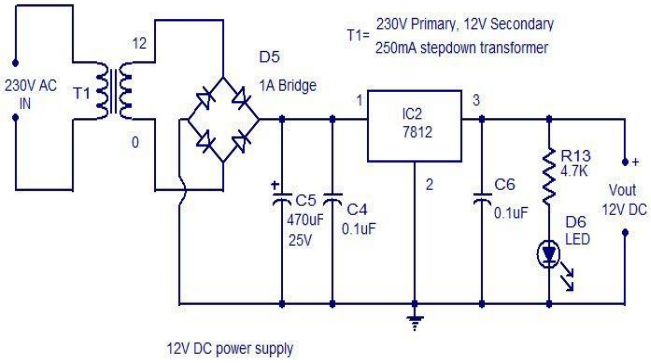


Fig 1: Picture shows the Power Supply of system

Here this circuit diagram is for +12V regulated (fixed voltage) DC power supply. This power supply circuit diagram is ideal for an average current requirement of 1Amp. This circuit is based on IC LM7812. It is a 3-terminal (+ve) voltage regulator IC. A transformer (Tx=Primary 230 Volt, Secondary 12 Volt , 1Amp step down transformer) is used to covert 230V to 12V from mains. Here used a bridge rectifier made by four 1N4007 diode to convert AC to DC . The filtering capacitor 1000uF,25V is used to reduce the ripple and get a smooth DC voltage. This circuit is very easy to build. For good performance input voltage should be greater than 12Volt in pin-1 of IC LM7812. Use a heat sink to IC LM7812 for safeguarding it from overheating. LED with resister is added to indicate the 12volt DC.

Mono-stable Circuit.

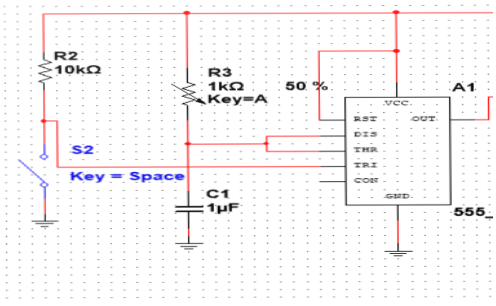
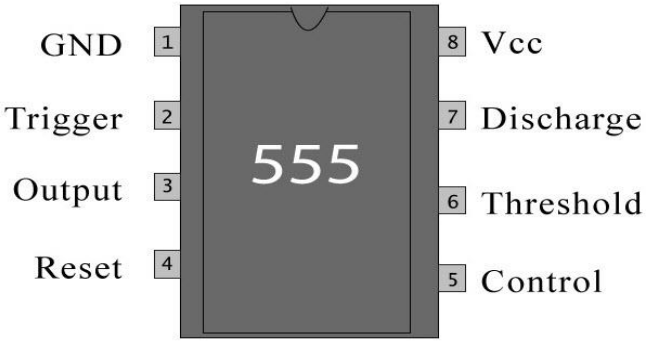


Fig 2: Picture shows the Mono-stable circuit diagram

When the 555 timer IC is used in Mono-stable multivibrator operation the delay is controlled by an external resistor and capacitor.

Fig 3: 555 Timer IC



In mono-stable multi-vibrator using 555 timer circuits, the term mono-stable indicates that it has only one stable state. The unstable state is called “quasi stable state”. The period of stable state is determined by the charging time constant of the c network. The transition of output from a stable state to quasi stable state accomplished by using the trigger switch. The circuit diagram of mono-stable multi-vibrator using 555 timers is shown above. By using this circuit we can find the duration of the pulse easily. The required components of mono-stable multi-vibrator using 555 timers mainly involve IC 555 timer, resistors, and capacitors and trigger switch. In the above circuit, the pin1 is connected to the ground and the trigger input is given to the pin2.In inactive condition of o/p, this i/p is kept at +VCC. To get transition of the output from a stable state to unstable state, a negative going pulse of narrow width and amplitude of greater than +2/3 VCC is applied to pin2. The o/p is taken from pin3 and pin4 is connected to +VCC to avoid accidental reset.Pin5 is connected to the ground to avoid noise. Pin6 and pin7 are shorted and a resistor is connected between pins 6 & 8. A discharge capacitor is connected to pin7 while pin8 is connected to VCC.

Working of Mono-stable Multi-vibrator with 555 Timer Circuit

- The output of the mono-stable multi-vibrator using 555 timer remains in its stable state until it gets a trigger.
- In mono-stable 555 multi-vibrators, when both the transistor and capacitor are shorted then this state is called as a stable state.
- When the voltage goes below at the second pin of the 555 IC, the o/p becomes high. This high state is called quasi stable state. When the circuit activates then the transition from a stable state to quasi stable state.

- Then the discharge transistor is cut off and capacitor starts charging to VCC. Charging of the capacitor is done via the resistor R1 with a time constant R1C1
- Hence, the voltage of the capacitor increases and finally exceeds 2/3 Volt, it will change the internal control flip flop, thereby turning off the 555 timer IC
- Thus the o/p goes back to its stable state from an unstable state.

Finally, in the mono-stable multi-vibrator using 555 timers, the o/p stays in a low state until it gets a trigger i/p. This type of operation is used in push to operate systems. When the input is triggered, then the o/p will go to high state & comes back to its original state.

Features & Benefits

- Produces UV radiation of 253.7 nanometers (nm) in the UV-C germicidal light band width
- The glass in the light bulb blocks out 185 nm ozone forming light
- This light bulb requires a ballast to operate
- Consistent output of UV-C wavelength over light lifetime
- Warning label on light indicates UV-C radiation output

Applications

- Killing or inactivating bacteria, viruses and other primitive organisms
- Air, water and surface disinfection in hospitals, bacteriological research and pharmaceutical environments, and food processing industries such as dairies, breweries and bakeries
- Disinfection of drinking water, waste water, swimming pools, air conditioning systems, cold storage rooms, packing materials etc.
- Used in a variety of photochemical processes

8 Watt T5 Philips UV-C TUV Germicidal Light Bulb Product Specifications	
Manufacturer	Philips Lighting
Product Number	299305
Voltage	56 Volt
Watts	8
Base Type	G5 Mini Bi-pin
Bulb Style	T5
Length	11.53 Inches
Diameter	5/8 Inches
UV-C Radiation	2.4 Watts
Nanometers (nm)	253.7 (See below image)
Rated Average Life	9,000 Hours
Energy Star Qualified	No
Full Product Name	TUV 8W G5 FAM
Ordering Code	TUV 8W G5 Base FAM/10
Case Quantity	250
Technology	TUV Germicidal (UV-C)
Alternate Product Number	29930-5

Fig:4 UV light Specification

ADVANTAGES

1. **Portable.**
2. UV treatment compares favorably with other water disinfection systems in terms of cost.
3. **Killing or inactivating bacteria, viruses.**
4. **Air, water and surface disinfection in hospitals.**
5. **Disinfection of**
   a. drinking water, waste water, swimming pools, air conditioning systems, cold storage rooms, packing material
6. Needs low labor.
7. Less need for technically trained personnel for operation.
8. UV treatment is rapid.
9. Needs less primary energy use, approximately 20,000 times more efficient than boiling.

APPLICATIONS

1) **Air disinfection.**
2) **Water disinfection Ultraviolet disinfection of water is a purely physical, chemical-free process.**
3) **Wastewater treatment.**
4) **Aquarium and pond.**
5) **Laboratory hygiene**

UVGI is often used to disinfect equipment such as safety goggles, instruments, pipettes', and other devices. Lab personnel also disinfect glassware and plastic ware this way. Microbiology laboratories use UVGI to disinfect surfaces inside biological safety cabinets ("hoods") between uses.

6) **Food and beverage protection**

3. CONCLUSIONS

No-touch surface decontamination technologies that use ultraviolet light may be effective in enhancing the results of the sort spent to reduce the microbial burden and potentially achieving lower. With UV light we can sterilize the hospital equipment's. We can easily control the time to expose the equipment's to UV rays. UV light is chip and easy to use in hospitals. As aimed for in infection control strategies. Hospitals will need to continue to improve in both hand hygiene and environmental disinfection. In conclusion, UV technology was effective at reducing overall bacterial counts and significantly more successful than manual disinfection alone on hospital equipment's. Our results underline important critical issues in standard terminal cleaning (combined manual cleaning and chemical disinfection) on high touch surfaces, to adequately remove microbial contamination from the hospital equipment's .We have demonstrated that the UVC device, significantly reduced microorganisms from common high-touch surfaces of hospital equipment's.

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REFERENCES

1. https://www.h2odistributors.com/pages/info/how-ultraviolet-purification-works.asp
2. https://academic.oup.com/cid/article/39/5/702/2022846
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4827199/
4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5824029/
5. http://microchemlab.com/test/uv-room-disinfection-devices
6. http://www.lightbulbmarket.com/product/738519_8-Watt-TUV-G8-T5-Philips-Germicidal-Ultraviolet-Light-Bulb.
7. https://www.homemade-circuits.com/7-simple-inverter-circuits/
8. https://en.wikipedia.org/wiki/Ultraviolet_germicidal_irradiation#:~:text=Ultraviolet%20germicidal%20irradiation%20(UVGI)%20is,to%20perform%20vital%20cellular%20functions.