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Research Article

The Effect Of Tem-Umw Ultraviolet Sterilization Box Radiation On Paper Money Bacteria

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ABSTRACT

Background: TEM-UMW UVC sterilization cabinets have been designed using door safety systems and timers. Door security systems are designed to avoid exposure to UVC rays in users. Sterilization is carried out to improve the quality of public health and ensure the cleanliness of an object. Sterilization using exposure to UVC light can decide the survival of micrinorganisms or bacteria. This causes UVC light to be widely used as a sterilizer for non-living objects. This study was conducted to determine the effectiveness of UVC exposure time to bacterial colonies on banknotes. Exposure is done by making one sample as a cocontroller.
Methods: This study banknotes are illuminated at intervals of 0, up to 30 minutes using a sterilization cabinet. The number of bacteria on the banknote is calculated by the bacterial culture method and then analyzed using a counter colony.
Results: Based on the results of the analysis of known samples without exposure to light, the number of bacteria was about 250 colonies when the first minute of exposure bacteria was reduced to 38 colonies. The number of colonies on banknotes is constantly reduced if the length of exposure is increased. By the 30th minute the number of colonies becomes 6
Conclusions: The results shown Exposure using UVC through strilization cabinets can kill bacteria on banknotes. The optimal exposure time of UVC rays affecting the number of bacterial colonies on the Rp. 2000 banknote is 25 -30 minutes.

Keywords : Sterilization; UVC; Bacterial; Radiation

INTRODUCTION

The COVID-19 outbreak that has hit almost the entire world has changed people's lifestyles. During the Covid-19 pandemic, maintaining personal and environmental hygiene is very important. One way to maintain the cleanliness of the environment and objects that are often in direct contact with humans is by sterilization. One of the sterilizations in the room environment aimed at inanimate objects is sterilization with exposure to UVC light with a certain power and a certain time.

Sterilization in general can be done in several ways, namely physical sterilization and chemical sterilization. Physical sterilization includes irradiation, drying, heating, filtration, radiation and by means of sonic vibrations. Chemical sterilization uses chemicals that can damage the cytoplasm of germs. On certain objects, chemical sterilization can have a negative impact [1]. The use of chemicals and disinfectants containing alcohol can help kill viruses, but the use of chemicals and alcohol can cause irritation, especially on injured skin. Irritation that is crushed in the form of dry and peeling skin besides that it can cause mild infections in the respiratory environment-unfriendly chemicals [2]. Irradiation sterilization can use UVC light at a wavelength of 254 nanometers can act as a disinfectant. In addition, sterilization with UVC lamps is more environmentally friendly. UVC sterilization is very suitable for small objects that are often in direct contact with the community such as bags, balpens, cellphones and groceries [3].

Sterilization using Ultra Violet (UV) radiation on inanimate objects is a method that can reduce the number of airborne germs. The ultraviolet sterilization process is very simple in principle, and does not damage the instrument to be sterilized [4]. Ultraviolet light is electromagnetic radiation to wavelengths shorter than visible light but longer than small X-rays [5]. UVC has the property of being able to convict bacteria, viruses or microbes where RNA and DNA proteins are absorbed by ultraviolet radiation, causing cell death and mutation [6]. A combination of lamp power, time and distance of the lamp and sample needs to be done to obtain a strong and effective dose of anti-virus on the surface of the respirator [7].

The application of UVC exposure as a sterilization medium for inanimate objects that are often in direct contact with humans is important. After successfully designing a sterilization cabinet in previous studies, it is necessary to know the effectiveness of the duration of UVC lamp irradiation against bacteria. Testing of one of them was carried out on banknotes. By doing the test time, a variation of time is carried out from 1 to 30 minutes. Before and after exposure, bacterial culture tests are carried out in the laboratory to find out what percentage of bacteria are lost. As a comparison material, a control sample is used. Through this study, a test was conducted on the effect of UVC exposure on Rp 2000 banknotes and how the effect of exposure time on bacteria on the surface of banknotes.

METHODS

The design of this research requires several stages ranging from case studies, preparation of materials and tools and design of sampling methods. Then plan experiments, data collection and analysis levels. The first stage in this research is to prepare the necessary tools and materials, namely banknotes, bacterial breeding materials. The tool prepared is the TEM

UMW UVC strilization cabinet to be tested, a petri dish as a place to culture bacteria.

The research was carried out experimentally in the Laboratory of Microbiology Prodi TLM UMW. The first activity was performed by performing maintenance and testing on a device that was previously designed. The study was done with a complete random design system with a time variation of 1 minute to 30 minutes. The variables in this study are the exposure times performed in variations of 0, 1, 5, 10, 15, 20, 25 and 30 minutes. In addition, the number of bacterial colonies produced in each sample was calculated at each exposure time by culturing bacteria for 24-48 hours then calculating the number of baketry in the sample using counter colonies. The indicators in this study are how the number of bacteria on the surface of the banknote relates to UVC exposure and how the relationship between the length of

exposure (in minutes) of the sterilizer with UVC light designed to the remaining bacteria on the banknote surface. A block diagram in this study is shown in Figure 1. Flow chart block for easy knowing each process and research steps Figure 1.

Figure 1. Research diagram beam

RESULTS

The specifications of UVC sterilizers tested for effectiveness are shown in figure 3. This sterilizer is designed to have an automatic door security system. When the door is still open, the tool cannot operate or when the door is opened, the tool will die. The TEM-UMW-0722 UVC sterilization cabinet has the following specifications:

Tool name : UVC Sterilization Cabinet TEM-UMW-0722

Voltage : 220 V

Lamp power : 2 x 9 Watt

PxLXT size : (44x30x34) cm

Function : As a means of sterilizing small and medium-sized objects

Material : Wood

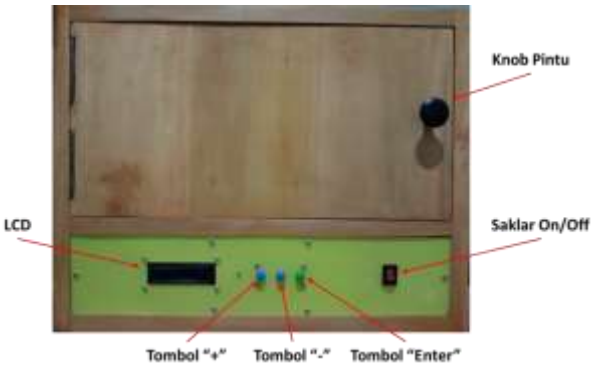

Figure 2. Sterilization cabinet

The results of the study tested the effectiveness of UVC exposure on Rp 2000 banknotes from minute one to 30 minutes are shown in Table 1.

Tabel 1. Time data of display and number of colonies

No	Time (minute)	Colonies
1	0	250
2	1	38
3	5	34
4	10	28
5	15	24
6	20	23
7	25	9
8	30	6

Based on the data, the results of observations showed that when without exposure, which is 0 minutes, many bacteria were found around 250 kaloni. At minute one the number of colonies begins to decrease very significantly compared to without exposure to UVC rays. Analysis carried out to determine the effect of UV exposure on bacteria can be done by adding liquid suspension to the sample [8].

The results of analysis through bacterial culture for 48 hours showed the difference between control samples, without exposure and exposure for 30 minutes. Figure 4 shows the perbedsn. Based on the results of media photos, it can be seen that exposure to UVC light affects the number of bacterial colonies remaining on banknotes. In control samples without bacterial contamination, negative results were obtained on the media as shown in figure 4a. In samples without exposure or 0 T, bacterial colonies were very large, about 250 colonies as shown in Figure 4b. In the 30-minute exposure sample, it is known that there are a few bacterial colonies, about 6 colonies, as shown in Figure 4c.

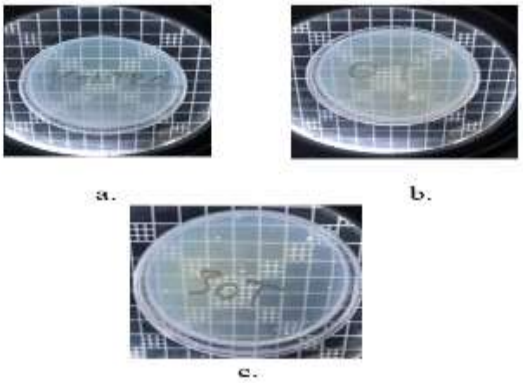

Figure 4. a. Control sample, b. Without UVC exposure, c. 30-minute UVC exposure

DISCUSSIONS

A graph of the relationship between exposure time in minutes and the number of colonies remaining on the banknote surface is shown in Figure 5. The graph shows that exposure from the first minute has shown a decrease in the number of bacterial colonies. At minute 30, the number of bacterial colonies is almost close to zero, which is about 6 colonies. Based on data and data analysis, it can be known that the number of bacteria missing on banknotes reaches 97.6%. According to research [9] the type of UVC light exposure on the metal bracket of the packaging, the number of bacteria decreases with increasing exposure time.

This is in accordance with previous research that shows exposure to UVC light is known to reduce or even kill Coliform bacteria in drinking water at PT. X. [10]. In addition, the length of exposure using UV light also affects the occurrence of bacterial reduction [11].

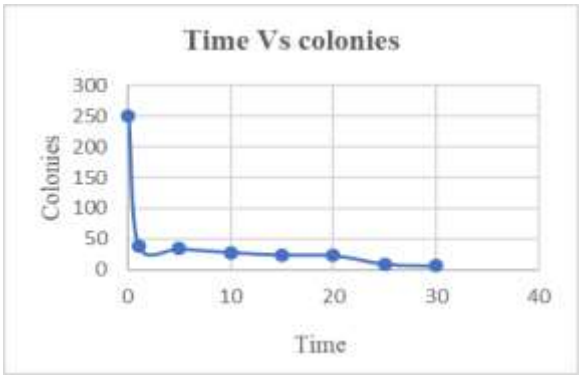

Figure 5. The relationship of radiation time and number of bacterial colonies

The results showed that exposure to UVC light can kill bacteria on the surface of the paper. It is known that UVC light with photon energy is able to damage bacterial DNA by penetrating microbial cell membranes and producing Cyclobutene Pyrimidine Dimers (CPDs). CPDs) are pyrimidine residues in nucleic acids. The formation of CPD causes damage to DNA molecules, this interferes with the doubling of DNA structure so that bacterial cells die [12]. This is good for the health of human organs, such as the kidneys, because bacteria can damage the kidneys and cause damage to organ function [13-14].

CONCLUSIONS

The conclusions that can be drawn in this study are:

1. Exposure using UVC through strilization cabinets can kill bacteria on banknotes
2. The optimal exposure time of UVC rays affecting the number of bacterial colonies on the Rp. 2000 banknote is 25 -30 minutes.
3. Longer exposure to UVC light on banknotes can reduce the number of kolni bacteria that develop.

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