NebulaX: A Therapeutic Mechanism Against Corona Virus

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***Abstract*—COVID-19 is a disease caused by the Coronavirus. This virus spreads quickly worldwide. Indonesia, like many other countries around the world, is preparing to respond to additional cases and possible widespread transmission of the disease. As cases of COVID-19 is increasing day by day, public concern in Indonesia regarding the severity of the disease and population vulnerability is also growing. In new normal situation, it is necessary to have a device to eliminate the spread of the Coronavirus, by eliminating this virus in the human respiratory tract. We introduce a NebulaX, is an anti-COVID-19 therapeutic device. It is a nebulizer's device, controlled by the Controller. The program in the Controller converts liquid into steam, thus if the liquid is a drug, it can easily enter the respiratory system and kill bacteria and viruses. The Casing of NebulaX is made from food-grade materials that suitable and also save in the respiratory process. In very useful for the prevention and cure of COVID-19 with the market segment of patients, medical workers, people in crowded places, and middle-high income families. The results of NebulaX is a light version with the specification as follows: weight Version 3.1 = 7.8 kgs, materials plat stainless, plastic ABS, dimension 32cm*15cm*30cm, display LCD 5", control unit AT-Mega, temperature Sensor DS18B20, power consumption 220 VAC(240 Watt), warm Oxygen 2 Liter/minute, nebulizer 1 cc/minute and Hydrogen Generator 160 mL/minute. The implication of further research is connecting the NebulaX into Internet of Things mechanism for collecting data of people for datamining purposes.**

Keywords—COVID-19, NebulaX, hydrogen generator, warm Oxygen, nebulizer, therapeutic device

I. INTRODUCTION

Until today, Coronavirus is continuing its spread across the world with about 70 million confirmed cases in 190 countries and more than 1.5 million deaths [1]. The virus is surging in many regions and countries that had apparent success in suppressing initial outbreaks are also seeing infections rise again. This virus spreads very rapidly and has a huge impact in the world, not only causing large numbers of deaths but also crippling the economy. This virus attacks human respiratory system. In some severe cases, COVID-19 can cause hypoxia and result in death. Recently, the vaccines for the COVID-19 virus are released and soon will be on market.

Meanwhile, to face the new normal, it is necessary to have a device to eliminate the spread of the Coronavirus, by eliminating the virus in the human respiratory tract. Therefore, we conducted study and developed NebulaX as an alternative device to use in the new normal.

The Coronavirus has a characteristic to die at the temperature of 70°C with inactivation time of 5 minutes [2]. Based on this fact, we use a heater and blower to introduce dry hot air to the respiratory tract. Since the Coronavirus can be found at the respiratory tract, we need a device that can change liquid to aerosol so that if the liquid is a drug, it can easily enter the respiratory system and kill the bacteria and virus. For this purpose, we use nebulizer to change liquid into aerosol.

This NebulaX has three main functions: oxidant therapy, medical therapy, and antioxidant therapy. In oxidant therapy, we use heaters to introduce hot air into the body. Then proceed with medical therapy, namely the insertion of food-grade herbs into the body, using the inhalation method, to kill the virus, that already register as Patent (with No. S00202103359) and Copyright with registered number EC00202058924 [3], [4]. Then it ends with antioxidant therapy, which is the introduction of hydrogen into the body, to relax, cleanse, and soothe the body. The combination of these three functions is very useful for the prevention and cure of COVID-19 with the market segment of COVID-19 patients, medical personnel, crowded places, and middle-high income households.

II. AIMS

The aim of this study is to provide an electrical therapy device to kill viruses consisting of: a heater, a blower, an atomizer or sometimes described as a Hydrogen-Oxygen Generator (HHO generator) and a controller to control the ignition and shutdown of the heater, blower, HHO producer and the atomizer. The electric therapy device further consists of a temperature sensor connected to the heater, a dimer connected to the heater, a PWM connected to a blower, the first relay connected to the HHO generator, a second relay connected to the atomizer, a display, and a number of indicators.

In addition, this study is also to support the Indonesian government program in handling the COVID-19 pandemic.

III. THEORETICAL BASIS

A. Corona Virus Disease 2019 (COVID-19)

In the beginning of 2020, the Centers for Disease Control and Prevention (CDC) begun to be observing the flare up of an unused Coronavirus, SARS-CoV-2, which cause the respiratory illness presently known as COVID-19. Authorities begin to distinguish the infection in Wuhan, China. The World Health Organization (WHO) have declared a public health emergency relating to COVID-19. The common symptoms of COVID-19 are fever, breathlessness, cough, it takes 14 days for the patience to notice the symptoms [5].

B. Nebulizer

Atomizer or usually known as nebulizer, is a therapeutic device that convert liquid into aerosol or fine mist with the size of μm that can easily reach the inferior part of the respiratory tract, through mouth or nose [6]. An atomizer can be used with an electric compressor, which vaporizes drugs so they can be inhaled to open airways, or it can use vibrating ultrasound. The mesh atomizer uses a new type of technology that forces liquid pharmaceuticals through nozzle, which has multiple holes, to produce a fine mist or aerosol. The following factors influence the process of administering drugs to patients through the nebulizer system:

- The method of interface between the patient and the nebulizer, and
- The volume of air given to the patient breathing [7].

The time it takes to nebulize a regular dose of common bronchodilators such as albuterol (used for asthma, emphysema, and other lung conditions) varies from a particular brand of nebulizer and the dose flow rate from the gas supply source (i.e., compressed air/gas). An efficient nebulizer machine is required to supply the dose in about six minutes. There are certain techniques that can determine the performance of a nebulizer. This includes:

- Analysis by weighing the nebulizer before and after nebulization.
- Volumetric analysis.
- Measure the particle size distribution.
- After filtration, the inhaled drug is adjusted with the help of in vivo radionuclide lung scanning or infrared photo spectrometry [8], [9].

The methodology to measure nebulized aerosol shown in Fig. 1. A constant inhalation of 15 L·min−1 is drawn over (or through) the nebulizer. Nebulized aerosol containing a NaF solute tracer mixes with the entrained air. A low flow cascade impactor samples aerosol at 2 L·min−1 from this flow, and impacted aerosol can be subsequently desorbed and analyzed from each size fraction from which the droplet size distribution can be determined.

The methodology for measuring the nebulized aerosol is shown in Fig. 1. A constant inhalation of 15 L·min−1 is sucked on (or through) the nebulizer. The nebulized aerosol, which contains a NaF-Solute tracer, mixes with the drawn air. A low-flux cascade impactor removes aerosols at 2 L·min−1 from this stream and the affected aerosol can then

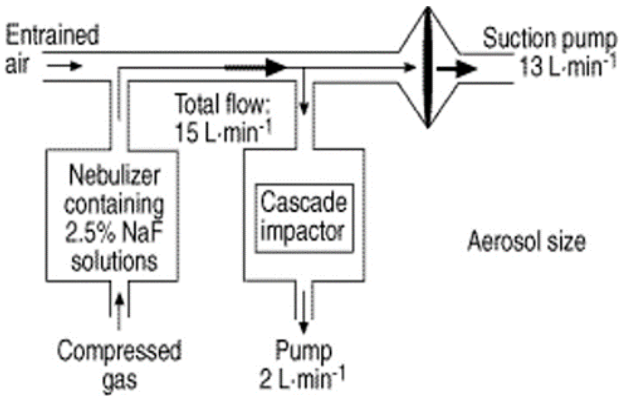

Fig. 1. The methodology to measure nebulized aerosol droplet size [10].

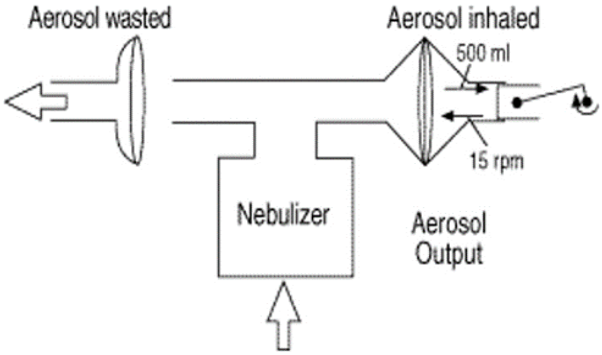

Fig. 2. Nebulizer scheme [10].

be desorbed and analyzed by any dimensional fraction from which the size distribution of the droplets can be determined.

In detail, the methodology for measuring the output of nebulized aerosol, as shown in Fig. 2. It is subject to the simulation of the breath of sinus flow, and the aerosol is collected on low-impedance electrostatic filters. Aerosols contain traces of sodium fluoride concentration, which can then be desorbed and measured electrochemically in rpm [10].

C. Hydrogen-Oxygen Generator (HHO Generator)

HHO generator is a hydrogen-oxygen generator with the aim of relaxing the body that is exposed to excessive oxidation. So, the function of the HHO generator is as an antioxidant for the body. Generally known as Hydrogen Water which can be consumed freely in the community. There are two HHO generator methods currently available, namely the Wet Cell method and the Dry Cell method [11]. In this research, we use Wet Cell Method for implementation of Therapeutic Device (NebulaX). In addition, two electrodes and a set of neutral plates are used in a typical Wet Cell. These plates are interconnected and connected to the edges of the two electrodes. In the design step the electrode and the neutral plate are completely submerged in electrolyte [12]. The O_2 gathering around the positive electrode starts to react with the metal plates used in the system which eventually causes corrosion of the plates. Also, here, the heat dissipation in the system is low compared to the dry cell configuration.

As if, the system heat will increase during the generator running which causes water vapor. The water vapor will mix with HHO gas and as a result the system efficiency is reduced [13].

IV. Device Design

NebulaX is a therapeutic device against COVID-19. It is combining three different therapeutic treatments which is heat treatment therapy or sauna therapy using heater and blower, herbal therapy using nebulizer with herbal liquid, and antioxidant therapy using HHO generator. These three-therapy treatments controlled by a controller for maximum efficiency.

The heater functions as a heat source and simultaneously functions as a sauna therapy, which is equipped with a temperature sensor to read the temperature of the heater, the dimmer, which regulates the ignition current of the heater so that the temperature of heater is not too low and does not rise too high. Indicator 3 used to indicate that heater is on. The temperature sensor is a PT-100 sensor. The PT-100 sensor is used because it has high accuracy and belongs to the RTD (Resistive Temperature Detector) group with a positive temperature coefficient, which means that the resistance value increases with increasing temperature. The heater is a heater with a working voltage of 220 V and 1000 W of Power.

The block diagram of the therapeutic device is shown in Fig. 3.

The blower draws hot air from the heater so that it reaches the mask (not shown in the picture). Blower is equipped with PWM which regulates the speed of hot air flow and indicator 2 as a sign that the blower is on. Blower is a blower with a working voltage of 12 V and a power of 50 W.

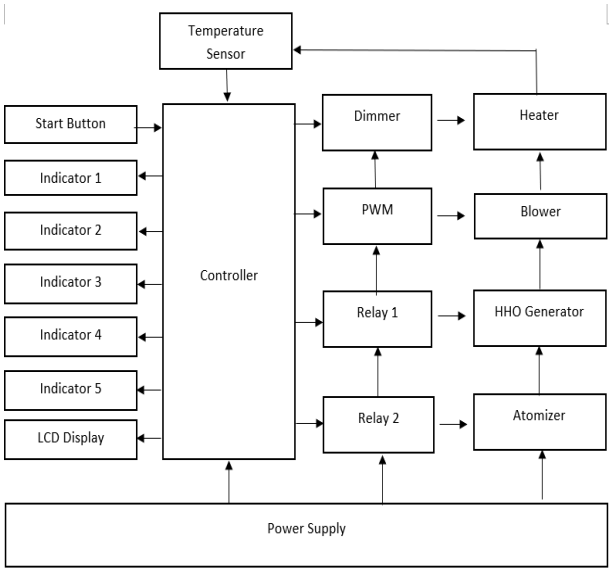

Fig. 3. NebulaX block diagram.

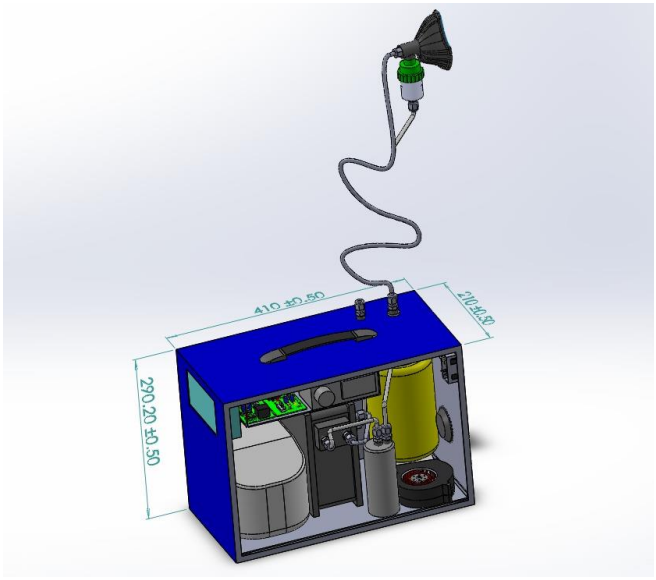

Fig. 4. NebulaX design Ver 2.1 (2019).

HHO generator produce HHO (oxyhydrogen) gas which functions for antioxidant therapy. The HHO generator is equipped with the first relay to turning on the HHO generator. Indicator 4 used as a marker that the HHO generator is active (on). The HHO generator is a hydrogen-generating device for the purpose of providing relaxation to the body that is exposed to excessive oxidation. Therefore, the function of producing HHO is as antioxidant therapy for the body. The technology for producing HHO can be in the form of wet cell technology and dry cell technology. The HHO generator is an HHO generator with a working voltage of 24 V and a current of 2.5 A.

The atomizer or well known as nebulizer is used as herbal therapy. It will convert drug/herbal liquid into aerosol or fine mist with the scale of the aerosol in µm. This atomizer is equipped with a second relay to turn on the atomizer and indicator 5 as a marker that the atomizer is active. The atomizer is an atomizer with a working voltage of 24 V and a current of 100 mA.

The controller basically controls the starting and stopping of the heater, the blower, the HHO generator, and the atomizer. The controller also manages the sensor, dimmer, PWM, first relay, second relay, indicators, and display. Furthermore, controller maintained the temperature between 56-60°C while the therapeutic device was functioning. The controller is the AVR ATMega 328 controller, the working voltage is 5 V with a current of 200 mA.

NebulaX is also equipped with LCD display to show the initial status of the device, temperature of the air produced, etc. Indicator 1 and 2 is used as status indicator for the device, whether it is in standby mode or already finished.

Fig. 4 is showing the design of NebulaX in 3 dimensions.

V. Device Design

NebulaX working procedure and implementation are presented in the Fig. 5 and Fig. 6 respectively.

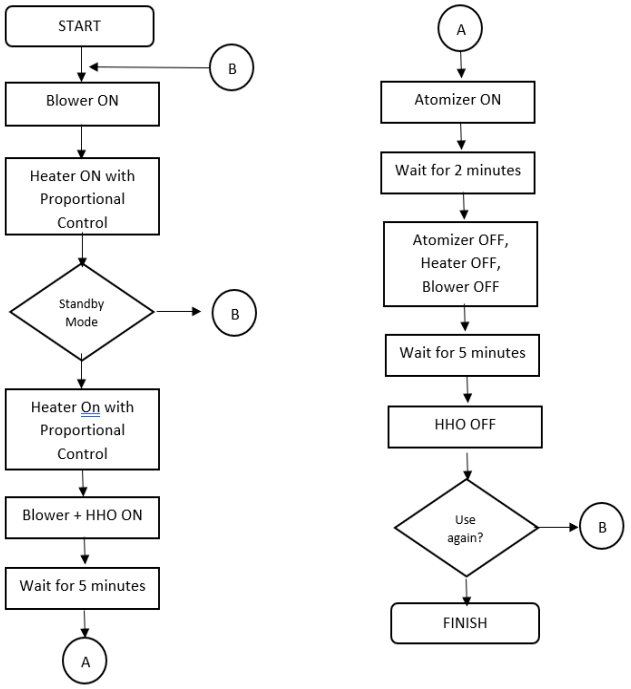

Fig. 5. NebulaX operational flowchart.

When the start button is pressed, electric power will be supplied to the appliance, the heater and blower turn on and a preparation time of approximately 3 to 5 minutes is required. After the green light on indicator 1 lights up, it indicates that the electric therapy device is ready for use. Then the start button is pressed, then the HHO generator starts to light up for approximately 5 minutes. The heater maintains its setting temperature (setting point). Then turn on the atomizer for about 2 minutes. After the 2 minutes are over, turn off the atomizer, blower and heater. Here, the HHO generator is still on and maintains this condition for approximately 5 minutes. After 5 minutes have ended, the red light on indicator 2 lights up indicating that the therapy process has been completed. For next use, we must wait until the red light on indicator 2 turns off and the green light on indicator 1 lights up, then we can press the start button.

In addition, the specification of NebulaX according to Fig 6. Can be described as follows:

- Weight Version 3.1 = 7.8 kgs
- Materials plat stainless, plastic ABS
- Dimension 32cm*15cm*30cm
- Display LCD 5”
- Control Unit AT Mega
- Standard Masker
- Temperature Sensor DS18B20
- Power 220 VAC (240 Watt)
- Function: Warm Oxygen 2 Liter/minute,
- Nebulizer 1cc/minute and Hydrogen Generator 160 mL/minute

Fig. 6. NebulaX Design 3.1 (2022)

VI. Conclusion

NebulaX is a therapeutic device against COVID-19 that combine three functions of therapies, which are sauna therapy, herbal therapy using nebulizer, and antioxidant therapy. This device claimed to be able to kill COVID-19 in human respiratory tract and help to prevent the spread of COVID-19 in Indonesia context. The dimension of NebulaX is suitable for handling in mobile. It is light and easy to use concerning the power. The idea of further research is connecting the NebulaX into Internet of Things mechanism for collecting data of people for datamining purposes.

Acknowledgment

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