

Investigation to the Effect of Cold Atmospheric Plasma on Corona virus as a Hygiene of Patient's Things

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ABSTRACT

Increasing the number of human infected by viruses around the world make some problems to the health care systems. Dealing with patients thinks is an important manner. The present work idea is to use cold atmospheric plasma in study the effect on the coronavirus. Samples of nasal had been used to the test. The samples were of people accident by the virus for certain time of examinations. Cold atmospheric plasma system used with argon as discharge gas in the experiments. PCR test made to all samples before and after exposure to plasma. Results show that the PCR test was negative after 6 minutes of exposure to the cold atmospheric plasma. Results leads to find a new fast novel method to sterilization or hygiene of patient things in simple way.

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INTRODUCTION

At the end of 2019 a severe acute respiratory coronavirus expanded globally and with the first quarter of 2020 all countries effected by the spread of this virus. Its effect on human life and the world witnessed a lot of deaths statues. The scientists made many studies as they could to find the way of disappeared and transmission. Also they tried to find the best ways for disinfection from this virus which can be pollute surfaces, air, and all used things. Physics is one of the science fields that contributes in a major manner in medicine and in human life. Many researches used application of physics in health. Such as investigation of heart electricity changes due to time of use of cell phone call,¹ studying the effects of radiation and measuring its concentrations in used human things such as wood.² Plasma physics take its place also. Cold atmospheric plasma is one of the main plasma physics fields. It has many applications in many important medical applications in dermatology, improve healing of infected and/or chronic, treat infective and inflamed skin diseases,³ treat or stop cancer cells diffusion.⁴ Cold atmospheric plasma used in treatment and deactivation of oral bacteria and showing possibility to be helpful in dental clinical applications as disinfection from bacteria.⁵ It was also found that plasma can be used to kill cancer cells by activated medium.⁶ Not stop in that, plasma can be used in plant growth by water treated with plasma discharges. This is due to that plasma make change water physicochemical properties.⁷ On viruses, and especially from the begin of respect coronavirus as pandemic, studies have been accelerated to find the helpful of plasma in this field. Many researches investigate that cold plasma can inactivate viruses.⁸⁻¹¹ Other study finds out that micro wave cold plasma could kill E. coli (negative bacteria).¹² In addition to all of that, cold atmospheric plasma found to inactivate COVID-19 on various surfaces such as plastic, leather.¹³ In the present research, a study to the effect of plasma on coronavirus samples collected from nasal samples of patients.

KEYWORDS: Cold plasma, Corona virus, Disinfection tool, Nasal, PCR test.

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METHOD

The importance of being aware of the virus and disinfection of all things around and used. Due to that this is a pandemic, and since the work needs to so aware, so the number of samples in the present work is 20. A medical specialist uses a swab to collect respiratory material samples found in patients nose. For each patient, four samples were taken, one to be tested to the assurance of the coronavirus positive test and the others to exposure to plasma source. In clinical lab the commonly used test is the "PCR assay," were done to all samples. PCR test which is a "polymerase chain reaction," is a specific type of nucleic acid test. It examines the amount of coronavirus' genetic material in samples. At medical lab, a long stick was inserted with a very soft brush on the end kind of like a pipe cleaner up nose and around for a few seconds. The PCR test then done at medical specialist lab by using certain chemical solutions or materials and enzymes and a thermal cyler. The thermal cyler increases traces of genetic material in the test tube at each heating and cooling step. After many cycles, millions of copies of a small portion of the virus's genetic material are present in the test tube. By using one of the chemicals in the tube, fluorescent light produced if the virus is present in the sample. Using special software to interpret the signal as a positive test result. The samples in the present study were of patients with positive test for different dates of examinations, sex, and ages. We use two samples for each patient test. The samples exposure time was 1 to 12 step 4 minutes. The cold plasma source was oxygen gas plasma in the laboratory with voltage 5 Kv and the design is the general system design.

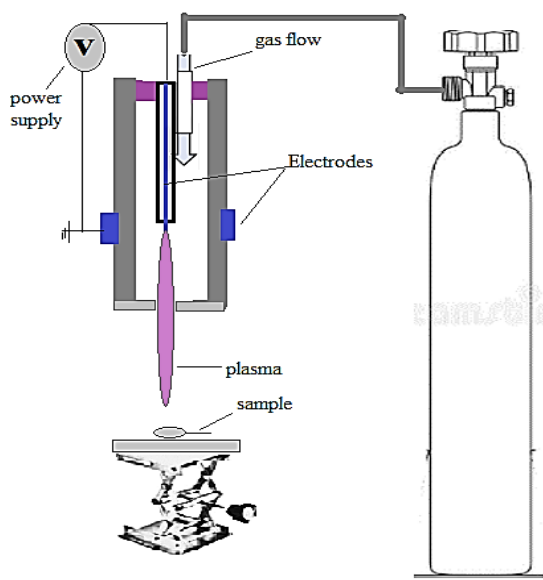


Fig. 1: A simple diagram to the cold atmospheric plasma system used in the work

Cold Atmospheric Plasma Jet

To make the exposure part, an atmospheric plasma jet was used for the process to produce cold plasma with argon gas at a constant voltage. Discharge gas which was Argon gas. The discharge gas is necessary to produce the generate plasma. Hollow tube of stainless steel with internal diameter 2 mm and length 3 cm. A meter connected to the tube which is of gas flow type to monitor the gas intake. Calibrator with flow 5 L/min. a high voltage source also used of D.C. supply of 10 kV voltage with a step frequency equal to 25 kHz. Figure 1 shows the cold plasma jet diagram.

RESULTS AND DISCUSSION

Nowadays, all the world works focus on the way of control on the corona virus pandemic. So researchers make tests and experiments to explain, understand or treatment from it. Table 1 the patient's information and PCR test.

From work and by notice the PCR test obtained, results show that at the beginning of exposure time there is no change in the virus. As the time of exposure was 6 minutes, the nasal

Table 1. The patient's information (sex, age) and the PCR Test before and after exposure to cold plasma

Sl. No.	Sex	Age	PCR before sample exposure to plasma	PCR after sample exposure to plasma
1	Female	35	+ve	-ve
2	Female	38	+ve	-ve
3	Female	33	+ve	-ve
4	Female	42	+ve	-ve
5	Female	39	+ve	-ve
6	Male	36	+ve	-ve
7	Male	35	+ve	-ve
8	Male	35	+ve	-ve
9	Male	40	+ve	-ve
10	Male	44	+ve	-ve
11	Female	43	+ve	-ve
12	Female	16	+ve	-ve
13	Male	50	+ve	-ve
14	Male	52	+ve	-ve
15	Male	38	+ve	-ve
16	Female	40	+ve	-ve
17	Male	41	+ve	-ve
18	Male	33	+ve	-ve
19	Female	33	+ve	-ve
20	Female	33	+ve	-ve

samples test shows no coronavirus in the PCR test. Which means, the cold atmospheric plasma ended the present of the virus in samples or reduced it to a value as little as that not significant. Increasing the time of exposure didn't change the test since it already (the sample) has no virus detection at time 6 minutes. The effect of cold plasma on the virus comes from the reactive species produced due to discharge of gas. These reactive species attack the virus cell, damage its surface by electrostatic disruption due to electrostatic force [14-15]. The electrostatic force may break open the virus cell membrane when exceeding the tensile strength of it. Increasing the reactive species will increase the effect on the virus activity and decrease the time of treatment. This can be done by increasing the gas discharge intensity. us to conclude that cold atmospheric plasma can be used as an efficient tool for disinfection of places, and things of people who are infected with coronavirus. Our results are in agreement with literatures used cold plasma in treatment with viruses. One note has to be said here is that the patients under our tests were not who under emergency. The work was not easy due to the danger of dealing with samples of coronavirus which is the most virus that attack world and causes millions of deaths in the world.

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