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ROLE OF DISINFECTANT IN REDUCING COVID-19 OUTBREAK

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ABSTRACT

The coronavirus disease (Covid-19) is a highly contagious viral infection caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which appears in Wuhan-China and Taiwan spread throughout the world. Genomic analysis revealed that SARS-CoV-2 was phylogenetically related to viruses carried by bats such as acute respiratory syndrome. Until now, bats are suspected as intermediaries from the spread of COVID to humans. Coronavirus is very fast to spread between humans to humans. There are no clinically approved antiviral drugs or vaccines against COVID-19. However, several broad-spectrum antiviral drugs have been tested against COVID-19 in clinical trials, resulting in clinical recovery. In order to reduce the spread of the COVID-19 virus, spraying disinfectants is carried out to sterilize the environment, goods and crowded places. However, at this time, there is a phenomenon of spraying disinfectants massively in various places, even directly to humans to kill the COVID-19 virus attached to clothes or the human body. This is very dangerous to human health because the side effects of the constituent disinfectants can cause side effects on the skin, eyes and breathing. So the use of disinfectant for the human body is not recommended.

KEYWORDS: Disinfectant, COVID-19, Coronavirus, Syndrome, Outbreak

1. INTRODUCTION

The coronavirus belongs to the coronaviridae family in the order of nidovirales. Corona stands for crown-like nails on the virus outer surface, and thus is called coronavirus. Coronaviruses are small (65-125 nm in diameter) and contain single stranded RNA as nucleic material, ranging from 26 to 32 kbs in length (Figure 1). In the family of coronavirus, the subgroups are: (a) alpha, (b) beta, (c) gamma, and (d) delta coronavirus. Coronavirus is a severe acute respiratory syndrome (SARS - CoV), H5N1 influenza A, H1N1 2009, and Middle East Respiratory Syndrome Coronavirus (MERS–CoV) that causes acute lung injury (ALI) and acute respiratory distress syndrome (ARDS) that leads to lung failure and death (Shereen, Khan, Kazmi, Bashir, & Siddique, 2020).

Animals are thought to be infected only until there is a serious outbreak of acute respiratory syndrome in Guangdong, China, caused by SARS-CoV in 2002 (Zhong et al., 2003). Only a decade later, another pathogenic coronavirus, called the Middle East Respiratory Syndrome Coronavirus (MERS - CoV) causes endemic disease in Middle East nations. More recently, the developing business center in Wuhan, China,

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experienced a new coronavirus outbreak at the end of 2019, killing more than 1,000,800 people and infecting over 70,000 people during the first 50 days of the epidemic. This virus is reportedly a member of the Coronavirus group B. Chinese researchers have named the novel virus the Wuhan coronavirus.

In the human body Covid-19 will multiply over an incubation period of 3 - 7 days and even up to 14 days. As long as an infected human body's immune system is sufficient, Covid-19 will die on its own (self - limiting disease). The International Committee for Virus Taxonomy (ICVT) names the SARS-CoV-2 virus, and the outbreak of Covid-19. Historically, in 26 countries around the world, SARS-CoV (2003) infected 8,098 people with a mortality rate of 9 per cent. In comparison, the coronavirus novel (2019) infects more than 9.3 million individuals with a mortality rate of 5.2% in 215 countries. That suggests that the transmission rate of SARS-CoV-2 is higher than that of SARS-CoV and the reason may be that a genetic recombination event in S-protein RBD region in the SARS-CoV-2 may have increased transmission capacity (Lai, Shih, Ko, Tang, & Hsueh, 2020).

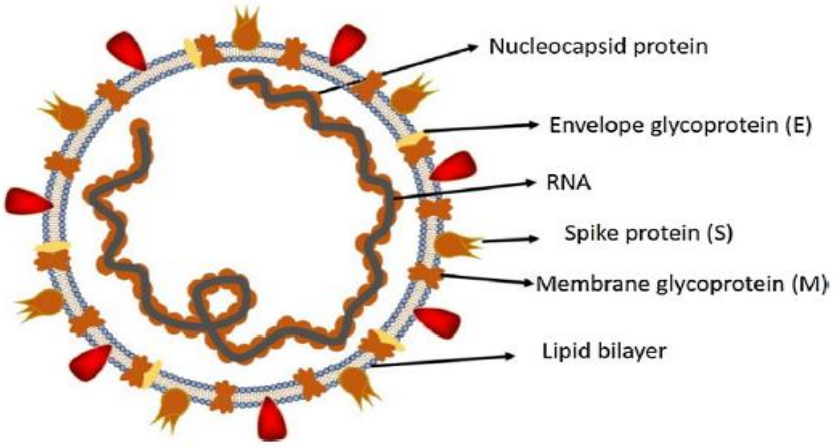

Figure 1. Structure of the Corona Virus Infecting the Human Respiratory Tract (Shereen et al., 2020)

Today, no specific antiviral medication has been recommended for Covid-19 therapy. The efforts can be made to prevent the spread (transmission) of the virus by washing hands with soap or hand sanitizer more often with running water, avoiding touching the face area, if coughing and sneezing are covered with upper arms or handkerchiefs, avoiding crowds and applying lifestyle clean and healthy or healthy living community movement. One way to break the chain of transmission of Covid-19 is to maintain cleanliness by killing the Covid-19 before the coronavirus infects humans. Various methods include using antiseptics to wash hands and body parts, and disinfectants that are sprayed or rubbed on various inanimate objects that may be exposed to the virus. However, at this time, there is a phenomenon of massive disinfecting

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spraying in various places, even directly to humans with the reason to kill viruses that may be attached to clothes or the human body. This is very dangerous to humans due to the side effects caused by disinfecting compounds.

In addition to washing hands using soap or hand sanitizers (Golin, Choi, & Ghahary, 2020) and spraying disinfectants for public places and the human body, efforts to prevent the spread (transmission) of the coronavirus can also be by consuming nutritious food. Eating a balanced nutritional diet is four healthy five-perfect meals with two to five servings of fruits and vegetables a day is an effort to maintain the immune system against Covid-19 infection. So that efforts are made to fight the spread of the coronavirus from individual human beings by maintaining nutritional intake for the body, adequate rest, and keeping a distance when in the crowd (social distancing).

This paper reviewed the characteristics of the coronavirus, the spread system, and the role of disinfectants in reducing the Covid-19.

2. DISCUSSION

2.1 Characteristics of Corona Virus

Coronavirus is a member of the subfamily Coronavirinae in the family Coronaviridae and the order of Nidovirales (International Committee on Virus Taxonomy, ICTV). There are four generations of alphacoronavirus, betacoronavirus, gammacoronavirus, and deltacoronavirus in this subfamily. Based on the genome structure and the phylogenetic relationships (Figure 2). Only mammals are caused by alphacorona and beta coronavirus. Birds are infected by gammacoronavirus and deltacoronavirus viruses but some can also infect mammals. Alphacorona and betacoronavirus viruses typically cause human respiratory disease, and animal gastroenteritis.

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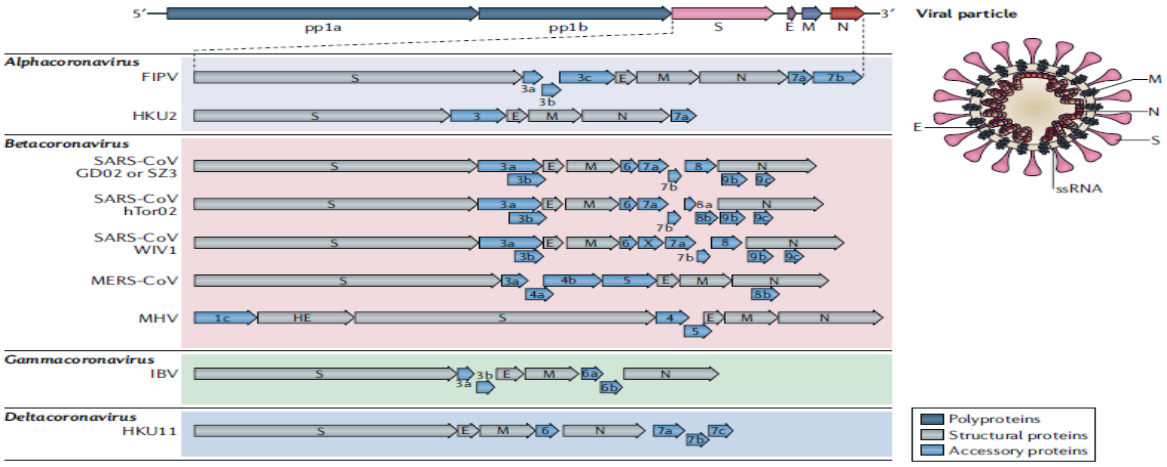

Figure 2. Genomes, genes, and proteins of different coronaviruses (Cui, Li, & Shi, 2019)

Two highly pathogenic viruses, SARS-CoV and MERS-CoV, cause severe human respiratory syndrome, and four other human coronaviruses (HCoV-NL63, HCoV-229E, HCoV-OC43, and HCoV-HKU1) induce only mild upper respiratory disease in immunocompetent hosts, although some may cause severe infection in babies, young children, and elderly people (Chan & Chan, 2013). Alphacorona and betacoronavirus viruses can cause severe animal disease burden including swine viral gastroenteritis transmission, swine epidemic diarrhea virus (PEDV) and swine acute diarrhea coronavirus syndrome (SADS-CoV). Based on the current order database, all human coronaviruses are of animal origin: SARS-CoV, MERS-CoV, HCoV-NL63, and HCoV-229E are thought to be carried by bats; HCoV-OC43, and HCoV-HKU1 are likely from rats.

As an intermediate host, pets may play an important role in triggering the transition of viruses from natural hosts to humans. Pets themselves may also suffer from diseases caused by batons or closely related coronaviruses: genomic sequences very similar to the PEDV found in bats, and the current spillover of bats for pig is SADS-CoV (Figure 3). Alphacoronavirus is currently assigned to 7 out of 11 species of ICTV, and only 4 out of 9 species of betacoronavirus are known to occur in bats. Hence, bats are likely to be the primary natural reservoir for alphacoronavirus and betacoronavirus viruses.

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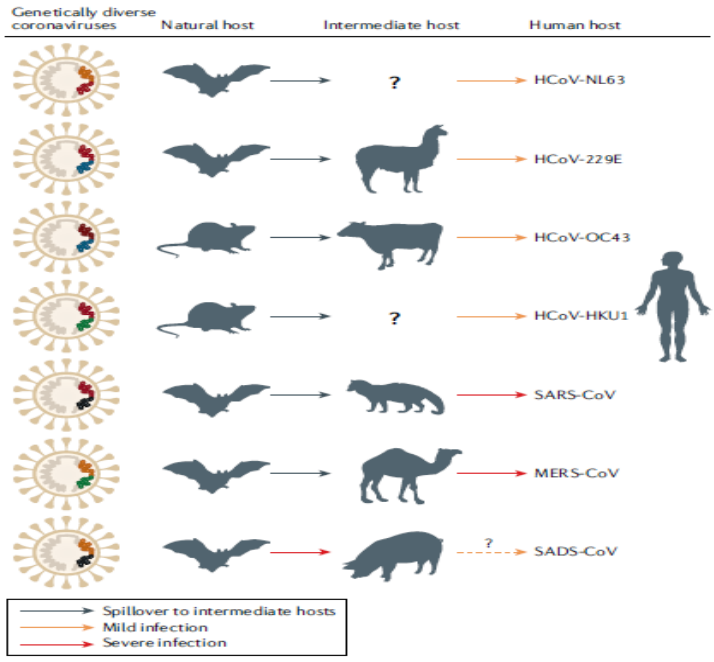

Figure 3. Animal Origins of the Human Corona Virus (Cui et al., 2019)

One way to prevent the coronavirus from being infected is by washing your hands or using a hand sanitizer. The alcohol contained in a hand sanitizer can kill bacteria or viruses.

Alcohol destroys bacteria and viruses, divides bacterial cells into pieces, or disrupts cell metabolism. At least 30 percent of alcohol can kill pathogens. Alcohol kills a variety of bacteria and viruses when the concentration exceeds 60 percent and will work faster when the concentration increases. But it can be even more effective if the alcohol content in the hand sanitizer reaches 90 to 95 percent. Even so, hand sanitizer is not enough to eradicate the gutters in hand. The best way a person can do to spread the infection and reduce the risk of disease is to wash hands regularly for 15 seconds.

2.2 Corona Virus Disease (COVID-19) Outbreak in Human

In 2003, the Chinese population infected with viruses in Guangdong Province triggered a serious acute respiratory syndrome (SARS). This virus has been confirmed as a member of the SARS-CoV betacoronavirus subgroup. Infected patients experience symptoms of alveolar pneumonia causing acute respiratory distress syndrome (ARDS). SARS first appeared in Guangdong, China, and then spread

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quickly to over 8,000 people all over the world. Several Saudi Arabians were diagnosed with another coronavirus ten years later in 2012. The virus detected has been confirmed as a coronavirus member and is referred to as the Middle East Respiratory Syndrome coronavirus (MERS - CoV) (Rahman & Sarkar, 2019).

The world health organization reports that more than 2428 people have MERS coronavirus and 838 deaths. MERS-CoV is a subset of betacoronavirus components that are phylogenetically different from other human CoVs (Omrani et al., 2013). MERS - CoV infection starts with mild upper respiratory injury, and severe breathing problems are caused by growth. Patients with MERS coronavirus, similar to SARS coronavirus, suffer from pneumonia, followed by Acute Respiratory Distress Syndrome (ARDS), and kidney failure. The WHO was recently notified by the Chinese government at the end of 2019 of several cases of foreign pneumonia. The outbreak started in Wuhan, China, and rapidly infected over 50 people. In the Hunan Seafood Market, live animals such as bats, frogs, snakes, ducks, guinea pigs, and rabbits are frequently sold.

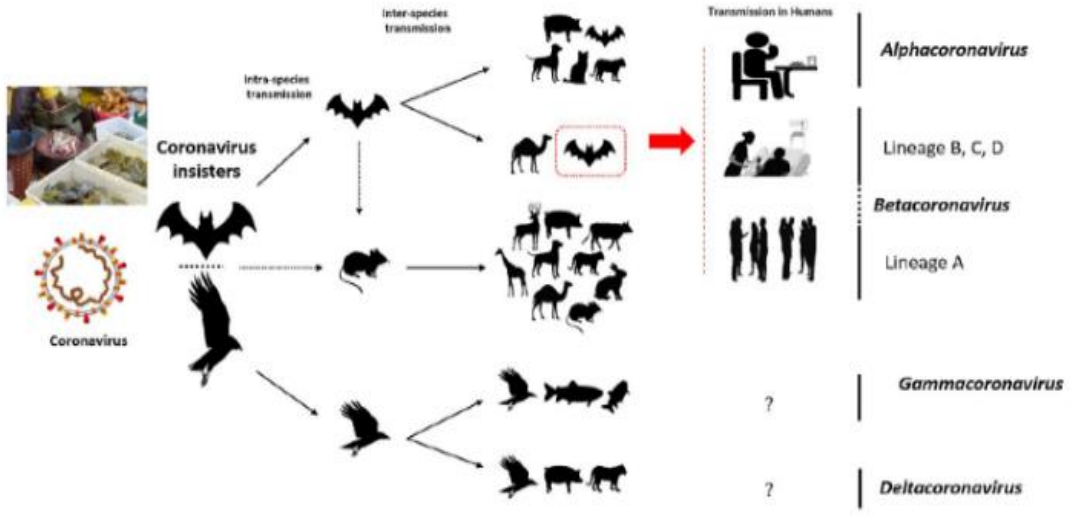

Figure 4. Key Reservoir and Corona Virus Transmission (Shereen et al., 2020)

Further details about the epidemic were released by the Chinese National Health Commission on 12 January 2020, suggesting viral pneumonia. The virus was identified as novel from the analyzes based on the isolated sequence of patients. Genetic sequences are actually also provided for the diagnosis of viral infections. Initially, it was suggested that patients infected with coronavirus induced pneumonia in China may have visited the seafood market where live animals were sold or possibly used as food source for infected animals or birds. Further investigations into coronavirus, however, revealed that some people

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contracted the infection without even visiting the marine food market records. These observations show the human capacity to spread this virus to humans, which was later reported in more than 100 countries around the world. Human to human virus spread occurs due to close contact with an infected person, being exposed to coughing, sneezing, breathing droplets, or aerosols. This aerosol can penetrate the human body (lungs) via nose or mouth inhalation (Figure 4).

It is important to be aware that sources of origin and transmission are determined to develop strategies for infection prevention. In the SARS-CoV case, the researchers initially concentrated on raccoons and ferrets as the main source of infection. However, on the food market only samples isolated from ferrets showed positive results for viral load identification, indicating that ferrets may be secondary hosts. A sample was collected in 2001 from safe molecular tests in Hong Kong and Taiwan showing a frequency level of antibodies against SARS coronavirus of 2.5 per cent. These indications suggest that prior to an outbreak in 2003, the SARS coronavirus could circulate in humans. Later, it was also found that Rhinolophus bats have anti-SARS-CoV antibodies which suggested bats as a source of virus replication.

Middle east respiratory syndrome (MERS) coronavirus first appeared in 2012 in Saudi Arabia. MERS-coronavirus is also associated with betacoronavirus and has camels as a source of primary hosts or zoonoses. In a recent study MERS coronavirus was also found in bats Pipistrellus and Perimyotis, indicating that bats are the virus medium's main host and transmitter. Initially, a group of researchers suggested the snake was a possible host, however, after the similarity of the genome The discovery of the new Corona Virus with a bat virus similar to SARS supports the claim that not snakes but only bats could be key reservoirs. Further study of the recombined homolog showed that only SARS-CoV (CoVZXC21 or CoVZC45) and Beta-CoV, which were not yet identified, had formed a receptor binding to the surge in coronavirus glycoproteins.

2.3 The Role of Disinfectant in Reducing COVID-19 Outbreak

One way to break the chain of transmission of Covid-19 is to maintain cleanliness by killing the Covid-19 virus before it infects humans. Various methods include using antiseptics to wash hands and body parts, and disinfectants that are sprayed or rubbed on various objects that may be exposed to the virus. However, at this time there is a phenomenon of massive disinfecting spraying in various places, even directly to humans with the reason to kill viruses that may be attached to clothes or the human body.

Antiseptics are chemical compounds used to kill or inhibit the growth of microorganisms in living tissue, such as skin surfaces and mucous membranes, to reduce the likelihood of infection, sepsis or putrefaction (Balan et al., 2017). Some antiseptics are true germicides that can destroy microbes (bacteriocides) while others are bacteriostatic, preventing or inhibiting their growth. Antiseptics are often used to clean wounds, to sterilize hands before performing actions requiring sterility (e.g. povidone-iodine, potassium

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permanganate, hydrogen peroxide, alcohol). Hand sanitizers usually have antiseptics, such as alcohol at 60-70%. In antiseptics the level of the active ingredient is much lower than in disinfectants.

Disinfectants are chemicals used to prevent or destroy microorganisms (for example, in bacteria, viruses, and fungi excluding bacterial spores) on the surface of objects, such as furniture, rooms, and walls (Solon & Killeen, 2019). Disinfectant is not used on the skin or mucous membranes, because it risks irritating the skin and potentially triggering cancer. This is distinct from antiseptics designed to disinfect the surface of the skin and the mucous membranes. To clean the surface of objects, disinfectants can be used by rubbing the disinfectant solution on the contaminated part, for example on floors, walls, table surfaces, doors, electrical switches. The use of spray or fogging techniques to disinfectants has been used to control the amount of antimicrobials and viruses in high risk rooms.

UV light with a specific wavelength is normally used in rooms which are difficult to reach. This mechanism can prevent pathogenic microorganisms from being transferred from object surfaces to humans. For example, sodium hypochlorite, quaternary ammonium (a type of cationic detergent), 70% alcohol, and hydrogen peroxide are several recommended disinfectant products for disinfection. Pay attention to the label instructions for use, so that the product can be used efficiently and safely. It should be noted, the concentration of disinfectant used and the contact time between objects and disinfectants (between 1 to 10 minutes depending on the type of disinfectant).

It is important to use of gloves and ensure good ventilation to reduce exposure when using disinfectants. The COVID-19 virus is known to have a viral wall layer composed of a lipoprotein envelope that wraps RNA inside. So that this virus can die, it takes materials that can damage the envelope and the material inside. This envelope cannot be destroyed with water alone, so it needs another ingredient, namely alcohol or surfactant according to WHO's recommendations. Environmental Protection Agencies (EPA), an environmental protection agency, has released a total of 351 preparations that can be used as disinfectants to kill viruses including human coronavirus complete with effective contact times.

Materials that can be used as disinfectants to kill coronaviruses include tannols, sodium hypochlorite, hydrogen peroxide, and quaternary ammonium. Ethanol with a minimum concentration of 60% is known to dissolve lipids or fats from the walls of the virus so that the virus will be damaged. Because ethanol is able to dissolve with water, it is very beneficial because it can dissolve viruses whose envelopes are water soluble (nonlipophilic virus). Chlorine class materials (for example chlorine dioxide, sodium hypochlorite, hypochlorous acid) can kill viruses by entering through the walls of the virus and will damage the inside of the virus. Chlorine has the risk of interfering with breathing when inhaled and causes shortness of breath to irritate the lungs, according to the amount of chlorine inhaled. Benzalkonium chloride, a class of cationic surfactants which is currently widely used in disinfectant liquids, is also capable of damaging the

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walls of the virus. When inhaled can also cause danger in breathing and some people can experience allergic reactions or recurrence of asthma.

Hydrogen peroxide (H2O2) is a powerful oxidizing agent that can damage the walls of the virus and be able to damage the material inside (Timchak & Gitis, 2012). Excessive use of hydrogen peroxide will irritate skin damage. The joint use of hydrogen peroxide (1%) and peracetic acid (0.08%) is also effective for damaging the walls of the virus. Ozone gas as an alternative disinfectant that can kill bacteria (Cegolon et al., 2014). Indeed, ozone is a toxic gas for humans which in high concentrations can cause dry mouth, coughing, headaches, and suffocation. Therefore, the use of ozone must be equipped with a monitor to monitor the concentration of ozone in the air.

The safe dose of ozone in the air is less than 0.3 ppm, with a maximum duration of 15 minutes. Air must be kept moist because the presence of water molecules can cause the formation of hydroxide radicals and can also bind with air nitrogen which in turn forms corrosive nitric acid. Therefore, the use of ozone as a disinfectant must consider air humidity (must be dry), ozone levels, duration of exposure, and carried out in a closed room. Some of these compounds, intended for disinfectant means to be applied to the surface of inanimate objects to reduce the number of contaminants from viruses or microorganisms attached.

A disinfectant spraying activity directly to humans (directly or through disinfection booths) or on the environment, certainly not good and still doubt the benefits (Manning et al., 2020). The risk that is accepted by humans as a sprayed target is very large such as the side effects that occur on the skin, eyes, and breathing because it is not controlled how much is exposed. Future hazards must also be considered. All chemicals that are spilt or intentionally discharged into the environment, whether by air, water or soil will experience interlocking movements. When the disinfectant is sprayed into the air, it will fall to the ground if there is rain falling, then some will be carried through the rainwater or soak into the ground.

This disinfectant is mostly broad spectrum, meaning that it not only kills the Covid-19 virus that is being targeted but can also kill other microorganisms that should be present in the environment, for example, those needed to break down waste. This will disturb the environmental balance. The microorganism in charge of decomposing disinfectant chemicals was also dead and extinct so that disinfectants will be longer in the environment. The remaining disinfectant in the soil or water, will be absorbed by plants and follow the food chain that is too small animals that eat plants, large animals, and to humans. If this disinfectant can bind to the fat on its predatory body, there will be a buildup in the body. Humans as plant and animal eaters will probably accumulate more.

Disinfecting agents can also change the genetic characteristics of microbes that are exposed and do not die, to mutate microbes, so that the environmental balance becomes chaotic. For example, benzalkonium

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chloride in nature can be deposited in the soil and will be able to be dissolved again and absorbed by plants. Chlorine, too, will be able to interact with aromatic benzene compounds to form polychlorinated benzene (PCB) which has a very long time to stay in nature and even a yearly count because it is difficult to decompose. Based on this study, it is necessary to reseat the disinfectant function, which is intended for objects such as furniture, floors, cabinets, table surfaces, and door handles and is not imposed directly on humans. WHO also states that spraying alcohol or disinfectants will harm humans and will not effectively kill the virus.

3. CONCLUSION

Spraying disinfectants to humans, plants and animals directly is not recommended. This is not only ineffective, but it is also feared that it will disrupt the microorganism ecosystem in the environment. The use of a chamber for spraying with disinfectant directly to humans is not recommended, except using an antiseptic liquid that has been ensured to be safe and protect parts of the body that are exposed to exposure. Spraying disinfectants on the environment need to be considered by limiting the number and area of sprayed, such as rooms that require sterility in hospitals. The best way to use disinfectants is to directly wipe on objects, such as the surface of tables, chairs, door handles, elevator buttons, etc. which are thought to be susceptible to the COVID-19 virus.

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REFERENCES

Balan, G., Grigore, C. A., Budacu, C. C., Calin, A., Constantin, M., & Luca, C. M. (2017). Antisepsis, Desinfection Sterilization-mehods used in dentistry. Revista de chimie, 68(1), 186-191.

Cegolon, L., Salata, C., Piccoli, E., Juarez, V., Palu, G., Mastrangelo, G., & Calistri, A. (2014). In vitro antiviral activity of hypothiocyanite against A/H1N1/2009 pandemic influenza virus. International journal of hygiene and environmental health, 217(1), 17-22.

Chan, P. K., & Chan, M. C. (2013). Tracing the SARS-coronavirus. Journal of thoracic disease, 5(Suppl 2), S118.

Cui, J., Li, F., & Shi, Z.-L. (2019). Origin and evolution of pathogenic coronaviruses. Nature Reviews Microbiology, 17(3), 181-192.

Golin, A. P., Choi, D., & Ghahary, A. (2020). Hand Sanitizers: A Review of Ingredients, Mechanisms of Action, Modes of Delivery, and Efficacy Against Coronaviruses. American Journal of Infection Control.

ISSN: 2582-6271

Vol.1 No.3; 2020

Lai, C.-C., Shih, T.-P., Ko, W.-C., Tang, H.-J., & Hsueh, P.-R. (2020). Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and corona virus disease-2019 (COVID-19): the epidemic and the challenges. International journal of antimicrobial agents, 105924.

Manning, E. P., Stephens, M. D., Patel, S., Dufresne, S., Silver, B., Gerbarg, P., . . . Sharma, L. (2020). Disinfection of N95 Respirators with Ozone. medRxiv.

Omrani, A. S., Matin, M. A., Haddad, Q., Al-Nakhli, D., Memish, Z. A., & Albarrak, A. M. (2013). A family cluster of Middle East Respiratory Syndrome Coronavirus infections related to a likely unrecognized asymptomatic or mild case. International Journal of Infectious Diseases, 17(9), e668-e672.

Rahman, A., & Sarkar, A. (2019). Risk factors for fatal middle east respiratory syndrome coronavirus infections in Saudi Arabia: analysis of the WHO Line List, 2013–2018. American journal of public health, 109(9), 1288-1293.

Shereen, M. A., Khan, S., Kazmi, A., Bashir, N., & Siddique, R. (2020). COVID-19 infection: Origin, transmission, and characteristics of human coronaviruses. Journal of Advanced Research.

Solon, J. G., & Killeen, S. (2019). Decontamination and sterilization. Surgery (Oxford), 37(1), 51-57.

Timchak, E., & Gitis, V. (2012). A combined degradation of dyes and inactivation of viruses by UV and UV/H2O2. Chemical engineering journal, 192, 164-170.

Zhong, N., Zheng, B., Li, Y., Poon, L., Xie, Z., Chan, K., . . . Xie, J. (2003). Epidemiology and cause of severe acute respiratory syndrome (SARS) in Guangdong, People's Republic of China, in February, 2003. The Lancet, 362(9393), 1353-1358.