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Impact of copper and Emerging Technologies against Novel Coronavirus ⋆

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Abstract

Coronavirus belongs to the novel virulent strains of the respiratory viruses. It is an invisible enemy having significant threats to human health. The major trouble is that the spread of coronavirus is not limited to its transmission from human to human (by contact, fomites, and droplets) but also continue to transmit from contaminated surfaces to humans. These infectious viruses can survive in different non- biocidal materials for a long time. Copper holds a significant position in different biological and biochemical processes because its ions Cu^{+2} and Cu^{+} can carry out oxidation, dioxygen transportation, and electron transference. It is a redox-active metal. It can convert into Cu^{+2} or Cu^{+} state by accepting or donating electrons. Reactive Oxygen Species (ROS) are generated on alloy surfaces. The redox reaction of copper ($Cu^{+2} \leftrightarrow Cu^{+}$) along with the generation of ROS results in enhanced inactivation of the virus. In this review, the effectiveness of copper against coronaviruses has been explained. The denaturing of specific proteins of coronavirus by the interaction of copper and its ions has also been reported. Hence, the copper coated surfaces could be used in public areas. Furthermore, the review represents the different techniques used for the coating of copper on conductive and non-conductive surfaces.

Keywords: SARS-CoV-2; anti-covid agents; COVID-19 respiratory disease; efficacy of vaccine

1 Introduction

Viruses are small intracellular infectious agents or microorganisms. The viral genome consists of DNA or RNA strands coated by a protective, virus-coded protein [1]. Treatment of the infectious

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disease, named as COVID-19, is facing the crisis point [2]. Coronavirus belongs to an animal virus family cause the human disease. There are different types of human coronaviruses which are generally categorized according to their severity and spreading range. According to the opinion of researchers, there are about seven different kinds of the coronavirus which can infect the humans. The most common of these kinds include HKU1 (beta coronavirus), OC43 (beta coronavirus), NL63 (alpha coronavirus) and 229E (alpha coronavirus). Some rare types that can cause severe infections include MERS-CoV (Middle East Respiratory Syndrome) and SARS-CoV (Severe Acute Respiratory Syndrome). SARS-CoV is not new as it broke out first in South China and later in Hong Kong [3, 4]. It turned into pandemic between November 2002 and July 2003 with 8, 273 cases and 775 human loses worldwide. Within weeks, SARS spread from Hong Kong to 37 countries [5]. After 10 years, MERS-CoV appeared in the Kingdom of Saudi Arabia (KSA) in 2012. On 7 February 2014, there were 182 total confirmed cases, out of which 79 (43%) were in critical condition. MERS-CoV belongs to the family of SARS-CoV having a comparable positive sense and a single-stranded RNA genome. The genome structures of single-stranded SARS and MERS-CoV and their transmission routes has been shown in Figure 1 [6]. In the year 2019, a new virus called SARS-CoV-2 broke out, triggering the spread of coronavirus disease 2019 or COVID-19. The curse of this identified virus spread too rapidly worldwide. This virus has not only received wide media coverage but also the attention of scientists. In December 2019, the occurrence of COVID-19 was first recognized in Wuhan, Hubei, China. The World Health Organization (WHO) on 11 March 2020 identified the COVID-19 as a pandemic [7]. Its transmission rate is very high as compared to that of the previous coronavirus. The main spread is due to close contact with others, respiratory droplets discharge, and by touching a contaminated surface. The risk increased when someone has close contact with animals. The calamity is that the virus does not show its symptoms in the first few days. The incubation period of the virus inside the human body is about 4-7 days. The infected person (during the time of incubation of the virus) keep on visiting different places, touching the surfaces, and remain in contact with people. It gets very late when the person develops the symptoms of infection. Till that time, the virus is delivered to many places, communities, or even to family members. When other people touched these contaminated places, the infectious virus transfers to the facial mucosa. Also, if we are using futile cleaning agents, they may leave behind the residual virus particles that again cause infection [8].

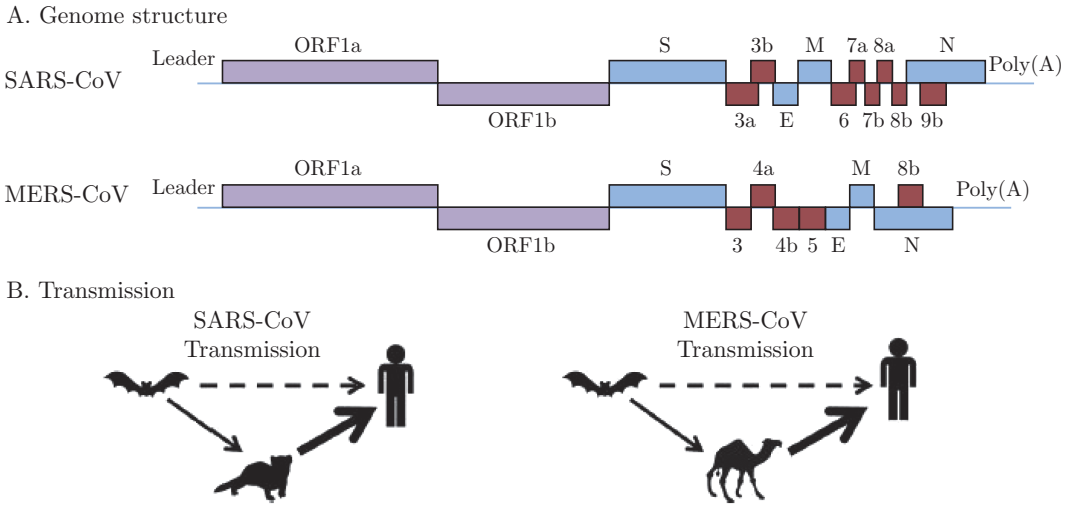

Fig. 1: Genome structures of single-stranded SARS and MERS-CoV and their transmission routes [6]