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Opinion

Silver and Copper Nano Particles in Mask for Corona Virus-19 Protection

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ISSN: 2637-8019

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Submission: September 08, 2020
Published: September 24, 2020

Volume 3 - Issue 2

How to cite this article: Sayani Maji*, Arpita Biswas, Supradip Mandal, Dhrubo Jyoti Sen. Silver and Copper Nano Particles in Mask for Corona Virus-19 Protection. Glob J Endocrinol Metab. 3(2). GJEM. 000556. 2020.
DOI: 10.31031/GJEM.2020.03.000556

Abstract

To prevent the community transmission people are used N-95 mask or simple mask. The diameter of the corona virus is 6 to 140nm. So, this mask can't prevent entry of this virus. So, a new redesigned mask is prepared, 'CORO-X' for the making of the mask nanoparticles are used. Total three layers are present in this mask. First and third layer is simple filtration layer and the second layer is nano particle layer where metals like silver and copper are present. Nano particles contain more surface area compare to microparticles. Polymer adsorption properties play important role to destroy the virus.

Keywords: Mask; Nanoparticle; Silver and copper; Polymer adsorption

Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) as the name of the new virus on 11 February 2020. Since the nineteenth century, silver & copper-based compounds have been used in many antimicrobial applications. Nanoparticles have been known to be used for numerous physical, biological, and pharmaceutical applications. Silver nanoparticles are being used as antimicrobial agents in many public places such as railway stations and elevators in China, and they are said to show good antimicrobial action Figure 1.

Figure 1: Mask.

Silver is a transition element of d-block having CAS: 7440-22-4. Copper is also a transition element of d-block having CAS: 7440-50-8. It is a well-known fact that silver ions and silver-based compounds are highly toxic to microorganisms which include major species of microorganisms. This aspect of nano particles makes it an excellent choice for multiple roles in the medical field. Silver is generally used in the nitrate form to induce antimicrobial effect, but when silver nanoparticles are used, there is a huge increase in the surface area available for the microbe to be exposed to. It has been hypothesized that silver nanoparticles can cause cell lysis or inhibit cell transduction. There are various mechanisms involved in cell lysis and growth inhibition.

NPs (Nano particles), due to their large surface to volume ratio and crystalline structure, trigger biological responses different from those produced by the traditional ionic form of the metals. Moreover, metallic NPs were found to have

A. 7-50 times less toxic effect to mammalian cells than their corresponding ionic forms and

B. prolonged effect as a source of elements in an organism.

How works this mask?

N95 Respirators: An N95 respirator is a respiratory protective device designed to achieve a very close facial fit and very efficient filtration of airborne particles. The N95 designation means that when subjected to careful testing, the respirator blocks at least 95 percent of very small (0.3micron) test particles. If properly fitted, the filtration capabilities of N95 respirators exceed those of face masks. However, even a properly fitted N95 respirator does not eliminate the risk of illness or death. An N95 respirator is a respiratory protective device designed to achieve a very close facial fit and very efficient filtration of airborne particles. Note that the edges of the respirator are designed to form a seal around the nose and mouth. Surgical N95 Respirators are commonly used in healthcare settings and are a subset of N95 Filtering Facepiece Respirators (FFRs), often referred to as N95s. The similarities among surgical masks and surgical N95s are: They are tested for fluid resistance, filtration efficiency (particulate filtration efficiency and bacterial filtration efficiency), flammability and biocompatibility.

They should not be shared or reused. When virus come into the contact of the mask from environment or any infected person, it passes easily through the first layer. Then contact with nanoparticle's layer. In this layer virus are destroyed by three ways:

A. Metal create a free radical like -OH ion and it is toxic for virus's cell.

B. Metal combine with N, O, S in the cell of virus to damage it by chelation.

C. Metal also damage the electron transport chain because both silver and copper belong to transition element having d-block. And finally, through 3rd filtration layer people can inhale less harmful air.

The silver ($_{47}Ag^{108}$: [Kr] $4d^{10}$ $5s^1$) ion is bioactive and in sufficient concentration readily kills bacteria *In-Vitro*. Silver ions interfere with enzymes in the bacteria that transport nutrients, form structures, and synthesise cell walls; these ions also bond with the bacteria's genetic material. Silver and silver nanoparticles are used as an antimicrobial in a variety of industrial, healthcare, and domestic application: for example, infusing clothing with nanosilver particles thus allows them to stay odourless for longer. Silver-infused fabric embeds the silver directly into the fibre rather than giving them a surface treatment this results in the use nanoparticles instead of conventional silver - nanoparticles release at the right rate to keep a thin silver film on the fabric, preventing a bacterial foothold. Nano-silver particles will not dissolve in water, but will increase their activity, and produce silver ions through slow-release, the bactericidal effect is even better making our nano silver face masks antibacterial. Nanosilver has become one of the most widely used nanomaterials in consumer products because of its antimicrobial properties. Silver nano particles works against bacteria only in ion form - it must lose an electron to become positively charged. Silver ions pierce through the external surfaces of the cells and damage their DNA, as well as the protein structure, halting their metabolism and reproduction until they die. After the cells have become inactive, silver ions leave but continue to act against microbes, delivering a constant antimicrobial performance with no toxicity or side effects. Silver nanoparticles (Ag NPs) are well-known antimicrobial materials effective against many types of bacteria and fungi. The antibacterial and antifungal activities of Ag NPs are mainly due to the inhibition of respiratory enzymes by released Ag^+ ions. Recently, the antimicrobial activities of Ag NPs against viruses such as HIV-1, hepatitis B, herpes simplex, respiratory syncytial, monkeypox, Tacaribe, and H_1N_1 influenza A virus have also been investigated. Unlike its antibacterial and antifungal activities, the major antiviral mechanism of Ag NPs is likely the physical inhibition of binding between the virus and host cell. A dependence of the size of Ag NPs on antiviral activity was observed for the viruses mentioned above; for example, Ag NPs smaller than 10nm specifically inhibited infection by HIV-1. This property of Ag NPs holds promise that antimicrobial materials based on Ag NPs will be effective against many types of bacteria, fungi, and viruses Figure 2.

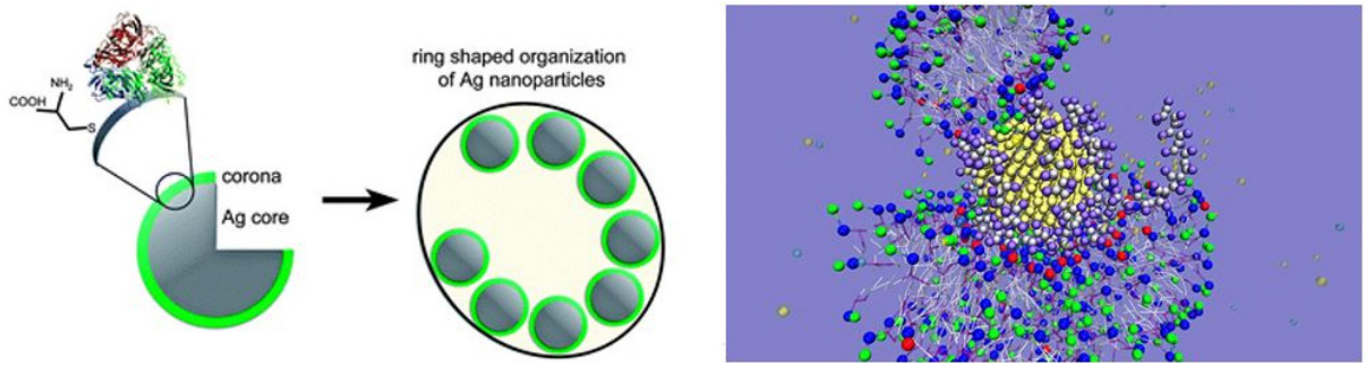

Figure 2: Ag NP technology.

As the number of confirmed cases of COVID-19 continues to rise sharply in the U.S., the Centers for Disease Control and Prevention is now recommending that people wear face coverings when out in public. The new guidance to wear a nonmedical "basic cloth or fabric mask" is voluntary but it represents a shift for the CDC, which previously said that healthy people who aren't caring for someone who is sick don't need to wear face masks to protect themselves from the novel coronavirus. The World Health Organization continues to stand by its previous advice, that medical masks be used by healthcare workers in health facilities and by people in the community who are sick and those caring for them. But while noting that research to support widespread mask use in communities is limited, the organization now says it is looking into the issue more deeply. The CDC announcement came after a growing number of health experts began suggesting that we should all be wearing masks of some kind. Government has advised all residents to wear face covering when out in public even before the CDC changed its guidance. Public health experts have also emphasized that the potential benefit of wearing a face covering is not for your own protection but to safeguard others around you. "This is to protect people around you if you are infected but do not have symptoms," according to the CDC website. "If you put a mask on someone who is ill, they are less likely to spread the virus to others," says Tom Frieden, M.D., a former director of the CDC. "That includes people who don't have symptoms. Natural Silver's ion properties have a proven long-standing reputation as an effective way to resist and kill more than 650 kinds of harmful bacteria. Natural Silver works against bacteria only in ion form - it must lose an electron to become positively charged $Ag \rightarrow Ag^{+} + e^{-}$. Silver ions pierce through the external surfaces of the cells and damage their DNA, as well as the protein structure, halting their metabolism and reproduction until they die. After the cells have become inactive, silver ions leave but continue to act against microbes, delivering a constant antimicrobial performance with no toxicity or side effects.

Silver-infused fabric embeds the silver directly into the fibres rather than giving them a surface treatment this results in the use nanoparticles instead of conventional silver - nanoparticles release at the right rate to keep a thin silver film on the fabric, preventing a bacterial foothold. Nano-silver particles will not dissolve in water, but will increase their activity, and produce silver ions through slow-release, the bactericidal effect is even better. If you are healthy, you only need to wear a mask if you are taking care of a person with suspected viral infection. Wear an Antibacterial face mask if you are coughing or sneezing to prevent the spreading of the Virus. Disposable face masks cannot block all pathogens and do not kill them making a discarded mask a route for disease as the pathogens multiply in its fibers. Washable, reusable masks with silver ions and anti-pathogen properties could provide a potent prevention tool against Viral Infections.

Viruses invade living cells in your body and penetrate the nucleus of the same cell and make the cell reproduce virus instead of healthy cells. It's this very subversive way of hijacking your healthy cells to do its dirty work that causes the deadly symptoms because it destroys your healthy cells. In the Coronavirus, it specifically targets the cells in your lungs which are known to have ACE2 receptors (which makes them the prime invasion point) and cause debilitating symptoms. That results in some seriously deadly forms of pneumonia which shows up as shortness of breath and difficulty breathing. Having pneumonia go untreated is like dying from slow suffocation as your body is gradually being starved of much needed oxygen.

The newly reproduced virus will then make its way into your circulatory system via bloodstream which then makes you even sicker as it replicates copies of itself and destroys healthy cells in the process. When a virus first invades a cell, part of the living cell reverts into its more primal cellular state and cell structure. The oxygen metabolizing enzyme in the cell wall also similarly becomes a primal form of itself which is then chemically able to react with the incoming colloidal silver. As a result, the primal form of the oxygen metabolizing enzyme then gets killed off by starving it of its ability to receiving oxygen, which also in-turn kills off the virus' self-replicating process within minutes. Yes, if you can get the colloidal silver to the area of infection, you give yourself a fighting chance of getting the virus replication under control.

Copper [$_{29}Cu^{63.5}$: [Ar] $3d^{10}$ $4s^{1}$]. A copper nanoparticle is a copper-based particle 1 to 100nm in size $Cu \rightarrow Cu^{2+} + 2e^{-}$. Copper ions pierce through the external surfaces of the cells and damage their DNA, as well as the protein structure, halting their metabolism and reproduction until they die. After the cells have become inactive, silver ions leave but continue to act against microbes, delivering a constant antimicrobial performance with no toxicity or side effects.

How do silver & copper nanoparticles work as an antiviral?

Silver & Copper nanoparticles interact with HIV-1 based on their size. Silver & Copper particles were tested found to be able to bind with the virus and show an ordered spatial alignment and have the capacity to be indeed virucidal depending on their size. In other words, to be effective virus-disablers, there needed to be sufficient small sized silver particles that would effectively create a "cap" that inhibited the virus from infectivity. Although a typical solution of colloidal silver contains nano particles as well as ionic silver, it was the nanoparticles that proved 12 times more useful in the inhibition of viruses, versus ionic forms, at concentrations were at about 0.44 to 0.91mg/mL. Colloidal Copper & silver is so effective in being antiviral that its effects are still present 12 hours after cell infection with a HIV virus, which makes it a prime candidate for being a broad-spectrum antiviral agent not prone to pathogenic resistance. Virus are of two types (pathogenic & non-pathogenic). Pathogenic virus only can create pandemic outbreak in environment.

In a nutshell, colloidal silver & copper particles, when generated at a low constant current will yield particles at such small sizes that they are perfect to attach themselves to viruses and disable their ability to replicate themselves with any host cell. This is truly nanotechnology working with medical science and it could save us

from trying to outwit constantly evolving bacteria and viruses [1-4].

How did Asian countries contain the coronavirus so fast?

Asian countries that have been successful in containing the virus without locking down society, such as Hong Kong, Singapore, and Taiwan, routinely use masks. As of March 17, 2020, the three countries together claim to have fewer than 1,000 cases of the coronavirus - despite having close connections to China's Hubei province, where the epidemic originated and exploded late last year. There are many explanations for this success, including the rapid recognition of the threat, swift application of lessons learned during the 2002 SARS outbreak, and widespread testing and strict isolation of confirmed cases. But masks are also used routinely for protection against infectious diseases in these countries, and universal mask use is part of their coronavirus guidance. In Taiwan, masks are such an important first line of defence that artificial intelligence is used to create live maps of local supplies of face masks so that citizens know where to get them.

Who should wear a mask?

Since the beginning of the COVID-19 outbreak, public health authorities have advised us that masks are not necessary and should not be used by the public for protection against the rapidly spreading virus. While it is true that medical surgical masks should be prioritized for use by medical professionals at greatest risk for infection, the rest of us can and should wear other protective face coverings. There are compelling scientific reasons for this.

3.4.1.In the media the guardian: Masks are effective at capturing droplets, which is a main transmission route of coronavirus, and some studies have estimated a roughly fivefold protection versus no barrier alone (although others have found lower levels of effectiveness).

If you are likely to be in close contact with someone infected, a mask cuts the chance of the disease being passed on. If you are showing symptoms of coronavirus, or have been diagnosed, wearing a mask can also protect others. So, masks are crucial for health and social care workers looking after patients and are also recommended for family members who need to care for someone who is ill - ideally both the patient and carer should have a mask.

Conclusion

In the crusade towards the development of drugs for the therapy of viral diseases, the emergence of resistant viral strains and adverse side effects associated with a prolonged use represent huge obstacles that are difficult to circumvent. Therefore, multidisciplinary research efforts, integrated with classical epidemiology and clinical approaches, are crucial for the development of improved antivirals through alternative strategies. Nanotechnology has emerged giving the opportunity to re-explore biological properties of known antimicrobial compounds, such as metals, by the manipulation of their sizes. Metal nanoparticles, especially the ones produced with silver or gold, have proven to exhibit virucidal activity against a broad-spectrum of viruses, and surely to reduce viral infectivity of cultured cells. In most cases, a direct interaction between the nanoparticle and the virus surface proteins could be demonstrated or hypothesized. The intriguing problem to be solved is to understand the exact site of interaction and how to modify the nanoparticle surface characteristics for a broader and more effective use. Besides the direct interaction with viral surface glycoproteins, metal nanoparticles may gain access into the cell and exert their antiviral activity through interactions with the viral genome (DNA or RNA). Furthermore, the intracellular compartment of an infected cell is overcrowded by virally encoded and host cellular factors that are needed to allow viral replication and a proper production of progeny virions. The interaction of metal nanoparticles with these factors, which are the key to an efficient viral replication, may also represent a further mechanism of action.

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