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Could silver nano-particles control the 2019-nCoV virus? An urgent glance to the past

Seyyed Amir Siadati,[a,*] Mohsen afzali,[b] and Mehdi Sayadi[b]

[a] *Department of Chemistry, Qaemshahr Branch, Islamic Azad University, Qaemshahr, Iran*
[b] *No.702, Navab st, Azadi st, Tehran, (P.O.BOX: 14195-371) Iran*

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ABSTRACT

2019-nCoV, this tiny crowned virus, which was first spread from Wuhan, China, killed thousands of peoples in China, Italy, Iran, and Spain, in a very short period of time. Now, it reaches to most countries all around the world, and thus, it becomes one of the most important threats against all human race. The fact is, the outbreak of this virus showed us, how much our science about the new viruses is weak and insufficient. In the near future, we have to revolutionary increase our knowledge about viruses and controlling those species.

Due to the recent reports about the effect of silver nanoparticles (AgNPs) (in vitro and in vivo) on corona virus family especially influenzas, in this study, we have made attempts to take a glance on the effect of AgNPs on the viruses, and ask ourselves "*may nano particles inhibit the 2019-nCoV?*".

1. Introduction

Scientific researches reveal about the unique nature of nanoparticles in developing novel diagnostic and antimicrobial agents by these tiny materials [1,2]. As the amazing effects of nanoparticles in a wide range of applications like using in biosensors, bio-labels, and cancer treatment are recognized, the attention of scientists for potential use of those nano-scale materials for other medicinal operations increases [3].

The antimicrobial properties of metal nanoparticles especially for the case of silver element, have received a considerable attention due to the physicochemical properties of those in bioactivities [4]. As described in following, the silver nano particles (AgNPs) have shown significant antimicrobial effects and were also considered as an option for antiviral activations [5].

Despite the fact that the amount of investigations on the interaction between different types of AgNPs with viruses is limited, a number of reports revealed about this important issue. For example, the Interaction of AgNPs with HIV-1 was investigated as the AgNPs inhibit the virus from binding to host cells, demonstrated in vitro [6]. Another report claimed that AgNPs show anti-HIV activities at an early stage of viral replication; via binding to gp120, somehow it prevents CD4-dependent virion binding, fusion, and infectivity. It results in acting as an effective virucidal agent against both cell-free and cell-associated viruses. On the other hand, the report says, AgNPs would inhibit the post-entry stages of the HIV-1 life cycle [7]. Also, the in vitro and in vivo study for potential application of AgNPs in controlling the infectivity of Rift Valley fever virus (RVFV) was performed by Borrego and colleagues [8].

A report revealed that respiratory syncytial virus could be interacted by a modified AgNPs 44% efficiency [9] which leads that to be a candidate for further studies as a

∗ Corresponding author. e-mail: Chemistry_2021@yahoo.com (Siadati)

candidate to be used against the mentioned virus. In another report, Lu, and co-workers discovered that AgNPs are able to inhibit the formation of intracellular HBV RNA. The AgNPs with mean diameters of approximately 10 nm and 50 nm were synthesized by from AgNO3 in HEPES buffer. The in vitro anti-HBV activities of those particles were determined using the HepAD38 cell line as the infection model [10]. In addition, a report describes that AgNPs capped with mercaptoethane sulfonate are effective in inhibition of herpes simplex virus type 1 [11]. Based on in vitro experiments, another paper demonstrated the effect of AgNPs in inhibition of monkeypox virus plaque formation [12].

It also added, that understanding the mechanism of silver-containing nanoparticles to exhibit anti-viral properties may be a function of the size, concentration, and cellular interaction (or shape of crystal) of the nanoparticle. In one of the last recent reports, the in vivo effect of AgNPs in controlling the Respiratory syncytial virus Infection was published in *Viruses* journal [13]. Also, the studies show that the antiviral effect of AgNPs is based on the binding of those to the viral particles. Thus, inhibiting the virus from binding to host cells leads to this situation [14-16].

2. Effects on influenzas

In our view, one of the first scientific reports about the control of influenza by AgNPs was about the experiments performed by Xiang and colleagues [14]. They revealed that those nanoparticles could inhibit H1N1 influenza virus (a common member of corona family) in vitro. They claimed that AgNPs have anti-H1N1 influenza A-virus activities. They also, said that inhibitory effects of AgNPs on influenza A virus could be a new clinical strategy for the prevention of influenza virus infection.

In 2013, Xiang and co-workers investigated the in vitro and in vivo effect of AgNPs in inhibition of H3N2 influenza virus [15]. They claimed mice treated with AgNPs showed a lower level of lung viral titer and less pathologic lesions in lung tissue, and also had a marked survival benefit in vivo. Those results provided evidences about beneficial effects in preventing H3N2 influenza virus infection both in vitro and in vivo. The results clearly showed that AgNPs are able to be used as potential therapeutics for inhibiting outbreaks of influenzas.

Also, in 2013, Gaikwad and colleagues investigated the antiviral activity of mycosynthesized AgNPs on human parainfluenza virus type 3. They found out the AgNPs are able to reduce the viral infectivity, via blocking interaction of the virus with the target cell, which may depend on the size and zeta potential of those nanoparticles. They revealed that the maller-sized nanoparticles were able to inhibit the infectivity of the viruses [16].

As given in the literatures, silver ions are capable of forming complexes with especial electron donor groups containing sulfur, oxygen, nitrogen, and phosphorous which exist in amino acids and nucleic acids, and thus inhibit post-entry stages of infection by blocking some proteins of viruses. Also, some reports debate about the clinical trial use of these nanoparticles [17]. Even in ancient times, silver had been using for medicinal applications without probable knowledge about existence of microbes. In addition, reports indicate that silver ions have been employed as an antimicrobial for several millennia.

Those claim that the allergy is rare, and resistance has not become clinically significant [18]. Also, it must be mentioned that some reports on dose-dependent animal toxicity findings revealed that at high level of concentrations, problems may occur [19]. Finally, they suggest that the effects induced by particulate silver are mediated via silver ions that are released from the particle surface into the targets. Thus, due to their data regarding toxicity and average human dietary exposure, Margin of Safety (MOS) calculations indicated at least a factor of five before a level of concern to the general population is needed [20].

3. Conclusion

This study is presented as an urgent suggestion for further investigation the potential use of AgNPs as a candidate for probable inhibition of 2019-nCoV by related medicinal researchers. The reports which were investigated above reveal that some types of AgNPs have been used for both in vitro and in vivo inhibition of fungus, bacteria, and viruses. Especially, in some reports, researchers used this nano-scale material for inhibition of corona virus family like H1V1, and H3N2 influenzas. On the other hand, some reports debated about the clinical trial or even clinical use of AgNPs for a variety of treatments. Also, some reviews mentioned that silver element was applied as an effective agent for a wide range of treatment in ancient medicine. It is suggested that at least the potential of silver nano particles as well as many non-hazard nano metals and nano metal oxides (by especial dosages) could be

considered (by related scientists) as candidates for inhibition of 2019-nCoV.

Conflict of interest

The authors declare that there is no conflict of interest.

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