Promising Contributions of Nanotechnology in Fight against COVID – 19

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Abstract

The World Health Organization (WHO) declared COVID -19 a pandemic on March 11, since then, scientists have been working tirelessly to develop drugs and vaccines against it. Unfortunately, yet there is no approved drug or vaccine available for the treatment of the virus. More so, developing effective antiviral and vaccine against COVID – 19 remains a major challenge. However, numerous NPs is known to have possessed an inherit antiviral effect and they have been utilized as a promising carrier for effective targeted delivery with low side effect/adverse effect. Perhaps, exploring the concept of nanotechnology in battling COVID – 19 will ensure an excellent therapeutic prognosis. The review focus on emphasizing the need to explore the concept of nanotechnology as a gold possibility that could potentiate the world to win the fight against COVID - 19. **Keywords:** COVID-19, nanomedicines, and nanotechnology

Introduction

Coronavirus is single-stranded RNA viruses, zoonotic and pleomorphic, having the diameter range of 100–160 nm. The virus named “corona” due to the resemblance of its spikes with the crown (monarch’s ornamental cap). Coronavirus (COVID – 19) out-broke in December 2019 at Wuhan Seafood Wholesale Market in China. The disease spreads rapidly, it transformed from epidemic to pandemic in a short period.

According to WHO COVID-19 situation report 152, the global population of total infected people as of today hits 8.75M with the mortality of 463,000 respectively.

However, scientists’ have lunched several investigations to establish medical countermeasures to mitigate the spread and its fatality rate. Moreover, several clinical trials are ongoing, but up to date; there is no clinically approved vaccine or medication designed to treat COVID-19 infection. Meanwhile, employing the concept of nanotechnology can open pathways that could lead to the designations of highly effective nanomaterials that will mitigate the COVID-19 spread at various grounds.

Fig 1: WHO COVID-19 situation report, 20 June 2020

Role of synthesized nano-silver colloids

Zachar et al., synthesized nano-silver colloids (NAGC) and proved that the formulation can effectively **arrest the early stages of respiratory bacterial and viral infections** including; hospital ventilator-associated pneumonia (VAP) and SARS-CoV-2 (COVID-19) (2). More so, AgNP-based nanomaterials could be alternatives to aid the mitigation of COVID-19 spread because of surface contamination (2). The potential anti-viral efficacy of NAGC on human coronavirus (SARS) seems promising from tests done on silver-impregnated nonwoven material by Swiss manufacturer HeiQ, as noted in Fig.2

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Study ID	Agent	Log reduction			% reduction	
		Control	Viroblock	Improvement	Control	Viroblock
798-110	H1N1 (Human Influenza A)	3.63	5.38	>50x more effective	99.9766%	99.9996%
798-111	H5N1 (Avian Influenza A)	2.86	4.86	100x more effective	99.862%	99.999%
798-112	229E (Human Coronavirus)	2.90	4.48	>30x more effective	99.874%	99.997%
798-114	H7N9 (2013 Influenza A)	1.93	4.24	>200x more effective	98.825%	99.994%
798-115	RSV (Respiratory Syncytial Virus)	1.40	3.10	>50x more effective	96.02%	99.92%
798-116	Mycobacterium terrae (ATCC 15755)	0.26	1.98	>50x more effective	45.05%	98.95%

Figure 2: Antiviral efficacy test, ISO 18184 test standard

Graphene Oxide-Silver Nanocomposites (GO-AgNPs Comp)

Ting DU et. al., reported that GO-AgNPs comp with adequate and good water solubility and high stability were successfully manipulated by interfacial electrostatic self-assembly method. The antiviral activity of the as-prepared GO-AgNPs comp against porcine reproductive and respiratory syndrome virus (PRRSV) was investigated and two possible molecular mechanisms were proposed. Detection of the titer and protein expression of the virus showed that GO-AgNPs had stronger antiviral activity than AgNPs and GO at the same concentration. Besides, the experimental results showed that GO-AgNPs comp also had antiviral activity against PEDV (another RNA virus), which means that GO-AgNPs comp might be a broad-spectrum virus inhibitor and this could be explored in repositioning the therapy against novel coronavirus (COVID 19) (2)

Fig 3: Viral cellular entry blocking mechanism of GO-AgNPs a

Conclusion

An ideal nanoparticle discovery pipeline would enable scientists to design novel drug, vaccines and protective materials effective against the contagious coronavirus and other pathogenic diseases

References

1. Ting Du, et al. *Antiviral Activity of Graphene Oxide-Silver Nanocomposites by Preventing Viral*. ACS Appl. Bio Mater, 2018.
2. Zachar et al. *Formulations for COVID-19 Early Stage Treatment via Silver Nanoparticles Inhalation Delivery at Home and Hospital*. Science open preprint, 2020.
3. *Antiviral efficacy test (ISO 18184): Nonwoven material for disposable face masks treated with HeiQ Viroblock NPJ03 has been tested according to ISO 18184 standard..*