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Influence of nanotechnology to combat against COVID-19 for global health emergency: A review

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ABSTRACT

Covid 2019 is spreading and emerging rapidly all over the world as a new social disaster. This virus is accountable for the continuous epidemic that causes severe respiratory problems and *pneumonia* related to contamination of humans, which leads to a dangerous condition of life. Due to the increasing threatening number of cases all over the world, the world health organization (WHO) declared coronavirus as a global health emergency. The pandemic disease affected nearly 80 million people positive cases were reported worldwide till now and cause the death of more than 1.7 million people. The virus has novel characteristics types of pathogens. Many clarifications are done and much more are still unknown and pending. The collaborative research will be useful during this pandemic time in order to meet the improvement of global health improvement. It will also help to know about the knowledge of this COVID-19. Recent advancements in nanotechnology proved that they can help in the production of vaccines in a brief timeframe. In this review, the requirement for quick immunization improvement and the capability and implementation of nanotechnology combat against coronavirus disease were discussed.

1. Introduction

The worldwide health framework comprises a system of associations that includes numerous private and general health divisions working at various provincial or worldwide levels that have built up a stringent structure that can protect the people effectively against rising and re-emerging maladies. Although mortality related to different irresistible ailments have diminished currently and the worldwide future has expanded in numerous parts of the world even though the danger of this pandemic disease still remains as one of the major worldwide difficulties and concerns still now as the most important and overall task even today [1]. The emerging microbes which are Zika, Chikungunya, MERS and SARS, influenza are responsible for the increasing assortment of contaminated diseases [2].

Coronavirus is an outbreak disease which was first emerged in Wuhan City, Hubei Province, China [3]. Most of the nanotechnology licenses on coronaviruses have focused on the diagnostics, vaccines, and treatment procedures against sicknesses due to these contaminations [4]. Human coronavirus (HCoVs) is a critical social threat that is acknowledged as respiration microbes related to lung and abdominal impurities and pneumonia. The beta coronaviruses, a Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) first emerged in Guangdong Province, China in 2003. Also, the Middle East Respiratory Syndrome Coronavirus (mers-CoV) diseases erupted in 2012 in the Middle East and realized high pathogenicity to individuals, who showed the contamination once. This virus has been transferred from animals species to humans. These two

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diseases were acknowledged to be evoked from bats and right now are transferred to individuals (Fig. 1), [5].

Sustainable development is a new concept to play a vital role in the growth of societies [6]. Reasonable economic loss on one hand of the scale and the improvement in air quality on the other may fundamentally affect the future plan of this world [7]. The COVID-19 is one of the most genuine difficulties since there has not been a lot of investigation concerning this issue [8]. Even though the comprehension of COVID-19 is constrained, a breakthrough in research facility bio care was presented by the WHO [9]. As a result of their outcomes, they made a few suggestions for avoiding more causes of this infection. The Hubei territories in China have opted to environmental for some significant elements such as temperature, wind speed, etc. The outcomes of the results were showed the relative stickiness and most extreme day by day high temperature had the strongest effect on the affirmed cases [10]. Having topographical nearness and a high volume of exchange with China, Vietnam was relied upon to have a high danger of transmission. More than 1,123, 024 individuals have been tainted with more than 59, 140 lives lost on April 4, 2020, as per the Global COVID-19 Tracker Map at John Hopkins University [11].

The fast virus spread and seriousness of the new illness have incited World Health Organization to refresh its articulation, structure characterizing the flare-up as a 'General Health Emergency of International Concern' on January 30 to a 'Pandemic' on March 11 [12]. In worldwide, over 80, 675, 736 people were infected, and 1, 764, 185 people died from coronavirus. The coronavirus affecting people considering the wonder of pre-lockdown alarm purchasing, in force in the United State, yet also to certain different nations, for example, France or Germany, nourishment instability and product lack have become genuine concerns. The social reaction can be seen from different gatherings, including private, business related, and casual gatherings. In enormous urban communities, places of business look measure to keep from the infection such as by disinfecting the entire structure or checking individuals' temperatures, safety measuring. This part of the asset justifies as much consideration from the governments [13].

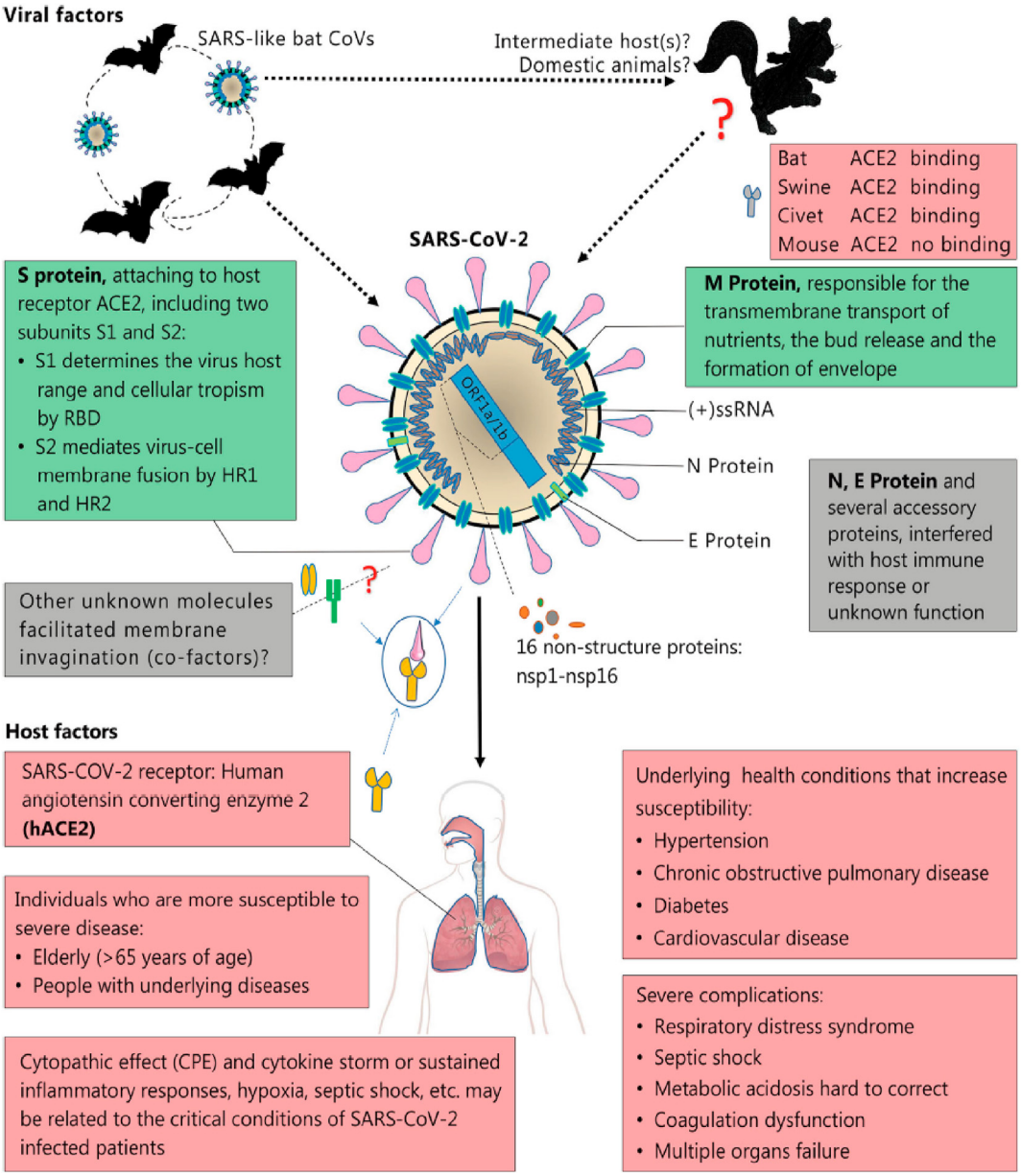


Fig. 1. Origin and transmission of coronavirus. Reprinted with permission from Ref. [28].

1.1. Viral nanoparticles

Viral contaminations are one of the main sources of dreadfulness and mortality in worldwide and which is one of the main purposes behind the huge economic losses [14,15]. Viral particles are the most tolerant and smart nanoparticles because it has in every case excitedly featured their basic attractive feature of nanoscale and their organic progeny in moving their hereditary substance into target cells and grab them to express of proteins. Table 1 shows that infections are transformative attraction and in the fields of quality treatment, vaccine, and immunotherapy (to give some examples), researchers are engineering and utilizing viruses for smart delivery of molecules and hereditary data [16].

2. Transmission of COVID-19

At present Covid-19 diseases are mostly spread through the direction of respiratory tract. An on-going report shows that SARS-CoV-2 diseases can be spreads through the fecal-oral route. But still it is not sure that the route of transmission of infection and also (Fig. 1) still there is no proof that SARS-CoV-2 can be transferred across vaporizers or mother to infant in the prenatal period [27].

Frequently the human to human transmission occurs with the intimate connection. The transmission of disease first occurs through the respiratory droplets of different sizes (>5–10 μm in diameter) or when the contaminated individual coughs in the same way as the spread of flu and other respiratory pathogens. These droplets are can settle in the entrance or indistinct mucosa and lungs by taking breaths in the air. At present, it is not clear whether an individual can be contaminated by COVID-19 by getting in touch with pollute the surface and subsequently touching their nose, mouth, or perhaps eyes [29,30]. Nanoparticles can benefit these pathogens even before they break into the body, as they clutch various objects and surfaces. The lab has created materials that can be spread on objects and enter into the structure of nanoparticles and attack the infections [31]. The target of this examination was to examine the effect of nanotechnology on COVID-19.

2.1. Origin and history of COVID-19 (global distribution of COVID-19 cases)

Towards the end of 2019, COVID-19 spread in a few nearby medical clinics in Wuhan, Hubei Province, China. Usually, the SARS-CoV-2 was insulated in natural examples of the Huanan Seafood Marker by disease control and prevention of CDC, inferring the source of the epidemic [2]. SARS-CoV-2 was first confined to three COVID 19 affected people from Wuhan Jinyin Hospital on December 30, 2019 [32]. All CoV are pleomorphic RNA infections naturally having peak form peplomers with a size in the range of 80–160 nm and 27–32 kb positive extremity. After a long year SARS this time, one of the more exceptionally pathogenic CoV has emerged in the Middle East countries [33].

Coronaviruses were provided their names based on the crown-like projection on their surfaces. The word 'crown' in the Latin language denotes 'halo' or 'crown'. Human Corona Viruses (HCoV) were firstly described in the duration of the 1960's in the noses of the patient with the regular virus. These are responsible to a greater extent to the normal virus. Two human coronaviruses are responsible for an enormous extent of common colds OC43 and 229E [3]. From the beginning, a pneumonia case was distinguished on December 12, 2019, and possible influenza and other coronaviruses were managed by inquiring about lab testing. Chinese experts have isolated the kind of coronavirus on January 7, 2020 (novel Coronavirus, nCoV) [29,34].

Table 1
Antiviral activity is studied by different types of nanomaterials.

Sl. No.	Nanomaterials	Name of the virus	Methods of synthesis	Ref.
1.	Ag NPs	HIV-1	Chemical co-precipitation	[17]
		Hepatitis	Reflux route	[18]
		Influenza virus H_1N_1	Polyol route	[19]
		Coronavirus	Microwave-assisted	[20]
		SARAS-CoV-2	Chemical	[21]
2.	TiO_2 NPs	H_9N_2	Microwave- assisted	[22]
		Influenza A virus	Sol-gel	[23]
3.	Fe_3O_4	SARAS-CoV-2	Microbial	[24]
4.	Au NPs	HSV-1	Green route	[25]
5.	Chitosan	Hepatitis-C	Green route	[26]

2.2. Classification of SARS-CoV-2

SARS-CoV-2 classifications are following [35].

Family	:	Coronaviridae
Subfamily	:	Orthocoronavirinae
Order	:	Nidovirales
Suborder	:	Cornidovirineae
Genus	:	*Betacoronavirus*
Subgenus	:	*Sarbecovirus* (resemble bat coronavirus)
Species	:	*Severe Acute Respiratory Syndrome*- related to *coronavirus* SARS-CoV-2.

2.3. Coronavirus structure and shape

The principal reports of neurotic discoveries from extreme COVID-19 cases were demonstrated the pneumonic respective di-utilize alveolar injury with cell fibromyxoid exudates. The right lung was demonstrated the apparent desquamation of pneumocytes arrangement of hyaline membrane and showed suffering from breathing disorder [36]. COVID-19 was brought about by SARS-CoV-2 a beta coronavirus. It includes a solitary abandoned of Ribonucleic Acid (RNA) structure. Investigate the arrangement of SARS-CoV-2 has demonstrated a structure of normal to that of different coronaviruses (Fig. 2). The genome was connected with the SARAS virus [37]. The run of the nonexclusive coronavirus genome is a solitary strand o RNA, 32 kilobases long, and it's the biggest known RNA infection genome.

Coronaviruses have the most elevated known recurrence of recombination of any positive-strand RNA infection, indiscriminately joining hereditary data from various sources when a host is polluted with different coronaviruses. At the end of the day, these infections transform and change at a high rate, which hinders indicative discovery and treatment (and immunization) regimens [38]. In people, coronaviruses were assumed to cause gentle respiratory diseases until the distinguishing proof of SARS-CoV-2 and MERS coronavirus (MERS-CoV) Table 2. Although the specific pathophysiological systems have hidden the development of SARS-CoV-2 (because of pending research facility preliminaries), genomic similarities to SARS-CoV could assist with clarifying the subsequent incendiary reaction that can be prompt the beginning serious of pneumonia [39].

Comparing these three coronaviruses, SARS-CoV-2 is very dangerous to people, and till it cannot be controlled, many death cases and researchers are struggled to identify the drugs against this virus and it's created economic problems worldwide.

2.4. Symptoms

The transportation of 2019-nCoV is regularly spread from individual to individual through the breathing droplets and it is created for the period of hacks or wheezes from an infected individual. It is spread predominantly from human to human through the cough. It is yet obscure whether the infection spread uniquely through human contact. The hatching time changes from 2 to 14 days after contamination. The symptoms may include are following:

Very common symptoms are

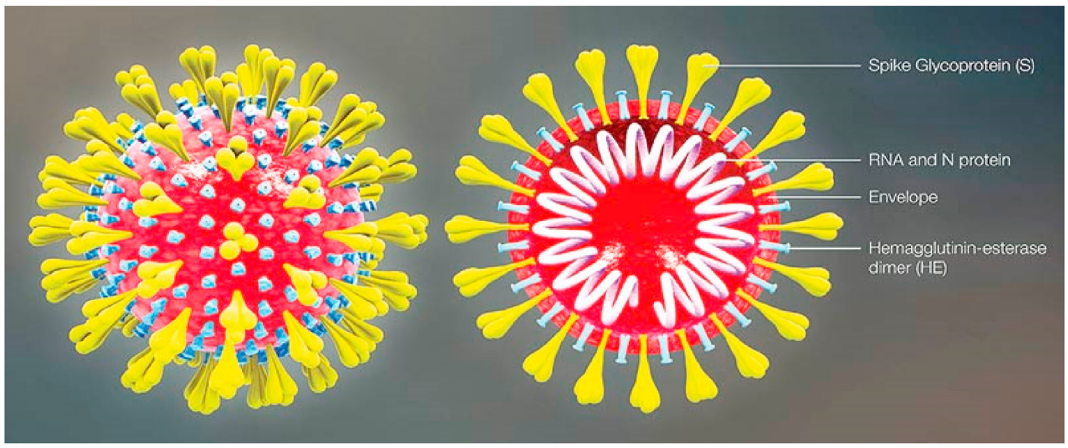


Fig. 2. Structure of nCoVID-19. Reprinted with permission from Ref. [38].

Table 2
Comparison between SARS, MERS, and COVID-19 [40].

	SARS	MERS	COIVD-19
Pathogens	SARS –CoV	MERS-CoV	SARS –CoV-2
Transmission	Sneeze, cough, breath or talk	From human to human,	Droplets formed by cough, sneeze, or talk
Period of incubation	2–7 days	–	2–14 days
Symptoms	A dry cough at first with fever, diarrhoea in the first or second week and illness (or both weeks)	A cough, a fever and shortness of breathing	A dry cough, a fever and shortness of breathing
Under risk categories	Persons with causal medical conditions	Group of men beyond the age of 60, (high blood pressure, mostly diabetes and kidney failure persons)	Group of adult's age of 65 ages and all persons with casual medical conditions.
Treatment	Not any	Not any	Not any
Vaccine	Not any	Not any	No vaccine while quite a few applicant vaccines are in progress

➢ A fever
➢ A dry cough
➢ Fatigue

Rare symptoms are

➢ Body pains
➢ Sore throat
➢ Difficult to speak
➢ Conjunctivitis
➢ Diarrhoea
➢ Loss of flavor or loss of odor
➢ Headache
➢ Rashes on skin, or discoloration of toes or fingers

Severe symptoms

➢ Difficult to breathe or shortness of breathing
➢ Loss of speech or movement
➢ Chest pain or pressure

2.5. *Diagnosis*

In all, AI (Artificial Intelligence) is used to identify the track forecast outbreaks and it is helping to diagnose the virus. It is also utilized for preparing in medical care claims. The robots are utilized to convey food and medication supplies just as in sanitizing public spots. AI is assisting with creating drugs and COVID immunization utilizing great PCs [41]. Computerized reasoning can be portrayed as Machine Learning (ML), Natural Language Processing (NLP), and Computer Vision applications. These capacities are taught PCs to utilize immense data based on the models to configuration, portray, and foresee. The general pandemic of COVID-19 altogether challenges open clinical structures. With confined clinical resources, treatment needs are constrained by the seriousness of the patient. Computer-based intelligence limits can be significant to investigate, anticipate, and explain about the COVID-19 pollution and help it's to direct the economic impacts. Previously the most clinical uses of computerized reasoning are mostly a response to the COVID-19 and it is focused on finding reliant on clinical imaging [42].

Researchers were said the AI application shows that it can give an additional opportunity to radiologists and do a finding faster and more affordable than with Covid customary tests. For this reason, the specialists can utilize the X-ray just as CT examines and Computed Tomography [43]. Optical sensors incorporate SPR-based, colorimetric-based, chemiluminescence (CL) aptasensor, fluorescence, and SERS-based aptasensors methods were used. The CL aptasensor is quickly depicted here because of its application in the location of extreme intense respiratory condition of covid (SARS-CoV). Based on the biosensors the novel qualities of nanobodies were improved for example: little size, high strength and solvency, high partiality and explicitness against targets. Spike proteins of COVID - 19 can be an objective to create a high-liking nanobody. For this reason, a recombinant or local type of protein ought to be accessible to the inoculation of camels and making a vaccinated cDNA library. By utilizing Field Effect Biosensing (FEB) and a monoclonal neutralizer, which is covalently bound to graphene, a biosensor can be planned, for the identification of the Zika viral antigens.

The quantitative information can be gotten from the graphene stage, which is gives an appropriate instrument for both the symptomatic application and clinical investigation [44]. Advanced radiography on patients characteristically shows an obscure cavity like fix or diffused divergent airspace, practically identical to the next pre-detailed covid kinds of pneumonia (SARS and MERS-CoV). A test directed on

Table 3
List of suggested drugs to COVID-19.

	Name of the suggested drugs	Compounds of drugs	Useful and targeting sites	Ref.
WHO	Chloroquine	Antimalarial drugs these compounds to fight SARS-CoV-2	Useful prophylactic and curative agent	[53]
	Hydroxychloroquine	Antimalarial drugs these compounds to fight SARS-CoV-2	Useful prophylactic and curative agent	[53]
	Ritonavir and lopinavir together drugs	As antiretroviral therapy	Combo maybe fight SARS-CoV-2 by directing a particular fragment that allows together HIV coronaviruses replicates	[54]

coronavirus patients demonstrated that 40 out of 41 patients have reciprocal lung inclusion in their chest electronic tomography (CT) scan [45].

PCR tests are for the most part acted in incorporated analytic administrations by exceptionally gifted faculty and their results may take from 4 h as long as 3 days [46]. Nanomaterials are helped in scaling down of the identification gadget by build-up the nanoscale stage, which is versatile, what's more, can accomplish for equivalent affectability of the complex instruments [47,48]. Business trials are furthermore not obtainable nowadays. In suspect cases in India, the best possible model must be to give the mention for the test centre in India or the National Institute of Virology in Pune. As the pandemic advances, the business trials will open up. The C- reactive protein (CSR) and ESR have assessed procalcitonin levels. The high level procalcitonin was mentioned the presence of bacterial infection. A high peptide precursor side by side may exhibit an infectious co-ailment. The chest X-bar is generally displayed two-sided attacks that may be regular in the initial ailment.

The computed tomography is continuously unstable. This imaging usually displays attacks, ground-glass opacities, and subsegmental mix. In like manner, it is unusual in asymptomatic patients with no medical confirmation of lower respiratory tract connection. An abnormal CT scan has been used to identify COVID-19. It is a number of patients who had a positive molecular test to repeat the testing [40]. Diverse strategies for analysis are epidemiology, origins, experimental appearance, investigation, contravention, and control.

2.6. Prevention and treatment

There are no particular medicines for sicknesses brought about by human coronaviruses. The preliminary step is to assure adequate separation to forestall transmission by various contacts, patients, and medicinal services laborers. Mechanical ventilation and equal additional physical film oxygen care can be required [49]. In India, Bacillus Calmette-Guerin (BCG), a live weakened immunization, is given regularly at the hour of birth against tuberculosis. Different systems like the traditional epidemiological models were applied to the assessment for the multiplication number (R0) of COVID-19 cases which helps in deciding the force of epidemic with the normal number of tainted people [50]. Recuperating plasma treatment is another treatment technique that is continued in India. Additionally, 'Arogya Setu' portable application is accessible which assists with illuminating individuals about the COVID-19 circumstance in their region and it is useful to self-survey and their health [51,52]. Some of the common treatments are recommended as followed by taking tablets for pain and fever, utilizing a room humidifier, take a hot wash it helps to ease a sore throat, stay at home, and take rest [3]. WHO has suggested some drugs for reducing the growth of COVID-19 viruses (Table 3). Other suggested drugs are presented in Table 4..

The WHO and various associations have provided additional general proposals.

- People with manifestations of severe airway infection should stay apart, more coughs or wheezes with expendable tissues or garments, and wash thoroughly their hands.
- Strengthening especially in emergency medication divisions, the use of very much cleaning measurements for prevention and regulate infections.

2.7. Histopathological

The histopathological is information from the lungs of two patients who experienced lung lobectomies for reflection of adenocarcinoma and there are maintained under the medical procedure for 1 h. Aside from the tumors, the lungs of both coincidental cases were indicated enema and significant proteinaceous exudates as huge protein globules [55].

3. Personal protective equipment against COVID-19

The Covid 2019 (COVID-19) was started spreading around the world without a single clear treatment to be found, avoidance turned into a significant piece of controlling the illness and its belongings. Coronavirus is spread from the vaporizers of a tainted individual if they are demonstrating any indications. Consequently, it is almost difficult to point out precisely where the patient is, for this purpose the Personal Protective Equipment (PPE) was established for example: masks, respirators, gloves, and emergency clinics Fig. 3. The PPEs assume a significant part in the anticipation and control of the COVID-19. The PPE can obstruct any attack of the infection particles into the arrangement of a person which is the reason it is a fundamental thing to have for medical services labourers [56]. Nanomaterials were helped to reduce in size of the gadget location to build up the nanoscale stage, which is compact furthermore it can accomplish the equivalent of affectability to the modern instruments [57].

These are protective equipment that gives a practical precise facial fit and viable filtration of airborne particles. They are given an appropriate seal around the mouth and nose, giving ideal assurance. As per the ongoing WHO, CDC, and FDA rules such are covered medical care suppliers [58]. Medical masks are thin, pleated, and disposable masks from breathing in dust particles, defiled fluid droplets, and microscopic organisms Fig. 4. They are normally two layers thick and produced using unwoven texture. These veils just go about as a physical hindrance between the client's nose and mouth [59].

The methodologies of washing or purification, condition of usage, and the extinction of treatment could change the impression of natural. All in all, reusable mask have been lower filtration proficiency than N95 mask and it is carefully protected from virus. This features that more examinations are expected to accomplish an agreement with respect to the productivity of protections (counting reusable mask) just as improving the standard rule for creation and use. WHO has lately suggested the protection of three layers of texture covers for solid individuals and also about the effectiveness of filtration [60].

4. SARS-CoV-2 virus life cycle and protection of target nanomaterials

SARS-CoV-2 viruses are bind with angiotensin pining for chemical 2 (ACE2) receptors on the surface of the host cell. Trans layer of serine protease 2 (TEPRSS2) empowers the cell segment through protease

Table 4
List of potential antiviral drugs to different virus diseases.

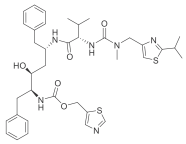
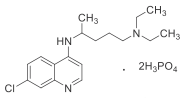
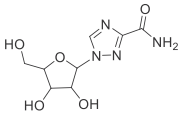
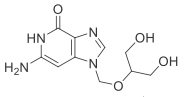
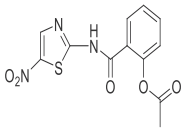
Status	Treatment	Structure of component	Active	Free infection tools	Achieve viruses	Ref.
Accepted	Lopinavir/ Ritonavir		Protease inhibitors	Restraint HIV-1 protease for protein cleavage coming about in non-irresistible, immature viral particles	HIV/AIDS, SARS, MERS	[34, 90]
Accepted, Investigational, Examine	Chloroquine		q-aminoquinolin	Expanding endosomal pH, immunomodulating, autophagy inhibitors	Malaria, autoimmune disease	[91, 92]
Approved	Ribavirin		Synthetic guanosine nucleoside	Meddling with the union of viral mRNA	HCV, SARS, MERS	[93, 94].
Approved, Investigational,	Ganciclovir		Nucleoside analog	Intense inhibitor of the Herpesvirus family including cytomegalovirus	AIDS-associated cytomegalovirus infections	[95]
Approved, Investigational, Vet approved	Nitazoxanide		Antiprotozoal agent	Moderating the endurance, development, and multiplication of scope of extracellular protozoa, helminths, anaerobic and microaerophilic microbes, infections.	A wide scope of infections including human/creature coronaviruses	[96, 97]

Fig. 3. Components of personal protective equipment (PPE). Reprinted with permission from Ref. [56].

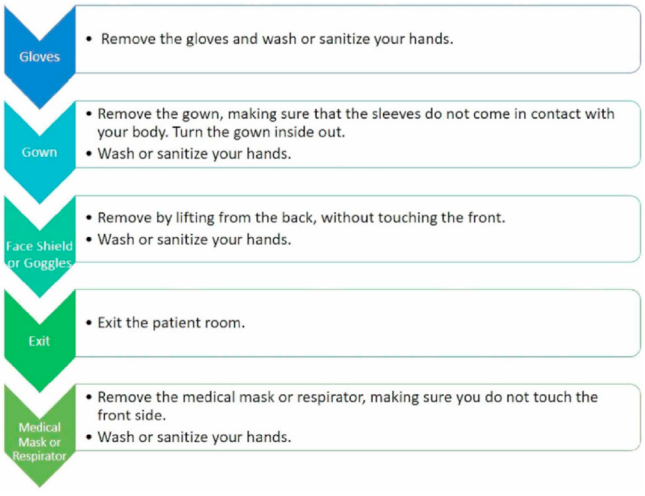


Fig. 4. Cleaning of personal protective equipment (PPE). Reprinted with permission from Ref. [56].

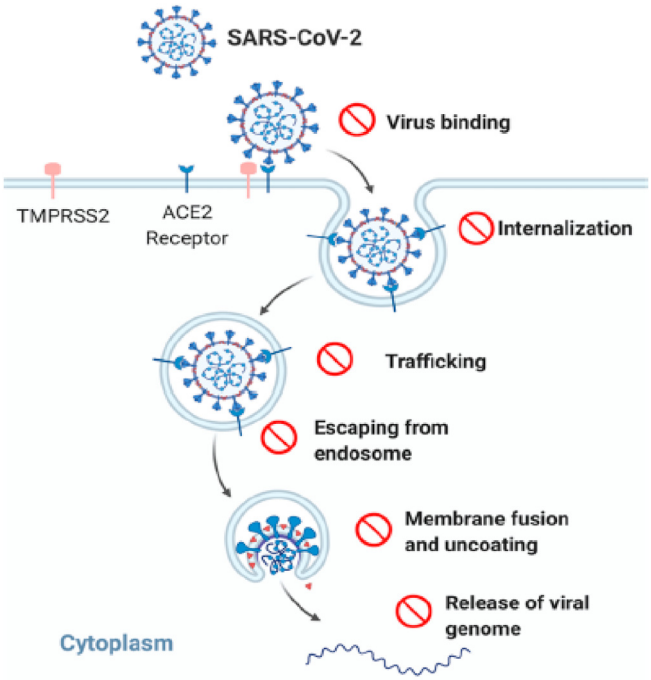


Fig. 5. SARS-CoV-2 virus life cycle and nanomaterials potential target. Reprinted with permission from Ref. [61].

development. Later the mainstream particles are disguised and go into endosomes. The low P_H endosomes of viral particles are uncoated and the viral genome is discharged for protein association. Subsequent viral RNA and amalgamation of protein of novel irresistible particles are gathered and discharged (Fig. 5).

4.1. Ferrite nanomaterials related to COVID-19

Nanomedicine and biomedical experts have made conveyance structures used in dissimilar arenas, comprising dangerous development treatment and reformative medication [62,63]. Nanoscale tools will most

allow watching to investigate and to act across the completed condition of a switch to help noticing either a fix or reducing strategies for COVID 19 and observing of SARS-CoV-2 [64]. The outstanding antimicrobial features of definitions and nanomaterials such as silver, copper, and zinc species [65,66] are combat against COVID-19 and protect from the infection and diseases. Silver nanoparticles are having highly antiviral movement. They are going about as for viral multiplication inhibitors, and their various veridical developments upon the objective disease. For example: the AgNPs can prevent the viral area in cells, because of the HIV-1 contamination, which was represented that AgNPs can associate with cell receptors. In this way, gold nanoparticles are balanced by biocompatible polymers exhibited to antiviral development against HIV-1 and few subcategories of influenza diseases. The AgNPs were represented of ability to obstruct the viral area in have cells by virtue of the HIV-1 contamination which was indicating that AgNPs can associate with cell receptors. The gold nanoparticles are settled by biocompatible polymers that have shown antiviral development against HIV-1 and few subcategories for influenza of contamination [67].

Nanomaterials ferrites are a class of delicate attractive materials that have excellent electrical, attractive, and optical properties. A ferrite is a material that is comprised of iron oxide (Fe_2O_4) and an enormous extent blended in with metallic components such as barium (Ba), manganese (Mn), nickel (Ni), zinc (Zn) to little extents. The idea of both the iron oxide and the metal is electrically non-leading and ferromagnetic. There are two kinds of ferrites are I) hard ferrites and ii) delicate ferrites. Hard ferrites making by a perpetual magnet are used to apply in the fridge, TV, clothes washer, etc. Delicate ferrites is a low coercivity, great conductor, it's a minimal effort, time, and temperature [68]. The current researcher endeavors are (both physical and chemical) concentrated the earth to explicit of antiviral medications and physical remedial against COVID. In the future, we have to attempt to convert this note to how non-intrusive treatment may create against COVID. To kill ++ssRNA, M (film)- protein and spike protein-containing to SARS-CoV-2 attractive field can assume an imperative part within the sight of non-harmful attractive nanoparticles [69].

The properties of MnZn ferrites incorporate are a high estimation of resistivity, porousness, permittivity, immersion polarization, low force misfortunes, and coercivity. MnZn ferrites can be improved by doping different metals for example: cobalt, zinc, magnesium are make to them reasonable for use in agrarian and electrical applications. With regards to the utilization of nanoparticles in the pandemic period for example in the ongoing COVID-19, MnZn delicate ferrites can assume a critical part in the improvement of high differentiation imaging colors for viral strains in the body liquids [68]. Attractive nanoparticles (NPs) for the most part incorporate metal NPs, metal oxide NPs, and metal combination NPs.

The regular attractive NPs are iron, cobalt, and nickel. Metal oxide NPs are the most part for incorporates the iron oxides, different ferrites and metal amalgam NPs. The attractive field applied from MT may, in this way, influence the detachment of spike protein from the SARS-CoV-2 infection that changes the film potential, which assumes a key function in the association among + ssRN, RBD of the spike protein and consequently may repress infection transformation in the human body, specifically in the lung [69]. Modernize MNP's are helped to examination of RNA convention and it was proposed for likely extraction and RT-PCR-based determination of COVID-19. The MNP's of zinc ferrite (ZNF) were manufactured by the cost proficient sol-gel auto-burning course and hence its surface was functionalized with carboxyl containing polymers (CPoly). Among the attractive materials, zinc ferrite was suggested because of its high synthetic soundness, delicate attractive conduct, simple planning, and biocompatible nature [70].

4.2. Nanotechnology approaches and its fight against COVID-19

Procedures based on nanotechnology must be used to assist the combat against COVID-19 similarly to any upcoming pandemics in various methods, comprising.

I) Novel antibodies and drugs, whereas nanoparticles can be used for direct movement of brad go antivirals and to help concentrate on medicines to the lungs;
II) Extremely express, quick and fragile tests to recognize for contamination or to recognize the obstruction (blood serum tests);
I) Superior channels for face cover or blood filtration;
II) Novel surfaces or surface covering that is impenetrable to viral connection and
III) The development of tools for contact following Fig. 6 [40].

4.3. Nanotechnology in combat against COVID-19

Virus particles are having different morphological structures and sizes from 20 to 900 nm [71]. The nanoscale is uncomplicated in size and structures of viruses are a generally difficult force to build up the extensive usage and its take long-term to structures for discovery of infection [72,73]. The antivirus nanomedicines are dependent on the graphene oxide (GO) which have been tried against a particular infection can likewise apply a similar antiviral impact against a more extensive scope of infections from the Herpes viruses to the novel coronavirus. Because of their two dimensional structure, sharp edges, and contrarily charged surfaces, graphene oxide nanosheets are suitable for communicating with microorganisms for example: microscopic organisms, infections, and to defect them by disturbing their plasma layer or by creating reactive oxygen species to actuate oxidative pressure [31].

SARS are identified to utilizing the AuNPs initial centre creating quick explicit molecular recognition through two principle tests 1) a colorimetric examination for lab-quality discovery (Fig. 7A), and 2) electrochemical measures for nucleocapsid protein location (Fig. 7B). The colorimetric measure included the capacity of AuNPs to absorb specially ssDNA over dsDNA and which was senses explicitly the existence of DNA object [74]. In the electrochemical measurements, AuNPs are used to upgrade the terminal conductivity and increment the surface area accessible for discovery test immobilization [75]. The high steadiness of the manufactured ITO/AuND/AuSP nanoprobe might be because of the way that there are no biomolecules consolidated in the detecting grid [76]. AuNPs based colorimetric is a simple and extremely high influence for measurement of nucleic acid. The utilization of AuNPs for the discovery of different infections either consuming changed methodology or in synthesis with other detecting attributes of Au NPs [71].

The conceivable instrument of AgNPs is rising the question about the administration of viral disease to other potential antiviral action [78]. A few studies are reported the AgNPs exposed the good inhibition of numerous infections, in particular, hepatitis B infection HBV [79], flu infection [80], human parainfluenza infection type 3 (HPIV-3) [81], vaccinia infection [82]. GO (Graphene oxide), is a marvel material with uncommon electrical property that can be utilized for the advancement of the elite COVID-19 biosensing framework using such an explanatory stage [83].

SARS vaccine nano-delivery system is disclosed in the Korean patent where a SARS-CoV DNA vaccine (psi-S) encoding the spike protein was complexed with a polymer polyethyleneimine (PEI) for effective delivery of pci-S into cells. That intranasal immunization with PEI/pci-S nanoparticles stimulates antigen specified humeral and cellular immune responses [84]. Biopharmaceutical new advancements (BioNTech) is a cutting edge in immunotherapy organization originating the novel treatments for cancer and different genuine illnesses. Because of its profound skill in mRNA antibody advancement and in-house producing capacities, quickly expanding losses of life of COVID-19 has been a reminder for worldwide wellbeing. At present not available no particular antiviral sources for controlling COVID-19. In this time among different fields of science innovation and nanotechnologies are can be a huge assistance for anticipation, analysis, and treatment of COVID-19. Using the anticipation method, nanofiber-based facial respirators, alongside nanotechnology-empowered profoundly compelling antimicrobial and antiviral disinfectants, have been the principal individual defensive

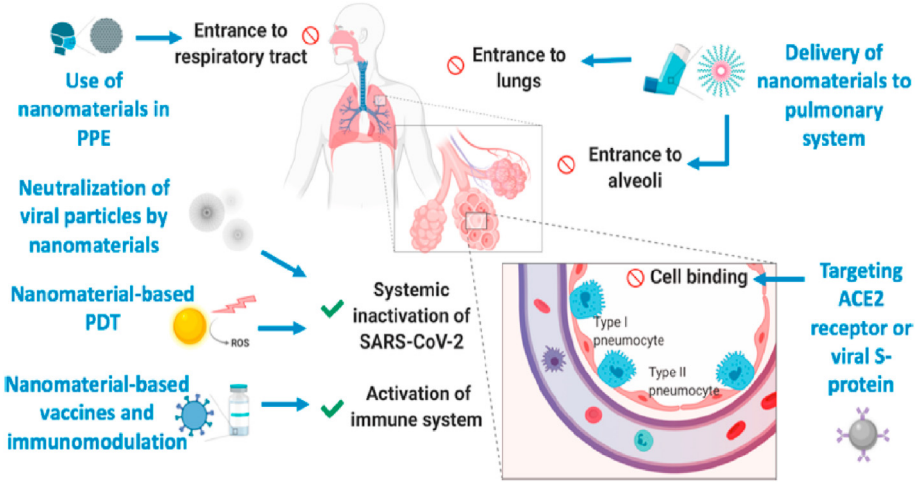


Fig. 6. Prevention and therapy of COVID-19 using nanomaterials. Reprinted with permission from Ref. [61].

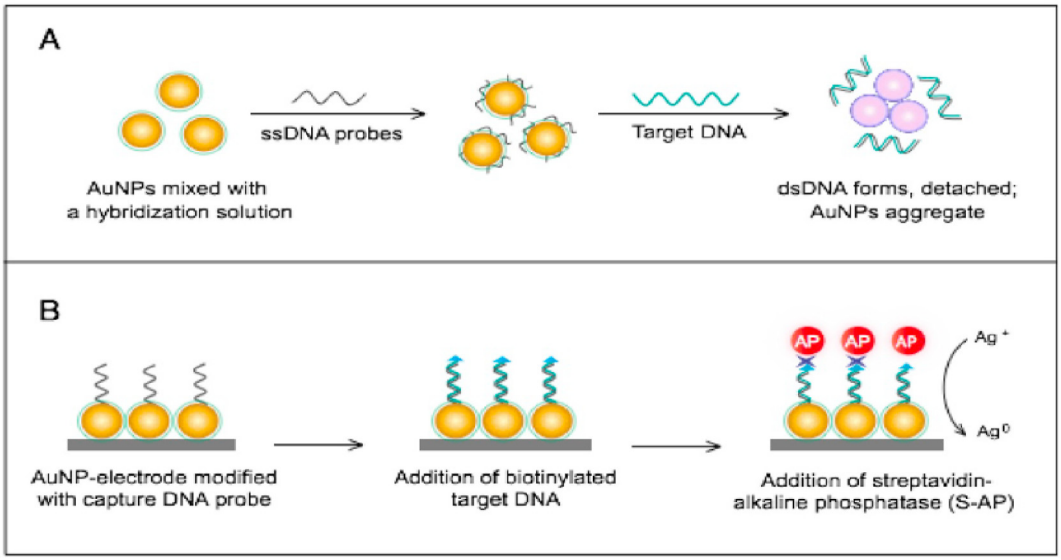


Fig. 7. Nucleic acid assays based on AuNPs for the recognition of severe acute respiratory syndrome (SARS) A) Colorimetric recognition of SARS consuming Au NPs. B) Enzymatic electrochemical recognition of SARS using Au NPs. Reprinted with permission from Ref. [77].

which implies that nanotechnology can forestall the spread of the infection; moreover, broad research is in progress to build up an immunization for COVID-19 based on various nanomaterials. In diagnostics, nanotechnology has demonstrated a significant guarantee in structuring sensors for growing brisk reaction of COVID-19 tests [85].

Webstar says iron-based nanoparticles could be guided with magnetic fields to target explicit organs in the body, for example: lungs and different susceptible to respiratory complications after contracting viral contamination. The looks into the nanotechnology-based coronavirus patent were showed that the President and Fellows of Harvard College head the top number of patents [86]. Sidelong stream innovation is utilized for the identification of protein, viral antigens, and little atoms dependent on a progression of narrow beds such as pieces of nitrocellulose paper or microstructure polymer, that every one of these pads can ship liquid precipitously [87]. The CONVAT venture drove and composed by Prof. Laura M. Lechuga, revealed that the biosensor gadget will permit the examining the kinds of coronavirus present in repository creatures for example: bats to screen the advancement of these infections and prevent a future irresistible outbreak in human [88].

Despite the wide and over developing manipulation of new nano drugs, pharmacokinetic contemplations are exceptionally irregular, restricted and toxicological information, just as those concerning the discharge and the amassing of conceivably toxic side-effects are fragmentary. Again we need prescient strategies and endorsed conventions to examine the poisonousness of particles sorted out at the nanometre level, particularly in vivo models. Nano drugs share a few properties that are exceptionally valuable in inventive treatment: low fundamental harmfulness, dynamic particles, that can be captured in a shell while flowing. Much progressively significant is the capacity to damage the objective as harmed tissue, delayed arrival area of the medications [89].

The pandemic virus is still spreading among the people due to a lack of medicines to control the SARS-CoV-2 virus. Currently, some of the basic medicines are available to treat COVID patients such as chloroquine, hydroxychloroquine, etc.

5. Strengths, perspectives, and limitation of the study

Nanomedicines have been at the focal point of numerous scientists were concentrated on clinical preliminaries in recent days. Nanotechnologists are completing their social obligation to handle the progressing worldwide health emergency. There is a critical need to create quick analytic instruments and immunizations or post introduction

prophylaxis to treat this contamination. A viable antibody ought to be reasonable and the creation stage should deliver appropriate immunization up-and-comers quickly at low cost, particularly outbreak the period of diseases.

6. Conclusions

Covid-19 is the most dangerous disease in worldwide. The number of people is affecting by a coronavirus in all countries. Many scientists are working to killing or reduce the coronavirus. Nanomaterials played a vital role in preparing PEP things like masks, sanitizers, gowns, etc. Even the researchers are trying to identify the vaccines against coronavirus without any side effects. In this review, we have been focused on the nanomaterials combat with COVID-19 for diagnosis, treatment, vaccines, etc. Few current medications have been assessed for the treatment of COVID-2 and demonstrated promising outcomes in clinical applications. Further, as the information about SARS-CoV-2 is progressing, new antibody-including and monoclonal counteracting agents could be found in near future. We are given to attention for substantial approaches that deal with kinds of public health emergency in both short and long terms.

Declaration of competing interest

The authors report no conflict of interest.

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