A Novel Artificial Face Mask based Nanofibers with Special Intelligent Engineered Nanocomposite Against Covid-19

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Abstract: We introduce our idea about a new face mask against Covid-19. Herein our novel face mask is a polymeric matrix of nanofibers. These nanofibers are decorated with special engineered nanocomposite. The later possesses antiviral, antimicrobial. A well-established IR temperature biosensor will be implanted in the face mask and connected to the mobile phone using App (Seek thermal) to allow temperature monitoring. Artificial Intelligence can play a vital role in the fight against COVID-19. AI is being successfully used in the identification of disease clusters, monitoring of cases, prediction of the future outbreaks, mortality risk, diagnosis of COVID-19, disease management by resource allocation, facilitating training, record maintenance and pattern recognition for studying the disease trend. Therefore, AI is used as a type of alarm which be connected through Global Position System (GPS) to a central networking system to monitor the crowded areas of probable infections. In this case, the hospital in this neighborhood will be charged to let a mobile unit of assessment travel quickly to the infected people areas.

Keywords: Covid-19, Nanofibers, Face Mask, Artificial Intelligent, Nanocomposite, Engineered.

1. Introduction

In a time of pandemic, we are all aware that the rational use of face masks can drastically reduce infections and deaths and postpone the peak time of the epidemic evolution. The necessity to realize a new generation of personalized and reusable face masks with high filtration levels, moisture pump technology, and self-sterilization properties is a mandatory need, especially for medical workers.

Nanofibers produced by the electrospinning technique, and molded/personalized in a face-like skeleton through 3D printing, can guarantee excellent comfort, a high filtration (efficiency ≥99 %), and low-pressure drop. The optimized facial comfort can be obtained by using 3D printing (Direct Digital Manufacturing; DDM) combined with personalized designs obtained from a library of 3D heads carried out from 3D scans of the head and neck of representative medical personnel. Thanks to their large surface area-to-volume ratio, nanofibers have the extraordinary capability to filter nanoscale particles and absorb biological and chemical contaminants while ensuring thermal comfort through their radiative cooling properties. The high filtration level and the moisture pump technology are enabled by utilizing a bilayer of electrospun membranes.

The innovation of healthcare services, infrastructures, and processes is impelling and worthy. The COVID-19 pandemic demonstrated how digital tools and artificial intelligence are necessary to improve the efficiency, efficacy, and quality of healthcare systems (i.e., by supporting tracking and data analysis). Intelligent agent-based system is one of the most exciting research areas in artificial intelligence, which have proven to be a key component for the digitalization of healthcare. Specific topics like ageing, active living, chronic diseases, or others related to quality of life play an increasingly important role in this research field.

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3. Methodology and Techniques

The fabric of the mask will contain polymeric nanofibers of chitosan as a biocompatible, safe, cheap material. It could blend with a specific ratio with PVA to be easily synthesized using electrospinning technique. The choice of chitosan is owing to its biocompatibility, biodegradability and ecofriendly. During the preparation of the polymeric solution, the nanocomposite will be homogenized with special ratio for at least 12 hrs to allow perfect distribution and dispersion of the powder inside the viscous polymer. The mesh size of the obtained fibers will be controlled by the separation between the source and target in electrospinning. Also, the crucial parameter varying the nanofiber dimensions and aspect ratio is the viscosity of the polymeric solution to be injected. The type of nanocomposite here is supposed to be tailored and examined for both antiviral and antimicrobial activities. Herein, ZnO nanorods decorated with Cu nanoparticles with be prepared using son-chemical technique together with simple reduction of the metallic Cu from its salt. The rod-shaped nanostructures will be chosen to emphasize the surface area and morphological features and to improve biological activity.

5. Conclusion

The COVID-19 outbreak has become a serious problem in modern human history. Wearing protective face masks, preserving personal hygiene, and social distancing should be followed to help prevent the spread of COVID-19. This disease has led to a worldwide increase in the usage of billions of face masks and respirators every day, resulting in a high demand for goods that produce them. In general, most commercial filtering facepieces use electrostatic filter media that can degrade over time (due to many different variables). Nanotechnologies play a crucial role in this issue by fabricating nanomaterials with special characteristics for air filtration. A nanofiber-based mask would not lose its efficiency in time or due to many different factors (because of its mechanical filtration efficiency protection, from the mask layers). In this regard, we summarize the filters based on electrospun nanofibers and their unique characteristics to increase filtration performance of face masks and respirators. Also, AI was found to be on par with and even more accurate than human experts in COVID-19 diagnosis and drug discovery. We need bigger datasets for training AI models and a legal framework and ethical considerations for sharing data before AI takes the forefront in diagnosis and other areas. Several bottlenecks in harnessing AI to its full potential in the current scenario are available for sharing of clinical and epidemiological data, computational resources, scalability, privacy and ethical concerns.

References

[1] O'Dowd, K.; Nair, K.M.; Forouzandeh, P.; Mathew, S.; Grant, J.; Moran, R.; Bartlett, J.; Bird, J.; Pillai, S.C. Face masks and respirators in the fight against the COVID-19 pandemic: A review of current materials, advances and future perspectives. Materials **2020**, 13, 3363.

[2] Chua, M.H.; Cheng, W.; Goh, S.S.; Kong, J.; Li, B.; Lim, J.Y.C.; Mao, L.; Wang, S.; Xue, K.; Yang, L.; et al. Face Masks in the New COVID-19 Normal: Materials, Testing, and Perspectives. Research **2020**, 2020, 7286735.

[3] Randhawa GS, Soltysiak MP, El Roz H et al. Machine learning using intrinsic genomic signatures for rapid classification of novel pathogens: COVID-19 case study. PLoS ONE 15(4), e0232391 (2020).

[4] Abdulla A, Wang B, Qian F et al. Project IDentif. AI: harnessing artificial intelligence to rapidly optimize combination therapy development for infectious disease intervention. Adv. Ther. 3(7), 2000034 (2020).

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