

# Design and Development of Reusable Facial Deactivation Masks for COVID-19

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## ABSTRACT

A novel strain of coronavirus, originating in Wuhan China, was designated coronavirus disease 2019 (COVID-19) on February 11, 2020. The disease is spread by transmission of respiratory droplets from infected individuals. While the US and many other countries were slow to embrace the protective benefits of protective masks, they clearly represent a precautionary step to limit the rapid spread of the virus and disease.

In this paper, the authors propose a model for thermoplastic 3D printing of respirator masks coated with NaCl, or clay/biocellulose impregnated with NaCl to create a sterile deactivating area which may further help control the spread of COVID-19.

(Keywords: deactivation system, protective mask, personal protective equipment, PPE, sodium chloride, coronavirus, respirator mask)

## INTRODUCTION

A novel strain of coronavirus (COVID-19) responsible for a global pandemic beginning in January/February 2020, is believed to be transmitted from person to person via respiratory droplets. However, the United States' Center for Disease Control and Prevention did not recommend that face masks be worn unless a person was suspected to carry COVID-19 or was around someone infected, until early April 2020.

By putting on a face mask, someone can take a precautionary harm reduction step to limit the spread of disease via coughing, sneezing, speaking, breathing, and eating. Additionally, concerns exist that people who excessively touch their faces can potentially bring viral particulates

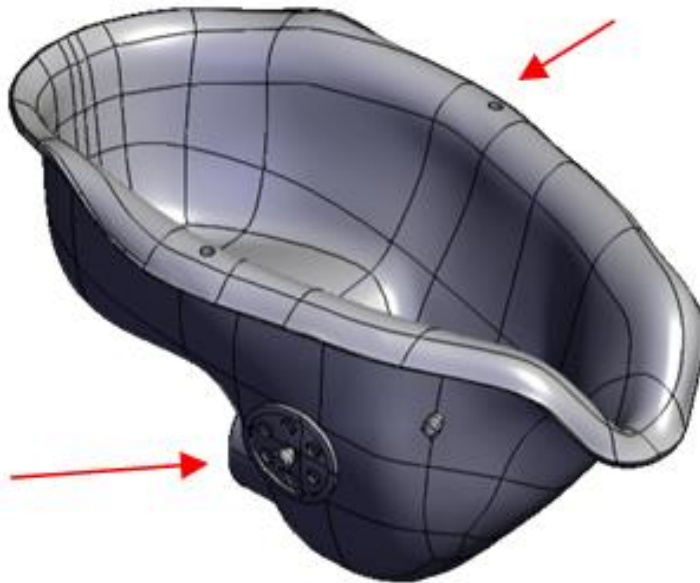
close to orifices of entry (i.e., nose, mouth, and eyes) into the body.

Despite controversies on their efficacy, protective masks have still been widely adopted during the H1N1 (swine flu) outbreak in 2009 along with other large-scale pandemics [1]. Researchers from the University of Alberta have recently found universal and reusable virus deactivation systems for respiratory protection in mice models [2]. In this paper, we suggest the development of a 3D-printed face mask, which uses table salt (NaCl) as a deactivating, neutralizing agent against the virus.

The goal of developing this mask lies on the principle that it may be used against aerosols and droplets, which are the underlying mechanism for transmission, by creating an aseptic, sterile environment around the face. Furthermore, masks are not one-size-fits-all solutions. The contours, sizes, and shapes of facial features can influence the fit of the mask.

## METHODS

Here we suggest two possible applications. The first is a 3D print design with commercial thermoplastic (PLA, ABS) that capitalizes on perforations and coating of existing N95 respirator design. The schematic in Figure 1 shows a CAD sketch up of an inhaler conduit nebulizer. Here we suggest compressor filters and channels for tubing (as indicated by arrows in the figure) can be coated with NaCl brine solution. This ensures that during respiration, there will be an aseptic environment around the face.



**Figure 1:** CAD Sketch-up of an Inhaler Conduit Nebulizer and Potential Targets of NaCl Coating.

The second application borrows elements from clay masks and biocellulose masks. An important part of these masks is the fact that these masks are formed to fit the face. Salt can be infused or layered on these masks as they are either applied to the face or during their manufacturing.

In light of the mass shortages of face masks around the world, and the development of many types of field-expedient and home-made types of protective face coverings, it may be advisable to dip mask cloth in brine prior to application.

## CONCLUSION

While the efficacy of masks are controversial, its widespread use warrants more sterile and hygienic tools and techniques. This proposal suggests a potential application for the seamless incorporation of salt, postulated to have beneficial effects in “flattening the curve,” into masks a method for curbing the current COVID-19 pandemic.

## REFERENCES

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### **SUGGESTED CITATION**

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