

Curie Biotech

Production of face masks that can “isolate and kill” COVID-19 with 99.98% effectiveness

Important problem

The SARS-CoV-2 virus (commonly known as COVID-19) continues to have a devastating impact on the world. As of writing, the virus has infected over 113 million people globally, resulting in more than 2.5 million casualties.

While governments across the world are beginning to roll out vaccines for the most vulnerable and high-risk populations, for the vast majority of people, masks continue to remain the first line of defense against infection. Research has shown, however, that **conventional masks themselves do not completely protect wearers from infection and do not kill the COVID-19 virus**. A [study](#) conducted by the University of Hong Kong showed that hamsters who were protected by a surgical mask partition still had a 25% chance of being infected. Moreover, frontline healthcare workers, who are typically equipped with the highest grade of masks and PPE, continue to experience high levels of infection due to their close proximity to the disease. In November 2020, a [study](#) published in the *International Journal of Infectious Diseases* found that approximately 300,000 healthcare workers from thirty-seven countries had been infected with COVID-19. By March 2021, the [Centers for Disease Control and Prevention](#) estimates that more than 415,000 healthcare personnel in the United States had been infected, with close to 1,400 dying from the disease. The situation at hand demands a solution that can more effectively protect frontline healthcare workers.

How it works

At Curie Biotech, our team has developed a polymer that, when applied to surfaces like conventional masks, has the ability to “isolate and kill” the **COVID-19 virus with 99.98% effectiveness**. Unlike conventional masks – which seek to prevent the virus from entering the wearer’s air passages – a Curie-enhanced mask destroys the COVID-19 virus, which results in reduced infection rates and reduced secondary infection, thereby protecting ordinary mask wearers and frontline healthcare workers. Our polymer does this by taking advantage of the virus’ negatively charged chemical structure.

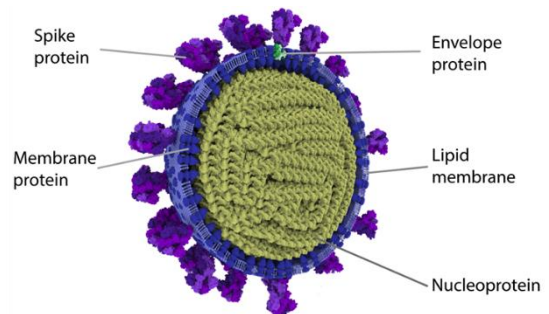


Figure 1: Diagram of COVID-19 virus. The spike protein and polar head of the lipid membrane are negatively charged.

Figure 1 illustrates the COVID-19 virus. The virus is composed of many negatively charged proteins, each containing a negatively charged polar head. It is important to note that these protein chains are fragile, meaning that when they experience a strong and stable positive chemical charge, the polar heads will be pulled off, breaking the protein chain. This creates a hole in the virus’ cell envelope, resulting in the virus’ death.

Our Curie polymer has been engineered with this concept in mind. The polymer has a positive charge strong enough to rip the virus’ protein chain, thereby destroying the virus. The charge is also stable enough such that it can withstand all types of deteriorating conditions brought on with time and transportation. Our experiments have found that the positive-charged chemical nano structure can only be destroyed at temperatures in excess of 572 degrees Fahrenheit or through exposure to strong acid.

The Curie polymer's COVID-19 killing properties were confirmed through a study conducted by Tampere University in Finland. Researchers sought to evaluate the COVID-19 killing properties of Curie-enhanced material against several controls – including an ordinary tissue paper, an FFP2 filter, and an FFP2 sponge. The preliminary results showed that compared to these controls, the Curie-enhanced material significantly decreased viral load (from 50,000 PFU to 2-5 PFU).

Competitive advantages

Aside from its COVID-19 killing properties, the Curie polymer also possesses several advantages:

- **Speed of virucide:** Our Curie polymer can kill the virus – and kill it fast. The Tampere University study showed that our polymer can virtually eliminate the virus within five minutes. This is critical, given that viral transference from a conventional mask is likely high, particularly when the mask-wearer temporarily takes off their mask to eat or drink. We believe the speed of virucide is likely faster than five minutes, and will be conducting additional experiments to test our hypothesis.
- **Applicability to other viruses:** Our Curie polymer can kill most forms of viruses. The Tampere University study showed that our polymer can effectively eliminate viruses that possess a lipid envelope structure and capsid structure.
- **Price:** Despite the added “isolate and kill” function of our Curie-enhanced mask, our pricing is competitive with conventional masks in the market.
- **Safe for human exposure:** We have designed our Curie polymer with safety in mind. Our polymer's main ingredient is a World Health Organization food additive. Moreover, unlike products created by our competitors, our products do not use metals such as Zinc, Silver or Titanium, in our formulation. These toxic metals that – when inhaled – have been shown to result in long-term health effects.
- **Biodegradable:** Our polymer is 100% biodegradable, and causes no environmental damage. We are currently in the process of creating a Curie-enhanced mask that will be 100% biodegradable.
- **Ease of deployment:** Our polymer is a high density and homogenous liquid, which can be deployed easily through a simple loading method over different material surface.
- **Ease of scaling:** Our speed of fabric processing can reach 80 meters/min. We are well-equipped to scale up production to fulfill market demand.
- **Compliance against existing standards:** Our masks have secured a wide range of certifications, from ASTM F2100 Level 3 to EN149 FFP3 NR.