Worldwide mask shortage and pollution concerns addressed by invention

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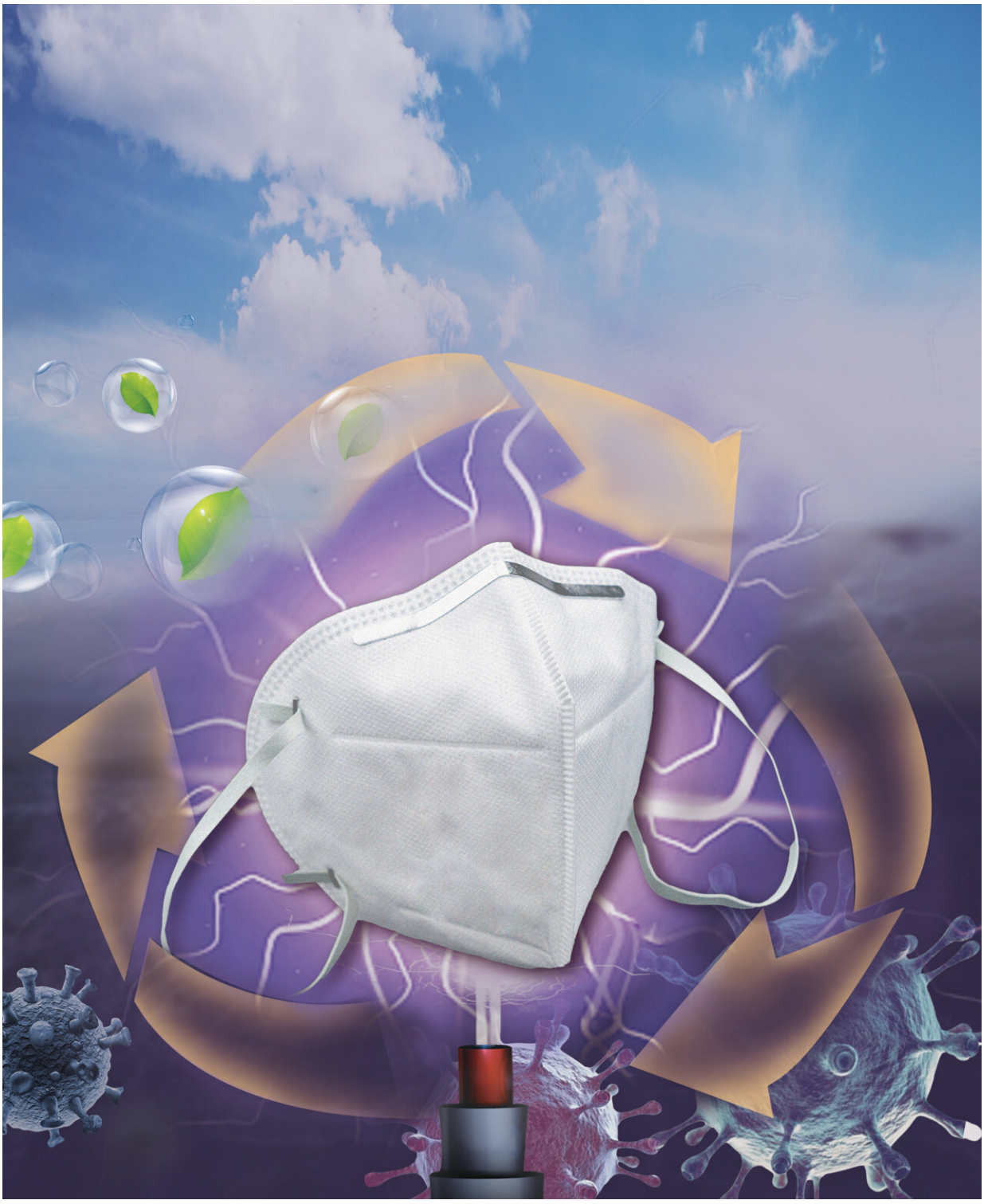

How technology created at the University of South Florida uses corona discharge to rapidly disinfect and electrostatically recharge N95 respirators. Credit: University of South Florida

Technology created at the University of South Florida (USF) could be the key to safely reusing disposable face masks. Researchers have figured out a way to rapidly disinfect and electrostatically recharge N95 respirators, recovering their original filtration efficiency and protection capability against COVID-19 and other airborne diseases.

In their study published in *Environmental Science & Technology*, the team demonstrated their patent-pending sterilization technology could restore an N95 respirator's original filtration efficiency of about 95 percent, even after 15 cycles of treatment. The technology fights coronavirus by using corona discharge—ambient atmospheric pressure plasma. The technology works by simultaneously deactivating pathogens on a mask and restoring its electrostatic charges. It is non-thermal, meaning it doesn't require extra heating, and doesn't require chemicals or contact, making it safe and convenient to use. It's reusable, safer than ultraviolet (UV) radiation and is a low-power consumption technique—only requiring 1.25 watts of electricity.

In addition to providing protection, corona discharge treatment can have a significant impact on the environment. According to a report released by the Hong Kong-based marine conservation organization OceansAsia, 1.56 billion face masks polluted the oceans in 2020 and will likely take more than 450 years to fully decompose. Instead of individuals using hundreds of masks per year, researchers say the technology will limit their consumption to dozens each year.

"It is a reduction of 90 percent for each user. If we assume that 10 percent of the population all over the world takes advantage of corona discharge mask reuse technology, there will be four to five billion fewer masks disposed to the environment," said project lead Ying Zhong, assistant professor in the USF Department of Mechanical Engineering.

"It will reduce at least 24 million tons of plastic pollution and reduce the amount of chemicals used for mask disinfection and avoid their environmental impact."

"Despite the challenging conditions of the pandemic, this was the most thrilling project that I have ever worked on. We wish our research advances the understanding of how corona discharge disinfection can be turned into products on the market as soon as possible," said co-project lead Libin Ye, assistant professor in the USF Department of Cell Biology, Molecular Biology and Microbiology.

The researchers are collaborating with a medical device design company to turn their prototypes into products available to hospitals and to the general public. The team is also working to develop handheld surface screening devices to sterilize homes, hospitals and other public areas, such as restaurants, schools and public transportation.

More information: Ying Zhong et al, Disinfection and Electrostatic Recovery of N95 Respirators by Corona Discharge for Safe Reuse, *Environmental Science & Technology* (2021). DOI: 10.1021/acs.est.1c02649

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