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**Top Performers Among Common Fabrics**

**Tested to Block Virus-Like Particles**

A team of chemical engineers at Northeastern University, Boston, evaluated over 70 different multi-layer material combinations and masks for their ability to reduce the risk of viral-aerosol inhalation. Infected individuals, whether symptomatic or not, emit invisible viral aerosols when talking. Several of the combinations tested were found to be excellent at filtering out virus-like particles, along with two types of N95s tested for comparison.

Ever since the CDC recommended wearing cloth face masks, researchers and the public have been scrambling to figure out which fabrics—and in what combinations—to reach for when making washable cloth face coverings. While the consensus among experts is that any covering is better than nothing, peer-reviewed studies are coming out that offer key science on the matter.

Top-performers were made up of both absorbent, wicking layers, *and* water-repellant barrier layers. Examples of repelling-type layers included nonwoven polypropylene, polyester, and polyaramid. Those layers may also repel droplets from nearby absorbing layers, such as terry cloth cotton, quilting cotton, and flannel, and help prevent wicking across the mask’s “sandwich”, the paper explained. See the chart of high performers below.

For the study, the researchers used equipment to simulate forceful respiration. Pulsed air containing fluorescent nanoparticles was used to mimic virus particles. The fluorescence helped researchers track “transmission” by increasing accuracy of detecting particles that went through each of the material samples.

Particles smaller than 300 nanometers become aerosolized, or temporarily airborne, when expelled while talking, sneezing, and coughing. For context, one millimeter is about half the side of a nickel—yet there are 1 million nanometers in a millimeter.

Researchers overall are using a variety of testing methods and equipment when studying fabric-filtration efficiency. For this study, the team used water-based aerosols that contained virus-like, fluorescent nanoparticles to assess the absorption and filtration of the virus-like particles. The SARS-CoV-2 virus itself ranges between 60 and 140 nanometers (nm) in diameter. Aerosols with nanoparticles are used to test blocking ability for certified masks and uncertified masks made from layers of common fabrics. For this study, less permeability means more particle blocking.

“Commonly available fabric materials can be used by the public in face masks to reduce the risk of inhaling viruses from aerosols generated by coughs, sneezes, and speech from infected individuals,” explained the researchers. “Masks may also be beneficial by serving as a reminder for wearers to avoid touching their face and, thus, prevent transmission from the hands to the user’s nose, mouth, and eyes.”

Lead author Dr. Steven R. Lustig and colleagues with the University’s Department of Chemical Engineering published the research findings in ACS-NANO May 21, 2020.

“It is critical that the materials’ edges conform snugly to the face to prevent aerosol from entering gaps between the face and mask,” the study explains. “Ideally, the mask does not contact the lips, or there is at least one water-resistant layer of fabric in contact with the face, so aerosol trapped from the exterior does not wick through the mask,” says Professor Lustig. “An absorbent layer can be near the mouth, as long as there is a water-repelling layer between water-absorbing layers.”

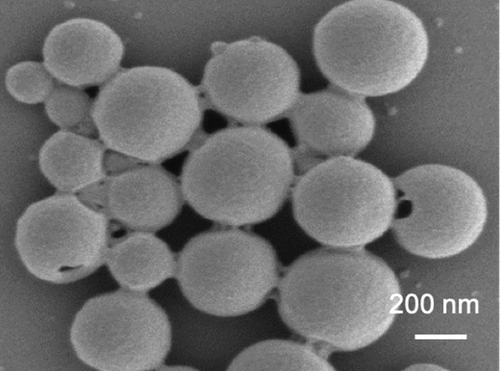
​ Research data on the performance of various commonly available fabrics used in making cloth face masks has been limited, and more studies are coming out.

Face mask safety is increasingly important as the CDC updated its guidance May 5, stating “Everyone should wear a cloth face cover when they have to go out in public, for example to the grocery store or to pick up other necessities.” CDC issued further guidance May 27 on how to safely wear and take off cloth face coverings to help mitigate the pandemic (cdc.gov/coronavirus).Xx*endFPA.2x*X

*Science News Service (SNS) provides science-based news focused on face mask safety free during the pandemic. News outlets can download the full-quote content at ScienceNewsService.com -- then click on SNS News Releases in the main menu. SNS is a non-profit dedicated to science-based journalism.*

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| **HIGH PERFORMERS ­—** EFFECTIVENESS OF COMMON FABRICS  TO BLOCK VIRUS-LIKE NANOPARTICLES **STUDY JUNE 2020** | | |
| FABRIC MATERIAL SAMPLE  (assuming no gaps) | COMPOSITION NOTES | **NORMALIZED PERMEABILITY INDEX WHERE N95 = 1.0** |
| 5-layer N95 (3M #1860) | “Fitted” around, 3M 5 layer | 1.0 |
| 3-layer N95 (3M #8200) | “Fitted” around, 3M 3 layer | 0.8 |
| Sheldon G mask w/ cellulose filter | Multi-layer mask designed by Sheldon Gentling | 0.3 |
| 1 12-oz heavy white denim, 2 OLY-FUN,  1 12-oz heavy white denim | OLY-FUN is 65 grams per square meter polypropylene nonwoven fabric | 0.5 |
| 1 Kona® cotton, 4 OLY-FUN, 1 Kona® cotton | Kona® quilting cotton fabric, supplied by JOANN Fabrics and Crafts, Hudson, OH | 0.7 |
| 2 Kona® cotton, 2 terry cloth | Cotton 100%, 120 TPI | 0.9 |
| 2 terry cloth towel layers | High density loop and weave | 0.9 |
| 4 Kona® cotton | Kona® quilting cotton | 0.9 |
| 1 lab coat, 1 flannel, 2 OLY-FUN, 1 Kona® cotton | Lab coat is a blend of polyester and polyaramid | 1.0 |
| Source: <https://dx.doi.org/10.1021/acsnano.0c03972>  *Chart compilation by ScienceNewsService.com* | | |

**Below, scanning electron micrograph of a small cluster of primary virus-like nanoparticles with a 200-nanometer-width scale. Saliva droplets temporarily go airborne with particles during talking, sneezing, and coughing. Corona-virus particles are about 60 to 140 nm in diameter.**

**To help relate, one millimeter is about half the side of a nickel—yet there are 1 million nanometers in a millimeter.** 

Source: <https://dx.doi.org/10.1021/acsnano.0c03972>

**PARTICLES GO AIRBORNE IN**

**WATER-BASED AEROSOL DROPLETS**