

# Cloth masks offer poor protection against air pollution

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Results of a new study by environmental health scientists at the University of Massachusetts Amherst suggest that inexpensive cloth masks worn by people who hope to reduce their exposure to air pollution vary widely in effectiveness and could be giving users a false sense of

security, especially in highly polluted areas.

Researchers Richard Peltier, Kabindra Shakya and colleagues believe theirs is the first study to rigorously test disposable surgical masks and washable cloth masks, which are widely used in Asia and Southeast Asia for personal protection against [airborne particulate matter](#). Their study shows that "wearing cloth masks reduced the exposure to some extent," but "the most commonly used cloth mask products perform poorly when compared to alternative options available on the market."

"This has clear [public health risk](#)," they add. Peltier says that particularly in the developing world, users should not assume that such masks convey protection, "especially if an individual makes personal choices not to avoid high concentration environments because they assume they are protected from these contaminants." Study details appear in the current *Journal of Exposure Science and Environmental Epidemiology*.

It was during an earlier air quality research project in Kathmandu, Nepal, and other travel in Asia that Peltier and Shakya were struck by how many people wore surgical or reuseable cloth masks on the street. Kathmandu has poor air quality because high polluting gasoline and diesel engines are common, as is burning tires and garbage. A poor air quality day in Los Angeles may see 100 micrograms of particulates per cubic meter (PM10), while in Kathmandu the level can be 800-900, Peltier says.

"We found ourselves wondering how effective these masks are. I was shocked that we couldn't find any research studies investigating them," he says, while the standard industrial hygiene mask known as the N95 is well tested. But such masks are not readily available in most developing countries, and at \$3 or \$4 each would be too expensive for most consumers. By contrast, reuseable cloth masks cost 10-15 cents and can be washed and worn for months.

In a series of experiments with an experimental mannequin, Peltier, Shakya and two undergraduate assistants tested four masks: one pleated surgical type, two cloth and one cone-shaped cloth with exhalation flaps. They tested for several variables and effectiveness in filtering out five different synthetic aerosol particle sizes plus three particle sizes of diluted whole diesel exhaust, which simulated real-world conditions. Among the cloth masks, the one with exhaust valves performed fairly well, removing 80-90 percent of synthetic particles and about 57 percent of diesel exhaust.

Plain cloth masks were "only marginally beneficial" they say, in protecting people from particles smaller than 2.5 micrometers, often considered more harmful than larger particles because they can penetrate the lungs more deeply. The least expensive cloth masks removed just 39-65% of standard particles of 30-, 100-, and 500-nanometers, and 1- and 2.5-micrometers. All masks performed worse for diesel combustion particles compared to monodispersed particles, the researchers report.

Filtration efficiency of cloth masks for particles emitted from diesel combustion ranged 15 to 57 percent for total particle concentrations (for 30-, 100-, and 500-nm) and 13 to 40 percent for total particulate mass. Cloth masks did offer measurable reduction in particle counts, but results were highly variable. The cloth mask with exhalation valve performed better than those without. The two worst performing masks performed better for larger particle size, but poorly on the more harmful smaller particle sizes.

"Unfortunately, the least effective two mask types are also inexpensive, reusable and are widely used in developing countries, implying they are a popular consumer choice where pollution mitigation is warranted," the authors note.

They found that mask shape and ability to mold to the face boosted

effectiveness. The cone-shaped cloth mask and snug-fitting surgical masks performed better than looser-fitting masks.

Peltier says this study has implications well beyond Nepal, because these masks are very common in China and India, and across much of southeast and southwest Asia. "What became clear to us is that millions of people probably wear these masks and feel safer, but we worry that this is potentially making things worse, if they stand next to a diesel truck and think they are protected by the mask, for example," he points out.

Shakya, who is from Kathmandu and has family there, says he hopes these results will help to further inform people who are already aware that air pollution poses a serious health risk. On World Environment Day this year, June 5, hundreds of people protested poor [air quality](#) in Nepal by donning face masks and laying down in the streets. "This study shows that people should know there is a limit to protection you can get from these cloth masks," he points out, "but also that something is better than nothing."

**More information:** Kabindra M Shakya et al. Evaluating the efficacy of cloth facemasks in reducing particulate matter exposure, *Journal of Exposure Science and Environmental Epidemiology* (2016). [DOI: 10.1038/jes.2016.42](#)

Provided by University of Massachusetts Amherst

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