



CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

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Project Title Can Your Sweatshirt Save You? Is Clothing an Effective Particulate Filter against Air Pollution?	
<p style="text-align: center;">Abstract</p> <p>Objectives During the wildfires Fall 2018, I observed many students at my school attempting to protect their lungs from air pollution by covering their mouths with clothing. The purpose of this experiment was to determine the effectiveness of seven common fabrics and two commercial masks in filtering out fine particulate matter.</p> <p>Methods A small room was polluted using a match, and the particulate concentration was measured with a Temtop AQ Monitor. A small, airtight box with an opening covered by the testing material and an attached pump was then inserted into the room. The pump sucked polluted air through the fabric sample. The particulate concentration inside the box was measured and recorded at ten second intervals. Each fabric, as well as one control without any filter, was tested three times. Fabrics were subsequently examined by microscope to measure pore sizes.</p> <p>Results The effectiveness of the filters was quantified as the percent reduction of average particulate concentrations before and after the air was filtered. Across three trials, the control with no fabric filter ranged between -16% and 6% reduction. All dry fabrics ranged between -18.3% and 7.7% average reduction. The commercial masks were substantially more effective, with the particulate respirator reducing pollution by 92% to 95% and the surgical mask reducing by 45% to 54%. Microscopic observations showed that the pores of the fabrics were an order of magnitude larger than the size of the fine particulates.</p> <p>Conclusions This experiment shows that articles of clothing are not effective as particulate filters. As expected, the particulate mask filters out most particulates. Surprisingly, the surgical mask appeared rather effective; however, it does not create an airtight seal and would undoubtedly be less effective in actual use. Thus, when experiencing air pollution, covering your mouth with clothing will not reduce the quantity of particles inhaled; other measures must be taken to protect your lungs.</p>	
Summary Statement Clothing is not effective at filtering out fine particulate matter and will not protect you from air pollution created by wildfires.	
Help Received I borrowed the air quality sensor from and was instructed in its use by my neighbor Jay Chesavage. I borrowed microscopes from the PA Junior Museum and Zoo for examining the fabrics. My parents assisted with data collection and safety procedures.	