# Photocatalytic Oxidation Utilizing Doped Titanium Dioxide for Air Purification

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Air pollution has become the deadliest environmental problem, leading to more than seven million deaths per year. People are forced to wear masks in China to protect themselves from the heavy smog in the area. In the U.S. alone, $500 million are spent yearly on air purifiers to increase indoor air quality. However, there are no air purifiers which are personal for someone to wear and use when they are outdoors. Furthermore, current effective air purifiers are extremely expensive (up to thousands of dollars) and cannot filter many dangerous pollutants such as volatile organic compounds (VOC). In order to mitigate these issues, a filter using photo-catalytic oxidation by doping titanium dioxide was created and tested. By using a sol-gel process, titanium dioxide nanoparticles were doped with various dopants such as silver nitrate and coated on a paper filter. This doping process reduced the band-gap energy, therefore; increasing the air purification efficiency. The screen was tested by passing polluted air through the filter and analyzing the outgoing air using air quality monitors. The PANI-doped titanium dioxide proved to be most effective in reducing air pollutants by bringing down the amount of VOCs by 99% after 2 hours. This data was also supported with the methylene blue degradation process seen through the ultraviolet-visible spectroscopy. Not only is the filter more affordable and efficient than others, the filter is the only air purification method capable of purifying air outdoors efficiently for a user.

**Awards Won:**

Intel ISEF Best of Category Award of $5,000

First Award of $3,000

Air Force Research Laboratory on behalf of the United States Air Force: First Award of $750 in each Intel ISEF Category