Skin oil -- ozone interactions worsen air quality in airplanes

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Airline passengers and crews who gripe about poor cabin air quality could have a new culprit to blame: the oils on their skin, hair and clothing. A study in the current issue of ACS' *Environmental Science & Technology* suggests interactions between body oils and ozone found in airplane cabins could lead to the formation of chemical byproducts that might worsen nasal irritation, headaches, dry eyes and lips, and other common air traveler complaints.

In simulated flights lasting four hours, American and Danish researchers placed two groups of 16 volunteers in a mockup of an airline cabin and then exposed them to varying levels of ozone and air flow, including levels typically experienced in real flights. Consistently, ozone in the cabin increased production of identifiable chemical byproducts including nonanal and decanal, a pair of aldehyde compounds associated with headaches, nasal irritation and with other symptoms of "sick building" syndrome.

More than half of the byproducts were the result of reactions with skin, hair and clothing, according to Charles Weschler, Ph.D., the study's lead author, who is with University of Medicine and Dentistry of New Jersey. These oxidative byproducts are produced when ozone reacts with squalene, oleic acid and other compounds in natural skin oils, he said.

"The role of these (by)products in the adverse health effects that have been associated with ozone is, at present, unknown," Weschler said. "If these oxidation products are demonstrated to be harmful, simple steps

can be taken to reduce their production in aircraft and buildings. For instance, installing ozone-destroying catalysts in airplane ventilation systems can help remove most of the ozone from incoming air, he noted.

In 2006, about 750 million people boarded commercial aircraft in the United States, according to the Federal Aviation Administration. At cruising altitude, the atmosphere outside of these aircraft contains very high ozone levels, frequently topping more than 500 parts per billion (ppb). According to FAA regulations, cabin ozone levels should not exceed 250 ppb at any time flying above 32,000 feet or average more than 100 ppb during any 4-hour flight segment that includes cruising at or above 27,000 feet.

Most wide-body planes are equipped with ozone-destroying catalysts in their ventilation systems, according to study co-author William Nazaroff, Ph.D., of the University of California, Berkeley. However, these catalysts are far less common on narrow-body aircraft. As a result, ozone in the cabin air of narrow-body planes can “exceed ozone levels in Washington, D.C., on a smoggy day,” Weschler said.

In fact, the study, which was supported by the FAA and the Danish Technical Research Council, could help scientists better understand the adverse effects of ground-level ozone, an important component of urban and regional air pollution. “Although this work was done in a simulated aircraft, the results certainly have implications beyond that,” Weschler said. “Any time you have a situation with high-occupant densities and elevated concentrations of ozone, the same kind of chemistry is going to occur.”

Source: American Chemical Society

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