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WHAT'S THAT STUFF?

# NEW CAR SMELL

VOCs account for the characteristic 'newness'

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There's something about the smell of a new car. To many people, the leathery, plasticky aroma that hits you when you slide behind the wheel is a pleasurable scent. Seductive. Perhaps even addictive. On the other hand, to a few people the smell is malodorous, particularly to someone who has an acute chemical sensitivity.

Exactly what gives rise to new car smell? The answer, not surprising to chemists, is a complex mixture of volatile organic compounds (VOCs), primarily alkanes and substituted benzenes along with a few aldehydes and ketones.

**SMELL OF THE ROAD** **Brown sets up monitoring equipment to measure total VOCs in a car.**
**CSIRO PHOTO**

Nearly every solid surface inside a vehicle is a fabric or plastic that is held together in part with adhesives and sealers. Outgassing of residual solvents and other chemicals from these materials leads to a dilute sea of VOCs floating about in the passenger compartment. The same holds true for new airplanes, homes, and offices.

A standard measure for automakers is to keep the gross amount of VOCs emitted by the textiles and flexible plastics low enough to prevent repeated fogging of window interiors. Each car manufacturer has its own standard for total VOCs in cars, one car company spokesman says, but he is unaware of any government standards regulating air quality inside new

vehicles.

Individual components of new car smell probably aren't harmful at the concentrations found in cars, but the cumulative effects of long-term exposure to the total mix of VOCs could pose health problems. Fortunately, high concentrations of these compounds quickly dissipate just a few months after manufacture. And although VOC concentrations can reach unhealthy levels in a closed vehicle on a warm day, the air-exchange rate in a car is high when someone opens a door, rolls down a window, or turns on the air conditioner.

Measurements for window fogging don't provide a breakdown of the chemical composition of air in new cars, however. Commentators in the media and on the Internet, as well as auto industry chemists contacted by C&EN, ascribe the pleasant scent of new car smell mostly to phthalate plasticizers used in polyvinyl chloride (PVC) or other plastics. However, bis(2-ethylhexyl) phthalate, generally used in PVC, is not very volatile. And the few publicly avail-able studies that identify VOCs in new cars don't report phthalates among the primary components of the total VOC mixture.

One such study, reported this past December, was carried out by Stephen K. Brown and Min Cheng of Australia's Commonwealth Scientific & Industrial Research Organization (CSIRO). The study took a look at VOCs in three new 1998 vehicles by gas chromatography/mass spectrometry analysis of air samples taken from the cars after they had been sealed for several hours. The cars were resampled at various intervals for up to two years.

The CSIRO researchers detected 30 to 40 VOCs in the cars, the most prevalent being toluene, acetone, xylenes, styrene, 1,2,4-trimethylbenzene, various $C_5$ to $C_{12}$ alkanes, ethylbenzene, and ethylene glycol butyl ether. Total VOC concentrations for the cars were initially as high as 64 mg per $m^3$ of air. For one of the cars, which was a few weeks older because it had been imported, the initial total VOC level was 2.1 mg per $m^3$. These values correspond to the parts-per-million to parts-per-billion range.

As a comparison, the report notes that total VOCs in the indoor air of new buildings is on average 20 to 40 mg per $m^3$, while established buildings have VOC levels generally below 1 mg per $m^3$. Negative sensory effects--headaches; drowsiness; nausea; respiratory distress; and eye, nose, and throat irritation--are likely to occur at concentrations above

about 10 mg per $m^3$, according to the report.

The total VOC concentrations in the cars fell off exponentially over time, the CSIRO researchers note, reaching about 1.5 mg per $m^3$ after six months. Two cars tested after two years had about 0.4 mg per $m^3$ of total VOCs. Outdoor air measured next to the cars was about 0.1 mg per $m^3$. There also is a temperature dependence to the VOC level: As the temperature rises inside the car, so does the total VOC concentration.

Not all of the VOCs are necessarily related to original materials in the passenger compartment, the CSIRO report points out. Benzene and other compounds from fuel or exhaust and siloxanes from cleaning products can contribute significantly to total VOCs.

CSIRO is considering developing a green air label to help consumers choose environmentally friendlier environments--such as cars, airplanes, offices, and homes--that have potentially healthier indoor air. Indeed, automakers try to eliminate parts that give off high levels of VOCs.

**THE OUTCOME** of these efforts is that some new cars just don't smell like new cars anymore. But therein lies the twisted irony of human nature: A host of air-freshener products with new car scent are designed to keep cars smelling showroom fresh indefinitely. None of these products, sold at car washes and automotive supply stores, has an ingredient list on the label--as "household products," ingredient labels aren't required--and companies contacted by C&EN would not divulge their proprietary secrets.

One fragrance industry spokesman tells C&EN that these products typically contain a small amount of the fragrance oil on a blotter card, in a gel, or diluted with water and/or alcohol. Simple fragrances may have only a few fragrance ingredients, generally aldehydes, esters, and ketones.

One of the first of these scents developed was the smell of treated leather, the spokesman notes. Tanned leather tends to give off a slightly rank odor, he says, so tanneries typically add artificial fragrance to the leather to keep it smelling fresh--think of the smell inside a shoe shop. The idea apparently caught on with some automakers, which have been known to add leather scent and other fragrances to cars.

Aromatherapy aside, new car owners should enjoy the original scent while it lasts. For the health conscious, Brown

suggests they should "make sure there is plenty of outside air entering the vehicle while they drive for at least six months after the vehicle has been purchased."

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