Chemistry

Janet Raloff reports from Anaheim, Calif., at the American Chemical Society's 192nd national meeting

Toxic showers and baths

Chloroform and trichloroethylene (TCE) are two highly volatile toxic chemicals that have been identified as contaminants in many municipal drinking-water supplies. In fact, points out Julian Andelman of the University of Pittsburgh Graduate School of Public Health, the National Academy of Sciences has estimated that 200 to 1,000 people may die in the United States each year from cancers caused by ingesting these contaminants in water. However, the major health threat posed by these water pollutants is far more likely to be from their inhalation as air pollutants in the home, according to preliminary data from a study Andelman and his colleagues have just reported.

In the past, he says, inhalation exposure to water pollutants has largely been ignored. But his data indicate that hot (43° C) showers can liberate about 50 percent of the dissolved chloroform and 80 percent of the dissolved TCE into the air. Emissions from hot baths, he finds, are half as high. (One reason, explains Andelman, is that because water droplets dispersed by a shower head have a larger surface-to-volume ratio than water streaming into a bath, more of the volatiles can vaporize out.)

Although showering can be an intense source of residential exposure to water pollutants, such as those studied here, it is far from the only important source. Andelman notes that only about 5 of the 50 to 70 gallons of water used daily by the average American goes for showers. Much of the rest is used in dishwashing and laundering.

Though actual doses will depend on many factors — especially the level of water contamination — the study does offer clues for limiting exposures. Cold showers can reduce the vaporization of dissolved volatile chemicals by 50 percent, Andelman says. And short showers help, since each doubling in shower time quadruples the dose from accumulating gases. Finally, to limit the spread of released gases into the rest of the home, he suggests closing the bathroom door while bathing and exhausting the room air outdoors.

Luring good bugs to feed on the bad

In recent years, chemists have characterized an increasing number of insect pheromones — chemical attractants that bugs use to find each other. Already many are used commercially to lure pests to a trap or to confuse pests by attracting them to a bait rather than a mate. In fact, note Jeffrey R. Aldrich and his colleagues at the Agriculture Department's Insect and Nematode Hormone Laboratory in Beltsville, Md., of the more than 200 insect pheromones that have been identified, all but two have been for pests.

Until now. Aldrich's team has begun focusing on identifying and synthesizing the lures for an entirely different class of bugs — those that feed on pests. Baits containing these predator pheromones can be used to draw in beneficial insects to feed on resident pests. Perhaps at least as important, they may also serve to protect the community of beneficials that arrive by offering a means of luring them out of fields or gardens before insecticides are sprayed.

Predators can be drawn to a new home by congregating pheromones, chemical attractants normally emitted when members of their species have scouted a rich feast of prey. As a result, Aldrich says, the agricultural use of congregating pheromones in baits should not encourage the buildup of insect resistance to a chemical the way toxic-chemical pesticides now do. In fact, he says, it "should actually select for the evolution of greater responsiveness by [beneficial] predators to man-made pheromones."

To date his group has identified the active ingredients in pheromones of several "true bugs" (Hemiptera) that prey on agriculturally important larval pests. While each bug responds only to its own species-specific pheromone, additional mixed-in chemicals have not reduced a predator pheromone's potency. (This is in sharp contrast, Aldrich says, to what has been observed for most pest pheromones.) The finding suggests that pheromones for several beneficial insects might be successfully combined in a single bait, he says. Aldrich expects that such baits, initially targeted for home gardeners (an enthusiastic market for alternative pest-control products), could become commercially available within "a few years."

How polluting is commuting?

Levels of some air pollutants in commuting vehicles "may be significantly higher than outdoor ambient concentrations and may constitute a substantial portion of an individual's total air [pollution] exposure," according to a pilot study conducted during rush-hour traffic in the Los Angeles Basin. The study, conducted by Margil Wadley and colleagues at the South Coast Air Quality Management District in El Monte, Calif., found that compared with typical outdoor concentrations seen in the area, mean in-car levels of benzene were 24 times higher than normal, toluene 5.5 times higher, lead 4 times higher, and nickel, manganese and chromium each 3 times higher than normal. However, Wadley notes, while these levels are seemingly much elevated over typical levels, with the exception of lead, each is still only about a thousandth or less of the permissible occupational-exposure limit set by the federal government. Mean lead levels were one-sixtieth the federal exposure limit.

Wadley says the Environmental Protection Agency has expressed strong interest in funding a larger follow-up study to investigate the relative contributions of such factors as freeway versus city-street routes and driving with the windows up, the air conditioner on or a smoker aboard.

New route to sweet navel orange juice

Some fruits — especially navel oranges — make for sweet eating but bitter drinking. The reason is the natural conversion of limonoids in the squeezed juice into intensely bitter chemicals such as limonin. Last year, Shin Hasegawa reported finding bacteria that could subtly transform limonin into nonbitter alternatives (SN:8/10/85,p.89). Now this biochemist, who is with the Agriculture Department's Fruit and Vegetable Chemistry Laboratory in Pasadena, Calif., reports identifying a potentially less costly treatment: spraying leaves of susceptible fruit plants with auxins — a plant hormone — before harvest.

Hasegawa's studies have shown auxins such as naphthaleneacetic acid to be potent inhibitors of nomilin, the chemical precursor of limonin. In 30 experiments, he demonstrated that auxin treatment of developing plants can block formation of up to 90 percent of the nomilin produced by similar but untreated plants — three times the reduction necessary to reduce limonin to nondetectable levels in navel orange juice.

Though Hasegawa's studies have not yet involved navel oranges, he says, "we are very confident that [auxins] will work in them" because the bitterness affecting their juice develops by the same nomilin-to-limonin conversion that occurs in the lemons and other fruits he studied. Still to be determined are the optimal timing, dose and frequency of auxin treatment. Hasegawa hopes to explore such factors in field tests, perhaps beginning next spring. If the process proves effective and economical, he believes it could bring California growers of susceptible fruit another $6 million to $8 million a year by allowing them to sell for juice any yields in excess of what can be marketed as fresh fruit.