CHEMISTRY

A cool heat pump

It will be no sweat for researchers at EIC Laboratories in Newton, Mass., to run their new heat pumps through the summer. The new chemical pumps, featuring methanol and calcium chloride, can air condition as well as heat.

When the chemical pump is in its heating mode, heat energy from outdoor air is used to boil liquid methanol. Because methanol has a very low boiling temperature, the pump can extract enough heat to evaporate the methanol even at wintery temperatures as low as 5°F. The methanol vapor travels to the absorber where it is "sucked in" by a bed of dry calcium chloride. The calcium chloride has a "thermodynamic affinity" for the methanol vapor. This means that it takes less energy for the compounds to exist together as a complex; so when the complex forms, the extra energy is released as heat, which can be used for space heating and domestic water heating or which can be rejected to the outside when the pump is air conditioning.

The air conditioning mode makes use of the calcium chloride bed once it is full of methanol. Because heat was released when the methanol was complexed onto the bed, heat is needed to drive the reverse reaction, or to liberate the methanol. Solar collectors provide this heat. The liberated methanol vapor passes into a chamber where outside air is used to cool and condense the methanol. Even when the thermometer hits 95°F, the air is still cool enough to condense the methanol vapor. The condensed methanol, now a liquid, moves to the evaporator, where, as in the heating mode, heat extracted from the outdoor air boils the liquid to form the methanol vapor. The evaporation process cools the stream of air from the outside, giving the heat pump its air conditioning ability.

While the electrical efficiency rating of conventional air conditioners is 8 (the cooling energy output is 8 times that of the electrical energy input), the chemical heat pump rates a 24. "In practical units," says EIC researcher Robert Malsberger, "this means that electrical consumption from 2-ton (24,000 Btu) cooling unit will be below 1,000 watts."

Dump the hunt?

To encourage citizens to meet with heads of hazardous waste-producing companies to evaluate each company's disposal sites, the Sierra Club this spring distributed more than 3,000 "Hunt the Dump" waste site evaluation forms. The U.S. Environmental Protection Agency estimates there are about 30,000 firms that store and dispose of hazardous wastes, but Sierra Club spokesman Blakeman Early says only five of their evaluations have been returned. The dump hunters now have turned their attention to developing a citizen's training course on how to approach community pollution problems.

Drool your resources

A chemical in mammalian saliva significantly increases the shoot growth of sorghum grass, reports Melvin I. Dyer of Colorado State University at Fort Collins. Dyer's discovery, published in the PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES (Vol. 77, No. 8), suggests that grazing animals directly stimulate plant growth. Dyer applied low concentrations of Epidermal Growth Factor — a hormone-like, cellular growth-regulating protein found in the salivary glands of mice and other mammals — to young sorghum seedlings. Three days later, the EGF-treated seedlings had grown about 15 percent more than untreated seedlings. Dyer hypothesizes that "EGF or EGF-like compounds provide a basis by which herbivores may regulate plant community productivity and possibly play an important role in co-evolutionary processes."

EARTH SCIENCES

Hydrogen may flag fault movement

Geologists involved in earthquake prediction are collectors, gatherers of the subtle signals given off by an earth that is ripe to crack. To that still-growing, largely unproved agglomeration — which includes precise measurements of earth movements as well as observations of abnormal animal behavior — a group of Japanese scientists may soon by able to add hydrogen. In the Oct. 10 SCIENCE, they report that hydrogen gas may be released from soil in increasing amounts as movement — such as that which may presage an earthquake — occurs along an underground fault. These observations, they say, may be "the first evidence of fault movement detected by a geochemical method."

Since November 1978, Hiroshi Wakita and Yuji Nakamura from the Laboratory for Earthquake Chemistry at the University of Tokyo and three co-workers from other Japanese institutions have measured the kinds and amounts of gases released from the soil along part of the Yamasaki fault in southwestern Japan. The researchers collected soil gas samples from 10-to-20-foot-deep holes at 21 sites, 10 of which were on the fault. The samples were analyzed for helium, hydrogen, oxygen, nitrogen, methane and argon. The researchers found that while concentrations of other gases at all sites were similar to those found in the atmosphere, "extraordinarily large" amounts of hydrogen were detected at the 10 sites along the fault. Hydrogen concentration at those sites ranged from 3 parts per million to 31,000 ppm, while hydrogen measured about 0.5 ppm at each of the 11 sites away from the fault. "There is a clear correlation," the researchers write, "between the sites with the high H_2 concentration and the fault system.... This result suggests a strong correlation between H_2 degassing and fault movement."

Wakita and co-workers suggest that the gas is produced in chemical reactions that occur when groundwater meets fresh rock surfaces exposed by fault movements. They note, however, that before their observations can become useful for earthquake prediction, continuous field measurements are needed to link specific increases in hydrogen with identified fault movements.

Hurricane batters coral reefs

When Hurricane Allen spun its 185-mile-per-hour winds through the Caribbean in early August (SN: 9/6/80, p. 150), it hopscotched around most of the populated islands where it might have done its worst. But populations of another sort were not so lucky, according to J. D. Woodley, director of the Discovery Bay Marine Laboratory in Jamaica. Allen brushed within 50 kilometers of the northeast coast of Jamaica, with minimal damage to the island, but "[b]eneath sea level, the spectacular fringing coral reefs suffered considerable damage," he says in the Oct. 2 NATURE.

The picture is not a pretty one: "[A]fter the hurricane waves subsided, the water was turbid with fine sediment and pulverized tissues; there was a smell of dead corals, gorgonian and sponges....Branching corals have been smashed, massive corals toppled or split, and plate-like ones fractured or torn off the reef slopes. Gorgonians and sponges have been ripped away or broken, echinoids destroyed and many fishes injured too....Tons of sediment have been removed from the reef slopes and terraces. Sand-blasting and flying missiles have caused extensive abrasions, especially in the shallowest zones, where almost total destruction prevails."

Studies are continuing, he says, to determine how and if damaged corals and other attached organisms will survive and to chart the process of regeneration of a new reef community. Freshly exposed surfaces already sport massive blooms of various green algae, he reports, but adds that where damage is extreme, recovery may take decades.