

A sieve for selecting cesium

One of the more deadly products of a nuclear reactor accident is the radioactive isotope cesium-137. Because this metal vaporizes easily, winds can carry it over long distances, contaminating large areas. Two researchers have now discovered a form of the mineral mica that acts as a highly selective sieve for capturing cesium ions. Such an ion trap could be useful for decontaminating the environment after accidental releases of nuclear material. Sridhar Komarneni and Rustum Roy of Pennsylvania State University in University Park report their discovery in the March 11 *SCIENCE*.

The researchers start with samples of a naturally occurring mineral known as phlogopite mica. The mineral is ground into a fine powder and then chemically treated to replace its potassium ions with sodium ions and water molecules. This process increases the spacing between the layers that make up the mica's structure. The modified material, when immersed in a cesium-containing solution, readily releases sodium ions while taking in cesium ions.

Presently, clay minerals and zeolites, both naturally occurring and synthetic, are used extensively in the decontamination and disposal of radioactive wastes. For example, after the Chernobyl nuclear accident, the mineral mordenite was added to animal feed in Sweden to remove cesium-137 from the gastrointestinal tracts of contaminated animals. The use of modified, powdered mica offers greater selectivity for cesium and much better resistance to acidic conditions like those found in an animal's stomach. Komarneni and Roy suggest that the mica powder can be used for decontamination by dispersing it in water or soil and then filtering out the cesium-laden product or by letting cesium-contaminated humans or animals ingest the material, which would later be excreted.

The newly discovered cesium ion sieve, the researchers say, "not only selectively exchanges cesium ions but also immobilizes them at room temperature through chemical bonding that . . . leads to the formation of a crystalline waste form at room temperature."

The brightness of 60,000 suns

People who want to use solar energy for high-powered applications must somehow concentrate the sunlight that is received on the surface of the earth. Various arrangements of mirrors and other optical components will do this. Now, at the University of Chicago, physics professor Roland Winston and graduate student Phillip Gleckman have designed a solar concentrator that uses "nonimaging" optics to concentrate sunlight to an intensity of 6 kilowatts per square centimeter, or 60,000 times the normal intensity of sunlight on the earth. The previous record for solar concentration was below 1 kilowatt per square centimeter, they say.

Winston and Gleckman use a 16-inch astronomical mirror borrowed from the university's Yerkes Observatory, but to it they add a device that squeezes the image the mirror makes. A large mirror will gather more sunlight than a small one, but it also makes a larger image than the small one, so it may not represent much gain in energy concentration. The "Winston concentrator" is a precisely machined cone of silver placed at the focus of the 16-inch mirror. It squeezes down the image of the sun made by the mirror, which is 1 centimeter across, to a spot less than 1 millimeter across.

One importance of this achievement is that it is above the energy concentration—about 5 kilowatts per square centimeter—needed to energize varieties of lasers that have many scientific and technical uses. Among the possible applications, according to Winston, are laser communication in space, development of materials, disposal of hazardous wastes and isotope separation for nuclear fuels.

To nurse? The black and white picture

Over the past two decades, there has been what the medical profession sees as a beneficial resurgence in the number of U.S. women choosing to breast-feed. However, data show that blacks are only half as likely to breast-feed as whites, and that black women who do nurse generally stop sooner than nursing whites. To better understand this trend, epidemiologists at the National Institute of Child Health and Human Development studied 1,179 first-time mothers in the Washington, D.C., area. In the March *PEDIATRICS*, Natalie Kurinij and her colleagues say education, rather than race, is the major factor affecting whether and how long women nurse.

In their study, 84 percent of the white mothers and 49 percent of the black mothers initially opted to breast-feed—far more than the national averages of 65 percent and 33 percent, respectively. The white mothers tended to be about five years older than their black counterparts, and to have had about three years more schooling (16 years). Moreover, white mothers were far more likely to be married, to have a higher family income, to attend childbirth classes and to receive prenatal care from a private physician.

When these were accounted for, the study showed that women—regardless of race—were 2.6 times more likely to breast-feed if they had a college education than if they attended high school only, and that those who went to graduate school were 5.2 times more likely than high school graduates to nurse. One other factor correlated with a white mother's choice: Delivering at a university teaching hospital instead of a county public hospital doubled the chance that a woman would nurse.

Among black women, the picture was more complicated. For example, the researchers found that, other things being equal, a black woman was twice as likely to breast-feed if she attended childbirth classes, if she was married or if she was 25 or older. However, even after accounting for these factors, the researchers found that whites were still twice as likely as blacks to breast-feed. Employment may offer a clue why. Kurinij notes that in this study, most whites had professional careers, while most blacks had clerical jobs. If the professional women were able to take longer maternity leaves, she says, this may have fostered a greater commitment to breast-feeding.

Finally, black women who did nurse tended to give it up earlier. After one month, 26 percent of breast-feeding black mothers had quit nursing, while only 10 percent of white mothers had. By seven months, half of those white mothers who chose to nurse were still breast-feeding, while only 26 percent of their black counterparts were. Women of either race who supplemented nursing with bottled formula during their hospital stay tended to abandon breast-feeding first.

How to eat heartily

The American Heart Association (AHA) has just issued minor changes to its dietary guidelines aimed at preventing heart disease. In the March issue of *CIRCULATION*, the group recommends: limiting dietary fat to less than 30 percent of calories, with polyunsaturated and saturated fats each accounting for no more than 10 percent of total calories; limiting dietary cholesterol to 300 milligrams per day; making carbohydrates 50 percent or more of one's calorie allowance, with emphasis on complex carbohydrates; letting protein provide the remainder of calories. In addition, AHA recommends limiting sodium to 3 grams daily and alcohol consumption to 1 or 2 ounces of ethanol daily.

The major difference between this list and the one issued in 1986 (*SN*: 8/30/86, p.135) is that the earlier one tied quantitative limits—such as 300 mg of cholesterol—to each 1,000 calories consumed. The new version makes such limits a rigid daily total, even for people consuming more than 2,000 calories.