ENVIRONMENT

For particularly bad toxics

Disposing of hard-to-degrade toxic chemicals and pesticides has been a problem. But tests by chemists at Lockheed Palo Alto Research Laboratory confirm that microwave plasma detoxification will completely break down the most persistent chemicals—such as kepone and PCB's. Depending on the waste, it may even yield salable byproducts.

Microwave (2,450 megahertz) energy excites molecules of a carrier gas, usually oxygen, into a glowing plasma, says the Environmental Protection Agency's Donald A. Oberacker; he oversees the Lockheed contract. Highly energetic free radicals within the plasma bombard and break down any wastes introduced, he explained. Although the physical temperature inside the chemical reactor is only about 200°F, the effective temperature is about 10,000°K, due to the excitation of the gas molecules, he told SCIENCE NEWS.

Lockheed's tests were run by Lionel J. Bailin and Barry L. Hertzler in a five-kilowatt, two-liter reactor capable of degrading five to seven pounds of wastes per hour. A 15-kilowatt, three-liter reactor to handle 30 pounds per hour is scheduled to begin tests soon.

Oberacker speculates that commercial systems may consist of a series of three-liter modules. A 100-pound-per-hour plant could likely destroy wastes at a cost of $.23 per pound, if operated year round, 24 hours a day, he said. It would be cost competitive with other techniques if used on concentrated, highly toxic, hard-to-degrade wastes. Environmentally it would be better, he said, because it ensures total destruction, regardless of the type of waste.

The tests and projected-cost calculations are described in the June ENVIRONMENTAL SCIENCE AND TECHNOLOGY.

Health costs due to air pollution

The cost of pollution-related death and disease runs from $1 billion to $10 billion annually, according to the American Lung Association's *Health Costs of Air Pollution*. Under a contract with the Environmental Protection Agency, author Stewart W. Herman surveyed 23 studies published between 1967 and 1977, then noted what he considered their deficiencies and future research needs for more accurate health-cost calculations.

The diversity of approaches and assumptions used supports the span of results as a "reasonable" estimate of health costs. All studies were incomplete, however; Herman said "their total would almost certainly exceed $10 billion" if each had not omitted at least two of the following:

- summing up costs of all pollutants;
- studying all pollutants. At best, most concentrated only on sulfur dioxide, particulates, nitrogen dioxide, hydrocarbons, carbon monoxide and photochemical oxidents;
- factoring in all health costs. "Studies covered only well known respiratory and heart diseases, excluding more subtle but perhaps equally significant effects";
- including all costs, such as compensation for time housewives lost to illness, for pain or for bereavement;
- attaching full value to pollution-related disease. "Victims" unused to placing a dollar value on health will probably escalate now-accepted values as they "learn in concrete terms how air pollution is undermining their health."

In private interviews, some researchers agreed more data is needed to establish scientifically acceptable dose-response information, the extent of individual exposures and how many are exposed to different pollutants. But a better gauge of health costs "would have limited usefulness apart from its shock value" unless it pinpoints specific pollution sources as targets for cleanup or action, Herman says.

BIOLOGY

Julie Ann Miller reports from Cold Spring Harbor, N.Y., at the Symposium on DNA: Replication and Recombination

Tandem genes for double action

Stepped up production of cell material during rapid growth might be accomplished by different plans. The cells could more efficiently crank finished products off their original templates, or they could increase the number of basic templates in use. John R. Roth of the University of Utah reports experiments done with Phil Anderson (now at the Medical Research Council in Cambridge, England) that suggest duplication of important templates during rapid bacterial growth.

Tandem duplications, gene copies one right after the other, commonly arise in bacterial DNA. Most seem to result from an unequal exchange between matched chromosomes. Roth proposes that the inequality is generated when similar sequences in different positions on the chromosomes line up, the chromosomes break and exchange pieces.

Roth and Anderson found tandem duplications most common in certain regions of the chromosomes. Most involve genes for ribosomal RNA, an important component of the protein-making machinery. One cluster of gene duplications was not in a known ribosomal RNA gene, but Roth predicts such a gene will be detected in that region. Because the frequency of duplications is highest in rapidly growing cells, Roth and Anderson believe creating extra copies of ribosomal RNA genes may be a significant mechanism for allowing faster protein production.

Gene in a cradle

The geometry of a protein-DNA interaction was reported by Alexander McPherson and colleagues at Pennsylvania State University. They have examined the structure of "unwinding" protein from the bacterial virus, fd. That protein destabilizes the DNA double helix, performing what McPherson calls "cooperative unzippering."

The protein has a globular shape with a single wing, according to X-ray diffraction analysis. McPherson identifies the underside of the wing, a shallow groove 30 angstroms long, as the DNA-binding region. That ledge contains the parts of the protein associated with DNA binding in other experiments. In solution, unwinding protein is found as dimers, in which the globular regions bind each pair of molecules together and the wings stick out on each side.

The researchers also examined complexes of the unwinding protein bound to fragments of DNA. They find the fundamental unit contains 12 copies (monomers) of the protein arranged hexagonally or pseudohexagonally. The DNA binding stimulates cooperative interactions between contiguous protein molecules. The researchers propose the protein forms a spindle around which DNA spools. The DNA thus remains accessible to other proteins for subsequent reactions.

"Go" signal for DNA synthesis

A viral protein is the signal that turns on DNA replication in an infected cell. Robert Tjian of Cold Spring Harbor Laboratory has isolated a protein from SV40, a virus that infects some cells and makes other cells cancerous. That protein (called T antigen), when microinjected into individual cells in laboratory culture, alone stimulates synthesis of the viral DNA.

Tjian has examined how the protein binds to DNA, because that interaction probably controls viral replication. He finds that the protein binds to three sites within the stretch of viral DNA that includes the area where the DNA copy originates. That stretch includes three repeated sequences of 23-base pairs with 25-base pair separations, Tjian reports. Further studies suggest the protein binds to a specific 12-base pair tandem sequence in the repeated stretches.