CHEMISTRY

Arms of the revolution: PSD . . .

Analytical chemistry is in the midst of its third revolution — one that is expanding the field's territory beyond the detection of single atoms and molecules. Chemist Herbert A. Laitinen of the University of Florida in Gainesville explained at the meeting in Las Vegas of the American Chemical Society that analytical chemistry developed from an art into a science near the turn of the 20th century and then evolved into an instrumental methods-oriented field during World War II. The third revolution, still in progress, demands an "increase in detail of information beyond elemental composition," Laitinen says.

Surface science — the study of how atoms and molecules behave at the edges of materials — is one of the seeds of the third analytical revolution. Research in this area includes the analysis of complex surface-bonding structures of catalysts to determine, for example, why some catalysts outperform others. Such information is of economic importance for petrochemical and synthetic fuels industries who regularly use catalysts in their processes. Researchers at the National Bureau of Standards in Gaithersburg, Md., and at IBM in Yorktown Heights, N.Y., recently reported an improved technique for gathering such surface data.

The new technique — angle-resolved photon-stimulated desorption, or PSD — zeros in on and breaks only selected surface chemical bonds, says NBS researcher Roger L. Stockbauer. In PSD, a synchrotron — a ring of accelerating electrons — emits photons of specific energy that selectively knock inner-shell electrons from the surface atoms under study. Electron ejection ionizes an atom and causes the desorption, or release, of that ion from its surface bond. The direction that the positive ion moves from the surface after photon stimulation is directly related to its initial location and surface bond angle.

modified laser-induced fluorescence . . .

Two familiar tools of the analytical trade have been combined to identify harmful and possible cancer-causing chemicals in industrial pollutants. Suzanne Deutscher and colleagues of Lawrence Livermore Laboratory in Livermore Calif., have combined laser-induced fluorescence — in which a pulse of laser light stimulates a chemical to glow with a characteristic light — and high performance liquid chromatography — in which molecules are separated on the basis of size, polarity and chemical composition — in an attempt to determine why fly ash from one western coal-fired plant shows cancer-causing potential while ash from another plant does not. Polycyclic aromatic hydrocarbons may be responsible for the difference.

and the Wee Pocket Chirper

Although it sounds like something one might encounter on an Audubon Society field trip, the Wee Pocket Chirper can more easily be spotted at nuclear power plants. Developed by C. J. Umbarger and colleagues at Los Alamos Scientific Laboratory (LASL) in New Mexico, the chirper is a tiny, sensitive, battery-powered warning device that "chirps" when exposed to radiation.

While the small, clip-on film and thermoluminescence dosimeter (TLD) badges now used by radiation workers also are sensitive, these devices only record the total accumulated exposure to be read later on special machines. Intended to supplement these other radiation monitors, the chirper immediately indicates radiation exposure by the number of chirps given off per minute. In older chirpers, gas-filled Geiger counters detected the radiation; the new wee chirpers use a smaller and more sensitive counter made from a chip of cadmium telluride that emits a small electrical signal when struck by radiation.

BIOLOGY

Yellowjacket nests welcomed in lab

Cornell scientists are not panicked but rather are proud that yellowjackets have built nests in their laboratory. It is the first time scientists have succeeded in persuading the stinging wasps to take up residence in specially designed laboratory cages. Captured queens of four species of yellowjacket began making nests this summer. Roger A. Morse and Kenneth B. Ross hope to maintain large colonies of the insects in order to provide yellowjacket venom for chemical investigations and material to desensitize persons allergic to the wasps' sting.

In the past 10 years, the German, or "picnic," yellowjacket has become a major problem in the eastern United States. The wasps have voracious appetites for most human foods, including meats, ice cream, soft drinks and even beer. Morse notes that a yellowjacket population explosion in the 1970s coincided with major expansion of the fast food industry.

Insulin alchemy goes commercial

In the race to produce human insulin for therapeutic use, the Danish insulin producer Novo Industri has announced plans to convert insulin extracted from pig pancreas glands into the human version of the hormone. Pig and human insulin differ in only one amino acid. Although Japanese scientists already have published methods for switching the differing amino acids, alanine, which is characteristic of pig insulin, and threonine, which is characteristic of human (SN: 8/18/79, p. 118), Harold Smith of Novo says the process the company will use is "our own internal development" and Novo has patent applications pending. Speaking in New York at an E. F. Hutton Investment Seminar on Biotechnology, Smith said the company will begin clinical trials early in 1981.

Eli Lilly and Co., Novo's major competitor in insulin production, already has produced human insulin from genetically engineered bacteria in clinical trials (SN: 7/26/80, p. 53). But unlike production of insulin by bacteria, Novo's conversion method would depend on the availability of pig pancreas glands. Smith says several major studies predict no shortage of glands, at least in the next two decades.

Better antidote for plutonium

Scientists at the University of California and Lawrence Berkeley Laboratory have taken another step in the development of a compound that can specifically bind to plutonium and carry it out of the body after accidental contamination. Last year, Fred Weitl and Kenneth Raymond reported the development of chemicals containing sulfonic acid groups (SO_2OH) that can remove plutonium from mice (SN: 10/6/79, p. 232). The sulfonated chemicals, however, turned out to be toxic to the animals' kidneys. At the recent meeting in Las Vegas of the American Chemical Society, Weitl described similar compounds with carboxylic acid (COOH) in place of sulfonic acid. Those chemicals bind plutonium as tightly and as specifically as the sulfonated chemicals do, but "they seem to work better in the body," Weitl says.

Animal tests performed by Patricia Durbin of LBL show that the carboxylated compound, called LICAM-C, removes plutonium injected into mice, rats and dogs. The bound radioactive material is excreted both in the urine and feces without any sign of tissue damage. LICAM-C may even be able to extract recently incorporated plutonium from bones, Weitl says.

The role for the plutonium-binding chemicals is expected to go beyond treatment of the approximately 10 people who are accidentally contaminated each year. Weitl says the compounds have promise for extracting plutonium from nuclear wastes and thus reducing disposal problems.