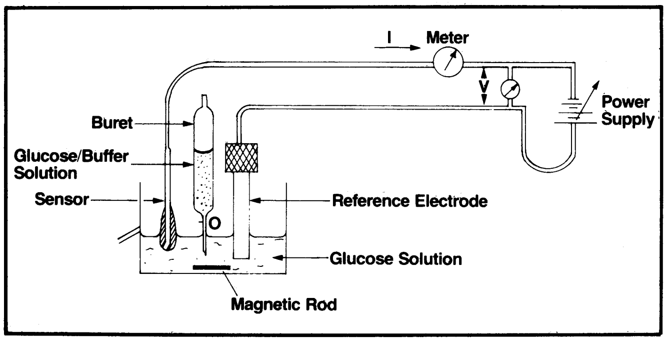
CHEMISTRY

Linda Garmon reports from Vancouver, British Columbia, at the 28th International Union of Pure and Applied Chemistry...

Sugar sensor

Researchers are attempting to conquer the complex enemy diabetes from several different fronts. One approach is to develop an implantable sensor that would continuously monitor the concentration of glucose in the blood or tissue fluid of diabetic patients. The sensor would work in conjunction with another implanted system that would deliver glucagon (to raise sugar concentration) and insulin (to lower sugar concentration) to maintain normal blood glucose levels. Unfortunately, the sensors that thus far have been investigated for such a system are too complex, short-lived or easily poisoned by certain natural body chemicals.

Now, however, Ebtisam Wilkins and C. Odayle of the University of New Mexico at Albuquerque report what they believe to be an improved sugar monitor—a coated wire glucose sensor (CWGS). Implanted in a small vein or body tissue, this device would measure glucose concentration in terms of potential between (or different concentrations of) the glucose embedded on the electrode and the glucose in the body fluid. Another needle-like wire would be implanted close by, and the two electrodes would be connected to an external meter. While the CWGS has performed well in the laboratory (see diagram of the test set-up below), it will be at least 2 years before it is tested in diabetic patients. Researchers first must determine the possible effects of other body fluid ions and compounds on the performance of the sensor.



The sopping of seaweed

Seaweed has had a high-mineral reputation for some time now, but Philippine researchers no longer believe the marine alga's aspirations should be limited to food and fodder supplements. Seaweeds, report G. J. B. Cajipe and colleagues of the University of the Philippines at Quezon City and Andrea H. Luistro and co-workers of that country's Ministry of Natural Resources, may prove useful in the control of marine metal pollution.

Cajipe and colleagues found that specific seaweeds were effective binders not only of minerals such as calcium, potassium and magnesium, but also of metals — particularly of lead and copper. Using absorption spectroscopy — an analytical technique that involves identifying elements and structures through their characteristic energy absorption and subsequent energy emission spectra—the researchers found that the high mineral concentrations can be attributed to the ionic attractions of positively charged mineral elements to the negatively charged gels carrageenan of *Eucheuma striatum* and alginate of *Sargassum polycystum*. They then found that the carrageenan and alginate also have high affinities for metals: One gram of *Sargassum*, for example, can soak up 99.99 percent of the lead and 95.83 percent of the copper in a 100-millimeter, multi-metal salt solution."Results point to the potential use of algae-derived products in the treatment of effluent water contaminated with these metals," Cajipe and colleagues conclude.

and then from New York, N.Y., at the American Chemical Society meeting

When they're hot, they're not

Five commonly used pesticides break down much faster in the tropics and subtropics than in temperate zones, reports N. S. Talekar of the Asian Vegetable Research and Development Center in Taiwan. Over a 4-year period Talekar conducted soil accumulation tests of DDT, dieldrin, fonofos, phorate and carbofuran. "The findings have far-reaching implications," he says, because pesticide use in developing countries often is restricted on the basis of test results obtained in temperate countries.

The stamping ground of chemists

Colors are the fingerprints of stamps. "Every serious collector is aware of the high values associated with color errors, rare shades and the like," explains Fred W. Billmeyer Jr. of Rensselaer Polytechnic Institute in Troy, N.Y. But, "How does the average collector know whether his U. S. 1861 3-cent Washington stamp is the common, inexpensive rose variety or the rare, very expensive pigeon blood pink, or the intermediate rose pink, pink, lake, rose red or any of a half dozen other varieties?" Identifying the precise color can be extremely difficult, says Billmeyer, "primarily because of the inconsistent, nondescriptive naming systems used by the publishers of stamp catalogues." Now, modern methods of chemical analysis have come to the philatelist's rescue to clear up this color confusion.

The colorants in stamp inks, papers, cancellations and postmarks are based on either organic materials—natural or the more recent synthetic dyes — or mixtures of inorganic substances such as iron oxide (red) and oxidized mercury (carmine). While time and handling can distort the initial color, those original organic and inorganic materials still can be identified using various chemical analyses.

Billmeyer's analytical specialty is searching for the *organic*-based stamp colorants using nondestructive spectroscopic techniques, or the reflectance of light from sample areas. Billmeyer can obtain tell-tale reflectance curves from solid-color stamp portions as small as 1 to 2 millimeters in diameter. Such curves can distinguish, for example, the U. S. 1893 4-cent Columbian Exposition stamp that was normally printed with an ink containing ultramarine blue from its rare counterpart that was printed once by error with iron blue like the 1-cent stamp of the same series.

But reflectance curves cannot always single-handedly crack the stamp color-code. Then, Billmeyer must combine his spectroscopic force with that of solution spectrophotometry — an analytical technique that also involves obtaining characteristic spectra of "unknown" colorants but that is less desirable because it damages the stamp — and X-ray fluorescence.

The X-ray method pinpoints the *inorganic*-based stamp pigments, says Rensselaer's Ivor L. Preiss. This nondestructive technique involves exposing sample areas to radiation and observing the resulting characteristic X-ray emission patterns.

X-ray fluorescence analysis recently was utilized along with the spectroscopic and spectrophotometric techniques to help decode the color history of the 1861 3-cent Washington stamp. It had been previously reported that this stamp first was printed with a form of the red, insect-derived cochineal. This ancient textile dye produced the shades now known as pink, rose pink and pigeon blood pink. Billmeyer and colleagues demonstrated that the various shades arose primarily from variations in the printing process—"The very valuable pigeon blood pink variety was merely one printed with a little more ink or a little more pressure in printing than normal." In addition, the chemists determined that because the cochineal dye was not adequately light-fast, later issues of the stamp were printed with inks that also contained iron oxide as a duller red colorant.