CHEMISTRY

Benzoyl peroxide: A radical expression

A chemical used in acne medications and cosmetics and also in various polymer industry applications promotes growth of skin tumors in mice. That chemical — report T. J. Slaga and colleagues of Oak Ridge National Laboratory in Tennessee and J. E. Trosko of Michigan State University in East Lansing — is benzoyl peroxide.

Composed of two C_7H_5O (benzoyl) rings joined by a weak O-O (peroxide) bond, benzoyl peroxide easily splits into two free radicals — atoms or groups of atoms with an odd (unpaired) electron. While this free radical-generating ability is desired in certain industrial processes such as polymerization, curing and cross-linking (bridging polymer chains), it also imparts to benzoyl peroxide a tremendous capability to alter biochemical pathways and damage cell membranes in the human body.

Benzoyl peroxide's potential harm has been largely overlooked in past years, perhaps because the results of earlier skin-painting studies indicated that it is not a carcinogen — that is, not a *complete* carcinogen. Slaga and co-workers, however, took into account that skin tumors can result not only from exposure to a complete carcinogen, but also from combined exposure to both a cancer initiator and promoter.

Topically applying benzoyl peroxide and various other substances to mice, Slaga and colleagues found that the free radical-generating compound plays the role of promoter in two-stage skin carcinogenesis. In the initial studies, published in the Aug. 28 SCIENCE, the initiator was a polyaromatic hydrocarbon, or PAH — a chemical class that includes substances found in cigarette smoke and car exhaust, for example. Now, however, the researchers are investigating the effect of UV light (initiator) and benzoyl peroxide (promoter) on mice, to simulate combined exposure to the chemical and sunlight.

When all the data are in, says Slaga, they undoubtedly will suggest that benzoyl peroxide-containing medications and cosmetics should be used only in moderation. "But the most important part of the research," he says, "is that it suggests that free radicals play a role in tumor promotion." Says Slaga, "A number of studies have implied they are involved in carcinogenesis, but this research assigns them to a specific role."

Chemistry capsules

• It is one small step toward the electric car and one giant leap for the organic battery. C&D Batteries and Allied Corp. of Plymouth Meeting, Penn., recently gained rights to use the metalless battery technology developed by Alan G. MacDiarmid and colleagues of the University of Pennsylvania in Philadelphia (SN: 2/14/81, p. 101). Officials of the firm say development of marketable rechargeable organic batteries — which could be ideal for electric cars because they have a high energy density, or quantity of electricity stored per unit weight — is within a decade's reach.

• U. S. Food and Drug Administration officials recently cracked down on some clandestine chemistry when they seized fake pep pills and other nonprescription "look-alike" drugs at nine manufacturers in New York, Illinois, Pennsylvania, Florida and Alabama. These products had been distributed nationwide — via campus newspaper advertisements and truck-stop handbills, for example. Some of the drugs — similar in size, shape, color and markings to amphetamine products such as Biphetamine-20 and Ionamin-30 that are often diverted to street sales — contained a combination of nonprescription ingredients such as caffeine, phenylpropanolamine (a nasal decongestant and appetite suppressant) and ephedrine (a decongestant). Such counterfeits are particularly dangerous because they deceive physicians attempting to provide proper medical care in overdose cases.

PHYSICAL SCIENCES

Hot star in the neighborhood

In the constellation Ursa Major is a faint star, 300 light-years away, that changes brightness with a 2.29-day period. However, what attracted the attention of astronomers was the star's intensely blue spectrum indicating a very high temperature. Even more puzzling was that the star's spectrum sometimes showed strong absorption lines and at other times sharp, intense emission lines in time with the brightness changes.

In the Sept. 17 NATURE, Bruce Margon of the University of Washington and Ronald A. Downes and Jonathan I. Katz of the University of California at Los Angeles conclude, based on spectrophotometric measurements, that the observed variations are not the eclipses of a binary system as one star passes in front of the other. Instead, they hypothesize that the variations are due to the effects of a very hot, white dwarf star heating its cooler companion.

Because the hot star emits mostly ultraviolet light, it would be largely invisible from the earth. However, its cooler companion would intercept the white dwarf's ionizing flux and reradiate the light. Margon reports, "Maximum light corresponds to observation of the irradiated face of the cool companion, and the strong emission spectrum is due to reprocessed radiation from the white dwarf."

The researchers estimate the hot star's temperature to be 100,000°C, making it possibly the hottest known white dwarf star. The astronomers note that BE Ursae Majoris, as the system is designated, seems likely to figure prominently in future studies of the heating effects of stars and the nature of extremely hot white dwarfs.

Bursting bubbles in space

One of the problems in making glass in space is finding a way to remove the bubbles that inevitably form during any glassmaking process. Normally, manufacturers rely on the effects of buoyancy to remove the bubbles.

To investigate a possible solution to the problem, Westinghouse Electric Corp. scientists flew a glassmaking experiment in a "Black Brant" rocket as part of the Space Processing Applications Rocket program of the National Aeronautics and Space Administration. The experiment showed that in a very low gravity environment, bubbles respond to a temperature gradient.

Bubbles tend to move to a region of lower surface tension. Because surface tension decreases with increasing temperature in most molten glasses, bubbles move toward the higher-temperature surface.

Senior scientist Harry D. Smith says the experiment is a very important early step toward glass made in space by a containerless-melting process. Because the glass never touches the walls of its container, it would have far fewer impurities that affect the glass's physical and optical properties. "We have the potential of refining these properties to their ultimate degree in a very pure glass material," Smith says.

The next step is to perform a more refined, quantitative experiment so theoretical models of bubble behavior can be checked in more detail.

Reflections in a golden sand

Researchers at the University of Arizona's Optical Sciences Center in Tucson have turned to gold-plated sandpaper as a diffuse reflector of infrared light, according to a report in the Aug. 1 APPLIED OPTICS. They tested a variety of sandpapers and concluded some samples gave repeatable results over long periods of time at small angles of incidence. It's not perfect, but it's the best material yet found for infrared systems.