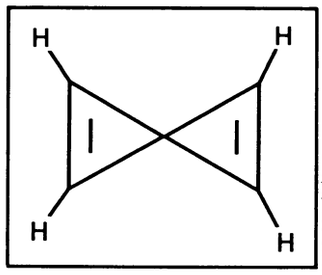
Chemistry

Elusive bowtie pinned down



Billups/Rice Univ.

Behold the "bowtie" diene.

Down the hall from the makers of the now-famous buckyballs, neighboring chemists have synthesized another long-sought carbonaceous compound and have given it an equally flip moniker. Their bowtie-shaped molecule, officially called spiropentadiene but nicknamed bowtiediene, consists of five carbon and four hydrogen atoms. The compound had fascinated theoreticians — and eluded experimentalists — for decades because of the very strained configuration of its carbon atoms. Its simple structure would pack in so much energy that chemists could not figure out how to make it stay together.

But W.E. Billups and Michael M. Haley of Rice University in Houston accepted the challenge. And in the June 19 JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, they report producing the molecule.

"It's a classical molecule that will probably find its way into textbooks," William P. Dailey, an organic chemist from the University of Pennsylvania in Philadelphia, told SCIENCE NEWS. "I was very excited to hear about this."

The molecule, which resembles a bowtie with one side bent perpendicular to the other, belongs to a chemical family called the spiroalkenes, whose members possess a single carbon at their cores.

Even though they had never seen it, theoreticians were tantalized by the size and inherent instability of the hypothetical molecule, and had sought to predict its properties. Each end of the bow consists of a doubly bonded pair of carbon atoms; a hydrogen atom hangs off each outer carbon. "It's aesthetically pleasing because of its simplicity and its symmetry," says Dailey. Those double bonds, though separated in space, are close enough to interact and to greatly stress the molecule's structure, adding to its appeal to researchers.

To make bowtiediene, Billups and his co-workers placed an unusual silicon-based compound in a reaction apparatus designed to generate gaseous, high-energy compounds. They collected the product in a tube cooled by liquid nitrogen. When sufficiently chilled, the compound's carbons stayed together, allowing them to perform analyses that confirmed its identity. The Rice team next plans to send a student to Germany to collaborate with researchers there in an attempt to find out whether the double bonds interact as theorized.

New meaning for 'dry-roasted' peanuts

Roasting brings out a peanut's flavor by increasing the amount of free amino acids and simple sugars in the tasty kernels. While experts usually judge peanut varieties by the quantity of these flavor precursors, food scientists in Taiwan have now shown that moisture content and roasting time can significantly alter the quality of the final product.

A team led by Robin Y.-Y. Chiou at the National Chiayi Institute of Agriculture in Chiayi pretreated peanuts to have a moisture content of either 10.5 or 3.4 percent. They roasted the samples for up to 45 minutes, assessed their color and then ground the nuts for chemical analysis.

In both the moister and dryer peanuts, amino acid and sugar content increased during the first 10 minutes of roasting, then decreased significantly 35 minutes later, they report in the June JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY. However, they found, the moister peanuts underwent a greater color change and retained more of the flavorful free amino acids.

Earth Sciences

Shrinking Arctic ice

When it comes to greenhouse warming, experts regard the Arctic and Antarctic as a planetary early warning system. These icy regions are thought to be particularly sensitive to changes in climate, and they may show clear signs of a warming before other parts of the globe do. Last week, scientists reported that the extent of Arctic sea ice diminished slightly between 1978 and 1987, although they say it is still too early to tell whether the ice changes bear the fingerprint of a greenhouse warming.

Satellite measurements reveal about a 2 percent drop in the extent of the Arctic sea ice over the nine-year period, according to Per Gloersen of the NASA Goddard Space Flight Center in Greenbelt, Md., and William J. Campbell of the University of Puget Sound in Tacoma, Wash. Regions of open water within the ice pack also diminished by about 3.5 percent. By contrast, sea ice in the Antarctic did not change significantly in the same period, the researchers report in the July 4 NATURE.

These observations bear at least a superficial resemblance to the results of some climate models, which suggest that rising concentrations of greenhouse gases in the atmosphere would warm the Arctic before the Antarctic. But Gloersen says the nine-year satellite record is too short to distinguish long-term climate trends, and that scientists must continue to monitor sea ice over the next few decades.

Less precipitation over land areas

Following three relatively wet decades, precipitation over Earth's land areas declined by some 5 percent during the 1980s, according to rain and snowfall records. The downward trend appears strongest in the tropics of the northern and southern hemispheres, says Henry F. Diaz of the National Oceanic and Atmospheric Administration in Boulder, Colo. He and his colleagues compiled the precipitation record from information collected at more than 5,300 land stations scattered around the globe.

Because the record shows strong natural variations over the last several decades, Diaz says it will be difficult to use rain and snow amounts to detect signs of human-induced climate change.

Quake rocks southern California

Los Angeles and its environs awoke to a rocking alarm clock on June 28, courtesy of a magnitude 5.8 quake that originated under the San Gabriel Mountains. This is the fourth strong shock to hit the San Gabriel Valley area in the last four years. Seismologists say they don't know why the region has become so shaky of late, but they expect the quake activity to continue in the future.

The recent temblor caused significantly less damage than the magnitude 5.9 Whittier Narrows earthquake that struck the valley in 1987. Why the difference in destruction? Aside from being slightly smaller, last month's quake centered in an unpopulated mountainous region, whereas the earlier quake originated close to Whittier and other cities, explain seismologists Kate Hutton of Caltech and Lucile Jones of the U.S. Geological Survey, both in Pasadena. The Whittier Narrows quake also cleared out many of the weakest buildings and prompted people to reinforce those that survived.

The geometry of the involved faults may have played a role as well, Hutton and Jones say. Scientists studying the recent quake believe it occurred on the Sierra Madre fault, which dips under the mountains at a 45° angle. During the quake, the northern side of the fault slipped up over the southern side, which holds the region's major population centers. The side that slips upward, called the "hanging wall," typically suffers more damage than the downward-slipping "foot wall."