Agriculture

Good news, if eating insects bugs you

"If you ate cereal for breakfast this morning, as I did, you ate some [insect parts]," notes Barrie Kitto, a biochemist with the University of Texas at Austin. "It doesn't hurt you in the least," he adds; in fact, some diners might even consider it a protein bonus. But Kitto doesn't. Nor does the U.S. Department of Agriculture (USDA), which contacted Kitto four years ago about developing a better insect-screening test for federal grain inspectors.

USDA and the Food and Drug Administration are currently investigating the new assay. If approved as a regulatory tool, it should speed and lower the cost of federal monitoring for insect contamination, says Kitto.

Currently, inspectors look for whole insects or big fragments by spreading out grain kernels and eyeballing them. To scout out smaller fragments, they put about a half cup of flour into a beaker with acid and heat it for several hours. Then they mix this stuff with mineral oil, shake it up, filter off what floats to the top – eight times – and dry the resulting extracts. Technicians view the residue under a microscope and count the individual fragments.

"It takes about six months of training to become an insect-fragment counter," Kitto says. Once proficient, technicians can process six or eight tests a day. At $5 each, the new tests cost a fraction of the old ones. Moreover, Kitto notes, after just two days of practice, an individual can usually perform up to 40 of the new immunological assays daily.

Kitto describes his test as "similar in concept to a home pregnancy test." It looks for myosin, a muscle protein present in insects at all life stages, and provides a good screen for all but tiny eggs, he says. When an extraction fluid is added to grain or foods containing the protein, the mix turns green. The deeper the hue, the more protein present. Using a color meter, "you can get very quantitative readings," Kitto maintains.

Right now, regulators don't know what to do with those readings. The current federal standard allows 75 insect fragments per 50 grams of grain: Fragment size – whether it's three-quarters of a large maggot or just a fruit fly's wing tip – is immaterial. Kitto's assay, by contrast, quantifies insect-contaminant mass. Deciding how best to correlate the two appears to be "one of the reasons that it's taking so long for [this test to win] approval as a regulatory standard," Kitto says.

Wheaty wastes fight rancidity

Manufacturers rely on additives – mostly synthetic compounds – to retard oxidation, natural chemical reactions that can turn fat-bearing foods rancid. However, concern about the potential carcinogenicity of the most popular synthetic antioxidants, especially BHT and BHA (SN: 2/15/92, p.104), has driven a search for all-natural alternatives. Cereal scientists at North Dakota State University in Fargo believe they have identified a promising source in durum wheat *(Triticum durum)*.

Several cereal grains – including durum – contain naturally high levels of phenols, aromatic organic chemicals that often exhibit antioxidant properties. Sylvester N. Onyeneho and Navam S. Hettiarachchy produced phenolic extracts from wastes in the production of durum semolina (a milling fraction used in high-quality pastas, such as macaroni and spaghetti).

When added to oil, all extracts displayed antioxidant activity, the researchers report in the September JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY. Bran's share was highest, cutting oxidation 70 percent over that seen in unprotected oil. Though a mix of BHA and BHT provided 12 percent more protection from oxidation, Onyeneho and Hettiarachchy believe improved separation techniques may eventually yield durum extracts that match or exceed the protection offered by such synthetic antioxidants.

Astronomy

Keeping an eye on Io

Until the Voyager 1 flyby in 1979, many astronomers thought of Jupiter's moon Io as pretty commonplace. But Io's proximity to Jupiter endows this moon with several intriguing features. Stretched and compressed by the gravitational tug-of-war between Jupiter and the planet's other satellites, Io is the only moon in the solar system known to undergo volcanic eruptions. Particles spewed out by Io can interact with the inner part of Jupiter's magnetic field and replenish the doughnut-shaped cloud of ions that encircles both the planet and its satellite.

Now, 13 years after Voyager's close-up view, the Hubble Space Telescope has cast its eye on Io. From its Earth-orbiting vantage point, Hubble can only resolve features larger than 250 kilometers across – one-third the sharpness of Voyager's camera. But the spectra and images taken earlier this year and released last week shed new light on Io and its environs.

By comparing the brightness of Hubble images taken in visible light and in the ultraviolet, astronomers confirmed that a frost of sulfur dioxide coats large areas of Io. Detecting the signature of sulfur dioxide – bright in visible light but dark in ultraviolet – clinched the finding, says Francesco Paresce of the Space Telescope Science Institute in Baltimore.

He adds that Io's overall appearance seems surprisingly unchanged since the Voyager flyby. Although volcanic eruptions on Io might dramatically alter the face of the satellite, Paresce suggests that other, unknown processes may remove or cover volcanic debris, preserving large-scale features.

Using a Hubble spectrograph to study sulfur and oxygen emissions, other researchers found that Io has a far shallower atmosphere than previous measurements had suggested. Melissa McGrath of the Space Telescope Science Institute and her colleagues report that Io's atmosphere extends about 900 kilometers above the surface, about one-eighth the maximum height inferred by another orbiting instrument, the International Ultraviolet Explorer. Accurately measuring the extent of the atmosphere, notes McGrath, will help researchers model how Io influences its Jovian surroundings.

Another team, using Hubble to analyze ultraviolet emissions, found evidence that Io's tenuous atmosphere is extremely patchy. Some areas may have 1,000 times the density of other regions, says John T. Clarke of the University of Michigan in Ann Arbor. This patchy atmosphere may result from volcanic "hot spots" that release more gas than other areas or from selective evaporation of surface frost due to sunlight.

Clarke also reports that the ultraviolet glow from Io's atmosphere vanishes 15 minutes after the moon passes out of reach of the sun's warming rays and into Jupiter's shadow. The finding suggests that the atmosphere condenses onto the moon's surface during the shadow period. Alternatively, he notes, the atmosphere may remain unchanged, but the supply of ions striking the upper atmosphere – and possibly triggering the glow – may dramatically decline in shadow.

NASA

Some bright patches in Hubble's visible-light image of Io (left) appear dark in the ultraviolet (right), an indication that sulfur dioxide ice coats the Jovian moon.