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The Gulf oil spill

Dramatic satellite-image pictures (see **cover** and article beginning **page 486**) of the Persian Gulf region show the smoke plumes from the burning oil fields and the slick caused by the release of 10 million barrels of oil on 24 January. The pictures have been processed from images obtained by the Indian satellites INSAT-1B and IRS-1A, and the US satellite NOAA-11. According to the estimates made by Indian Space Research Organisation (ISRO) scientists the smoke has reached a height of at least 3 km, i.e. it has got well into the upper atmosphere. Smoke emitted owing to normal fuel consumption for the entire world is 15 million tonnes per month, whereas the smoke from the Gulf flames caused by the burning of 75 million barrels of oil per month is about 600,000 tonnes per month. How the injection of 4% to 5% extra smoke into the atmosphere from a very small region of the earth would affect the environment, the weather and the monsoon is the question that ISRO scientists try to answer in their paper. The analysis of the smoke plumes has been done using visible radiation in the orange–red region, while the oil-slick analysis has been done using thermal-infrared-region data. This oil slick is approximately 10 times the accidental spill from the tanker *Exxon Valdez* that occurred in Prince William Sound in Alaska in 1989. The study of the Alaskan spill gave us an understanding of the effect of such oil spills on marine life and satellite imagery provided insight into the dynamics of oil films on the surface of the sea. Within 24 hours about 40% of the oil evaporates, and the heavier hydrocarbon fraction sinks to the bottom of the sea. Only 40 to 45% of the oil, the medium-density component, remains on the surface, forming an emulsion with seawater. Winds drive the oil and the spill is thickest at the downwind edge. With time, wind and sea waves break the film into small, semisolid balls, which either wash ashore or drift in the ocean. When the film becomes very thin, surface-tension effects take over. In the early stages, the thick films have a temperature higher than that of the surrounding water, mostly owing to heat absorbed from the radiation from the sun. (In the case of the first Gulf slick it was 4 to 5 K higher. This difference in temperature had decreased by 2 K on 2 February.) When the films are thin enough emissivity differences are predominant and the film becomes colder than the water. Using such information it is possible to separate the thick films from the thin in the satellite images. Infrared radiometers can detect oil-film thicknesses as low as 25 μm.

After careful analysis of the data, the authors have also given their views on how the smoke and the oil slick will affect our environment. They feel that (a) the environmental effect of the oil slick may not be too significant, (b) the smoke-induced cooling over the Indian subcontinent may be less than 1 K, (c) there may be a very small delay in the arrival of the monsoon and there is also the possibility of the monsoon being slightly weaker than normal.

Pyrogenicity checks

An innocuous note (**page 457**) draws attention to the LAL test for detection of bacterial endotoxin. This test is of importance to India as the Government has pledged itself to fulfil the goal of the World Health Organization of 'Health for all by 2000 AD'. It is estimated that India would need Rs 50 billion worth of medical devices by the start of the millennium to meet the target. All these supplies have to pass the mandatory tests for sterility and pyrogenicity. The classical method for pyrogen testing, which involves the use of rabbits, is cumbersome, difficult to reproduce, and expensive. The US Food and Drug Administration has accepted an *in vitro* test for endotoxins of gram-negative bacteria, called LAL (Limulus amoebocyte lysate) test, which reliably detects these pyrogens. The comprehensive guidelines cover validation procedures, applicability and contra-indications. The LAL test uses an extract derived from horseshoe crabs (*Limulus polyphemus*), which abound in our coastal waters. The extract gives a highly sensitive, characteristic reaction with endotoxin. Being a highly reproducible *in vitro* test, it is difficult to fake, and does not require an animal house with a large number of animals.

The horseshoe crab can be cultivated like lobsters in farms. There are rumours that large 'Boeing loads' are being collected and transported to the more advanced countries for the extraction of LAL. Such illegal removal of one of our important resources can be banned provided we take steps to produce the extract, not only for indigenous consumption but also for export. It is also important that ecologically responsible solutions be found even in the beginning. The Indian Pharmacopoeia has not yet accepted the LAL test for endotoxin. However, there are encouraging signs. The Bureau of Indian Standards has taken the first step to draft standards for the LAL test. It is also heartening that the Chitra Tirunal Institute for Medical Sciences and Technology has initiated steps to introduce the test in India in a systematic way. The National Institute of Oceanography has already done much work on the horseshoe crab. Obviously this work must be supported and enhanced. It must be ensured that this simple test finds its way into the Indian Drugs and Cosmetics Act soon in the interests of users of the vast number of biodevices that the country will have to produce.

A question of strain

The increasing concern voiced in regard to the use of chemical pesticides in recent years has stimulated much interest in alternative strategies in pest control. When the insecticidal activity of *Bacillus thuringiensis* (BT) was discovered a few decades ago, the future of microbial insecticides appeared very bright. The insecticidal activity of BT resides in insecticidal proteins, which lyse the epithelial cells of the midgut of certain insects. However, users had many questions to ask, e.g. the extent to which insects are able to develop resistance to this microbe. Fortunately, even after three decades of testing, no significant resistance has been observed. Use of this microbial insecticide is banned in India because of the fear that it might harm the sericulture industry, which depends on the careful rearing of silkworms. On the other hand, there are many strains of BT, and four major classes of insecticidal proteins whose target-insect groups are fairly distinct, some of these strains are harmless to silkworms while being effective against several pests. Malla Padidam and Kunthala Jayaraman discuss (page 464) strategies of using BT as a safe, environmentally sound pest-control method in India.

Phosphogenesis

Around Udaipur in Rajasthan in North-west India, there are large deposits of phosphorites in the dolomitic limestones (of the Aravallis), whose age has been estimated to be 2 billion years. Geologists are interested in knowing how these phosphorites were formed. Most phosphorite deposits of the world are known to be closely associated with organically rich sediments, and living organisms seem to play an important role in the genesis of these minerals. M. S. Sisodia reports (page 497) the observation of microsized bodies of 20 to 100 μm, which he has identified as fossils of cyanobacteria. With this discovery a fairly reasonable picture seems to emerge about the genesis of these phosphorites. It is suggested that the stromatolites in which the phosphorites are confined originally consisted of cyanobacteria. Since the cyanobacteria did not have any serious competition they grew luxuriously In this process, there was a considerable accumulation of phosphorus. After the metabolic process stopped, the cells slowly transformed into these large stromatolite beds.