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Striking oil in a marine plant

Scientists in Bangalore are designing a novel solar panel using diatoms which can produce oil in a jiffy. **T.V. Jayan** reports

In his lab located in a quiet corner of the Indian Institute of Science (IISc), Bangalore, ecologist T.V. Ramachandra is preparing to design a unique solar panel. Millions of solar panels are in operation all over the world, but this one will trap sunlight to produce not electricity or heat but oil, which is quite similar to petroleum.

Dotting the panel is not an array of photovoltaic cells that convert light into electricity, but tens of thousands of tiny single-celled marine plants called diatoms, which produce an oily substance. This oil, Ramchandra hopes, can be separated and tapped on a continuous basis. “It is quite like milking a cow,” he says.

Diatoms, which belong to the algae family, are microscopic plants that frequently appear as phytoplankton in oceans or as a brown, slippery coating on submerged stones. There are more than 1,00,000 species. Barely a third of a hair strand in diameter, they are known for their intricate, beautifully sculpted shells that resemble fine lacework.

When diatoms die, they drift to the seafloor and deposit their shells and oil into the sediments. This oil is believed to have played a crucial role in the formation of petroleum reserves millions of years ago. Such reserves are the source of nearly 70 per cent of the conventional energy in use today. However, they run the risk of exhaustion in the next few decades if the current levels of exploitation continue.

“Diatoms are producers of much of our fossil oil, although their relative contribution hasn’t been quantified properly,” says Canadian scientist Richard Gordon, whose chance meeting with Ramachandra in Bangalore two years ago led to the innovative idea. “We hope they would be even more efficient in producing fresh oil,” says the professor of radiology at the University of Manitoba. “This offers a possibility to fast-track petroleum production,” adds Ramachandra.

Ramachandra and Gordon, whose collaborative work appeared recently in the journal *Industrial Engineering and Chemistry Research*, delved deep into available scientific studies to come up with some astonishing facts. For instance, they found that nearly 25 per cent of the body weight of diatoms is purely oil, and that the figure goes up to 35 to 40 per cent when the organisms are starved of nitrogen. In contrast, only 5 per cent of the biomass of oil-bearing plants such as soybean and oil palm — which are widely used to produce biofuels — is oil. Also, diatoms — unlike other oil crops — have an extremely high rate of growth. Some species can actually double their biomass within five to 24 hours.

Scientists have estimated that a hectare of diatom cultivation can yield 30,000 litres (nearly 200 barrels) of oil which is 100 to 200 times greater than the capacity of soybeans.

It is these figures that prompted scientists to sit up and think. But although the idea is appealing, the path is strewn with difficulties, says Ramachandra.

“The idea is still on the drawing board, even though we have a clear notion of how to proceed,” Ramachandra told *KnowHow*. One of the first things the scientists want to do is genetically manipulate diatoms so that they produce maximum oil.

As envisaged, the diatoms floating in a nutrient-rich medium (water) inside the “biological” solar panel will harness sunlight to continuously produce oil, which can then be separated using simple techniques. The diatoms inside the panel will be periodically replaced as they

live for only a few days.

Ramachandra has already roped in biochemists and geneticists from other departments of the IISc to work on improving the lifespan and oil content of diatoms. And funding doesn't seem to be a problem as a few international oil companies have evinced interest in the project.

N.V. Joshi, a researcher at the Centre for Ecological Sciences, who is not connected with the study, feels this is an innovative and plausible idea. "It most certainly has the potential to be hugely successful," he says.

Joshi wonders why other scientists didn't think of it earlier. "The information that forms the basis of the venture has been available all along," he says.

Gordon is happy to be associated with the project. There are a number of teams worldwide trying to exploit algae for biofuels. Prominent among them is Synthetic Genomics of San Diego, California. The founder of the firm is Craig Venter, the head of a privately financed version of the human genome project in the late 1990s.

Clearly, a race is on to create a biofuel substitute for petroleum. And Gordon thinks there is no reason why India can't lead the race. "It is a question of geopolitical motivation versus vested interests, the imagination of politicians and business people, and a willingness to take risks," observes Gordon. "Venter has cash (US oil giant Exxon is funding his project), but the US has yet to achieve the necessary motivation," he says, adding he would be glad to be an advisor to a team put together in India.

If they succeed, Ramachandra and his colleagues may be able to cut short the protracted process of petroleum formation by millions of years.