

The Signs & the Science

How IIT-Delhi is coming up with eco-friendly technologies to boost a sustainable environment

:: Vanita Srivastava

A nasal filter that can ease breathing problems, a three-wheeler running on hydrogen, and cement that has a lower polluting effect, all have a common target: protect our precarious environment from further degradation. Scientists at Indian Institute of Technology (IIT) Delhi are experimenting with new technologies, eco-sensitive devices and mapping pollutants to make our environment and ecological habitats sustainable. The experiments, besides weaving a multi-disciplinary apparatus, have also boosted the industry-academic collaborations.

"We have seen a drastic change in the environment in the last few years and, if not checked, this can be detrimental. While policy formulation will be done at the government level, there is an urgent need for academic institutions to scientifically analyse the data emanating from the atmosphere and provide the right unbiased inputs to the government," IIT-Delhi director V Ramgopal Rao says. "IIT Delhi is at the forefront of such research."

On the eve of World Environment Day, here's a peek into some of the eco-friendly experiments underway in the labs of the institute:

Nasal Filter for Pollution-free Respiration

When Prateek Sharma graduated from IIT-Delhi in 2015, he had a dream – to make a device that could ward off pollutants. The civil engineering graduate had seen his mother suffer from asthma and wanted to build a prototype for resisting the pollutants in the environment.

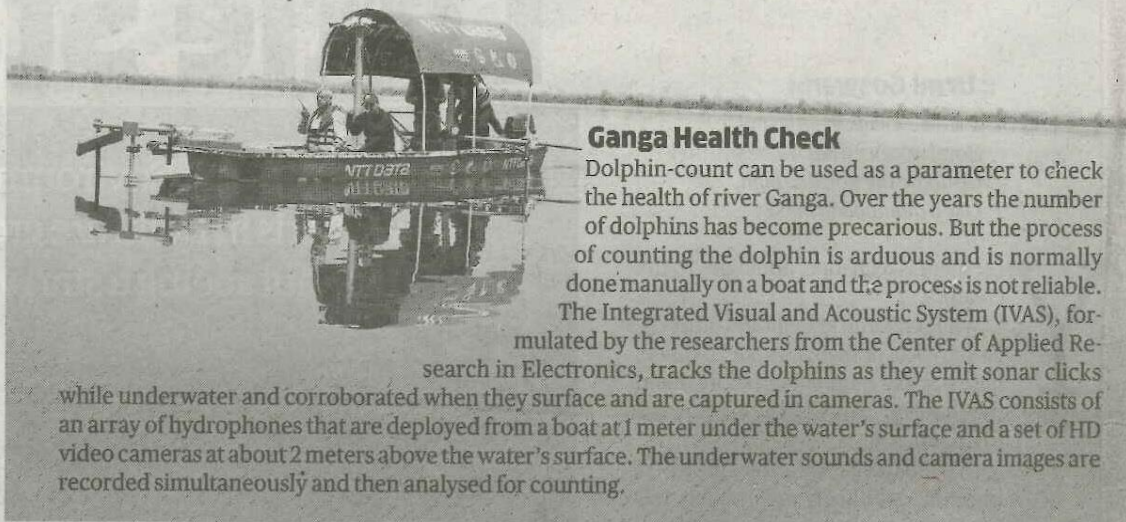
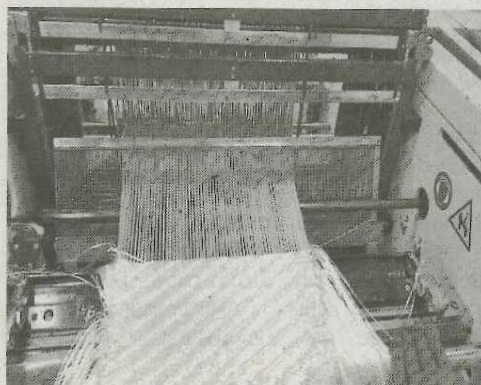
Sharma, together with a bunch of IIT-Delhi graduates and faculty members of the textiles department, formed a company Nanoclean Global to commercialise the. The team used nanotechnology to build

Nasofilters that sticks on the nasal orifice. The technology involved assembling millions of small-sized pores to create a thin flexible membrane, which could capture minute particles with high efficiency. If you're wondering how does one breathe with the nostrils closed, Nasofilters contains a porous substrate, which does surface filtration; it can auto clean itself as one exhales, so there is no breathing resistance.

The device was recently awarded the Startups National Award 2017 by the Technology Development Board. With a price tag of a mere ₹10, the filter is set to be available in the market by August. The team is also targeting a global market for the filters.

Sustainable Vehicle 3D Textiles

Replacing the steel structure of automobiles with a 3D fabric made from glass, carbon and natural fibers can reduce fuel consumption by nearly 25%. That's the target a team of researchers from IIT-Delhi's textiles department are aiming at. Together with the collaboration with companies like Toyo



Ganga Health Check

Dolphin-count can be used as a parameter to check the health of river Ganga. Over the years the number of dolphins has become precarious. But the process of counting the dolphin is arduous and is normally done manually on a boat and the process is not reliable. The Integrated Visual and Acoustic System (IVAS), formulated by the researchers from the Center of Applied Research in Electronics, tracks the dolphins as they emit sonar clicks while underwater and corroborated when they surface and are captured in cameras. The IVAS consists of an array of hydrophones that are deployed from a boat at 1 meter under the water's surface and a set of HD video cameras at about 2 meters above the water's surface. The underwater sounds and camera images are recorded simultaneously and then analysed for counting.

ta, Maruti and Mahindra, the project was sanctioned funding of ₹10 crore from the textiles ministry in March. "By replacing the stainless steel in automobile with this fabric, there will be a nearly 40% reduction in weight. This will result in a saving at least 25% in fuel consumption," head of textiles department BK Behera said.

Hydrogen-powered Vehicles

Researchers at the Center for Energy Studies (CES) have been working on alternate fuels, mainly hydrogen-powered vehicles for transportation. "Hydrogen fuel has near zero emission and is capable of solving the twin problems of energy crisis and energy degradation. Application of hydrogen as transport fuel can improve the air quality in our cities," says LM Das, one of the principal investigators of the project. The 15 hydrogen-operated three wheelers, developed in collaboration with Mahindra & Mahindra, were used at Pragati Maidan, Delhi from 2012 till May 2017. The research team also developed two hydrogen mini buses as part of the project, which are currently undergoing field trials.



Converting Biomass

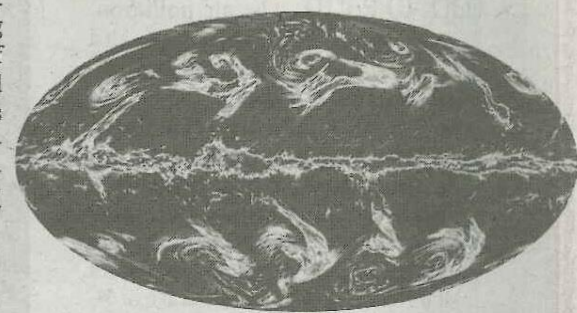
For the residents of Delhi, the thick envelop of smog just after last year's Diwali was debilitating. When the smog refused to budge, analysts reasoned that it was because of the burning of agro-residues in the field of Punjab and Haryana. Burning of paddy straw releases greenhouse gas which disturbs the chemistry of the atmosphere. The researchers at Centre for Rural Development and Technology have evolved a technology to convert the agricultural residue into bio-methane, thus generating energy and silica-rich bio manure, evolving an eco-friendly platform for reducing the pollution. The team has provided technical support to Asia's first biogas-based power plant based on paddy straw at Fazilka, Punjab. They have also collabo-



rated with the Indian Oil Corporation for setting up a plant in Punjab to convert paddy straw to bio-methane, which can be used as fuel and electricity generation.

Eco-friendly Cement

Researchers from the civil engineering department have collaborated with JK Lakshmi Cement and carried out the first full-scale trial production of a new cement known as Limestone Calcined Clay Cement (LC3) and developed an environment-friendly additive for concrete that makes it easier to produce high quality cement. Trial applications have shown that it can reduce as much as 30% CO2 emissions and 20% energy consumption in cement production. Shashank Bishnoi, who is coordinating the collaboration at IIT-Delhi, says, "Direct interaction with the industry will also ensure a more practical and hands-on training for the students and researchers, instead of rote learning."



India-centric Climate Model

The Centre of Excellence in Climate Modeling, funded by the Department of Science and Technology, will develop an India-centric climate model to address the pressing issues of climate change. The researchers aim to develop an India-Centric Climate Model (ICCM) through process improvements and region-specific customization that can simulate the regional climate of India and can be used for future climate projections at district level to assess the impacts of climate change on agriculture, health, water resources, and the energy sectors. The ICCM output will be downscaled at ultra-high resolutions for various applications. ■

The writer is a freelance journalist