

interactions malfunctions, it may lead to disease. The scientists combined the information on gene expression profiles and protein-protein interaction networks to create their algorithm.

To test the algorithm, the researchers applied it to many cancer datasets. They could identify several genes significantly linked with the corresponding disease. Then they used the algorithm exclusively on colorectal cancer datasets. And they established that their algorithm can detect more colorectal cancer genes than other disease gene identification methods.

The researchers plan to improve their algorithm further, to make RelSim a useful and powerful tool for identifying other disease-related genes.

Information Sciences, **384**, 110–125

Ethanol from Lignocellulose

Lignocellulosic biomass represents a large feedstock for bioethanol production. However, the costs associated with producing biofuel using lignocellulases represent a limiting factor in the development of a biomass conversion process.

Scientists at the CSIR IICT, Hyderabad, collaborated with scientists in Egypt and Australia to explore *Pongamia pinnata* seed residue as a low cost resource for ethanol production. *P. pinnata* seeds are composed of 30–35% oil which can be processed to biodiesel. The residue after extraction of oil has holocellulose, which can be hydrolysed to sugars and fermented for bioethanol production. So, the researchers used the de-oiled seed residue as feedstock for ethanol production.

Enzymatic hydrolysis of the seed residue using cellulase results in significant yield of sugars. But the scientists explored another possibility: growing microorganisms that produce lignocellulases on de-oiled seed residue. They selected two microorganisms – *Spingomonas echinoides*, a bacterial strain, and *Iprex lacteus*, a white rot fungus. And they found that these organisms were able to produce a wide array of lignocellulase enzymes while growing on *P. pinnata* seed residue. Solid state fermentation using both the strains produced lignocellu-

lases with high activity, 10–50 times greater than that observed in liquid cultures! So the organisms can be useful for the hydrolysis of biomass, while doubling up as a source of lignocellulases.

Pongamia pinnata seed residue is a cheap inedible resource for both lignocellulases and ethanol production. It has the potential to produce ethanol in an efficient manner compared to other costlier resources. And, most importantly, the technique improves the economics of *P. pinnata* biodiesel production.

Renewable Energy, **103**, 682–687

Pomegranate and Grapefruit

Extend storage of fruits of sea

White shrimps, with high protein and low fat content, are nutritive and a commercially important seafood. Its aquaculture in Asia has rapidly increased over the last decade. India now exports frozen shrimps to the USA, the European Union, the UAE and Japan.

Shrimps have short-shelf life due to degrading enzymes. Exporters need to preserve freshness and maintain quality from harvest to delivery. So several preservation methods are in use such as low-temperature preservation, modified atmosphere, chemical as well as biological preservation. But importing countries have strict sanitary standards and zero tolerance to use of chemicals and antibiotics in preservation.

Researchers from the Anna University, Chennai, now report an effective alternative to chemical preservatives: extracts of fruit peels and seeds. They used extracts of pomegranate, grape and grapefruit wastes. Shrimp samples were treated with four different extracts: (a) pomegranate peel, (b) pomegranate seeds, (c) grape seeds, (d) grapefruit seeds and left to dry at ambient temperature for a few minutes in an aseptic condition.

Samples were then packaged using different methods. Some were packed in vacuum pouches containing different transmission rates of O₂ and CO₂. Some were subjected to packaging with various percentages and combinations of gases and stored at 3 C.

Different parameters including bacterial load, sensory evaluation of col-

our and odour were recorded every third day for 24 days of storage. Samples treated with extracts of pomegranate peel and grapefruit seeds combined with modified atmospheric packaging without oxygen and increased CO₂ were found to have very good quality and great antibacterial property.

Such fruit-based extracts which are biosecure, eco-friendly and cost-efficient will have a better market than chemicals for preserving the fruits of the sea.

LWT-Food Science and Technology, **77**, 217–224

Chicken Sausage with Sugars

Fermentation by L. plantarum

Antioxidants are endogenous compounds in food. They increase nutritional benefit and preserve lipid components from deterioration. Lactic acid bacteria are an important natural source of antioxidants, used in industrial fermentation. The ability of the lactic acid bacteria, *Lactobacillus plantarum*, to produce desirable effects in sausages depends on the processing of food such as heating which may kill the bacteria and their sensitivity to curing salts, spices and other ingredients used.

Last fortnight, scientists from the ICAR-Central Avian Research Institute, Izatnagar, devised a novel approach to protect *L. plantarum* throughout the process of sausage preparation, including heat processing. White Leghorn was deboned, minced and mixed with *L. plantarum* using dextrose and starch as substrates in different formulations. There were two controls: one containing only meat and the other with meat and *L. plantarum*. Both control and treatment formulations were divided into two parts. One was used for making an emulsion, with spices and condiments added, which was cooked at more than 100 C. The other was fermented with *L. plantarum*. After fermentation for 24 hours, ingredients were added and the meat was cooked.

The researchers performed antioxidant, pH and free fatty acid analyses on the meat, with and without fermentation. And they evaluated the microbiological quality and sensory properties of the fermented sausages.

The antioxidant profile and sensory scores of *L. plantarum* fermented sausages, with added dextrose and starch, performed better than those of conventional sausages. *L. plantarum* also protects the ingredients with the antimicrobial effect it exerts due to the addition of sugars. This potential of *L. plantarum* could find industrial applications for making healthier minced meat.

LWT-Food Science and Technology,
77, 249–258

Unmanned Aerial Vehicle

Solar energy to power conversion

The Unmanned Aerial Vehicle (UAV) is in demand for use in intelligence and surveillance operations. Aviation fuels used to power aircrafts are petroleum based and contribute to greenhouse gases. Moreover, aircraft engines are too noisy for surveillance. So, the power has to come from the battery. However, battery power is restricted.

Last fortnight, B. S. Karthik Reddy and Aneesh Poondlaa from the VIT University, Vellore, Tamil Nadu, proposed a conceptual design for a solar powered UAV. They built an experimental plane using lightweight balsa wood and carbon fibre rods. The gross weight of the plane was 2 kg. They chose a 3 S battery, which consists of 3 lithium-polymer batteries connected in series and used it as a single unit. For a constant safe charging voltage of 12.4 V for the 3 S battery, 24 solar cells were connected. The solar cells are arranged in series on top of the wing, and supplied the required voltage for charging the battery. And the battery power was supplied to the motor such that it shuts down during constant level flight, to save energy. The central part of the wing containing solar cells is perpendicular to the fuselage, and parallel to the ground for maximum efficiency.

The researchers analysed the energy efficiency, exergy and power conversion efficiency to work out the feasibility of the design of a solar powered UAV. The energy needed to power the

entire plane was conceptually analysed. They also analysed exergy, the maximum work possible during the process for equilibrium with the surroundings. The energy and exergy efficiencies were calculated for a solar wing by considering the mixed effect of both temperature and wind speed.

And then they tested the results of the analysis with experimental flights. It was observed that energy efficiency, exergy and power conversion decrease slowly during morning, remain low in the afternoon and start rising in the evening due to high ratio of output to input voltage. Higher global solar radiation and lower outdoor temperature were favourable for both exergy and power conversion efficiency. The energy efficiency was found to be always higher than that of exergy and power conversion. The UAV built by the team could fly for more than 6 hours using only solar energy which can be further increased by storing the excess energy in the battery.

These findings can be utilized for meeting the demand for an unlimited inexhaustible source of energy for UAVs, thus decreasing greenhouse gas emission to a large extent.

Renewable Energy, 104, 20–29

Risk Analysis of Nuclear Plants

The risk associated with nuclear power plants is a major concern all over the world. Existing risk calculation methodologies address risks associated with a single reactor. The Fukushima accident has raised the need for second-thoughts on this method, especially when the site hosts multiple nuclear plants. Nuclear power generating sites around the world are mostly twin or multiunit sites. With no acceptable methodology to assess the risk posed by multi-unit nuclear plant sites anywhere in the world, Mahendra Prasad and team from BARC, Mumbai, proposed a holistic framework to do this. The strategy was to integrate the risk from all units, dependencies on external events and operation time of individual units.

The team has put forward two analytical approaches. The first one combines the risks associated with each unit considering them as constant values while the second approach combines the risks considering them as random variables.

The first method takes into account core damage frequency and operational years of each of the units. The probability of core damage resulting from internal as well as external events of each unit was also separately considered.

The result of a case study on hypothetical data shows that site level core damage frequency is not a sum of effects of all units but around 18% higher than unit level effect.

By using the second method, this effect was found to be 50% higher than the risk effect of a single unit. The scientists comment that the second method is technically correct as it relies on data on failure rate and the failure probability of components.

The new methodology takes into consideration external dependencies as well as the combined effect of all the units within the site. And it confirms that installing nuclear reactors of advanced design at the site, along with the old reactors, reduces the combined risk of the site.

Nuclear regulatory authorities, the world over, now have a new risk assessment methodology to consider for making nuclear sites safer.

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96, 56–61

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