

TECHWATCH LANKA

ADVANCEMENTS IN ENVIRONMENTAL
SCIENCE & TECHNOLOGY



"A vital link between global technology developers and the local technology practitioners"

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Waste Treatment

Ultrasound and algae team up to clean mercury from sediments

Ultrasound and algae can be used together as tools to clean mercury from contaminated sediment, according to an Ohio State University study. This research could one day lead to a ship-borne device that cleans toxic metals from waterways without harming fish or other wildlife, said Linda K. Weavers, the John C. Geupel Chair in Civil Engineering at Ohio State.

Doctoral student Ziqi He described the group's latest results in a poster session on March 27 at the American Chemical Society meeting in Atlanta. Weavers' research group previously determined that ultrasonic vibrations can shake mercury loose from sediment. It has been found by the group that ultrasound to be very effective at getting mercury out of sediment and into water.

In laboratory tests, they vibrated an ultrasonic probe inside beakers containing water, sediment, and algae. The vibrations freed mercury from the sediment, and within seconds, the algae adsorbed up to 60 percent of the mercury from the water. The combined system of ultrasound and algae removed 30 percent of the mercury from sediment within the first few minutes.

There are alternative cleanup methods that also absorb a high percentage of metals, Sayre admitted, but they are less selective — they absorb all metals. His modified algae species absorbs five times the normal amount of a select group of toxic metals, including mercury, cadmium, copper, and zinc. If the algae are not selective, they will absorb those other metals and recover less mercury. So the advantage of these modified algae is that other metals do not interfere with the cleanup.

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DNAzymes in environmental sensing

DNAzymes are biocatalysts with a promising capacity to selectively identify charged organic and inorganic compounds at ultratrace levels in industrial waste streams, chemical emissions, environmental samples, or biological systems for a variety of applications. Combining the specificity of nano-biological recognition probes and the sensitivity of laser-based optical detection, DNAzymes are capable of detecting and differentiating chemical constituents of complex systems to provide unambiguous identification and accurate quantification. This article reviews the state of the science of DNAzymes, as well as challenges to be met toward their widespread implementation. The results indicate that these nanosensors are

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CIVIL ENGINEERING

New techniques of construction

Floating houses for flood plains

The Dutch are responding to climate change by building floating houses in high flood risk areas. If rivers rise above their banks, the houses simply float upwards as well. This innovative form of housing could offer a solution for other parts of the world, including UK flood plains such as the Thames Gateway, where 200,000 new homes are planned. The houses have built-in flotation in the form of a flat-bottomed, sealed concrete box that provides buoyancy and also offers additional living space in the form of a basement. When flooding occurs, the house can rise up to 15ft, guided by two concrete piles.



To be continued to pg. 2

Rice straws to make construction material

The Institute of Materials under the Ministry of Construction has successfully produced spongy panels from rice straws, which can be used as a material for building houses in flood-prone areas.

Because they are made of processed straw powder, cement, pulp and other additives, spongy panels are sound-proof and water and heat-resistant, thus they can be used as a material to make walls. In addition, they are light and durable so they can be easily transported to remote areas. Spongy panel walls

are 10 times lighter than brick and the time required to install walls made of spongy panels is only one-third of the time needed to build brick walls. According to researchers, one year after the material was marketed, it had been used for almost all model houses in the flood-prone Mekong delta region. However, because of its high production cost, the material is still not popular among low-income earners. In order to boost sales of spongy panels, the Institute of Materials has cooperated with the Institute of Architecture Research to consider using the material for the Son La hydro-electric power plant resettlement apartment buildings and schools in remote areas.

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ADVANCEMENTS IN FOOD SCIENCE & TECHNOLOGY



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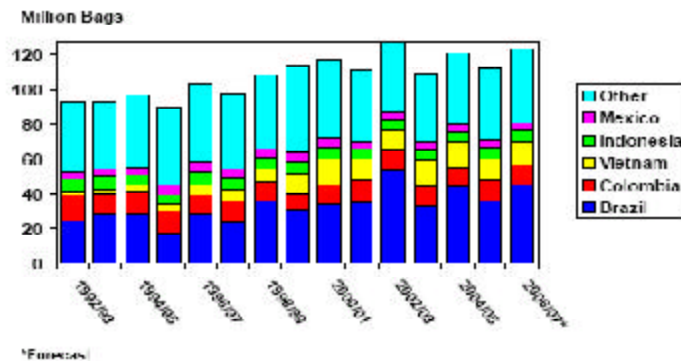
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Forecasting the world coffee production

Coffee is one of the major products in the world, and is favoured by people in all over the world. It supports lives of people who cultivate coffee and has become the major source of foreign exchange after oil for many developing countries, to sustain their economies. It also had big impact on the world economy, because coffee is one of the important primary products in world trade. Therefore, however, the price of coffee is very volatile due to the natural causes and supply and demand.

World coffee production in 2006/07 is forecast at 123.6 million bags (60 kilograms or 132.276 pounds), up nearly 10%, or nearly 11 million bags over the previous year. Most of the increase is attributed to the rise of the coffee crops in Brazil and Vietnam. Brazil's production of coffee during 2006/07 is forecast at 44.8 million bags, up nearly 25 percent over the previous year. Since Brazil is the largest coffee producer, swings in Brazil's supplies of coffee account for a large portion of the change in the world total supplies of coffee. Total coffee supplies in 2006/07 are forecast at 146.9 million bags up nearly 7% from the

World Coffee Production in 2006/07
Forecast Up Nearly 10 Percent



2005/06 preliminary level. With the increased supplies, coffee exports are forecast to recover. World coffee exports in 2006/07 are forecast at 92.8 million bags, up 7.2 million bags from 2005/2006.

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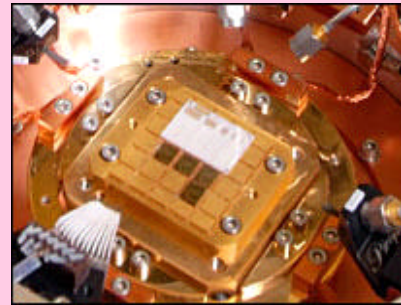
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Chilly chip shatters speed record

The prototype operates at speeds up to 500 gigahertz (GHz), more than 100 times faster than desktop PC chips. To break the world record, the researchers from IBM and the Georgia Institute of Technology had to super-cool the chip with liquid helium. The team believes the device could eventually speed up wireless networks and develop cheaper mobile phones. Faster and faster chips open up new applications and reduce costs for existing products.



Exotic chips

At the moment, most microchips are made from silicon. But in recent years, there has been a realization that silicon cannot match other materials in terms of processing speed. For applications that require huge amounts of calculations every second, like collision warning systems in cars and trucks, companies use exotic materials to produce the necessary power. Materials like gallium arsenide are commonly used, but are expensive and difficult to fabricate. However, the chip industry would like to continue to use proven silicon manufacturing technology that is reliable and cheap. The new experiments were part of a project to explore the speed limits of devices made of silicon and germanium.

Super cooled

Germanium is already added to the silicon chips used in mobile phones to make them operate more efficiently.

Adding the element allows chips to run faster and use less power. Importantly, they can also be fabricated using existing silicon techniques. These chips are already known to operate at faster and faster speeds as they are cooled. To break the speed record, the researchers super-cooled an IBM prototype of a new "high frequency" device to -268.5 degrees Celsius, using liquid helium. This temperature is just above absolute zero, the theoretical minimum temperature possible. When cooled, the chips were able to perform half a trillion calculations every second, a speed of 500 GHz. By comparison, a powerful desktop PC is capable of about five billion calculations per second. A decade ago one could not even envisage being able to run at these speeds.

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The emerging Triple Bottom Line of the new economy

*The notion of "Triple Bottom Line" (3BL) accounting has become increasingly fashionable in management, consulting and investing over the last few years. The idea behind the 3BL paradigm is that a corporation's ultimate success or health can and should be measured not just by the traditional financial **bottom line**, but also by its social/ethical and environmental performance.*



Ten trends to watch in 2006

Those who say that business success is all about execution are wrong. The right product markets, technology, and geography are critical components of long-term economic performance. Bad industries usually trump good management, however: in sectors such as banking, telecommunications, and technology, these account for almost two-thirds of the organic growth. Companies that ride the currents succeed; those that swim against them usually struggle. Identifying these currents and developing strategies to navigate them are vital to corporate success. What are the currents that will make the world of 2015 a very different place to do business from the world of today?

Predicting short-term changes or shocks is often a fool's errand. But forecasting long-term directional change is possible by identifying trends through an analysis of deep history rather than of the shallow past. Ten trends that will change the business landscape will be highlighted here.

Macroeconomic trends

Three macroeconomic trends that will deeply transform the underlying global economy are identified.

1. Centers of economic activity will shift profoundly, not just globally, but also regionally. As a consequence of economic liberalization, technological advances, capital market developments, and demographic shifts, the world has embarked on a massive realignment of economic activity.

2. Public-sector activities will balloon, making productivity gains essential. The unprecedented aging of populations across the developed world will call for new levels of efficiency and creativity from the public sector.

3. The consumer landscape will change and expand significantly. Almost a billion new consumers will enter the global marketplace in the next decade as economic growth in emerging markets pushes them beyond the threshold level of \$5,000 in annual household income.

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ADVANCEMENTS IN BIOTECHNOLOGY



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RESEARCH BREAKTHROUGH

Producing bio-ethanol from agricultural waste



World energy sector has exposed many countries to shocking changes during past few years creating many financial burdens to most of them. Sri Lanka has also experienced the same situation, and as a consequence in year 2004, Sri Lanka had to face three price changes in petrol and diesel. In order to cope with escalating fuel prices, scientist have found biomass utilization as a better option as an alternative energy source. In this regard research conducted at the Delft University of Technology, has demonstrated an efficient approach to the production of ethanol by converting sugars in agricultural waste using advancements in biotechnology.

The search for alternatives to the current oil-based fuels is the focus of great interest around the world. One of the most attractive alternatives is bio-ethanol - alcohol produced from agricultural crops. At present, bio-ethanol is only made from sugars derived from corncobs, sugar beets, grain and sugarcane, with the help of baker's yeast. A great number of by-products result from the cultivation of these crops, such as straw and corn husks. It would be a major step forward if this leftover material, which also largely consists of sugars, could be used for the production of bio-ethanol. This would allow agricultural land to be used more efficiently and at the same time prevent competition with food supplies. Until recently, the problem was that the complex mixture of sugars that make up these leftover materials

could not be efficiently converted into ethanol by baker's yeast. Delft University of Technology, however, has recently devised a solution for this, which is achieved by genetically modifying the baker's yeast. The Delft researchers have inserted a gene (derived from a fungus that is found in elephant faeces) into baker's yeast, allowing it to convert an important sugar type, xylose into ethanol, thereby making the production of bio-ethanol from supplies of leftover materials possible.

Delft University of Technology and the Kluuyver Centre for Genomics of Industrial Fermentation are working together on this project with Royal Nedalco and BIRD Engineering.

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ADVANCEMENTS IN TEXTILE TECHNOLOGY



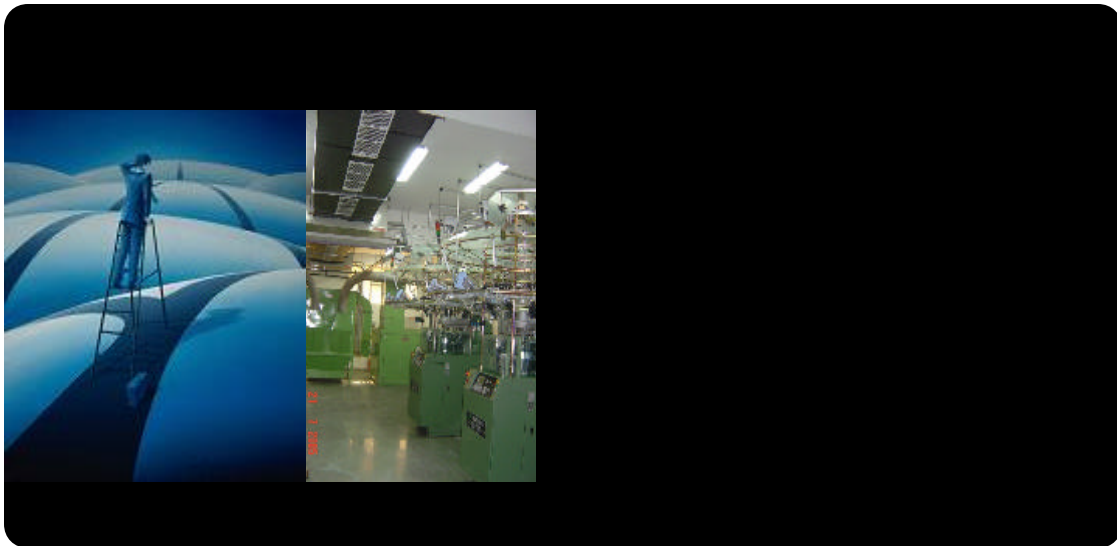
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Clothing Science

Gerber Technology to convert 3D design models into 2D

Gerber Technology announced the availability of a new release of V-Stitcher™ 3D garment design and visualization software which offers powerful, true-to-life modeling that enables users to create a virtual garment from a 2D pattern over a 3D body image.

V-Stitcher is the only commercial and proven application for 3D design and visualization currently available on the market. As a distributor, Gerber has developed a software interface that enables seamless integration between its AccuMark™ pattern design soft-

are and the V-Stitcher application. Available exclusively to customers who purchase V-Stitcher from Gerber, the interface allows pattern data to be created in AccuMark and sent directly to V-Stitcher and back. In addition, when pieces are modified in AccuMark, the garments displayed in V-Stitcher reflect these changes in real time.

This new version of V-Stitcher offers, among other features, a new male personalized figure ("avatar") that offers unprecedented photo realistic quality. The new male avatar will allow for the creation of any extreme pose to enable more accurate fitting of athletic, infant and children's apparel. The avatar also features realistic faces – even those of celebrities, actors, specific athletes, etc. – can be used – to add to

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New culture techniques

Growth of the abalone (*Haliotis diversicolor*) fed with macroalgae in floating net cage and plastic tank

The abalone is being cultured in Kagoshima, southern Japan for stock enhancement of fishing grounds. However, with decreasing catches from the wild some fishermen's group may eventually resort to rearing tokobushi until of marketable size. Growth experiments of tokobushi fed with macroalgae in floating net cage and plastic tanks were conducted to evaluate the influence of culture system, macroalgal feed, age and water temperature on their culture. In floating net cage, marketable sizes were obtained at the age of 457–822-day old (15–27-month old) with highest growth rate of 2.36% g per day and 0.21 mm per day. One advantage of the plastic tank culture system was that the tokobushi shell remained clean throughout the culture period. Macroalgal food affected the growth rate; *Sargassum fusiforme* (Setchell) and *Ulva pertusa*-fed tokobushi were better than those fed with *Meristotheca papulosa* (Montagne). Further, 1-year-old tokobushi had better growth performance and condition index than the 2-year-old cohort, and growth rates were higher at 17°C than at 12°C. These findings should help tokobushi farmers design their mariculture scheme considering both economic and environmental aspects.

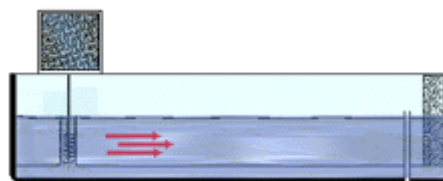
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"Living Stream" System provides a controlled environment for aquatic life

The Living Stream is a revolutionary design of recirculating water in a closed system. All the water in the insulated tank makes a complete cycle every 1-1/2 minutes, thus providing an equal amount of dissolved oxygen and the desired temperature throughout the entire tank.

The Living Stream has a false bottom made of one piece of fiberglass, which can easily be removed for cleaning as it is lightweight and has no screws or bolts to unfasten. The tank can be easily washed and the false bottom replaced.

The filtering system consists of two double screens, the primary filter picks up the residue, and one carbon filter, 4" thick, holds 25 pounds of activated carbon charcoal. Both filters can be easily removed for cleaning. In addition, there are vinyl divider screens and embossed channels making it possible to adjust the tank compartments to your own requirements.



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Nano coatings paint green future

New spray-on, nanotech coatings could keep iPod screens from scratching, make paper products waterproof and perform other minor modern miracles. And because they are cheaper, easier to apply and more environmentally friendly than substances currently in use, nanotechnology-based coatings could replace many of today's industrial paints and coatings.

The nano coatings, "liquid solids" composed of extremely tiny particles, possess unique characteristics — like extreme flexibility, easy adhesion and resistance to corrosion and microbial growth — that could profoundly change the manufacturing process.



Sally Ramsey, co-founder of Ecology Coatings, began exploring the costs and potential environmental benefits of nano coatings in 2003. She used nano-sized particles of mineral oxides to create waterproof coatings for paper at half the cost of synthetic paper. According to her, derivative materials could be used to produce waterproof cardboard boxes, or integrated into building materials such as drywall to prevent mold from growing if it becomes wet. The wonder coatings also might make small video screens on electronic devices such as iPods and mobile phones more durable. Abrasion-resistance and scratch-resistance is very much enhanced when the nano coating is applied and surface hardness is strengthened without losing clarity. A similar nano coating, licensed from Ecology Coatings by chemical giant DuPont, could revolutionize the auto parts industry when it is commercialized, possibly in this year.

DuPont hopes to produce nano paint that seals and protects automotive components, greatly reducing the environmental impact of producing cars by slashing the amount of energy and materials needed. The nano-based coating could radically alter the time-consuming and costly process of applying coatings to auto parts. The nano particles are small enough to be applied using conventional spraying equipment, Ramsey said, and the nanotech coating can be cured simply by exposing the surface of the auto parts to ultraviolet light for 10 seconds or less.

After the UV (light) hits it, it becomes a thin sheet of plastic. UV curing, which is completed at room temperature, would replace the standard curing process, which requires placing parts in ovens at temperatures of up to 400 degrees Fahrenheit for as long as 40 minutes.

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TECHNOLOGY BREAKTHROUGH

Nano pH Meter passes acid test

A pH meter is an instrument used for measuring the acidity of a chemical or other liquid medium. Measuring the exact value is a bit cumbersome without a high sensitivity detector. This is more crucial when it comes to medical applications, where the physicians need to put extra effort to keep the pH level in body fluids at a consistent value during any medical treatment.

To overcome this difficulty researchers at the Rice University have developed a tiny device that can measure the pH inside cells.

The miniature device created by the scientists consist a nano particles that converts laser light into useful information. According to the lead researcher Naomi Halas, the Director of Rice's Laboratory for Nanophotonics (LANP), the device is especially useful to identify the nature of the cancer cells, i.e. whether the cancer tumours are malignant or not.

Currently available methods involve physically removing the tumour via a biopsy, or visually evaluated under microscope. But the new nano-pH meter could be used instead as an "optical biopsy" to measure the pH inside the tumor with nothing more invasive than an injection. The LANP team created the pH sensor using nanoshells with optically tuned nanoparticles invented by Halas. Each nanoshell

contains a tiny core of non-conducting silica that is covered by a thin shell of metal, usually gold. Many times smaller than living cells, nanoshells can be produced with great precision, and the metal shells can be tuned to absorb or scatter specific wavelengths of light.

pH sensor has been constructed by coating the nanoshells with pH-sensitive molecules called paramercaptobenzoic acid, or pMBA. When placed in solutions of varying acidity and illuminated, the nanoshell-molecule device provides small but easily detectable changes in the properties of the scattered light that when "decoded," can be used to determine the pH of the nanodevice's local environment to remarkably high accuracy.

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