

10 Top Technologies to Watch in 2007

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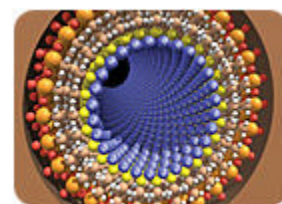


Technology breakthroughs continue to come with what appears to be an exponential rate. Some 30 years ago, recycling wastewater from a manufacturing operation and “zero discharge” were no more than a dream. A fine filter was something that was usually only used in laboratories by qualified technicians. If you had organic emissions, they were burned in flares, not RTOs. We no longer have to use boilers and condensers to desalinate sea water for potable use as filters can remove specific constituents from the water and keep on working

Just imagine where technology may lead to next – perhaps 30 years from now, they will be making fun of our giant precipitators while they adjust a special light beam that transports contaminants into a bottle for reuse. Industry experts have speculated upon thousands of future technologies that could change the way we treat, measure or control pollution. Here are 10 new technologies for people to watch and see if they develop into something we can depend on over the next few years.

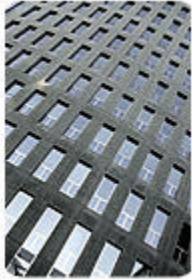
I. Selective Filtering

Pollution Engineering's contributing editor, Barbara Quinn, introduced us to a new technology in the October 2006 issue called Self-Assembled Monolayers on Mesoporous Supports, or SAMMS. This process was discovered by government researchers and licensed by Steward Environmental Solutions LLC to develop it into a marketable product.



The system is a special porous material that will preferentially filter out mercury from a liquid. The company believes it can further develop the materials to remove mercury from air emissions, or selectively remove other metals as needed by other industries. The benefits of this technology could be better control with the possibility of recoverable metals at a lower price.

II. Smog-eating buildings



Italcementi SpA, based in Bergamo, Italy, is building a laboratory out of concrete in its hometown, to be completed by 2009, in which the concrete is designed to automatically remove smog-forming compounds from the atmosphere.

The concrete is treated with a specially formulated cement called TX Active. The final product uses light to accelerate natural oxidation through the process known as photo catalysis to degrade NO_x and SO₂, which are byproducts from automobile exhausts and heating systems. The chemicals are transformed into harmless gases or salts with no external energy required.

A test section of treated concrete road was constructed outside the town of Milan. Studies in the area demonstrated that levels of NO_x were reduced by as much as 70 percent.

"I am pleased to stress that this innovative outcome developed by Italcementi is the result of Italian research," said Giampiero Pesenti, the company's chairman. "An important goal for those who believe, like us, that the mission of a major industrial group also includes meeting the need to improve the quality of life for all of us.

"This award 'catalyzes' our commitment to sustainable development, a path that Italcementi adopted six years ago by joining the World Business Council for Sustainable Development and by signing the Agenda for Action, the first formal commitment binding the 10 international cement companies to an action plan on climate protection, responsible use of fuels and raw materials, health and safety at workplace, interactions with local communities and stakeholders."

It is reported that the Japanese have demonstrated similar success in reformulating window glass to obtain a similar result.

III. Nanotechnology

Nanotechnology is one of the fastest growing fields in this and many other industries. The general description of nanotechnology is any material or structure that is between 1 and 100 nanometers, although there is, as of yet, no standard definition.



The concept has many potential applications in the

environmental industry. According to Jennifer Smith of Conestoga Rovers and Associates, the use of nanotechnology in the environmental remediation field has the potential to ameliorate environmental damage caused by the release of contaminants into aquatic and terrestrial environments. Even though nanotechnology is currently at the exploratory stage, the application of this technology in the environmental remediation field is likely to provide many benefits through the purification of water, artificial photosynthesis of energy or the cleanup of contaminated soil and groundwater.

Subsurface remediation efforts may be improved upon by using engineered nanomaterials. These materials have high surface area, greater transport capabilities and their surface properties can be customized.

Nanoparticles can be used in slurries to provide treatment of soil, sediment or waste contaminated with various solvents. The particles also can be affixed onto other types of reactive media to provide further treatment potential. Research has suggested that nanotubes could provide sorption for dioxin that is three times the sorption capacity of activated carbon. Studies also have shown the effectiveness of nanoscale iron particles introduced directly to the subsurface can be quite suitable for the degradation of chlorinated solvents in groundwater.

Example applications of nanotechnology include:

- Using carbon nanotube fuel cells to store hydrogen
- Photovoltaic cells
- Biomimicry

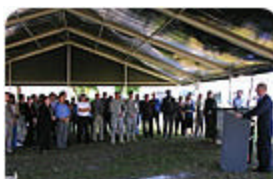
Agricultural Applications

- Nanosensors to monitor soil quality
- Nanomagnets for soil contaminant retrieval

Water Treatment and Remediation

- Nanomembranes for water treatment/purification
- Nanoporous media for contaminant removal
- Nanoscale processes in the environment

IV. Batteries not required



3An announcement from Florida International University's Applied Research Center unveiled a lightweight water purification system that is powered by solar photovoltaic cells.

The current design is a 40- by 50-foot canvas tent with 50 flexible photovoltaic array solar cells attached. The cells can quickly be set up anywhere by a team of six trained operators. The research center believes that future development will allow them to reduce the size of the enclosure so that it can be affixed to the top of a large utility vehicle, thus enhancing its portability.

The system can be quickly deployed anywhere and does not require outside electrical lines be brought in to power the equipment. It is anticipated that such a system could be used to provide quick environmental cleanups in disaster areas, undeveloped countries and battlefield operations where diesel-powered electricity generators are not practical or available.

V. The longer-lasting light bulb



There are two ways to make a battery last longer: either start with a greater energy potential or draw less energy. New developments in lighting may very well accomplish the second option.

Most people are familiar with LEDs or light-emitting diodes. These tiny lights do not require as much energy and, when bundled, can produce considerable light for a variety of tasks.

There are two developments in this technology that may boost their usage in many applications that require the production of light.

The OLED is an organic light-emitting diode. A thin film of organic compounds can be printed in rows and columns to form an electroluminescent layer of polymeric substances to provide lights in displays for computers, televisions or portable equipment. They could also be used in advertising or general lighting usages. OLEDs do not require backlighting to be viewed, which can greatly reduce their power requirements.

PHOLED is a newer design that could lower power consumption even more. Typically, an OLED converts about 25 to 30 percent of the electricity to light. Compare that to the PHOLED that converts up to 100 percent of the electricity to light energy. Imagine having the entire ceiling providing light instead of just a few sources. The effect would be a more even application of light and would greatly improve visibility. Glares would be eliminated. It is anticipated the PHOLEDs will also be used for computer monitor screens.

VI. Thermal soil remediation

Mobile Environmental Technologies Inc., Portland, Ore., has developed and patented a new twist on thermal soil remediation. Generally, soils are excavated and agitated in various ways in order to expose the materials to enough heat to drive off the volatile constituents. On average, about 60 percent of the heat energy is lost.



The company's new twist is to use infrared heat to drive the soil temperatures to the desired levels and capture the fumes that are generated. There are no moving parts, which reduces maintenance and costs. The energy transfer is about 90-percent efficient. Blowers or vacuum pumps are not needed to capture the vapors. This also means there are no exhaust gases to carry away extra heat or odors.

The process has demonstrated an ability to decontaminate soils polluted with chlorinated solvents, diesel fuels, drilling muds, gasoline, heavy oils, manufactured gas plant waste, PAHs, pesticides and tank sludge.

VII. Microbial fuel cells



Bacteria grow by catalyzing chemical reactions and harnessing and storing energy. Bruce Logan and John Regan of Pennsylvania State University published a report in the September 2006 issue of *Environmental Science and Technology* describing the potential of harnessing this energy in a process called microbial fuel cells.

While the power generated so far has not been very high, their studies and experiments have demonstrated great potential as they continue to improve the output. Suggested applications for this technology include wastewater treatment facilities. It has been reported that a typical wastewater treatment plant may contain over nine times as much energy as that used to treat the water. These researchers believe it may be possible to harness this energy from the surface areas of a typical trickling filter. Extra energy could be fed back into the grid. Other possible applications include bioremediation and hydrogen gas production.

VIII. Particulate removal



A system designed by Tri-Mer Corp., Owosso, Mich., uses clouds to remove very tiny particles from exhaust emission. The aptly named Cloud Chamber Scrubber boasts a removal rate of particles between 0.1 and 2.5 microns of 90 percent.

The system can be configured as required by the characterization of the exhaust emissions. A preconditioning chamber lowers the exhaust gas temperatures, knocks out some of the larger particles and tends to agglomerate many of the tinier ones.

The next chamber is where the scrubbing cloud is formed. Very tiny droplets of water are provided with a charge via a specially designed system. Each droplet is capable of collecting thousands of very tiny particulates. The droplets then tend to agglomerate and drop to the bottom of the vessel, where the particulates are filtered for removal and the water recirculated back to form new cloud materials. Energy requirements are low as the charging mechanism only draws 10 watts of power for each 1,000 cfm of flow.

If additional efficiency is required, a second chamber can be added. A mist eliminator efficiently contains the tiny water droplets.

IX. Finding leaks



VOCs are often smelly and most often invisible. This imaging device could make finding leaking VOCs as simple as pointing a camera.

FLIR Systems, Boston, has developed a new infrared imaging device that enables workers to quickly scan a large area to focus in on a problem. Leaks of gases such as benzene, propane or methane can be picked up by the device.

The generally accepted method of leak detection is to use toxic vapor analyzers or sniffers. However, these monitors can be labor-intensive and must continually be calibrated. The new camera can be set up to take real time infrared images that allow VOCs to show up as black smoke on the screen and can cover large areas. The images can be recorded and transmitted for reports.

X. Renewable energy



Expect this field to grow rapidly as political and economic pressures continue around the world. A number of U.S. states have written rules that require utility companies to produce specific percentages of power using renewable energy sources within defined time frames.

By March 2007, Spain requires that all new buildings in the country include solar panels. This includes both residential and commercial structures.

The EPA organized a Green Power Partnership that companies can join. The partnership helps companies find sources of renewable energy they can purchase. There are currently over 400 members' facilities that, as members of the Leadership Club, have pledged to buy a certain percentage of renewable energy. The list includes large and small companies such as Johnson & Johnson, Apple Computers, Lockheed Martin, Los Angeles Airport, My Organic Market and Whole Foods Markets.

Costs for renewable energy can be less volatile as well. Some of these technologies are cropping up to run remote equipment. For example, solar panels are easily adapted to run pumps, cameras, communication gear or sensors where it might be difficult to run electrical lines or drag a diesel generator. PE