

Biotech solutions for the modern world

June 21, 2012 | Analysis | By BioSpectrum Bureau

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Biotechnology has helped Jiangxi Copper, China's largest producer of copper, remove tons of copper from waste water at its plant in Dexing City of Jiangxi Province. It uses a patented technology of a Canadian biotechnology company, BiotecQ, to treat the water and extract copper from it.

In 2009, Dexing Copper Mine, which produces tons of copper concentrate every year, treated 5.5 million cubic meter of water and removed close to 1.7 million pounds of copper from the environment. Jiangxi Copper, which also produces sulphur, gold and silver, and operates the five largest mines in China, uses the BioSulphide and ChemSulphide processes of BiotecQ for the job.

Similarly, there are other companies like BioteQ around the world that are focusing on biotechnology for producing biofuels, improving cloth material, finding alternative to petroleum-based plastic, nutraceuticals and other things. The technology has found its use in a variety of other fields such as forensic science, aquaculture, industrial production and animal husbandry. In forensic sciences, biotechnology has applications in the DNA-matching tests, establishment of genetic relationships; DNA-mapping; DNA-fingerprinting and genetic analysis. In animal husbandry, biological processes can be used for poultry production and goat rearing.

The technology used by Jiangxi Copper, called bioleaching, uses bacteria, principally *Thiobacillus ferrooxidans*, *Leptospirillum ferrooxidans*, and thermophilic species of *Sulfobacillus*, *Acidianus* and *Sulfolobus*, to leach metal of value, such as copper, zinc, uranium, nickel and cobalt from a sulphide mineral. Bioleaching places the metals of interest in the solution phase during oxidation. These solutions are then handled for maximum metal recovery and the solid residue is discarded. The Dexing plant generated an operating profit for the joint venture, ensuring that the water treatment plant is both economically and environmentally sustainable. Biotechnology has many such potential applications in the mining industry, including metal leaching, metal recovery, impurity removal, product upgrading and treatment of acid rock drainage.

Commercial applications include processing of refractory gold concentrates to release gold for conventional recovery and bioleaching of copper in heap and dump leach operations. Commercial application of stirred tank bioleaching for the recovery

of copper has also developed in the recent years that require installation of large bioreactors. Applications of biotechnology in biofuels producing biofuels is also becoming significant, given the need for alternative and green fuel. An Indian biotechnology company, Sea6 Energy, is developing a bio-process for converting seaweed into biofuel. The Sea6 Energy team is researching the crucial components of new biotechnology required to enable the conversion of seaweed biomass into sugar and then to biofuel. The team is also looking to minimize the use of fresh water in the processes. The company hopes that it will be possible to rapidly scale-up seaweed biofuel as it is eco-friendly and a viable replacement for fossil fuels.

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Another company AgActive, which is based in Australia, is working on bringing some exciting advances in the nanotechnology industry to the public. One of its technology, Silversure, allows minute particles (nano-particles) of pure silver to be embedded in plastics and fabrics making them resistant to bacteria, virus and fungus. The company has launched anti-bacterial products, such as bedsheets, towels and socks, using this technology. The products are highly effective against foot odor.

Biomimetics Group, also based in Australia, has developed an innovative enabling technology to coat bone-like nanohydroxyapatite for the production of unique synthetic bone graft material that have increased superiority in bioactivity, strength-controlled solubility and drug delivery over similar products already in the market. It is a platform technology with a wide range of applications in nanotechnology industry.

Wuhan Huali Environmental Technology, a high-tech enterprise from China, has been involved in environment protection by engaging in research and industrialization promotion of biodegradable materials. The multi-purpose bio-based and biodegradable materials produced by Huali can be used to replace petroleum-based plastic for application in many areas such as industry, pharmacy, food, electronics packaging, tableware, kitchenware, toys and flower pots. The company produces about 40,000 tons of bio-based and biodegradable materials in a year.

Besides these companies that are doing path-breaking work in integrating biotechnology in everyday life, there are others such as Zhejiang Hangzhou Xinfu Pharmaceutical that has built the world's largest continuous and closed PBS production line with an annual capacity of 20,000 tons. Another Chinese company, Zhejiang Hisun Biomaterials, ranks third in terms of PLA industrial capacity in the world with the annual output of 5,000 tons. Anqing Hexing Chemical, China's first large-scale PBS enterprise, has an annual capacity of 10,000 tons.

Nutraceuticals is another promising field where application of biotechnology is addressing problems of hunger and lack of nutritional food in emerging countries. Parry Nutraceuticals from India has developed two health supplements, Spirulina and Natural Beta carotene, that meet stringent world health standards using microalgal biotechnology. There are many companies in this space across the world that are using biotechnology applications to produce foods that provide functions beyond the basic nutrients they contain. These functional foods or nutraceuticals have become increasingly important to consumers who are interested in health benefits of functional foods for prevention of illness and chronic conditions.

The applications of biotechnology are so broad, and the advantages so compelling, that virtually every industry is using it to prove its offerings. Developments are underway in diverse areas where biotechnology is enabling industries to make new or better products, often with greater speed, efficiency and flexibility.