Mother Nature

From forensics to catching smugglers, how DNA is being used to secure the world

In the 50 years since the discovery of the "double helix" , many DNA-based applications used by forensic scientists and police to track criminals have been developed, with research into the human genome for medical treatments progressing rapidly.
In addition to these well known applications, DNA-based solutions have also been developed with the scope of catching, discouraging and preventing counterfeiting and fraud. In fact, as counterfeit products flood the market, scientists all over the world have been working to develop effective fraud prevention measures. Imagine the concept of embedding a natural, unique code of botanical DNA into brand products to prevent counterfeiting. There are now technologies available that can bring this concept to market, and help prevent that seven percent of world trade based on counterfeit goods - a market worth $350 billion.

Anti-counterfeiting market opportunity

According to the International AntiCounterfeiting Coalition (AICC), the size and scope of product counterfeiting has skyrocketed in recent years. The United States economy alone is losing millions of dollars in tax revenue and tens of

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to the rescue

thousands of jobs because of the manufacture, distribution and sale of counterfeit goods. Globally, the market opportunity for anti-fraud solutions is at $6 billion, with over $386 billion counterfeit products sold per year. In the U.S. alone, corporations spend $3 billion a year on anti-counterfeiting measures.

Embedded-DNA technology

A Los Angeles California-based company, Applied DNA Sciences, is marketing patented DNA-embedded technology for security solutions. This state of the art biotechnology is used for tagging, encrypting and protecting confidential information from counterfeiters. The natural plant DNA is comprised of sequences of organic molecules that together make up a code specific to each and every living organism. By manipulating specific DNA from a plant, the company is able to create a unique string of DNA codes that become traceable markings for branded products, security ID and access cards, passports, licenses, etc., for security applications in corporate and government sectors.
The key to Applied DNA Sciences' biotechnology is the ability to mix or apply scientifically selected and processed plant DNA to specific media such as paint, glue, polymers, inks, labels and microchips. In doing this, the characteristics of DNA are used to tag and distinguish genuine products from counterfeits. This technology is applicable for a multitude of products such as pharmaceuticals, textiles, aviation and auto parts, software, hardware, consumer electronics, food, wine, fashion labels, securities, ID cards, credit cards, jewelry, antiques and fine arts, and many others.

Applied DNA Sciences believes that its embedded-DNA technology is nearly impossible to duplicate. The easy detection process provides two levels of security which combined - for the labels and ink - is immediate, 99.9999% accurate, affordable and can be securely mass-produced. Embedded-DNA technology also has the potential to be combined with other anti-counterfeit measures to create new products for the marketplace.

A DNA Test Applicator Pen containing patented buffer fluid is applied across an authentic Applied DNA label surface. A biochemical reaction manifests as a reversible color change, with the ink changing color from blue to pink, and back to blue within seconds

Hope for the U.S. textile industry

According to The Washington Times (2/24/03), textiles and apparel represent about 45 percent of all the duties annually collected by the US Customs Service. There are about 55,000 importers of textiles and apparel that bring goods into the country for a total vlue of about $80 billion each year. Being able to cost-effectively identify the country of origin of textile components would be extremely important to the U.S. Customs Service, which is responsible for enforcing the country's textile and apparel preference laws.

In October 2002, as part of the Bush administration's long-term effort to address trade challenges facing the U.S. textile industry, the US Department of Commerce secured the expertise of the Oak Ridge National Laboratory, one of the Department of Energy's premier research laboratories, to evaluate and select the best process to verify whether components of foreign-made goods were from the United States or another country. The Commerce Department responded last April by selecting DNA marker technology, along with ultraviolet florescent marks, and nanobarcodes, as security technologies to be further researched in a comprehensive study for the authentication of textile imports.

For Applied DNA Sciences, the uniqueness of its Applied DNA Marker system is that it will remain embedded in fabric or yarn for many decades. Furthermore, as the textile marker can withstand the rigors of textile processing, DNA markers can be inserted during the manufacturing process. When embedding DNA into textiles was first tried back in the '90s, scientists discovered that it lasted only for a month at most and was unsuitable for textile applications. In fact, as DNA is sensitive to many factors, the problem was stabilizing the material so that water, heat sunlight and solvents used in the textile manufacturing process would not cause it to deteriorate. Today, the technology can provide a unique and specific authentication code for each manufacturer and could be used to tag and identify textiles.

Unique, invisible and nearly impossible to replicate

The marking process of Applied DNA Sciences works as follows: various combinations of specially processed botanical DNA fragments, with unique characteristics and one-of-a-kind sequences, or codes, are embedded into ink or onto a label, which becomes a unique and traceable tag or marker for any imprinted product. The process structures plant DNA molecules that are treated to withstand environmental conditions (such as UV light, heat, solvents, etc.) that would otherwise cause DNA molecules to disintegrate. Applied DNA Ink is extremely difficult or nearly impossible to copy or counterfeit due to the specificity of DNA sequences and the minute

quantities of DNA utilized. The ink can be tailored to meet customer-specific product requirements. For example, the DNA code sequences can be generated based on one or more DNA sources and can be used in conjunction with more than one anti-counterfeiting technology or application such as holograms or others. With the DNA instant verification kit, "instant detection" and authentication can be obtained at the point-of-purchase, rather than the 24 to 48 hours required by traditional analysis. The technology thus becomes an effective and time saving deterrent against counterfeiters.

No waiting for the future

Research and development is ongoing at Applied DNA Sciences and Biowell. Solutions for corporate and government agencies to secure passports and visas, and various applications for the nuclear power plant industry are being investigated. In addition, the company is evaluating the market potential for food-grade anti-counterfeit coated materials and sprays for use in medicines and food products.

The future is imminent for further exciting new applications of DNA technology. One day, this might even include profiling technologies, or identification of the DNA codes in fruits or grains from member groves or crops and from regions where unauthorized food products are believed to be grown. From farm to fork - high profile market segments include specialty and feed grains, produce, meats, seafood and dairy industries. Tracking and preserving the country of origin, right down to the producer, is not just a matter of trade, but also a matter of quality and safety to the consumer.