Know Your Supply Chain: from Pellet to Product

Botanical DNA Solutions for Sustainable and Responsible Supply Chains

Knowing where your product comes from, how it's made, who made it, are questions inquiring consumers want to know. As a supply chain manager, you also want to ensure that reliable, high quality and safe products are manufactured in ethical and efficient environments. In this solution brief, we show you how SigNature® T DNA systems help to keep the supply chain pure, from pellet to product.

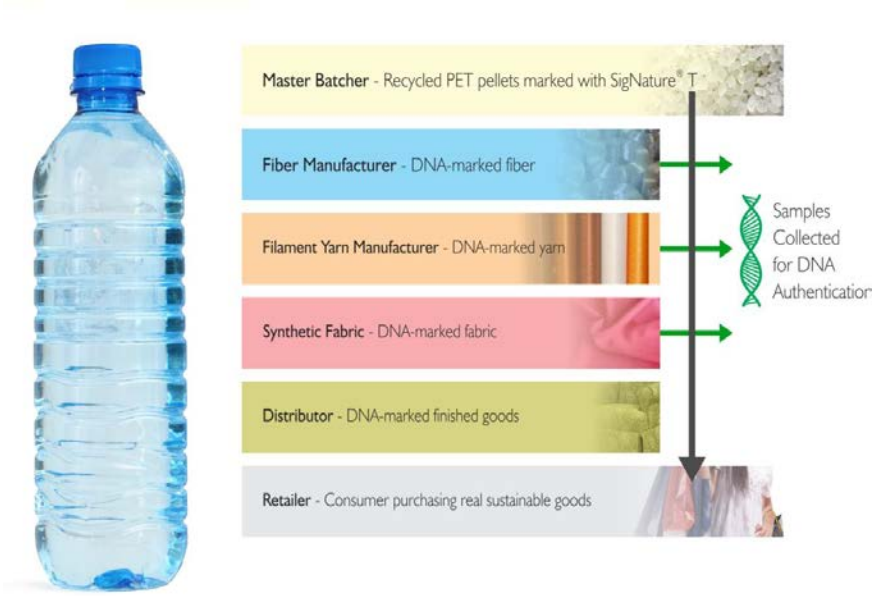
Beyond the Paper Trail

Commonly, companies are forced to rely on the paper trail, where documents themselves can be forged. At the other end of the continuum of tools, exotic assays such as testing for electromagnetic signatures, and RFI-enabled trace fibers, are at experimental and untested stages. Visual inspection techniques such as measurement of fiber length, burn tests, and other inspection provide results, but often do not provide conclusive evidence, often needed in a court of law.

Safe Guarding Polyester Fiber Integrity

The blending of polymers, colorants and other performance-enhancing additives into polyester, has grown to be a core technology in the synthetics textile industry: especially when the polyester fiber is to be used for high performance, high value applications. As the technology used to enhance polyester quality increases in complexity, the cost of the finished product may increase relative to low-performance alternatives, thus creating a significant commercial incentive to (criminally) substitute the high tech polyester with a less expensive, lower-quality substitute in a way that corrupts the entire supply chain, increases the risk of liability, and may compromise the reputation of the supplier and of the retailer.

Innovation in Physical Chemistry and the Physical Chemistry of Polyester Fiber



Although DNA is well known as a molecular tag that can be used to identify human beings (as in crime scene forensics) or to identify animals and plants (as in DNA based ecological research) it is not yet widely known that DNA can also be used to tag and to identify industrial commodities, such as polyester or other synthetic textiles.

By combining unique DNA molecules into standard polyester master batches and extruded into fiber, a new system for tagging would be possible for synthetics. Subsequent to extrusion, it is shown that the DNA complement of the fiber (at parts per trillion) can be recovered from a snippet of the polyester fiber via a simple hot water soak, followed by the same sophisticated DNA analysis methods used in human forensic science: the difference, of course, being that the DNA in polyester fiber can inform as to where the polyester came from, rather than where the (human) DNA came from at a crime scene.

The Science and Technology Behind the Solution

DNA is itself polyester: a polyphosphate ester in this case, with organic side chains on the polyester. Applied DNA Sciences has developed proprietary methods to coat ordinary NPET pellets with synthetic DNA of that kind, made at an industrial scale, and then subsequent to such pellet coating, use the DNA-coated pellets as part of the ordinary process of polyester master batch fabrication: along with colorant and other stabilizers.

Subsequent to ordinary heat-based fluidization and extrusion, the resulting PET-DNA composite, with DNA in the parts per trillion range, by mass, can be fabricated into ordinary fibers which can then be employed in any textile or textile-related application, exactly as more-ordinary (unlabelled) polyester would be employed.

In fiber, coatings and plastics – a custom DNA molecule is permanently adhered to the master batch. SigNature T tagging coupled with supply chain hygiene protocols allows for a complete and verifiable forensic chain of custody. The parts-per-trillion of DNA in the polyester fiber introduces a completely new dimension into synthetic fiber analysis: based on the information-rich nature of the DNA polymer, plus the stability that ADNAS formulation affords to DNA in the polymer melt, and the ability to recover the DNA blended into the polyester via proprietary variants of the same technology used by the FBI and others to analyze very small quantities of DNA at a crime scene.

Benefits

A new chapter in the field of high-technology synthetic textiles: where any batch of a high-tech fiber can be tagged at the molecular scale, at parts per trillion, with a unique DNA that is customized to the manufacturer or even on a batch-by-batch basis, so that at any point in the textile supply chain [from master batch to finished goods] the polyester can be sampled from fiber or woven textile, to yield an unambiguous determination of its commercial origins in a way that will make it nearly impossible to substitute the “real” polyester with a “cheap” substitute.

This provides an array of benefits for all parties involved throughout the supply chain and most importantly the end product. Brand owners are demanding safeguards in providing products of high integrity, quality, and sustainability to ensure the smallest possible environmental footprint. The solution presented allows for the following benefits to be realized:

- Quality expectations are met
- Brand claims can be substantiated
- Remove illegal blending from the process
- Authentication testing protocols to validate and protect the integrity of the supply chain

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Certainty is only a molecule away