

New Sustainable Synthetic Textiles

Natalia Allen, Young Global Leader, Annual Meeting of the New Champions 2010

Stephen A. Miller, Young Scientist, Annual Meeting of the New Champions 2010

- **Natalia Allen** is an entrepreneur and founder of Design FuturistSM, an innovative design studio that creates sustainable and high-tech clothing and accessories—from concept to completion—for the increasing number of modern companies choosing to go green. Allen is the recipient of several key industry awards, such as Designer of the Year, and has created modern, eco-friendly products for DuPont, Donna Karan, and Calvin Klein, to name a few. <http://www.designfuturist.com/>

- **Stephen A. Miller** is an Associate Professor of Chemistry at the University of Florida, where his primary research objectives are the design and synthesis of novel, sustainable polymers that will replace fossil fuel-based polymers. Professor Miller is also co-founder and CTO of Sestar Sustainable, a start-up company that commercializes his proprietary laboratory inventions. <http://www.chem.ufl.edu/~miller/>
<http://www.chem.ufl.edu/~miller/sestarsustainables/>

Our mission is to bring innovative sustainable synthetic textiles to the apparel sector at a global scale.

Genesis of the Partnership

The interest for this Partnership began during the Young Global Leaders Joint Session with the Young Scientists at the Annual Meeting of New Champions, 2010. During a breakout session where the Young Scientists were detailing their innovative approaches to world sustainability issues, Stephen Miller described his research that identified a new polymer that mimics the properties of the common plastic polyethylene terephthalate (PET), used for water bottles and a wide variety of other packaging applications. Natalia Allen posed a straightforward, but salient question: “Can you spin this polymer into fibers and make textiles for clothing?” Miller—normally focused on simple packaging and much less on fibrous applications—responded affirmatively. From this conversation, the Partnership between Sestar Sustainable and Design FuturistSM to bring sustainable synthetic textiles to the apparel market was created.

Market Analysis

Polyethylene terephthalate (PET, *aka* polyester) is a widespread fossil fuel-based polymer that currently garners 18% of the worldwide market share of synthetic plastics. It is highly versatile and finds uses in thermoplastic, film, and fiber applications. However, as fossil fuel supplies dwindle and as consumers increasingly demand environmentally friendly products, various companies have begun to commercialize sustainable or *green* polymers.

One example of this new approach to plastics is the PlantBottleTM, marketed by Coca-Cola (<http://www.thecoca-colacompany.com/citizenship/plantbottle.html>). This material is chemically identical to PET, but the smaller component of the copolymer is sourced from bio-ethanol—which means that 30% of the polymer is sustainable. Another example is DuPont’s Sorona[®], which is almost identical to PET, but employs a slightly larger sustainable comonomer and thus the polymer is 37% sustainable. (http://www2.dupont.com/Sorona/en_US/index.html). PlantBottleTM and Sorona[®] have had commercial success; however, they both maintain reliance on petroleum (fossil fuels) for the primary copolymer feedstock.

Competitive Advantage

The technology for this Partnership originates with a new PET mimic, recently invented by the Miller Research Group at the University of Florida. Polydihydroferulic acid (PHFA) is 100% derived from sustainable feedstocks (lignin and acetic acid) and, importantly, mimics the structure and thermal properties of PET but does not rely on fossil fuels. The synthetic methods and polymer characterization were published recently in the journal *Green Chemistry* (<http://dx.doi.org/10.1039/C0GC00150C>) and the University of Florida has filed a Provisional Patent Application for this invention (Serial No. 61/334,342, submitted May 13th, 2010). The manuscript was extolled in a story for *Highlights in Chemical Science*

(www.rsc.org/Publishing/ChemScience/Volume/2010/08/wood_mimics_packaging.asp, *Wood mimics packaging polymer*) and the October 2010 Issue of *Green Chemistry* features an exclusive cover graphic for this manuscript (<http://dx.doi.org/10.1039/C0GC90024A>). The University of Florida recently completed a confidentiality agreement with a Fortune 50 consumer product company regarding this technology. Much testing needs to be performed but this company hopes to bottle beverages in 100% sustainable PHFA and thereby compete directly with Coca-Cola's PlantBottle™.



Production of Textiles

The objective of the Partnership is to prepare and then commercialize textiles made from PHFA. We will need an industrial partner to produce a fiber and then textiles from PHFA because we do not have the resources or equipment for independent prototype production. To attain an industrial partner we will offer exclusive licensing rights to our proprietary technology as incentive for the industrial partner to support development.

Once we have secured an industrial partner, the Miller Research Group will calibrate the PHFA production to the kilogram scale. Working in collaboration with Design FuturistSM and an industrial partner, these large batches of polymer will be spun into fibers and then woven into textile fabrics for preliminary testing and evaluation by Design FuturistSM. This grant would provide critical working capital to establish an industrial partnership and create textiles from the PHFA.

Industrial Partner Leads

One likely industrial partner is the Sorona[®] Group at DuPont. Because our polymers are functionally similar to Sorona[®] and the methodology for preparing textiles from Sorona[®] is established, the calculated likelihood of success is high—although with any new synthetic fiber, it is difficult to predict the quality of the textile obtained. Another targeted industrial partner is InvistaTM, a former subsidiary of DuPont that is now the world's largest integrated producer of polymers and textile fibers. A third likely candidate is TenCate, a multinational company with specialties in protective fabrics and industrial fabrics, with whom Sestar Sustainables has a very close and existing relationship. Bionic[®] Yarn is an additional textile manufacturer that will be approached; this company specializes in recycled PET fabric and has existing connections to Design FuturistSM.

At this time we have engaged scientists and market development managers at DuPont, Invista, and TenCate. Professor Miller was recently invited to visit DuPont in Wilmington, Delaware by Ray Miller, one of the original Sorona[®] team members at DuPont. DuPont's Sorona[®] business has grown more than 300% in the last two years and the sector is poised for continued growth through 2015 (http://www.fibre2fashion.com/news/textiles-company-news/newsdetails.aspx?news_id=85953). Ray Miller is genuinely interested in the prospects of PHFA, would like to further investigate questions about economics, performance, and lifecycle, and stated specifically that "We are interested in knowing the answers. How can we [DuPont] put some resources forward to capture some of the value that is possible?"

Budget for Development

Laboratory supplies and chemicals for PHFA scale-up operations	\$4,000
Travel/accommodation for visiting industrial partners and for strategic meetings	\$4,000
Small-scale marketing campaign, including samples and website development	\$2,000

The Business Outlook

From the functional soft textile prototypes of PHFA, Design FuturistSM will create apparel samples and introduce them to the fashion industry. With this evidence we will further engage the industrial partner and demonstrate to them that products made from PHFA have wide-ranging market appeal and economic competitive advantages. The industrial partner will license the proprietary technology, produce the soft-textile commercially, and supply it to apparel manufacturers globally.