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Pall Corporation: Turning PET to Textiles

**China's Fiber Industry
Looking Westward**

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Advanced Filtration Technology Enables the High-Quality Recycled PET Fibers for the Textile Industry

BY RAJ SHAH, PALL CORPORATION

The 2012 London Olympic Games were as much about the “green” as they were about the “gold,” and described by some as being the greenest Olympics to date. Not only did the Olympic organizing committee and sponsors do their parts in ensuring a green approach to constructing and operating the Olympic venues, but the apparel companies designed sustainable clothing and accessories, which were worn by the athletes.

According to the website of a major apparel company, each uniform that the USA men’s basketball team wore was made from 22 recycled plastic bottles. Several countries and teams proudly wore uniforms featuring material that was largely made from recycled content. This was a major accomplishment considering the importance given to the function of the athletic wear.

Polyester fiber is the most common building block for sustainable clothing and delivers high performance for flexible, light-weight, reduced-wind, and drag-resistant fabrics. However, in order to produce such athletic garments from recycled materials, the quality of

the recycled polyester fiber needs to be on par with that of virgin material.

Pall Corporation is a leader in filtration, separation and purification and has been providing filtration solutions to the textile industry since the 1960s. In recent years, Pall’s technology has extended into the recycling industry and has enabled the production of high-quality fibers from recycled feed stock. Pall helps its customers to enable a greener, safer future and has once again been named one of the greenest companies in America by Newsweek magazine.

Chung Shing Textile Company was founded in Taiwan in 1949. It is a fully integrated, large-scale textile manufacturer engaged in chemical fiber manufacturing, yarn spinning, weaving, dyeing & printing, and garment manufacturing. Chung Shing Textile operates an 850-ton per day manufacturing site at Yang-Mei Chemical Fiber factory in Taiwan, where it produces virgin-grade polyester fibers and chips for textile use.

Synthetic fiber production and processing is a chemically intensive process that is costly and draws on limited natural resources. As an eco-conscious cor-

poration, Chung Shing Textile believes in contributing to environmental sustainability and operates under the 3R waste management principle (Reduce, Reuse, and Recycle). In fact, in 2005 it started manufacturing high-quality PET textile fiber from recycled plastic bottle waste. These fibers are currently marketed under the “GreenPlus” brand and are used in a wide variety of textile applications by leading manufacturers of popular brands. GreenPlus fibers are certified by Oeko Tex Standard 100 (Certificate Number: TPYO 055042) and Greenmark (Certificate Number: 3159).

GREENPLUS FIBER PRODUCTION

Post-consumer PET bottles are collected at communities and recycling centers throughout the world. The bottles are baled and brought to a processing facility, where they are sorted by type (PET, HDPE, LDPE, etc.) and color. The PET bottles are then stripped of their labels and caps and washed multiple times to remove any adhesives and other possible contaminants. Next, the bottles are crushed and chopped into flakes. The small flakes are fed into an extruder, filtered,

Production of Textile Industry



Large photo shows used plastic bottles of various kinds, and after they are turned into bales (insert) from Chung Shing Textile.

and spun through spinnerets to produce recycled PET fiber. The fiber is crimped, cut, drawn, and stretched into required lengths for baling. Baled fiber can be processed into fabric for a variety of textile products.

CHALLENGE OF QUALITY FIBERS

Polyester fibers made from post-consumer bottles are expected to be of equal quality to those produced from virgin raw materials. These fibers should possess the same desirable properties including strength, abrasion resistance, flexibility, and moisture absorption. While good for the environment, recycled fibers present a real challenge to manufacturers, as the primary feed stock (recycled PET flakes) can vary considerably in quality.

There are several reasons why the quality of recycled fibers may vary:

- The feed stock is from different sources (water bottles, soft drinks, detergents, and other packaging containers).
- Washing and other technologies used for converting the bottles into flakes can differ substantially between processors.

- Recycled flakes may contain impurities such as paper, metal, foil, other polymers, sand, or dirt.

As a result, melt filtration must play an important role in the recycling process by removing contaminants and ensuring consistent, high-quality feed stock. This crucial step is necessary to eliminate variance in the feed stock quality, which ultimately will impact the end fiber quality.

Two technologies are typically used during the melt filtration process:

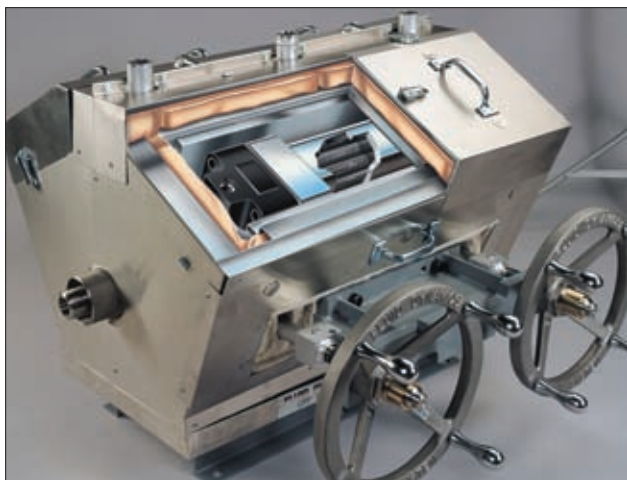
- 1) Screen changers
- 2) High-area duplex-style continuous melt filter systems

Screen changers allow operators to collect hard contaminants on woven wire screens during the extrusion process. They are easy to use, but offer limited filter area and thus plug up very rapidly, resulting in undesirable polymer shearing and high differential pressure. They also require multiple daily interventions, resulting in an unstable operation that lasts a few hours on-stream at best. Even the

most expensive and sophisticated screen changers result in discontinuous operation. In general, screen changers are considered basic technology and are hardly ever preferred by any fiber producer.

High-area continuous melt filter systems allow operators to run substantially longer with less downtime than screen changers. These systems offer clear advantages when processing recycled materials, as well as materials that require long run cycles. Continuous melt filter systems are often the technology of choice.

Chung Shing Textile had been running a duplex-style filter system for processing its recycled fibers. A European textile company supplied the duplex filter system, which used a plug-style diverter valve that caused polymer degradation and rapid plugging of the filter elements. The on-stream life of the filter was only 1-2 days, requiring expensive changeovers and considerable down time. More importantly, the quality of the resulting fibers was not comparable to that of fibers made from virgin material.



CPF System from Pall



Inside of Chung Shing Textile plant.

PALL'S ADVANCED TECHNOLOGY

After reviewing the polymer feed stock and operating conditions, Pall offered its duplex-style Continuous Polymer Filter (CPF system®) customized to suit process requirements. Pall's CPF technology uses a patented, contoured spool-type diverter valve and is designed for use in various polymer melt filtration processes. To date, Pall has sold over 2600 CPF systems, many of them in polyester fiber production processes.

Chung Shing Textile has adopted Pall's model 100 CPF system across its 11 chip spinning lines. Currently, five of the lines are used to produce GreenPlus fiber. The system was designed to use filter elements made with Pall's Dynalloy® filter media – a premium nonwoven type sintered metal fiber media suitable for removing hard and soft gelatinous content through its tapered pore geometry. The results were immediately noticeable – the operation became stable and on-stream filter life increased to 7-8 days.

"Pall's CPF technology enabled us to achieve the high-quality recycled polyester fiber that is comparable to virgin fiber," said Mr. Dai, Chung Shing Textile

plant manager. "The CPF system is a compact and proven design ideally suited for such fiber processes. The system provides consistent fiber quality and improved on-stream filter life with minimal operator intervention. This was fundamental in lowering our cost of production. We are proud of our GreenPlus fiber product and its widespread use at the 2012 London Olympic Games."

RESULTS

Since its beginning in 2011, GreenPlus fiber capacity has expanded to five production lines totaling 56 MTD. Each production line is now retrofitted with Pall's CPF technology for high-quality continuous fiber production. The next step is to extend the on-stream life of the filters by introducing Pall's innovative Ultipleat® Polymer Candle elements into the existing systems.


PALL CORPORATION

Pall Corporation is a filtration, separation and purification leader providing solutions to meet the critical fluid management needs of customers across the broad spectrum of life sciences and industry. Pall works with customers to advance health, safety and environ-

mentally responsible technologies. The company's engineered products enable process and product innovation and minimize emissions and waste. Pall Corporation is an S&P 500 company, serving customers worldwide. Pall has been named by Newsweek magazine "a top green company." To see how Pall is helping enable a greener, safer, more sustainable future, follow them on Twitter @PallCorporation or visit www.pall.com/green.

CHUNG SHING TEXTILE CO.

Chung Shing Textile, founded in 1949, is a fully integrated, large-scale textile manufacturer based in Taiwan. It includes five operating divisions: chemical fiber manufacturing, yarn spinning, weaving, dyeing & printing, and garment manufacturing. All are vertically integrated through a comprehensive coverage of the upstream, midstream and downstream operations. Its capital has skyrocketed from the initial NT\$40,000 to today's NT\$8.4 billion.

The company markets its products both at home and abroad under brand names, which have become synonymous with quality. 



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