

## Sustainable raw material for sustainable textile production

by DyStar Ecology Solutions.

### Background

With sustainability being the current buzz word, the question remains as to how far the industry can go to achieve measurable improvements in sustainability with the existing choices of raw materials like dyestuffs, chemicals, eco-friendly textile fibers.

One important aspect is to identify the key elements and areas in the textile production chain which could contribute the most towards improved sustainability, if managed in the correct manner. With our first paper of the sustainability series, we gave an elaborate introduction and insight into the most important elements of sustainability in the textile supply chain. We looked into the economic, social and environmental aspects of sustainability and identified the key challenges in the chain. We emphasized the importance of sustainable design, informed selection of dyes and chemicals, accurate color communication and controlled coloration by Best Available Technology.

In this paper we will deal with individual fibers to give you an insight into their basic features and how DyStar expertise in textile coloration and finishing can help our customers meet the requirements and challenges of processing sustainable textiles.

### Sustainable textile fibers

Recently, with the increase in consumer interest and the establishment of third party certification systems a greater focus has been given by the textile companies to the production of sustainable fibers. New alternatives have been investigated, developed and introduced to the market. Challenges arise when these fibers have to be processed in the industry using the available dyestuffs, auxiliaries, and chemicals. The Best Available Technology has to be identified in order to maintain the sustainable nature of the fiber and to achieve sustainability in processing in order to deliver the sustainable end product. DyStar anticipated these challenges well ahead due to its network of contacts with innovative fiber producers and started its research on the applicability of our dyestuff ranges for the various sustainable fiber bases. With environmentally compliant dyestuffs, highly experienced process expertise and a solid foundation of textile industry knowledge, DyStar can help its customers face the upcoming challenges of the new eco fibers and contribute towards realizing sustainability in the textile supply chain.

### Organic cotton

Organic cotton has gone a long way to becoming the most sustainable choice of today's fashion world. With well researched globally established standards and certification systems this fiber has made its place in the textile world. This is definitely a first choice for the brands and retailers when coming to introduce a sustainable line. However the questions related to its processing are still there among manufacturers.

#### **DyStar's efforts toward organic sustainability**

Under our econfidence® program DyStar has co-operated with organizations like the Institute of Market Ecology – (IMO) which was instrumental in developing and implementing the global organic textile standard (GOTS).

DyStar is the leading global supplier of dyes for cellulosic fibers and has always been committed to environmentally-responsible dyestuff production and optimized application processes using best available technology to minimize resource use and waste.

DyStar was one of the first companies to get its dyestuffs approved to the GOTS standard for the specific use on organic cotton. These low impact dyes from DyStar meet the demanding requirements of the organic textile standard and provide the basis for achieving a wide range of shades by all application methods (exhaust dyeing, continuous dyeing, cold pad batch dyeing and printing).

DyStar is currently preparing a manual for organic cotton processing where the optimum processing technology by exhaust and continuous pretreatment and dyeing methods can be shared with the industry. DyStar takes a holistic approach towards achieving sustainability. We believe in not only developing suitable products but also advising our customers on the most efficient recipes and processes to achieve efficient and sustainable results.

### Bamboo

Bamboo's eco-friendly positioning in the market has been based on the following properties:

1. A natural (that is, non-synthetic) fiber.
2. A quick-growth plant (it belongs to the grass family) that sequesters greenhouse gases.
3. A renewable plant that can grow back after its three to five year harvesting period.
4. A plant that doesn't need pesticides or fertilizers during its growth phase.

The manufacturing of bamboo fiber is where the debate really gets heated. There are three methods by which bamboo may be processed into fiber for fabric production.

The first is a mechanical process similar to that used to process flax or hemp; the stalks are crushed and natural enzymes break them down further, allowing fibers to be combed out. This is an expensive process but it is eco friendly. The second other method follows the process by which rayon is made where the fibers are broken down with aggressive chemicals and extruded through mechanical spinnerets. A third method follows the closed solvent spinning loop which is used for the production of Lyocell fibres (see further below).

Today the majority of bamboo on the market is processed as rayon. As long as it is manufactured by the rayon process, Bamboo fibre and fabrics will not be more sustainable than Conventional rayon method. Retailers have sold both end products as "bamboo fabric" to cash in on bamboo's current eco-friendly image. However, the US Federal Trade Commission is cracking down on the practice of labeling bamboo rayon as natural bamboo fabric. Under their guidelines these products must be labeled as rayon with the optional qualifier "from bamboo". True bamboo fabric is known for its softness and boasts strong absorbency and anti-microbial properties, but the chemical process in bamboo rayon destroys this anti-microbial effect.

Bamboo fiber can be dyed with all dyes recommended for cellulosic fibres. As usual, the dye class selection depends mainly on fastness requirements. But as always when producing a sustainable fibre, sustainable products in pre-treatment, dyeing and finishing should also be selected.

DyStar offers a full range of GOTS 2.0 approved dyes and auxiliaries which should be the first choice. In reactive dyeing high fixation Levafix® CA dyes, with outstanding retailer fastness performance in the pale to medium shade area, are highly recommended. Remazol® RGB / Ultra RGB are the economical and ecological solution for medium to ultra deep shades. Under critical dyeing conditions (e.g. high density of yarn bobbins) Procion® H-EXL hot reactive dyes keeps you on the safe side.

If the highest overall fastness levels are required, Indanthren® vat dyes are the solution. On the other end of the fastness scale, Sirius® direct dyes are highly suitable if only a moderate wash fastness level is necessary.

## Lyocell (Tencel™)

The manufacturing process for lyocell is different from that of other regenerated cellulose's such as rayon, in that it proceeds without the formation of intermediate compounds and there is no curing or ripening stage, therefore the whole process is complete in 3 hours. The use of minimal chemicals means that the pure cellulose pulp used to feed the lyocell process remains chemically unchanged by processing. No aggressive chemicals are used for this spinning process only an organic solvent. Therefore no regeneration of the cellulose is necessary. The average polymerisation value (DP value) of the cellulose used for the Lyocell process is the same at the beginning and at the end.

Additionally the production process for lyocell is characterized by an almost completely closed solvent cycle. The spinning bath is cleaned, the excess water is removed by evaporation and the solvent is then recovered for re-use. The water generated during evaporation is used in the washing process. On account of the closed-loop process, the solvent necessary for the production process is recovered almost completely. The remaining minimal emissions are treated before disposal.

According to DyStar experts, the unique properties of the DyStar's Remazol Ultra RGB reactive dyes on lyocell fibers leads to a significantly reduced impact in the effluent discharge and in the total environmental load calculation.

Because of the higher build-up and fixation yield with the Remazol Ultra RGB dyes, the lower amount of dye required to achieve a given depth also means reduced quantities of electrolyte resulting in lower TDS values in effluent. Additionally the build-up of the Remazol Ultra RGB dyes is higher on lyocell than on unmercerised cotton leading to significant further reduction of unfixed colour, Chemical Oxygen Demand and Total Dissolved Solids.

A full story about the sustainability of Tencel fibre in cooperation with Remazol Ultra RGB dyes can be found on Dystar homepage ([www.dystar.com](http://www.dystar.com)).

## PLA (Ingeo™)

Ingeo is a polylactide acid fibre (PLA fibre) made from 100% annually renewable resources and was introduced by Cargill Dow LLC in January 2003 to the textile market. In 2003 out of Cargill Dow LLC the company NatureWorks LLC was formed. The name Ingeo literally means "ingredients from the earth".

Ingeo is produced by fermentation of dextrose obtained in this case from corn starch. Other potential feedstock could be rice and potatoes and even grass or straw. The

fermentation products are subsequently transformed by condensation and vacuum extraction into a high-performance polymer called polylactic acid from which the branded Ingeo fibres and filament yarns are extruded.

Ingeo combines the comfort properties of natural fibers with the performance of man-made fibers like breathability, moisture management, crease resistance, no support of bacterial growth, inherent flame retardancy and UV resistance. In addition, the fibres have environmental benefits that result from using renewable resources as their feedstock, including reduced CO<sub>2</sub> emissions and less fossil fuel usage than other materials (estimated at up to 50%). In textile application Ingeo is used for fibre fill, knitted apparel, furnishings, carpets and denim.

For successful processing of Ingeo fibres in the textile mill, the following aspects need to be considered:

The melting point is 170°C – this is important for determining the heat setting conditions, and fabrics can be stabilized at 125 – 130°C for 30 seconds.

Hydrolytic degradation of the polymer can occur, particularly under combined high temperature and alkaline conditions. The degree of hydrolysis is influenced by time, temperature and pH, and can be influenced by the modification of the dyeing and finishing process.

The Dianix® range of disperse dyes are the preferred dye class for exhaust dyeing of Ingeo fibers. Intelligent dye selection on Ingeo is crucial, as individual dye behavior is quite different from dyeing polyester. Disperse dyes should be chosen for:

- ❖ High levels of dye bath exhaustion: to optimize batch-to-batch shade reproducibility, reduce dye costs and to minimize effluent pollution.
- ❖ Compatible dye combinations: to optimize Right-First-Time dyeing performance and to reduce the production costs.
- ❖ Good color fastness: to washing, perspiration, light and rubbing

More detailed information about preparation and dyeing of Ingeo fibres and their blends is available in DyStar's "Ingeo™ Fiber Coloration Pack."

## Recycled polyester

Two kinds of recycled PET are available on the market: One is mechanically recycled PET (only melting of PET) which has a strong yellowish shade and is not suitable for white or pale shades. To get a better degree of whiteness a bleaching process has to be carried out and even then the OBA has to be tinted with some dyes to get close to the required level of white. The bleaching process is not eco friendly at all and adds additional

cost to the process. This kind of recycled PET should only be used for dark shades (mainly Navy + Black).

The other type of recycled polyester is a full chemical recycled PET. This has a similar shade to "virgin PET" and can be used without any problem for all shades. It is claimed that the cost of recycled PET can be twice the cost of virgin PET.

Regarding dyeing, both recycled PETs behave the same as "virgin PET" but careful dye selection is necessary to ensure highest levels of exhaustion compatibility and fastness. As part of its econfidence program DyStar has recently launched a range of "green" Dianix dyes which are ideally suited for the processing of recycled PET. A comprehensive screening program covering raw materials and intermediates as well as sophisticated dye manufacturing controls ensure that no harmful chemicals are carried through onto the fiber.

## Organic wool

Organic wool is different from conventional wool in at least two major ways: (1) sheep cannot be dipped in insecticides to control external parasites such as ticks and lice, and (2) organic wool farmers are required to ensure that they do not exceed the natural carrying capacity of the land on which their animals graze.

The term "organic" doesn't only cover management of the livestock according to organic or holistic management principles but also (1) processing of the raw wool, using newer, more benign processes rather than harmful scouring and descaling chemicals; and (2) wastewater treatment from scouring and processing according to Global Organic Textile Standard (GOTS). DyStar recommends its GOTS-approved Realan® EHF reactive dyes for organic wool and a complementary range of GOTS-approved wool auxiliary chemicals are available.

## Dye and Chemical selection for eco fibres

As for all eco fibers it is important that the Best Available Technology (BAT) is used for coloration and finishing in order to preserve as far as possible the eco credentials of the fabrics produced. Using dyes and chemicals covered by DyStar's econfidence commitment gives both the dyer and the retailer peace of mind that top quality products have been used and confidence in the ecological qualities of the articles produced. For more details please visit [www.dystar.com](http://www.dystar.com).

The next article will be published in April 2010 issue of Pakistan Textile Journal will highlight sustainable methods/measures of colour communication. ♦