



# Dyehouse Selection:

## A major opportunity to reduce environmental impact

Recycled, organic fabric that is dyed in a poorly managed dyehouse will likely have a much higher environmental impact than a conventional fabric dyed in a well-managed dyehouse.



To find out more about the heaviest environmental impacts in the fashion industry, please see the Clean By Design website: [www.cleanbydesign.org](http://www.cleanbydesign.org)



### What are the environmental impacts of a dyeing mill?

Preparing, dyeing, and finishing fabric is a water-intensive process that uses large quantities of chemicals and energy—and one that causes an enormous amount of unnecessary pollution. Improving dyehouse performance provides a significant opportunity to reduce the environmental impact of textile production. In fact, experts estimate that in China, more than 80

percent of the water and energy used to make apparel and more than half of the chemicals used post fiber production are in this one step of the manufacturing process. NRDC's Ten Best Practices provide simple, cost saving suggestions to improve fabric mill process efficiencies, reducing the mill's environmental footprint and saving money.

#### UNTREATED OR POORLY TREATED WASTEWATER DISCHARGE

Many dyehouses (and printers and laundries) do not properly treat their wastewater effluent either because they lack adequately trained staff or because they want to save costs in the electricity and chemicals required for proper operation and maintenance.

#### HARMFUL CHEMICAL USE

Although the industry is making progress identifying and specifically restricting certain hazardous compounds, there are still many harmful chemicals used in conventional production of textiles, many of which have safer substitutes.

#### POOR PROCESS MANAGEMENT

Even factories that comply with discharge limits and minimize the use of toxic ingredients can be very wasteful in terms of water, energy and chemical consumption. In addition, poor manufacturing controls often lead to problems in getting the color on an order right. Right first time dyeing is important in reducing environmental impact because if the order needs to be run again, all the chemicals, energy, and water used the first time around has been wasted. Typically *half* of the fabric dyed worldwide comes out the wrong color and needs a correction.

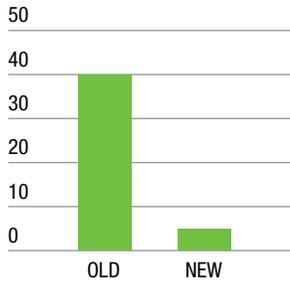
### What are the solutions?

#### TEN BEST PRACTICES

NRDC's Ten Best Practices provide an excellent starting point for reducing impact. They reduce inefficiencies and waste typical in many dyehouses in China and the developing world.



### Dyeing Machine litres/ kg/process bath



Experts estimate that **half** of the fabric dyed worldwide comes out the wrong color and needs a correction. Good dyers get things right first time and use much less water, energy and chemicals as a result.

### And the winner is....!

The lowest impact dyeing method is achieved by dyeing polyester as the fibers are made with the incorporation of pigments. This process is called "**dope dyeing**" and is the best way to reduce dyeing impacts from synthetic fabric dyeing mills.

## SUBSTITUTE HARMFUL CHEMICALS WITH LESS TOXIC OPTIONS

Each phase of the dyeing and finishing process offers opportunities for substitution of safer chemicals for production: highest priority is to substitute the toxic detergents and bleaches used to pretreat fabric, to replace toxic and low fixation dyes, and to select finishing formulations without harmful ingredients. Even where chemicals are not harmful, it is beneficial to use the minimum needed to achieve the desired effect.

## LOOK FOR MILLS WITH NEW EQUIPMENT AND WELL-FUNCTIONING METERS:

The type and age of process equipment makes a big difference in the amounts of water, energy, and chemicals used in a dyeing mill; newer equipment of all types tends to use less water than older machines, and certain types of dye machines (paddle machines for example) are notorious water hogs.

Ancillary equipment, such as boilers, generators, and air compressors, as well as water heating and cooling systems, also have a major impact on environmental impacts from mills.

However, it's important to note that a factory with new machines can still run them badly, treat its effluent poorly, or use illegal chemicals, so it is not as simple as choosing factories with new equipment. Look for mills that meter their steam, water, and electricity use and benchmark their performance; routine measurement allows these mills to detect excess usage and address it expeditiously.

## PROCESS MANAGEMENT AND CONTROL:

Management capability is the single most important factor in minimizing environmental impact. Good quality managers will treat effluent, avoid illegal chemicals, treat workers fairly, and hire dye masters who will dye each fabric right the first time. They will measure and minimize the amount of water, energy, and chemicals used to do the job. The difference between the world's best dyehouses and the world's worst in terms of water, energy, and chemical consumption is greater than a factor of 10.

## Why is it so difficult for buyers to promote improvements at dye houses?

The main problem is the lack of relationship between buyers and dye houses; designers and brands often have an active business relationship only with the garment factory at the end of the supply chain, not up the chain to the fabric mill. There is also a lack of expertise. The skills required to dye fabric right the first time, increase reliance on clean production techniques, and even properly run a wastewater treatment plant are scarce in China and the rest of the developing world. NRDC's Ten Best Practices provide an excellent starting point for many dyehouses to avoid needless wastage of resources without the need for extensive technical help.

## NRDC recommends:

- Choose dyehouses yourself rather than leaving the decision to middlemen—who have price, price, and price at the top of their list! Assess dyehouse's environmental performance before orders are placed.
- Avoid dyehouses, printers, and laundries that chronically discharge untreated or poorly treated effluent. Walk away. Do not endorse this practice.
- Promote the metering of steam, water, and electricity with your suppliers and request data to benchmark their uses.
- Promote substitution of dangerous chemicals with environmental superior alternatives
- Promote NRDC's Ten Best Practices.
- Avoid the embarrassment of dyeing eco-fibres through poorly operating dyehouses that produce products with larger footprints than conventional fibres produced by well-operated mills

## Environmental Impacts of Dyeing Four Fiber Types

	<b>Cotton/ Organic Cotton</b>	<b>Polyester/Recycled Polyester</b>	<b>Viscose (Rayon)</b>	<b>Wool</b>
<b>Heat setting</b>	Not required	Required	Not required	Not required
<b>Scouring/Bleaching</b>	Long, energy intensive boiling process using lots of caustic, detergent and bleach. A hot post scour rinse is required	Short, warm scour with small amount of detergent. Rarely a need for bleach	Short, warm scour with small amount of detergent. If bleached, the process is hotter and longer than scouring	Water and energy intensive scour to remove vast amounts of lanolin that is collected for other uses
<b>Dyeing</b>	Warm dyeing. Long process that requires large amounts of salt and alkali	Simple, relatively short process at high temperature (130° Celsius)	As for cotton but lower amounts of alkali and salt	Simple process carried out at 100° Celsius.
<b>Dye fixation to fiber</b>	Low. Typically 75% is fixed	High. Typically 99%+	Medium. Typically 85% to 90%	High. 95%+
<b>Wash off (Rinse)</b>	Long, energy and water intensive process using multiple process baths—with at least one at boiling temperatures	Shorter process requiring less energy, water and chemicals than cotton. Uses alkali and chemical reducing agent	As for cotton but shorter process possible due to less unfixed dye to be removed	Generally a relatively simple wash off procedure
<b>Contaminants in waste water</b>	Significant. Natural oils and waxes from the cotton, sizing (typically starch), knitting oils, unfixed dye, salt, process chemicals	Low. Some oils and sizing/ knitting oils plus small amount of reducing agent	Similar to cotton but less salt, alkali and unfixed dye. No natural impurities from the scouring process	Low. Lanolin from scouring is collected as a byproduct
<b>Basic finishing</b>	Fabrics are dried and forcibly pre-shrunk to avoid consumer dissatisfaction. Normally a two/ three stage process on energy intensive equipment	Single stage drying process requiring less energy than cotton but a high temperature (180° Celsius) pre-set is normally carried out before scouring	Similar to cotton but often requires a chemical resin treatment to give good shrinkage performance. Can have issues with formaldehyde	Machine washable wool requires a chemically and energy intensive pre-treatment or post treatment. Many wool treatments use chlorine based product and/resins
<b>Performance finishing e.g water repellents, stain resistance</b>	No major difference among fibers	No major difference among fibers	No major difference among fibers	No major difference among fibers