

Dyeing Without Water



Image Courtesy: flickr.com

**By: Deepak Kumar, Ambadas Garje,
Kushal Desai, Dharmendra Gupta**

Dyeing Without Water

By: Deepak Kumar, Ambadas Garje, Kushal Desai, Dharmendra Gupta

ABSTRACT

The new emerging technology of dyeing; which is a really enthusiastic for Indian textile industries. Indian textile processing one of the highly water consuming industries , Such technologies have reached the international advanced level and meet the state emission-reduction and energy-saving requirements for environment-protection products and new technologies of the textile industry, producing a good economic and social benefit and making a positive contribution to the energy-saving and emission-reduction work. This technology also reduces the effluent load. This new technology called as “AIRDYE”.

Keywords: Air Dyeing, Cost Reduction, Energy Saving, Environment Protection, Water Saving.

INTRODUCTION

AirDye technology manages the application of color to textiles without the use of water. It was developed and patented by Colorep, a California-based sustainable technology company. Depending on the fabric, and type of dyeing, AirDye uses up to 95% less water, and up to 86% less energy, contributing 84% less to global warming, according to an independent assessment requested by the company^[1]. AirDyed fabrics do not leach colors or fade as easily as vat dyed fabrics, because the dye is actually inside the fibers. The process of making textiles can require several dozen gallons of water for each pound of clothing. The AirDye process employs air instead of water to help the dyes penetrate fibers, a process that uses no water and requires less energy than traditional methods of dyeing; the technology works only on synthetic materials and is currently available only in the United States.

Features of Air dye Technology^[2]

- a) Does not pollute water in the color application process. By using air instead of water to convey dye, no hazardous waste is emitted and no water is wasted.
- b) Greatly reduces energy requirements, thereby lowering costs and satisfying the strictest standards of global responsibility.
- c) Does not use boilers, screen printing machines, drying ovens, or cleaning step and simplifies the process, creating revolutionary possibilities of new industry and employment in unfarmable, arid regions of the world.
- d) Gives consumers a way to choose style and sustainability at a realistic price at the point of purchase.
- e) Environment:- The process of making textiles can require several dozen gallons of water for each pound of clothing, especially during the dyeing process. 2.4 trillion gallons of water are used in synthetic dyeing, AirDye's addressable market, each year. AirDye technology eliminates hazardous wastewater as a byproduct of dyeing fabric. Water scarcity affects one in three people on every continent and is getting worse as water needs

rise with population growth, urbanization and increased usage by households and industries.

- f) Depending on the fabric, and type of dyeing, AirDye uses up to 95% less water, and up to 86% less energy, contributing 84% less to global warming, according to an independent assessment. Additionally, some companies state that with AirDye technology they can print to order which eliminates production excess and waste.
- g) Economics:-Colorep claims that its AirDye Process is priced competitively compared to traditional technology. Additionally, Colorep claims that companies using the technology find the AirDye process reduces waste as 10% of traditional, vat-dyed fabric is damaged during the process, whereas with AirDye, only 1% is damaged. Colorep also says that AirDye enables companies to wait longer to decide what color or print to put onto their fabric, which would reduce the need for apparel makers to guess what colors consumers will want to wear months ahead^[1]
- h) Consumer:-The AirDye process manufactures fabric that can be washed at any temperature, with whites or colors, with or without bleach. Because the AirDye process injects the dyes in the fabric and not on the fabric, bleach and cleaning agents do not affect them.
- i) With AirDye, a company estimates for every 25,000 T-shirts sold, the plant will save:
Energy:- 1,132,500 mega joules
Water:- 157,500 gallons
Green House Emissions:- 57,500 (Kg CO₂ equiv. emissions)
By using Air Dyeing amount of fresh gallons of water can be saved instead of traditional dyeing methods^[2] are shown in TABLE-1.

MATERIAL AND METHODS

How Is AirDye Different

Conventional dyeing, such as vat dyeing or cationic dyeing, can produce good looking results. On the down side, they use polluting heavy metals, a huge amount of precious water and do not provide permanent coloration. Sublimation printing has been used to decorate textiles but is limited in application. AirDye advances both^[3]. Here are four microscopic photos of the neck section of a dyed synthetic T-shirt^[2]:

- **Standard Sublimation & Heat Transfer Printing:** The dye does not completely penetrate the fibers, therefore, white fiber may show after cutting or needle penetration are shown in figure-1.
- **Conventional Dyes:** After treatment in a water dye-bath, the fibers show complete dye penetration. However, colorfastness is low to moderate are shown in figure-2.
- **AirDye Controlled Penetration:** Using our proprietary Sibius™ Dyes, penetration is deeper. Colors are richer and colorfastness is better. Penetration control is used with Dye Contrast, Print 2 Dye, and Print to Print products, including AirDye woven are shown in figure-3.
- **AirDye Complete Penetration:** AirDye is so advanced that it not only colors the yarn, but also thousands of filaments in each piece of yarn, yielding rich, brilliant colors. Penetration is complete are shown in figure-4.

1. DESIGN^[4]

Fabrics dyed with AirDye technology supposedly feel no different than conventionally dyed textiles. They can be dyed all one color, a different color on each side, a pattern on one side and a solid color on the other, or a pattern on both sides as follows

Dye-to-Dye Contrast: AirDye technology that dyes two different colors on opposite sides of a piece of fabric without the use of water is shown in figure-5.

Dye-to-Print: AirDye technology that, on a single piece of fabric, dyes one side a solid color and one side a print, without the use of water is shown in figure-6.

Dye-Squared: AirDye technology that dyes the same solid color of ink on both sides of a piece of fabric, without the use of water is shown in figure-7.

Print-to-Print: AirDye technology that dyes one side of a piece of fabric with a print and the opposite side of the fabric with another print, without the use of water is shown in figure-8.

2. APPLICATIONS^[4]

Promotional Items

- banners
- retail display / signage
- short run branded products
- tote bags / reusable bags / aprons

Apparel

- fabric for all types of garments
- finished accessories – scarf / ties / aprons / etc.
- specialty fabrics for custom items
- flags / umbrellas / awnings / tents
- uniforms – civic / corporate / medical
- swimwear / sarongs
- outerwear
- sportswear / yogawear / activewear / dancewear
- infant / toddler apparel
- junior apparel
- missy apparel
- women's wear
- lingerie / intimate apparel / sleep wear
- accessories / handbags / cosmetic bags / etc.
- shopping bags

Interiors

- carpet / ceiling tiles
- drapes / curtains / blinds
- top of bed product – coverlets / bedspreads / etc.
- linens
- wall covering
- tabletop / napkins
- shower curtains (72")
- pillows / mattress coverings
- upholstery – sofas, chairs, etc.

Industrial Print Applications

- hard surface laminate
- melamine
- thin paper
- vinyl transfer
- thermo films

Medical

- cubicle curtains (72")
- hospital gown

CONCLUSION

The AirDye process radically reduces the environmental profile of the color application process while improving the use phase performance of the finished fabric^[5]. By removing the requirement of water at the point of color application, AirDye technology creates a significant opportunity to localize production for regions of the globe that lack the water resources traditional methods require. Because traditional processes require considerable energy to heat the water and dry the fabric, AirDye technology also significantly reduces the energy required at the point of color application. As AirDye technology matures, we expect to see additional benefits from increased efficiency in power usage, power source, and the direct application of dye without a donor media^[6].

ACKNOWLEDGEMENT

We experience our sincere & great thanks to Prof.(Dr.)S.B.Vanbhatte, Prof.S.K.Laga, Department Of Textile Chemistry, D.K.T.E.'s Textile and Engineering Institute, "Rajwada", Ichalkaranji, for his valuable guidance and timely help during this study.

REFERENCES

1. www.colorep.com
2. www.airdye.com

3. <http://www.triplepundit.com/pages/airdye-dyeing-fabric-without-water.php>
4. www.transprintusa.com
5. China Textile Magazine Nov.2009,P-45
6. http://www.ecotextile.com/news_details.php?id=859
7. <http://www.hunterdouglasshospitality.com/transformation/technology.jsp>

TABLE-1: By using Air Dyeing amount of fresh gallons of water can be saved instead of traditional dyeing methods^[6]

Sr.No.	Products	Water Saved(in gallons)
1.	Men's Hoodie	31.25
2.	Men's Jersey	13.75
3.	Men's T-Shirt	7.75
4.	Women's Knit Wear	38.75
5.	Women's Top	7.75
6.	Women's Pants	18.75
7.	Women's Tank	5.75
8.	Women's Skirt	24.5
9.	Infant's Top	4.75
10.	Infant's Pants	4.0
11.	Men's Pants	25.0

AIR DYE PROCESS FLOW DIAGRAM ^[2]

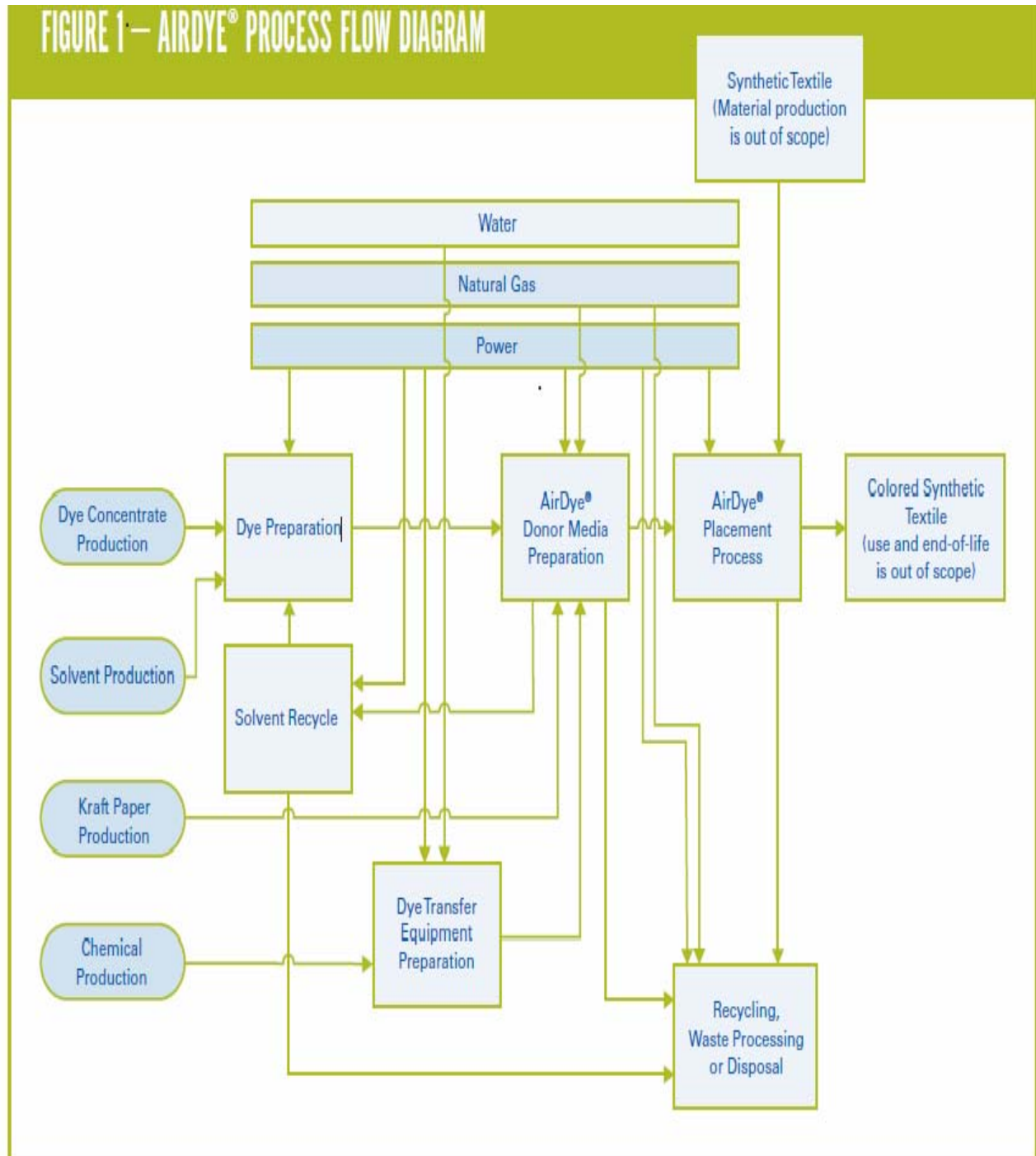


FIGURE – LCA SYSTEM BOUNDARY DIAGRAM

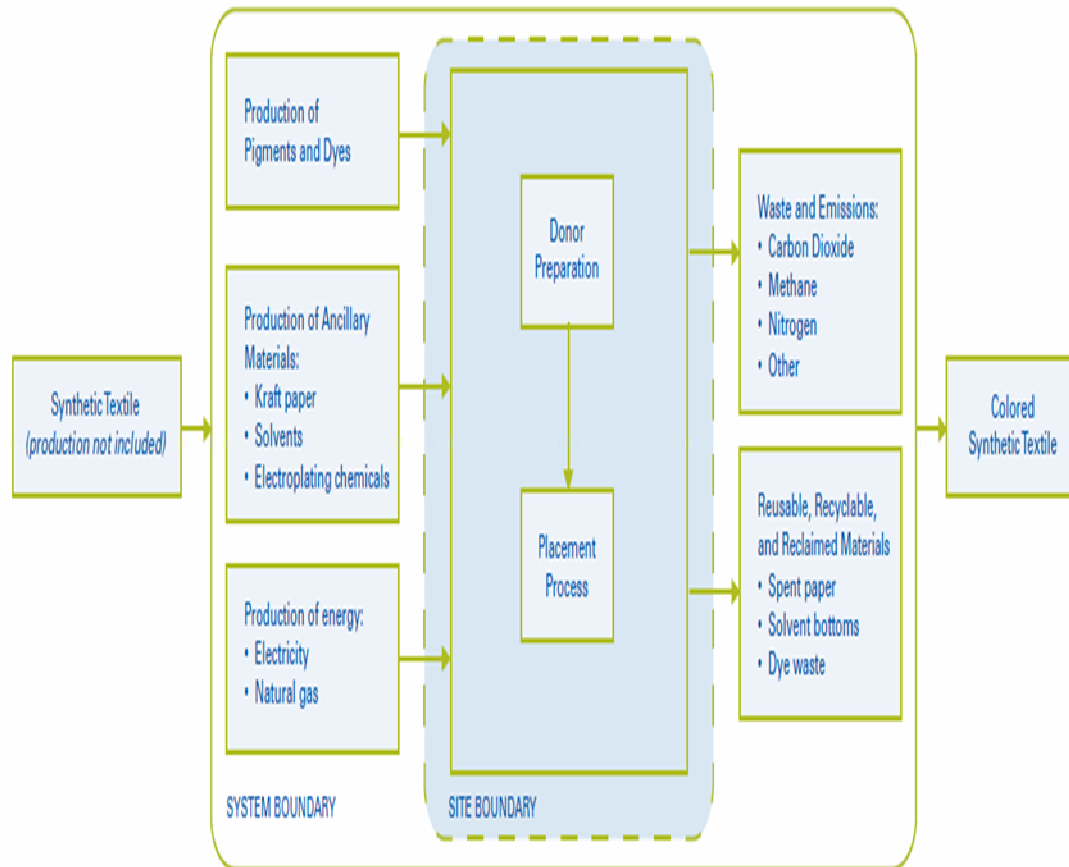




FIGURE-1

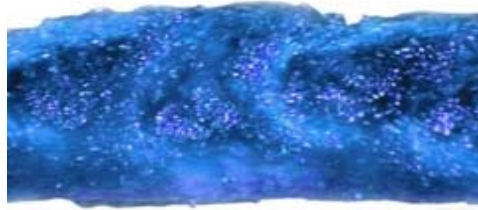


FIGURE-2



FIGURE-3



FIGURE-4



FIGURE-5



FIGURE-6



FIGURE-7

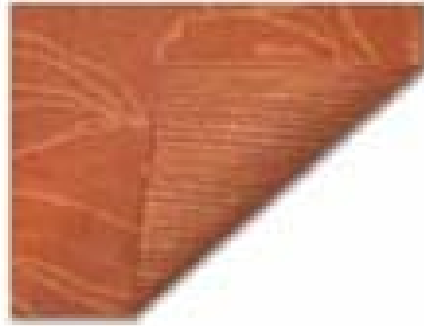


FIGURE-8

The authors are associated with Department of Textile Chemistry, D.K.T.E. Society's Textile & Engineering Institute, "Rajwada", Ichalkaranji, Dist-Kolhapur (M.S.)