

Naturally Coloured Cotton: A Game-Changer In The Textile Industry

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ARTICLE ID: 036

Introduction

Cotton is used all over the world and is currently the world's most used fibre also known as the 'king of textile fibres'. The majority of the clothes in our closet have some percentage of cotton in them because of their high demand. It is a fluffy, soft cellulosic staple fibre. Typically, the fibre is spun into yarn or thread and utilised to produce a soft, breathable, and long-lasting textile. Cotton textiles are prominently known for their comfort wear, moisture absorbency, and natural appearance with their renewable capacity. Global production of raw cotton fibre is estimated to be at 25 million tonnes or 110 million bales per year, representing 2.5 % of the world's agricultural land.

Adverse effects of conventional 'white' cotton fibres

- The processing of cotton fibres (scouring, bleaching, dyeing, printing, etc.) into textile materials demands the use of a lot of water, dyes, chemicals, energy, and other resources. Due to the employment of chemical textile dyes and auxiliaries, dyeing operations may pollute the environment.
- According to United State of Environmental Protection Agency (USEPA)(1996), the average water consumption in wet processing (bleaching, dyeing and printing) is 360 m³/ton of cotton textile material.
- Energy consumption is high in terms of maintaining hot bath or steam required for pre-treatment processes or for dyeing, also, later for washing the dyed cotton fabric.
- It is believed that nearly 10,000 various dyes and pigments are utilized in industries and over seven lakh tonnes of synthetic dyes are manufactured every year worldwide.

- In textile industries, due to the inefficiency of the dyeing process, up to two lakh tonnes of dye matter are lost to effluents every year during dyeing and finishing processes.

Hence, there have been some potential major initiatives currently happening to reduce the energy, cost, environmental risks and waste produced during cotton textile production, as well as to develop sustainable and green materials.

The naturally coloured cotton fibre could be the next buzzword in the textile and clothing market as the globe shifts toward pollution-free textiles, and to produce environmentally friendly products. So because the manufacture of naturally coloured cotton textile avoids the most polluting activity of textile product manufacturing (dyeing), it is a much more environmentally and economically friendly option further enhance those green credentials.

What is naturally coloured cotton?

Naturally coloured cotton is naturally grown cotton where it is genetically engineered to achieve inherent colour (other than the commercial yellowish off-white colour). Coloured cotton that are grown include shades of red, green and brown. The colour of the engineered cotton fibres does not shade unlike conventional dyed cotton fibres. Contrarily, naturally coloured cotton does not need any of these processes and stuffs required in dyeing cotton fibres, as it is genetically manipulated to harvest in-built colour.

How does the colour in cotton develop?

The colour expressed in the cotton is a genetically determined trait. Before the cotton ball bursts out, the pigments collect in the lumen. But in *Gossypium hirsutum*, pigmentation appears 32 days after fertilisation in the developing cotton lint, and the colour takes six days to mature. While in *Gossypium arboreum*, the colour pigments are apparent after 46-47 days of fertilisation. After that, the colour development process takes 5-6 days to complete. The full development of cotton lint/fibre colour occurs only after when the cotton boll bursts open and the lint/fibre is exposed to sunlight.

The pigments found in the cotton are responsible for inherent colouration of cotton fibres. A variety of colours can be produced from tan to green and brown in these pigments. Caffeic acid, a derivative of cinnamic acid, is found in the suberin (wax) layer, which is deposited in alternating layers with cellulose on the outside of the cotton fibre, giving it

natural green colour. Brown and tan cottons get their colour from tannin vacuoles in the fibre cells lumen, whereas green cotton gets its colour from wax layers.

In diploid cotton, coloured variants were more popular (*G. herbaceum* and *G. arboreum*). These varieties are cultivated in Asian countries like India, China and Central Asian countries. In India, a few colours of coloured cotton be grown are; brown (light brown to intense mahogany red) and green colour (light green and dark green).

Commercial cotton growth process in India:

- The All India Coordinated Research Project (AICRP) would advise on the growth of coloured cotton. They would notify farmers about the specialty areas, which will have distinct ginning and processing facilities.
- After the seed has been commercially released, state governments will be expected to manage the process.
- Each university would form partnerships with various farmers or processing units for agriculture, weaving, and manufacturing operations.

Advantages of coloured cotton:

1. No dyes means less water consumption
2. Reduced environmental pollution
3. Soft on skin due to no harsh chemical usage and not irritable to skin
4. Avoids hazardous dyes and chemicals
5. Lesser effluent generation in cotton wet processing
6. Protect cloths from fading
7. Economic in terms of time and cost of dyeing
8. Source of revenue

Limitation:

1. Fibres are short, weak and coarse
2. Low yield
3. Poor fibre quality
4. Limited and instability in colour

Conclusion

Growing consumer demands and environmental impacts have resulted in an increase in the awareness of sustainable textile materials. Hence, the cultivation, processing, and



adoption of naturally coloured cotton fibres will play a game-changer role in the textile industry in the near future as a result of its naturally available, reusable, biodegradable, sustainable, environmentally and economically friendly options. Additionally, it can contribute in reducing water usage and avoid its pollution. Giving more importance to growing naturally coloured cotton will cut-off added expenditure on dyeing. Presently, the yield of naturally coloured cotton fibre is often lesser and fibre is weaker and shorter, still it has softer handle than the more readily available white-cotton fibre. This important breakthrough can accelerate the cotton textile industry to demand natural coloured cotton which will lead to cover more areas of production and it will result in increasing farmers' income.

