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Research Paper

Colour fastness properties of dyed mesta fibre

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■ **ABSTRACT :** Mesta is the name given to the fibres obtained from commercially cultivated species such as *Hibiscus cannabinus* and *Hibiscus sabdariffa*, which belongs to the family Malvaceae, harvested at 15 days prior to physiological maturity and physiological maturity stage. Stalks were treated with 2 per cent urea and steeped in horizontal and combination of vertical-horizontal. Fibre was scoured, bleached and dyed using napthol dyes. Dyed fibre was studied for its fastness properties. Study revealed that scoured+bleached+dyed fibres extracted from stalks harvested at physiological maturity stage was good to excellent and poor for the fibres extracted from stalks harvested 15 days prior to maturity. Thus, scoured+bleached+dyed mesta fibres can be utilized in producing textiles and accessories that require minimum or no washing.

■ **KEY WORDS :** Mesta fibre, Harvesting stage, Urea treatment, Steeping method, Wash fastness, Light fastness

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Colour fastness is a term used in dyeing of textile material means resistance of colour to fading,*i.e.* it refers to the notion of an object having colour that retains its original hue without fading or running. The first known use of the word *colourfast* was in 1916. In general, textile materials should be tested for colour fastness before one uses bleach, or another type of strong cleaning product. Poor colour fastness in textile products is a major source of customer complaint. Dyes can also behave differently when in contact with different agents, for instance dyes which may be fast to dry-cleaning may not be fast to washing in water. It is therefore important to test any dyed of printed product for the fastness of the colours that have been used in its decoration (Saville, 2004)

In view of recent global environmental issues and inadequate raw fibre resources, scientists worldwide have begun to show interest in exploiting the full potential of natural fibre and their diverse uses. In today's world, the commercialization of natural fibres is loosing prominence owing to synthetic fibres and the difficulties in large-scale production due to the cultivation of cash crops by farmers. But the present day requirements of textile materials are many, such as fashion, comfort and eco-friendliness in use as well as production. From time immemorial, the textile industry has been dominated by cotton fibre, the supply of which is presently fluctuating and the scope to increase its supply is found to be limited.

India has a large variety of other cellulosic fibres obtained from different parts of the plant *viz.*, leaf, stem, husk and kernel (seed) *etc*. Similarly, 'mesta' is the bast fibre obtained from commercially cultivated species such as *Hibiscus cannabinus* and *Hibiscus sabdariffa*, which belongs to the family Malvaceae. These species are mainly grown for its fibre purpose. The fibre was discovered in Africa where the fibre was obtained from plants growing in a wild state that were used for twines, bags and matting (Jyothirmai and Jacob, 1997). In India, mesta stands next in importance to jute and it is called as *Patwa* (Hindi), *Lal-mista*, *Chukar* (Bengali), *Lal-ambadi* (Marathi), *Yerra gogu* (Telgu), *Puichchai* (Malayalam) and *Chukiar* (Assam) (Mahadevan *et al.*, 2009). Consumers demand for variety in any product that is manufactured. Colour of the fibres is one of the important aesthetic requirements. The purpose of dyeing is to produce economically a uniform shade without any variation in tone or depth (Shenai, 1984).

Hence, mesta fibre was extracted and dyed for present

study to explore for utilization and production of various value added products.

■ RESEARCH METHODS

Selection of fibre:

Mesta species, *Hibiscus sabdariffa* variety AS73, CP 560 grown in the Institute of Organic Farming, UAS, Dharwad, Karnataka.

Extraction of mesta fibre :

Harvesting stages :

Plants were harvested at fifteen days prior to physiological maturity (135-150 days) and physiological maturity stage (150-160 days).

Treatment :

Completely dried and rippled stalks were sprayed with 2 per cent urea solution. The stalks were then bundled for retting.

Steeping methods :

Two methods of steeping *i.e.*, horizontal and vertical-horizontal were followed for the study.

Dyeing :

Dyeing is the process of colouring textile materials by immersing them in an aqueous solution of dye called dye liquor. Dyeing increases the aesthetic appeal of the article on which applied. Napthol dyes a class of azoic colours are not ready-made but are produced within the substrate using different components. *i.e.*, napthols and bases, reffered to as 'coupling' and 'diazo' components, respectively.

Preparation of napthol bath :

Turkey red oil was added to specified quantity of napthol. Turkey red oil acts as a surface active agent or wetting agents. A known quantity of water was added to this mixture and was mixed thoroughly. This solution is then subjected to boil, when boiling 3g to 5g of NaOH is added until the napthol bath becomes transparent. The solution then mixed in the remaining amount of water to make the quantity of the ultimate bath to 1:20.

Preparation of base :

To the known quantity of the base (scarlet RC) 10g of salt was added as a wetting agent and added adequate water enough to mix the content thoroughly. 15ml of HCL acid was slowly added into the base solution with constant stirring. 10g of sodium nitrate was dissolved in known quantities of water that was later added into the base+HCL concentrate. Care was taken to maintain the temperature of the bath, hence sodium nitrate solution was added to the base bath very slowly. This converts the insoluble form of the base particle into the soluble form. The base solution is acidic in nature, hence to neutralize, aluminums sulphate dissolved in known quantities of water is added to the base bath. The material to liquor ratio, was finally maintained to 1:20 by adding the remaining quantity of water.

Treatment (napthol bath) :

The scoured and bleached mesta fibres were soaked in water for 10 min, squeezed properly and deeped in the napthol bath. Care was taken to move the fibre up and down in the bath for even dye uptake. Fibre was treated in this bath for 20 mins.

Treament (base) :

The fibre were squeezed properly and then treated in the base bath (developing bath) for 20 mins. The fibres were properly moved in the base bath to accelerate optimum and even dyeing.

After treatment :

The dyed fibres were squeezed out and deeped in sufficient amount of plain water to remove the excess amount of dye molecule from the surface of the fibre that are unabsorsed. Then fibres were squeezed and dried in shades.

Colour fastness :

Wash fastness was assessed by Launder-O-Meter, ISO-3. K/S, ?E, colour change and colour staining were measured using Double Beam QC4808 Spectrophotometer. Light fastness was measured in Digital light fastness tester, ISO-9001 by exposing dyed fibre sample to Mercury Tungsten Fluorescent Lamp (MBTF) lamps of 3 hrs per day for 8 successive days. Treated samples were assessed for K/S values and light fastness ratings by using the JAYPAC 4808 QC Spectrophotometer.

■ RESEARCH FINDINGS AND DISCUSSION

The results of the present study as well as relevant discussions have been presented under following sub heads:

Colour fastness of napthol dyed mesta fibres :

Table 1 and 2 record the wash fastness and light fastness ratings of scoured+bleached+dyed mesta fibres extracted from stalks harvested 15 days prior to maturity and at physiological maturity stage, respectively. The results are explained herewith under different sub-headings.

Wash fastness and light fastness ratings of napthol dyed mesta fibres extracted from stalks harvested 15 days prior to maturity :

A glance at Table 1 reveals that the K/S value of the naphthol dyed mesta fibres extracted without any treatment

by horizontal steeping method was higher (12.907) than the vertical-horizontal steeping (12.108). On washing the K/S value changed to 8.907 for the fibres extracted by horizontal steeping method and 8.425 for the fibres obtained by vertical-horizontal steeping. The wash fastness rating was 4 for both the samples. Similarly the K/S value of the samples tested for light fastness was 9.065 for the fibres obtained by horizontal steeping and 9.334 for the fibres obtained by vertical-horizontal steeping. Therefore, the light fastness rating was 4 for both the samples. This implies that the wash fastness ratings of the scoured+bleached+dyed fibres had Medium- Excellent wash fastness. It is stated that the stage of harvesting has a impact on dye uptake of the lignocellulosic fibres. Hence, dyeing such fibres need to be carried out for items that need less or no washing at all. For example preparing value added product and apparel accessories that need less washing.

K/S values of the naphthol dyed mesta fibres extracted by urea treatment and horizontal steeping was higher (11.862) than the vertical-horizontal steeping (11.734) method. On washing the K/S changed to 6.490 for the fibres extracted by horizontal steeping method and 4.877 for fibres obtained by the vertical-horizontal steeping. The wash fastness rating hence was found to be 3-4 for both the samples. Similarly, the K/S value of the samples tested for light fastness was 5.666 for the fibres obtained by horizontal steeping and 7.878 for the fibres obtained by vertical-horizontal steeping. However, the light fastness rating was 4 for fibres obtained by horizontal steeping and 3-4 for the vertical-horizontal steeping, respectively (Table 1).

Simultaneously a glance at the fibre properties implies that there was an adversed effect of scoured+bleached+dyed on fibre length, fineness, strength and elongation. The fibres became weak on scouring+bleaching+dyeing. Therefore, it is imperative that scoured+bleached+dyed mesta fibres can be used in combination with other un dyed fibres so that the lose in physical characteristics can be camouflaged.

Wash fastness and light fastness ratings of naphthol dyed mesta fibres extracted from stalks harvested at physiological maturity :

Table 2 reveals that the K/S value of the naphthol dyed mesta fibres extracted without any treatment by horizontal steeping method was higher (11.336) than the K/S value of fibres obtained by vertical-horizontal steeping(10.676). On washing, the K/S value was changed to 10.466 for the fibres extracted by horizontal steeping method and 9.528 for the fibres extracted by vertical-horizontal steeping. The wash fastness rating hence, was 4 for both samples. Similarly the K/S value of the samples tested for light fastness was 10.437 for the fibres obtained by horizontal steeping and 7.785 for the fibres obtained by vertical-horizontal steeping. However, the light fastness rating was 4 for both the samples. Washfastness ratings of the scoured+bleached+dyed fibres obtained from stalks harvested 15 days prior to maturity was poor compared to the fibres obtained from physiological matured stalks that has Medium- Excellent wash fastness. Therefore, it can be concluded that the stage of harvesting has a impact on dye uptake of the lignocellulosic fibres. Hence, mesta fibres that are extracted from physiological matured stalks are practically suitable.

K/S values of the naphthol dyed mesta fibres extracted by urea treatment and vertical-horizontal steeping was higher (12.212) than the horizontal steeping (9.893) method. On washing the K/S was changed to 10.532 for the fibres extracted by vertical-horizontal steeping method and 8.489

Table 1 : Colour fastness of scoured+bleached+dyed fibres extracted from stalks harvested 15 days prior to maturity

Treatments		Control	Wash fastness			Light fastness	
		S+B+D (control) K/S	Colour strength (K/S)	Colour change (Rating)	Colour staining (Rating)	Colour strength (K/S)	Light fastness (Rating)
Control (without	H	12.907	08.907	2-3	4	09.065	4
urea treatment)	V-H	12.108	08.425	3	4	09.334	4
Urea treatment	H	11.862	06.490	1	3-4	05.666	4
	V-H	11.734	04.877	1	3-4	07.878	3-4

Note: H: Horizontal steeping, V-H: Vertical-horizontal, K/S: Colour strength, S+B+D: Scoured+Bleached+Dyed

Table 2 : Colour fastness of scoured+bleached+dyed of fibre extracted from physiologically matured mesta stalks

Treatments		Control	Wash fastness			Light fastness	
		S+B+D (control) K/S	Colour strength (K/S)	Colour change (Rating)	Colour staining (Rating)	Colour strength (K/S)	Light fastness (Rating)
Control (without	H	11.336	10.466	3	2	10.437	4
urea treatment)	V-H	10.676	09.528	4-5	1	07.785	4
Urea treatment	H	09.893	08.489	3-4	2	06.737	4
	V-H	12.212	10.532	4	1	08.408	4

Note: H: Horizontal steeping, V-H: Vertical-horizontal, K/S: Colour strength, S+B+D: Scoured+Bleached+Dyed

for the fibres extracted by horizontal steeping. The wash fastness rating hence was 3-4 for fibres obtained by horizontal steeping and 4 for those obtained by vertical-horizontal steeping. The K/S value of the samples tested for light fastness was 6.737 for the fibres obtained by horizontal steeping and 8.408 for the fibres obtained by vertical-horizontal steeping. However, the light fastness rating was same (4) for fibres obtained by both the horizontal steeping and vertical-horizontal steeping method (Table 2). The light fastness of all the mesta fibres irrespective of stage of harvesting, urea treatment and steeping methods was found to be good. Thus, the dyed mesta fibres can be utilized for apparel accessories and other value added product.

Conclusion :

From the study, it was observed that the scoured+bleached+dyed fibres extracted from stalks harvested at physiological maturity stage was good to excellent (3-5) and poor (1) for the fibres extracted from stalks harvested 15 days prior to maturity. It can, therefore, be concluded that scoured+bleached+dyed mesta fibres can be utilized in producing textiles and accessories that requires minimum or no washing.

Light fastness of all the fibre samples, irrespective of the harvesting stage, urea treatment and wet processing was good (4). If dyed mesta fibres are intended to create aesthetic appeal, then such fibres need to be used in optimum quantities to increase the serviceability of the goods. However, quantities of bleached and bleached+dyed fibres should be minimum in any product that is designed using mesta fibres.

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