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Manisha Gahlot
 Department of Textiles and
 Apparel Designing, College of
 Home Science, GBPUA & T
 Pantnagar, Uttarakhand, India

Beenu Singh
 Department of Textiles and
 Apparel Designing, College of
 Home Science, GBPUA & T
 Pantnagar, Uttarakhand, India

Manisha Kumari
 Department of Textiles and
 Apparel Designing, College of
 Home Science, GBPUA & T
 Pantnagar, Uttarakhand, India

Rashmi Bala
 Department of Textiles and
 Apparel Designing, College of
 Home Science, GBPUA & T
 Pantnagar, Uttarakhand, India

Corresponding Author:
Manisha Gahlot
 Department of Textiles and
 Apparel designing, College of
 Home Science, GBPUA & T
 Pantnagar, Uttarakhand, India

Value addition of Himalayan nettle fiber

Manisha Gahlot, Beenu Singh, Manisha Kumari and Rashmi Bala

Abstract

In India, the arts and handicraft sector is the second largest employer sector. In this sector use of bast fibers addresses sustainability issues. Bast fibers are used to make handicraft items like bags, mats, lamp shades, footwear etc. This paper reports a study on the value addition of nettle fiber through dyeing and mordanting for handicrafts. Hand-spun yarn was prepared using *Bageshwari Charkha* from dyed and mordanted nettle fiber. A range of products was developed from yarn through the crochet technique. The developed products were evaluated on a five-point rating scale on the novelty of design, colour combination, craftsmanship and overall appearance. The findings of the study revealed that the wine bottle cover was given the first rank followed by pot holder and dream catcher. A comprehensive effort has been made to improve the potential of environment-friendly material for sustainable handicraft production. In this way, products developed from Himalayan nettle yarn can be helpful for the rural hill population in providing a sustainable source of income through the commercialization of products.

Keywords: Crochet, dyeing, hand spun yarn, Himalayan nettle, mordanting, nettle fiber

Introduction

The growth of technology and industry has distanced us from nature. Our dependency on nature for what we use and consume on a daily basis has not changed. It always remains the same which results in many connections within nature and many of those connections are imperilled. The transition towards a bio-based economy and sustainable development as a consequence of the Kyoto protocols on greenhouse gas reduction and CO₂ neutral production offers high perspectives for natural fiber markets. Natural fibres are the solution towards environmental improvement^[4]. All the textile goods made using green fibres can boast high comfort/health properties and are ecological items. They can be labelled as "Natural" which is the key to market success^[9]. Natural fibres are used for versatile and diversified end uses ranging from apparel, fashion accessories and furnishing products to ropes and nets. Natural fibres are believed to contribute to a greener planet and can be promoted for their use as CO₂ neutral resource. Plant fibres have greater strength and stiffness than most conventional fibres. Plant fibers such as bast fibers are easily available and accessible as these are produced locally in different regions. Therefore, the most suitable and economical fibres for the production of bio products are plant-based fibres^[12]. Products from bast fibre crops increase in popularity as science makes progress in their study and utilization. Handicrafts have a high potential for creating job possibilities for artisans^[15]. Ironically, products are being represented as being handmade more and more at an age of technical growth. A wide range of products for different applications is available at lab, pilot or industrial production scale^[11]. In the case of textiles, bast fibres play a significant role in producing handicrafts that are extracted from the stem of various plants and are environment-friendly in nature. The bast fibres can also improve the livelihood of the poor farmers who are involved in the cultivation of the plants, extraction and processing of the fibres^[6]. Raw fibres can be directly used as insulation, fluid sealing, upholstery and reinforcement in composite materials^[13]. Different products developed from natural fibers like pine needles, ramie, flax and hemp have very high domestic and export demand^[3]. Leaf fiber like banana is also suitable for value-added fancy items and has good export potential. Portraits drawn and filled with colorful banana fibre chips have become popular in the handicraft industry in Mizoram, India^[5]. The Handicrafts of Bamboo universally practiced at varied regions throughout India. The craft of Bamboo cane is full-time employment of thousands of individuals in India^[10]. A product can be established under the idea of sustainability in dimensions of ecology, economy and social pillars.

The Himalayan nettle has the advantage of 100% sustainability and it has been added to the list of commercial fibre-producing plants. It becomes imperative to create opportunities for employment generation in small towns and rural areas in a sustainable manner utilizing locally available resources. Many movements and campaigns were launched to promote the concept of “Vocal for Local” and buying of products that are made locally. There are some NGOs and designers, who are conducting training of local people in processing, spinning and weaving of Himalayan nettle fibres based on the traditional and indigenous knowledge under income generating programmes. The development of optimized methods of nettle fibre processing might help in employment and income generation for many local peoples. Nettle is spun into yarns and crocheted or woven into shawls. The other products made of nettle fibres are stoles and bags (<https://asiainch.org/craft/nettle-fibre-weaving-of-uttarakhand>). Nettle fabric will do well as yardage, shoe-uppers and shoe-strings, lamp shades, upholstery, pillows, bed-linen, table-linen, drapes, kitchen-linen and apparel for all ages ^[1]. In Uttarakhand, fabric is being developed from nettle fibre through weaving in the form of union fabric and blended fabric. Different products such as scarves and shawls are available in different varieties using pure nettle fibre or nettle fibre blended with local wool, angora hair fibre or silk waste fibre. Value addition of nettle fibres can further be done through dyeing with natural dyes to impart different colours. Himalayan nettle is laden with immense possibilities and offer vast opportunities for small scale enterprise development. The present study was planned for the value addition of nettle fibres through the application of natural dyeing and mordanting for the development of innovative products using crochet technique.

Materials and Methods

The delignified nettle fiber was used for this study. Delignification was done with three step optimized process involving use of Sodium chlorite, Sodium hydroxide and acetic acid. The delignified fibres had better visual properties with less impurities and whiter colour. Lignin is a biochemical polymer that functions as a structural support material in plants and it hinders with the dye absorption by the fibres. Removal of lignin makes the fibres more hydrophilic and suitable for the textile applications ^[17]. The dyeing of nettle with natural dye extracted from the madder (*Rubia cordifolia*) roots was carried out at optimized dyeing conditions which were 3% dye concentration, 45 minutes dyeing time and 1:15 dyeing M:L ratio and dyeing temperature was kept constant at 90 °C. Two synthetic mordants namely alum and ferrous sulphate and one natural mordant i.e., gallnut were used in the present study. An optimized mordanting procedure was used to develop different hues on delignified nettle fiber ^[2].

Preparation of yarn and assessment of its physical properties

The undyed as well as dyed and mordanted fibres were combed manually with the help of hand combs. The combed fibres were spun into yarn on *Bageshwari charkha*. The prepared undyed yarn was tested for determining the physical properties namely yarn count, twist per inch and yarn strength and elongation using the standard test methods of ISI Handbook of Textile Testing (1982). Yarn count, twist per inch and yarn strength and elongation were determined as per standard test methods IS: 570-1964, IS: 832-1964 and IS: 1670-1970 respectively.

Product development and its evaluation

Diverse value-added products were planned comprising fashion accessories, decorative and utility products. The main aim of product development was to explore the possibility of using dyed nettle fibres spun into a range of innovative products which can be made available as souvenirs and mementoes for visitors. Different products namely, earrings, necklace, anklet, dream catcher, wine bottle cover and pot holder were developed from dyed and mordanted nettle fibre spun yarns using crochet technique. The Crochet technique was chosen as it is very simple and easy to do and can be done with a simple metal crochet hook. Being a hilly state, women of Uttarakhand are skilled in the art of knitting and crocheting, hence they can be trained easily in product development with nettle fibres using crochet, which can be used as a means of income generation by them. Millions of people in India make their living by producing traditional handicrafts using traditional skills and knowledge ^[8]. People of Khetikhan and Lohaghat have been practicing knitting and crocheting from several generations ^[16].

The planned products were evaluated by thirty respondents. Respondents consisted of faculty members, Senior Research Fellows, Ph.D. and M.Sc. students of College of Home Science GBPUA&T, Pantnagar. The products were evaluated to study the acceptability of the developed products. The evaluation of products was done on basis of novelty of design, colour combination, craftsmanship and overall appearance. Different products were rated on a five-point rating scale. The weighted mean score was calculated for each criterion.

Results and Discussion

Physical properties of prepared yarn

Dyed as well as undyed Himalayan nettle fibres were spun into single yarn on *Bageshwari charkha*. The undyed yarn was tested against different quality parameters. The results are given in Table 1. Yarn count of undyed handspun single yarn was 5.21 Ne and 5-7 turns per inch were observed in case of twist (Table 1). Strength of yarn was observed to be 410.3 kgf and percent elongation was observed 3.99%. Dyed and undyed nettle yarns are shown in table 2.

Table 1: Yarn quality parameters for handspun yarn

Type of yarn	Yarn quality parameters			
	Yarn count (Ne)	Twist (tpi)	Strength (Kgf)	Elongation (%)
Nettle (handspun)	5.21	5-7	410.3	3.99

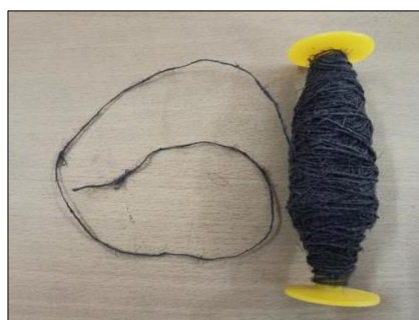
Table 2: Dyed and undyed nettle yarns



Undyed nettle yarn



Dyed nettle yarn mordanted with alum



Dyed nettle yarn mordanted with ferrous sulphate



Dyed nettle yarn mordanted with gallnut

Prepared yarns were used for the development of products using crochet technique. Handmade products may be thought to include the "essence" of the artisan in the form of their love for the product and the manufacturing process. Handmade products symbolically "contain love" [7]. Younger generations and well-educated consumers are more willing to accept

artisan innovation. Furthermore, older shoppers are willing to buy genuine and high-quality goods [14]. Details of product made along with material used are given furnished in table 3. Development dyed and mordanted products are furnished in Table 4.

Table 3: Details of products made by using yarns prepared with dyed and undyed nettle fibres

S. No.	Products	Mordants used	Colours
1.	Earrings	Gallnut	Light brown
		Ferrous sulphate	Blackish grey
2.	Necklace	Gallnut	Light brown
		Ferrous sulphate	Blackish grey
3.	Anklet	Gallnut	Light brown
		Ferrous sulphate	Blackish grey
4.	Wine Bottle Cover	Alum	Pink
		Ferrous sulphate	Blackish grey
5.	Pot Holder	Gallnut	Light brown
		Ferrous sulphate	Blackish grey
		Control	Off White
6.	Dream Catcher	Control	Off White
		Ferrous sulphate	Blackish grey
		Alum	Pink
		Gallnut	Light brown

Table 4: Developed products made by dyed and undyed nettle fiber spun yarn



Anklet



Necklace



Pot holder



Dream catcher



Wine bottle cover



Earrings

It is clear from table that gallnut mordanted yarn was used to prepare a maximum number of products i.e. 5 as the colour was attractive. Ferrous sulphate-dyed yarn was used for six

products and the alum-mordanted yarn was used in two products.

Table 5: Weighted mean score of the developed products based on respondents' rating, N=30

S. No.	Developed products	Criteria for evaluation	WMS	Overall WMS
1.	Earrings	Novelty in design	4.50	4.34
		Colour combination	4.33	
		Craftsmanship	4.33	
		Overall appearance	4.23	
2.	Necklace	Novelty in design	3.16	3.73
		Colour combination	3.83	
		Craftsmanship	3.90	
		Overall appearance	4.06	
3.	Anklet	Novelty in design	4.46	3.88
		Colour combination	3.56	
		Craftsmanship	3.73	
		Overall appearance	3.80	
4.	Dream catcher	Novelty in design	4.70	4.46
		Colour combination	4.36	
		Craftsmanship	4.20	
		Overall appearance	4.60	
5.	Wine Bottle cover	Novelty in design	4.86	4.90
		Colour combination	4.90	
		Craftsmanship	4.86	
		Overall appearance	5	
6.	Pot holder	Novelty in design	4.73	4.73
		Colour combination	4.83	
		Craftsmanship	4.86	
		Overall appearance	4.53	

All the developed products were evaluated by thirty respondents on five-point rating scale. Weighted mean scores were calculated on the basis of ratings given by respondents. Table 5 shows the WMS of selected parameters for each product and overall WMS of individual products. As evident from the data in Table 5, earrings were preferred

more for novelty of design with highest WMS (4.50) and lowest WMS (4.23) was observed for overall appearance. It was observed that colour combination and craftsmanship had the equal WMS of 4.34 each.

In case of necklace, most of the respondents gave highest rating to the overall appearance of the necklace, the recorded

value of WMS was 4.06, which meant that respondents liked the product as a whole. In case of novelty of design, value of WMS was 3.16, which was found to be the lowest. Calculated value of WMS for colour combination and craftsmanship were 3.83 and 3.90 respectively (Table 5).

Design of the anklet was liked for novelty by most of the respondents and value of WMS was 4.46 followed by the craftsmanship WMS was 3.73 and overall appearance which had WMS i.e. 3.80. Lowest value of WMS (3.56) was observed for the colour combination of anklet (Table 5).

In case of dream catcher, highest WMS (4.70) was observed for novelty of design. Observed value of WMS for overall appearance was 4.60 followed by WMS of colour combination which was found to be 4.36. The value of WMS for craftsmanship was 4.20 which was observed to be the lowest (Table 5).

Table 5 reveals that wine bottle cover was preferred by most of the respondents as it obtained highest overall WMS among

all the products. Calculated value of WMS for overall appearance was 5 followed by colour combination with WMS 4.90. The values of WMS were equal for novelty of design and craftsmanship i.e. WMS 4.86 each.

In case of pot holder, it obtained highest rating for craftsmanship with WMS 4.86. The value of WMS for colour combination was 4.83. The calculated value of WMS for novelty of design and overall appearance was 4.73 and 4.53 respectively (Table 5).

Overall comparison of the developed products has been shown in Fig. 1. As evident from the Figure 1 wine bottle cover had highest WMS (4.90) and it was given rank I. It was followed by pot holder (Rank II) and dream catcher (Rank III) with 4.73 and 4.46 WMS respectively. In case of jewellery set, earrings with 4.34 WMS (Rank IV) were preferred over anklet (WMS 3.88) and necklace (WMS 3.73) and ranked V and VI respectively.

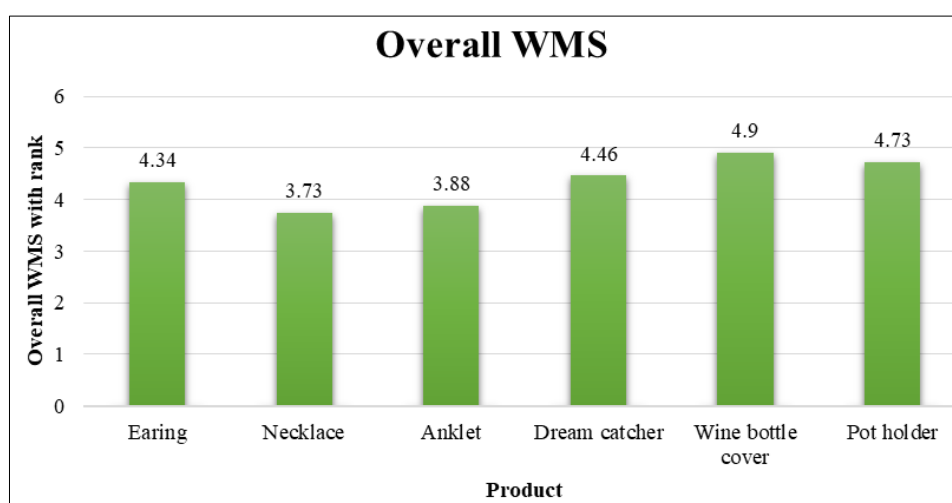


Fig 1: Overall WMS and rank obtained by developed products

Conclusion

Value addition of nettle fibre through dyeing would not only improve the aesthetic properties of the fibres but can amplify its scope for diversified end uses. It would help the rural hill population by providing a sustainable resource for income through commercialization of nettle-based products. Innovative products made with simple techniques and tools could be taken up easily by rural people especially women to fetch extra income; such products could be offered as gift items and could be promoted as mementoes. Women are very prosperous in the art of crochet. They are used to do such work for their domestic use.

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