An intensification of sustainable eco-friendly sisal fiber crafts in healthcare industry

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Abstract
India’s rich cultural diversity and heritage provide a unique and huge resource for developing craft products. India is one of the important suppliers of handicrafts to the world market. The industry is mostly spread in rural and urban areas, highly labor-intensive, and cottage-based decentralized industry. Many artisans, on a part-time basis, are involved in the crafts work. In addition, many Governmental and non-governmental organizations are engaged creating income opportunities for these artisans. Few of them are engaged in women empowerment programs, developing training programs for women to make them self-reliant and independent learners. In today’s world, all are talking about sustainability. Many artisans are engaged in making eco-friendly and sustainable crafts from various natural materials when it comes to handicrafts. Natural fibers play a very important role in the production of the handicraft industry in India. The crafts like baskets, carpets, wall hangings, bottle holders, bags and accessories, home décor items, and many more are made using natural fibers like jute, banana, coir, sisal, bamboo, etc. The present paper will explain the procedures used for manufacturing these crafts using natural Sisal fiber. The data has been collected from various organizations for the process and methods used to manufacture these crafts. Producing a craft using natural material and eco-friendly processes helps in reducing the carbon footprint (the number of greenhouse gases, mostly CO₂ released into the atmosphere by any activity) and makes the manufacturing process more environmentally friendly. Many Indian handicrafts and artisans have incorporated the ideology of eco-friendly fashion and contributing to reducing the environmental impact of these handcrafted products. Natural fibers are promoted in large quantities for making handicrafts. The growing popularity of fiber crafts is following the huge demand for Eco-friendly products throughout the world. Fibers extracted from bananas, sisal, Pina, and jute are mainly used to produce crafts.

1 Introduction
For thousands of years, natural fibers have been at the core of the textile industry. Over the last 50 years, natural fibers have started to become displaced by synthetic, artificial materials such as polyester, acrylic, and nylon, which are much cheaper and easier to manufacture in bulk. These materials are strong contributors to carbon emissions and waste (http://blogs.worldwatch.org/). Growing awareness of environmental issues has led to increasing demand for natural materials, including natural fibers [1]. There is a wide variety of vegetable fibers, although only a few are used largely commercially. Unlike synthetic fiber, natural fibers are renewable, carbon-neutral, biodegradable, and eco-friendly and not only come from the environment but also benefit it. Minor fibers like flax, jute, Banana, Sisal, Coir, Ramie and many other vegetable fibers have been used for more than 8,000 years [2]. All these minor fibers are sourced from nature. Sisal fiber is exceptionally durable with low maintenance with minimal wear and tear, recyclable, anti-static, does not attract or trap dust particles and exhibits good sound and impact absorbing properties.

Sisal is a leaf fiber, which occupies sixth place among fiber plants and represents 2% of plant fibers’ production. Sisal with the botanical name Agave Si- salana is a species of Agave native to southern Mexico but widely cultivated and naturalized in many other countries. In India [3], it is mainly grown in arid & semi-arid regions of Andhra Pradesh, Orissa, Karnataka, Maharashtra, Bihar, Chhattisgarh, and West Bengal (Bhoj R., Karolia A. (Feb 2016) A Comparative Study on The Effect of Chemical & Enzyme Treat- ments on the Softening of Sisal Fiber [4]. International Journal of Scientific Research, 05(02). Brazil occupies the lion’s share, both in terms of area and production. Trade Information Import China is the largest sisal fi-
India's rich cultural diversity and heritage provide a unique and huge resource for developing craft products (http://www/jhea.in/indian-handicraft-industry). India is an important handicrafts supplier to the world. The industry is mostly spread in rural and urban areas, highly labor-intensive, and cottage-based decentralized industry. The industry employs over 6 million artisans, including many women and people belonging to weaker sections of society.

Although exports of handicrafts appear to be sizable, India's share in world imports is minuscule. Famous centers for craft in India are Uttar Pradesh, Rajasthan, Gujarat, Andhra Pradesh, Maharashtra, etc., but this is just a small part of it; India offers much more. The craftsman uses different media to express their originality [6]. The diversity of the handicrafts is expressed in textiles, metals- precious and semi-precious, wood, precious and semi-precious stones, ceramic, and glass (www.gfe.de/Publication/Indian%20Handicrafts%20Industry.doc).

In the Mysore district, there are women making Sisal products in Kuderumole, Dasanur, and Nerale. This craft was introduced to the women so that they could supplement their income; initially, it was a large group of women who were trained, but the numbers declined to a handful when orders for the type of products they were making were not regular or large enough to ensure constant work for all the women [7]. Then Indo-Dutch Project management Society (IDPMS) approached the National Institute of Design (NID) to undertake a design intervention project for design development and upgrading of skills. The objectives of the project were mainly product development and skill improvements. The training program was organized on various topics like dyeing, color, and quality control for product development. NID designers developed the products and tested the products' marketing at exhibitions and Melas for market feedback [8]. A market survey was done in the cities like New Delhi, Hyderabad, Bangalore, and Goa for the products available in the market. Then products like slippers, floor mats, different types of bags, chiks, containers, swings, ladders, tablemats, dusters, etc., were made during this project by the artisans. There are several places in India, including Ahmednagar, Aurangabad in Maharashtra, Corlim in Goa, Alappuzha in Kerala, and Madhya Pradesh and Tamil Nadu are engaged in Sisal craft making. Sisal fiber products are tougher than jute and are crafted into attractive and colorful bags and mats (https://asiainch.org/craft/sisal-fibre-craft-of-aurangabad-maharashtra/). Shopping bags, ladies purses, coasters, wall hangings, and other essential accessory items used for daily purposes are made of banana or sisal fiber. The major fiber craft center is situated in Corlim (https://www.bestgoadeals.com/Goan-Culture-Events/Handicrafts-of-Goa/Fibre-Craft.html). Madhya Pradesh also harbors the precious Sisal plant, known for its social and environmental contributions to the natives of the state [9]. Sisal has generated livelihoods in the state by its value as a ‘Future fiber.’ Multiple SHGs in the state, many of these comprising women solely, use the fiber from the plant to make purses, dolls, doormats, and wall décor (https://www.thebetterindia.com/90488/india-handcrafted-products-protect-environment/).

Many organizations and government policies naming Community Action for Social Transformation (CAST), Indian Handicrafts, Craft Council of India, Women’s Development Organization (WDO), Ambedkar Hastashilp Vikas Yojana (AHVY) under Ministry of Textiles and Asia Inch, etc., are also making and supporting these artisan clusters for developing their skills and manufacturing these sisal crafts [10]. Many online portals like craftsbaazaar.com, kauthuk.com, uttarakhandcrafts.com, etc., are the online sites that provide a platform for organizations and artisans to portray their skills and provide suitable markets to sell their products.

In the light of the above background, the researcher in the present paper focused on the documentation of the natural sisal fiber craft making, studying the different procedures followed during the product manufacturing of these crafts [11].

2 Methodologies

The research paper aims at the documentation of Sisal fiber crafts. A descriptive study was planned to fulfill the objectives. A review was conducted to collect relevant data in the requisite format. A sample selection was purposely done, taking into consideration the organizations engaged in sisal craft-making were chosen. An interview method was implemented to collect data. The researcher interviewed
the Program Head of Community Action for Social Transformation (CAST), Mrs. Sucila Pandian [12]. The questionnaire tool was prepared that deals with the region, artisans cluster engaged in craft making, type of products, raw material used, process or technique of making craft, procedures used fiber extraction, dyeing, yarn manufacturing, a market of the craft, economic conditions of the craftsmen. The researcher also collected data from other NGOs like the HOPE Foundation through different studies, reports, and articles published in different journals or online sources. The data is supported with tables and photographs of the process of fiber extraction, yarn making, fiber dyeing, craft making, and finished crafts of different varieties [13].

3 Results and findings

Today's rationalized lifestyle is changed completely. There has been a change in the fashion industry about the usage, color pallet, and designs [14]. It can be stated that life has become more creative and attractive for many years. Natural fibers are used in rural areas and in urban areas for making artistic crafts, products, and daily usage products. Due to this change in society, it is essential to have an eco-friendly product in the market for consumers to suit the modern lifestyle. In today's world, the concept of sustainability is in the boom; hence, all are turning toward these eco-friendly products and crafts. The present paper reveals the traditional craft skills in terms of design, product modification, and eco-friendly production of the craft having aesthetic values to reach the global market.

Community Action for Social Transformation, also known as CAST, is an agency established in 1984 working for vulnerable communities, including rural women, poor artisans, infected and affected children with HIV/AIDS, emotionally disturbed women, sexually abused women, prostitutes, and others facing social problems [15]. The main vision or mission of CAST is transforming the community into a Healthy Society by doing marginalization, building up collective capacity, and creating demand for social actions, enabling these people to manage individually and empowering them with sustained systems.

The main objective of CAST is to identify the needs for self-employment opportunities, particularly for women, and to enhance their socio-economic status to achieve gender equality, for which they have started income generation programs, in which sisal and banana fiber products plays a very prominent role. The organization had trained more than 200 women with the help of the District Rural Development Agency (DRDA), Tamil Nadu Women Development Corporation, Council for Advancement of People's Action and Rural Technology (CAPART), and other private organizations in making natural fiber craft. The organization is also involved in helping these artists with marketing products like toys, bags, vanity and scrubbers, and many more. Until now, they have done four workshops for design development and skill up-gradation training programs. The CAST organization supporting the rural people for income generation self-employment opportunities, help them to enhance their Entrepreneurial skill by training with changing the mindset of rural women and youth to develop various income sources.

3.1 Artisan Cluster

CAST being an NGO, has undertaken a Cluster Development Project to enhance the Sisal Fiber Craft based at Kalakad block with the sponsorship of the office of the Development Commissioner (Handicrafts) Ministry of Textiles, Government of India. CAST has identified 220 women artisans. They were helped to be trained in upgrading the craft development skills to make a wider range of livelihood products under the Ambedkar Hastashilp Vikas Yojana (AHVY) Scheme. All these artisans come from the poor and marginalized sections of the targeted area. The majorities of them are from the poor Muslim Minority community and scheduled caste.

3.2 Process

3.2.1 Extraction of fiber-sisal

The basic raw material used for the production of these products is sisal fiber (Agave Sisalana). This plant is a locally available plant that grows as bushes in southern India. The plant belongs to the Agave family, and fibers are extracted from the leaves of the plants. Leaves have a lance shape growing out from the stalk, which is fleshy and rigid in green color. Figure 1 shows the sisal fiber is the plant of tropical and sub-tropical regions that means temperature above 250°C and enough sunlight. The average length of the fiber is 0.5-2 meters long and 7-8 cm wide at the base. A plant grows with around 200-250 leaves. For the fiber extraction, the leaves are plucked from
the matured plant, which takes around 4-8 years after planting, and then the leaves are collected to make bundles. All these bundles of leaves are then brought to a central place for the extraction of fiber, and the cost of processing these fibers varies depending on the location and season; the best fact of these plant species is that, after the leaves are harvested from the plant, the new leaves are always re-growing. Each leaf has an average of around 1000 fibers. Fibers report for only about 4% of the plant by weight.

The processing of the sisal leaves is done in different stages. The fibers are extracted with the help of a long-handled flat knife. As the leaves are not dried before the process, the raw fibers obtained are very wet, watery, and quite strong, soft, and flexible to make decorative items. However, for long-lasting use of these products, the fibers extracted are dried well in the sun for 3-4 days.

### 3.2.2 Dyeing of fibers

Figure 2 shows the extracted Sisal fibers are dried completely, fibers are dyed in different bright and attractive colors for making the products more decorative and interesting before using. New and unique shades are obtained to bring in aesthetic value addition to the sisal fiber products. Artisans use chemical and natural dyes for the purpose, which are available in the market in various colors; the extracted fibers are dried and cleaned without any knots or impurities. The fibers are dipped in cold water for the dyeing process, washed, and immersed in a boiling dyeing bath. Salt is added to prevent dye from sticking in hand and to the vessel (for better dye exhaustion). The dye bath is prepared with a proportion of 2:1 (2-liter water and 1 TBS dye (Chemical) and 2 TBS ordinary salt. After the dye bath is ready, cleaned and wet fibers are immersed in the dye bath. Long sticks are used to dip the fiber completely in the dye bath. The dye bath is agitated continuously to ensure uniform dyeing of the fibers. After the dyeing process, fibers are removed from the dye bath and dipped in cold water for washing and removing excess unabsorbed dye. Fibers are dried in the shade for 2-3 days to drain water and get it ready for making the craft.
3.2.3 Manufacturing of yarn and product making

There are varieties of products made from sisal fibers and in different sizes; some are listed in Table 1.

Once the fibers are dried after dyeing, they are twisted to make yarns. Some of the crafts are made directly using fibers, some are made using braided fibers, and some are with yarns. Figure 3 shows for making yarns; the ancient technique of spinning is used. Yarn is taken from the fiber with the spindle. The yarn twined from the fiber is used to make different natural fiber craft materials. Figure 5, Figure 6, Figure 7, Figure 8, Figure 9 and Figure 10 in Different techniques like braiding, twisting, knotting, crocheting is used to make different products like bags, scrubs, hats, dolls, baskets, bottle cover holders, ropes, storage buckets, soap bags, coasters, trays, lampshades, and many more. Figure 4 shows the craft making in sisal fiber.

<table>
<thead>
<tr>
<th>Table 1: Sisal fiber products</th>
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<tbody>
<tr>
<td>Bags</td>
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<td>Baskets</td>
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<td>Shopping bags</td>
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<tr>
<td>Tray and tea sets</td>
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<tr>
<td>Jars</td>
</tr>
<tr>
<td>Fruit bowls</td>
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<td>Medical kit</td>
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Fig. 3. Sisal fiber yarn making

Fig. 4. Sisal fiber craft making
3.2.4 Market ability of the products

Manufacturing of the products is based on the demand and need of the individual buyers. Body Scrubbers in different sizes like 8 to 14cm, soap bags or pouches, fancy dolls, lampshades are products that are more popular. Soap bags or pouches in different sizes with crochet techniques used for inserting soap to prevent allergy and skin irritation are also used to keep room fresheners. Some people may use it for mobiles. Decorative items like fancy dolls for special seasons like Christmas, New Year, and other festivals are manufactured. Figure 11 shows the Different shapes like a globe, stand, cylindrical, and sizes lampshades are made per the demand from buyers. The products are sent through private agencies. Pondicherry, Tiruppur, Bangalore, Chennai are some places where the orders
are sent. Other than these, NGOs also participate in most exhibitions, Tourist places through Government or Non-Government agencies. Some other agencies like Women Development Corporations, Poompuhar, Handicraft Department, Social Welfare agencies are organizing the exhibitions. SIPA (South India Producers Association) has few outlets in Chennai for these crafts. All the artisans involved in craft making are directly participating in such events through the federation or individually. Sisal fiber make the bangle box and flower vase stand in Figure 12 and Figure 13.
4 Conclusions

Sisal fiber has versatile nature encompassing Eco-friendliness, its sustainability. It is apt for changing climatic situations due to low water requirement, survival, and economic output even in very high ambient temperature; it puts minimum pesticide load to the environment through its cultivation process, semi-perennial and lower agro-activity, it conserves soil as well.

The craft is practiced in areas with ample Sisal fiber available, which also makes it possible for employment opportunities and rural development in the tribal-dominated and socio-economically less urbanized parts of the country. Many organizations are working for the development of these socio-economically less developed people and making them self-reliant. As these artists are getting employment opportunities, it improves their living conditions by helping and facilitating them with mainstream resources, Government institutes, and other services.

Efforts taken by the government and non-government agencies to motivate these people from rural communities and providing skill training for better exposure to the world are remarkable.

There is much demand for these handmade natural fiber crafts or products, and these products are made to order. Sisal fiber products have gained popularity in Madhya Pradesh, Chhattisgarh, and other states in India. The crop is available in abundance, and its multiple usages are known to locals.

Sisal fiber crafts are made with contrasting color combinations using dyed and raw fibers, decorated with different surface ornamentation techniques and materials like sequins, pearls, and beads. The artisans, mostly women, engaged in craft-making, use different techniques like weaving, knitting, and crocheting to create beautiful bags, purses, stationery products, mats, and wall hangings.

Training programs have been organized by NGOs, independent trainers, and government departments had provided sisal artisans with expanding opportunities for urban enthusiasts.

These supports from different organizations address the need for self-employment opportunities, particularly for women, and to enhance the socio-economic status of women to achieve gender equality.

Much diversity in the designs and the types of products are found in these sisal fiber crafts. Suppose the larger manufacturing companies collaborate with them. In that case, they will be advantageous for both, as these artisans will get bigger platforms to showcase their skills. The new market of sustainable crafts will be introduced to the world.

5 Recommendation for future research

In the current research paper, the researcher covered the process used to extract fiber, dyeing of fiber, making yarns, techniques used for manufacturing the crafts from sisal fiber, market available, and efforts taken by the organization for empowering artisans from rural communities. The researcher will be working on the next part of the research, in which the researcher can take the efforts to add various products by helping artisans in developing and designing the new products. Also, help the products to reach the global platform. Another approach can be given to further research regarding the different pre-treatments and finishes applied to make the fiber suitable for different medical and industrial applications considering today’s pandemic situation.

Conflict of interest

None declared.

Author contributions

The author read the ICMJE criteria for authorship and approved the final manuscript.

References

11. http://www.keycolour.net/blog/many-uses-sisal/