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Aspects of repurposed yarns

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Abstract
The world is facing an increasing problem of textile waste. Repurposing is a method of using textile waste as a raw material. There are several techniques which fall under repurposing methods. Creating yarns from the textile waste is one of the techniques which fall under repurposing methods. There is a lack of study on the specific subject of repurposed yarns. The objective of this study is to understand the various aspects of (characteristics and limitations) of repurposed yarns through user research. The study relies on primary research of semi structured interviews conducted on 10 prominent users including textile manufacturers and designers of repurposed yarns. Data Analysis was done using grounded theory through which aspects and attributes of repurposed yarns are highlighted.

Keywords: Pre consumer textile waste, repurposing, yarns

1. Introduction
Repurposing can be defined as "using a waste product in a manner different from its original usage" (Kate & Lynda, 2012) [8]. Repurposing also does not break down waste fabrics to its fibre stage, thus avoiding emission of additional carbon, as is done in recycling of fabrics (Zero Waste Scotland, 2019). It is an important technique of converting waste into raw materials and such methods are gaining a lot of attention, as there is an urgent need to reduce the environmental burden caused by piling textile waste (Sinha, 2012) [11]. The accumulated textile waste if not used then it not only leads to the depletion of natural resources but also occupies the landfill and radiates toxic gases, which seeps into the ground water and creates a threat to the plants and animals (Kate & Lynda, 2012) [8].

According to Woolridge (2006) [12], repurposing is useful for low impact waste minimisation as using one ton of discarded polyester utilises only 1.8% of the total resources required to produce new polyester, whereas using of one ton of waste cotton only requires 2.6% of the resources used to produce new cotton. Thus, through this technique 93%-98% of the textile wastes can be recovered (Sinha, 2012) [11].

Through the ages repurposing technique has been practiced using various methods e.g. patchwork, quilting, layering, repurposed yarn making, laser cutting etc. "Quilt Making" in America and "Kantha Textiles" in India can be taken as examples of repurposing. However repurposing has been practiced primarily for self-consumption and has rarely been practiced commercially.

Amongst all the techniques this paper focuses on repurposed yarns made from small pieces of pre consumer textile wastes, which would otherwise end up in the landfill sites. Therefore, there is an absence of data regarding the emergence of its various techniques chronologically.

Repurposed yarns are the yarns which are made directly from the unsorted pre consumer textile industry waste. Pre consumer waste accounts for 10% - 20% of the total amount of textile waste (Domask, 2007) [6]. This waste includes short length fibres, filaments and fabric pieces which are twisted together to form a continuous yarn. Repurposed yarns are coarse (Figure 1) and mainly used in weaving durries, rugs, and carpets for both the local as well as the export markets.

This research aims to study the repurposed yarns made from unsorted pre consumer textile waste so as to underline its various aspects *viz* characteristics and limitations.

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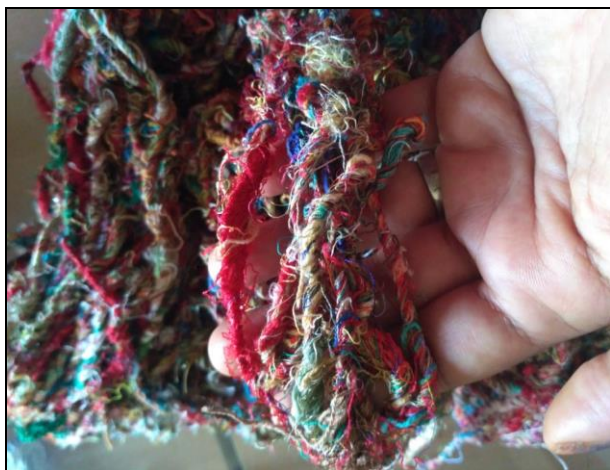University, Gurugram, Haryana,
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Fig 1: Repurposed yarns which are used in Panipat.
Photo: Self Photography.

2. Research Methodology

This paper is based on the research of repurposed yarns made from unsorted pre consumer textile waste. There is a lack of study in the area of repurposed yarns and therefore the research problem was formulated on the basis of the need to understand the features and aspects of repurposed yarns through the following methods. Figure 2 shows a flow chart explaining the research methodology followed for this study.

2.1 Primary data collection: Interviews

Qualitative data was collected through interviews with ten top designers and merchandisers working with repurposed yarns. The category of interview conducted was semi structured interview consisting of 19 questions. The technique of semi structured interview was selected as it is open-ended and permits the researcher to analyse the research results from the users' point of view. This helps the researcher to formulate the research gap. In this research the hypothesis is generated through coding of the unstructured interviews. This approach was found appropriate in the present study for achieving the research objectives (Japhet Lawrence, 2013) [7]. Table 1 summarizes the Data collection methods and the list of participant stakeholders.

As the topic was fairly new, the purpose of the research was explained to the interviewees and then they were asked to speak freely on the subject of repurposed yarns. Anonymity

was not demanded by the interviewees and they can be named if required. The interviews lasted between 40 minutes - 2.5 hours duration. The interviews were semi structured with little prompting from the researcher to ensure that some standard topics were covered across all interviews. The researcher hand wrote the interview on sheets of A4 size paper and at the end got it corrected and signed by the interviewee.

The study uses qualitative approach by comparing the views of industry members expressed through the interviews. Qualitative research designs are very different from the commonly used quantitative research design. Quantitative research is a hypothesis testing design whereas qualitative research is a hypothesis generating research design (Carl Auerbach, 2003) [5]. The data from the interviews was reviewed and compared along two primary aspects namely current status of repurposed yarns and characteristics of the repurposed yarns.

2.2 Data analysis

Data analysis for the user research followed the interpretation techniques mentioned under grounded theory, a methodology which is often implemented in the analysis of qualitative research. Grounded theory is different from the conventional model of data analysis (Japhet Lawrence, 2013) [7] where the researcher selects an existing theoretical model and then collects data to prove if the theory applies to the area of research or not.

During this stage all the interview transcripts were re-read and the key issues discussed were identified and codified. The questions asked in the interviews were already designed to cover the broad characteristics of the repurposed yarns, the type of industry using these yarns, the production centres, the existing products of repurposed yarns and its market share. The common themes in the interviews were classified under different codes. One significant point should be made clear before analysing the interview data which is that, at the beginning of the interviews the researcher explained and clarified the term 'pre-consumer industrial waste' and 'repurposed yarns' to the interviewees, as these terminologies were not common amongst them. Most of them associated these terminologies with the broader terminology of 'waste' but once these terminologies were explained it was found that the industry members were already aware and conscious of the various elements that comprise it up.

Table 1: Data collection; methods summary and participant stakeholders

Data collection sites: Textile factories (current users of repurposed yarns) in Panipat and NCR	Primary Data collection method Interview-1
1. Director Marketing, Gupta Textiles, Gohana Road, Panipat(Annexure-A) 2. Business head, Kalakrity Designs, Sec-25, HUDA, Panipat(Annexure-B) 3. Design Director, Savoy Creations, 576, Model Town, Panipat(Annexure-C) 4. Development Manager, Sheena Industries, Sec-25, Panipat May design studio, Sec-45, Gurgaon(Annexure-D) 5. Design Director, H.C. Overseas sec-24, Panipat(Annexure-E) 6. Freelance designer, New India Export, Old Industrial Area, Panipat (Annexure-F). 7. Business head, Creative India, Model Town Panipat(Annexure-G) 8. Freelance designer, Manu Mishra, Freelance designer, Gautam Nagar, Delhi(Annexure-H) 9. Business head, Hira home, East Park, Karol Bagh, Delhi(Annexure-I) 10. Proprietor, Mohawk Home, Nehru place, Delhi(Annexure-J)	10 Qualitative (in-person) 1-1 Semi structured interviews

3. Results and Discussions

The study is conducted on the repurposed yarns after the literature review and interviews of textile industry members working with repurposed yarns. Repurposing is proposed as a viable solution for the problem of textile waste (Kate & Lynda, 2012) [8]. It was found that the repurposed yarns are

comparatively a new addition to the yarn market. Its usage started only five years back. These yarns are hand drawn and do not have a uniform count. These yarns are currently being made majorly in Bhadohi, Bhagalpur, and Karur. These places have close proximity to the textile producing clusters of Uttar Pradesh, Bihar, and Tamil Nadu respectively. These

yarns are suitable majorly for the floor covering industry.

Qualitative data analysis from interviews comprises of analysis of text, describing information and developing themes as explained in the research methodology section. The following major themes emerged during the 10 interviews conducted with the 10 distinguished textile designers cum merchandisers who were asked to discuss various topics related to the repurposed yarns. The methodology of the analysis of this data is given in the research methodology (Figure 3). As the data was reviewed recurrent ideas, themes, concept, or schemes became prominent. These were then amalgamated as codes representing the various ideas or viewpoints put across by the different interviewees. Table 2 explains the development of the coding process in a tabular form.

Open coding is the first step of grounded theory. At this stage word to word comparisons were made within the interviews and as a result basic 30 themes emerged in the pre study investigation. The basic themes which emerged under open coding are 'synthetic', 'cellulosic', 'protein', 'count not specified', 'hank form', 'cotton', 'pre-coloured', 'mixed', 'thickness', 'recent development', 'Banaras and Bhadohi', 'virgin yarns for warp', '10%-20% of the product', 'easy to make durries', 'weaving technique', 'tax exemptions', 'cottage look', 'handmade look', 'not finished', 'unique raw look', 'pre dyed', 'multi coloured', 'no disadvantages if buyer is educated', 'big market,'cho-cho', 'age group', 'target market', 'suitable for all markets, 'large orders', 'longevity'.

After this process axial coding was followed to categorically evaluate the open themes (Ylona Chun Tie, 2018) [13] developed during the pre study investigations. Axial coding is the process of relating codes to concepts and to each other (Allen, 2017) [1]. This process is a qualitative research technique which associates data to reveal codes and categories within different interviewees' opinions. This involved derivation of sub themes and creation of links or flow between the different information categorised under each theme. This resulted in the refinement of the previously developed themes under open coding (Allen, 2017) [1]. The 8 themes which emerged out of the process of axial coding were 'mixed composition', 'usage of yarns', 'colouring of yarns', 'look of yarns', 'thickness of yarns', 'production of yarns', 'marketability of yarns' and 'availability of yarns'.

Selective coding refers to the concluding stage of data analysis (Albert J. Mills, 2010) [9]. This stage involves establishing a connection between themes and sub themes so as to create a code for encompassing all the ideas put forward. It involves choosing one category or code which represents or relates to all the themes. Selective coding is the process of choosing one category to be the core category, and relating all other categories to that category (Ylona Chun Tie, 2018) [13]. The final results of the coding were formed as:

a. Characteristics of Repurposed Yarns (this theme explained the composition of the yarns, its construction, percentage of application in products, market share, durability aspects and availability).
b. Advantages of Repurposed Yarns (this theme elucidated the advantages unique to this yarn).
c. Disadvantages of Repurposed Yarns (this theme illuminated the drawbacks of this yarn).

Table 2: Analysis of the interviews through the development of the codes using the grounded theory

Open Codes	Axial Code	Selective code
1. Synthetic 2. Cellulosic 3. Protein 4. Cotton 5. Virgin yarns for warp 6. 10%-20% of the product 7. Easy to make durries 8. Big market 9. Cho-cho 10. Longevity 11. Banaras and Bhadohi	a) Mixed composition b) Usage of yarns	I. Characteristics of purposed Yarns
1. Pre-coloured 2. Mixed 3. Cottage look 4. Handmade look 5. Not finished 6. Unique raw look 7. Pre dyed 8. Multi coloured 9. No disadvantages if buyer is educated 10. Tax exemptions 11. Age group 12. Target market 13. Suitable for all markets 14. Large orders	a) Colouring of yarns b) Physical appearance of the yarns c) Marketability of yarns d) Availability of yarns	II. Advantages of Repurposed Yarns
1. Count not specified 2. Hank form 3. Thickness 4. Recent development 5. Weaving technique	a) Thickness of yarns b) Production of yarns	III. Disadvantages of Repurposed Yarns

These three themes are explained below:

3.1 Characteristics of Repurposed Yarns

The repurposed yarns have entered the yarn market very recently and were unavailable before five years. These yarns are produced in the unorganised sector and there are no research and development department of this industry. These yarns are made by twisting the pre-consumer textile waste yarns and fibres and according to the Director Marketing, Gupta Textiles, Gohana Road, Panipat "it is easiest to produce thicker yarns as these are made up of unsorted short length waste yarns". These yarns are available in hank as well as cone form. Their composition is made up of mixed fibres i.e. synthetic, cellulosic and protein. These yarns are a mixture of cotton, polyester, silk, rayon etc. These are used mostly in durries and floor coverings. Other uses include floor cushion covers, poufs, wall tapestry etc. Repurposed yarns are not strong as they are made of short length waste yarns and the average product made from these yarns comprise of 10%-80% of the products. Virgin yarns are used mostly as warp in combination with repurposed yarns to make the products. Repurposed yarns are available as pre-dyed in mixed colours.

A wide range of colours is available in these yarns but procuring these yarns in desired colours may be difficult. The product developers of repurposed yarns is wary of taking orders from customers who are not aware of the origin of these yarns as colour matching remains a problem. Although colour matching is possible but the resultant yarns are more expensive than mixed coloured yarns.

3.2 Advantages of Repurposed Yarns

Apart from the environmental advantage of using repurposed yarns there is also a price advantage of these yarns as they are made from waste. The products made of repurposed yarns are long lasting, as they comprise mainly of polyester. According to the Design Director, Savoy Creations, Model Town, Panipat, the products made from these yarns last for 10-15 years. These products give a distressed or unfinished look and no finishing machines are used for these products. This not only saves the cost of finishing but also creates a handmade look.
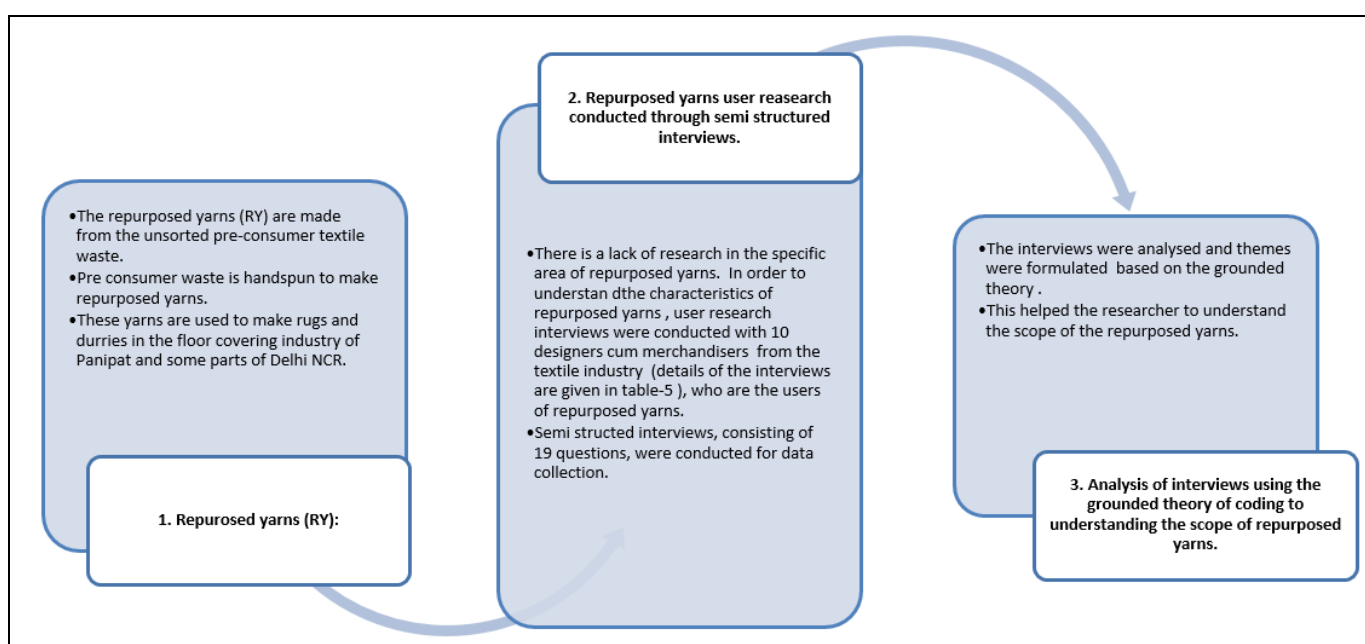
Fig 3: Flow chart of the research methodology

3.3 Disadvantages of Repurposed Yarns

Repurposed yarns are available only as coarse low count yarns and this limits their usage to the floor covering industry. The sorting of the waste fibres and yarns is also hand done and the cost rises due to this being a labour intensive product. Also as the yarns are made up of short length waste fibres and fabric pieces it is weak and not suitable to be used as a warp yarn (unless used in a frame loom). It may only be appropriate to be used as weft insertions.

4. Conclusion

Repurposed yarns (RY) are a fairly unexplored area and very little research is conducted in this specific field. This research was undertaken to document the distinctive attributes and aspects of the repurposed yarns. It was found that apart from several strengths, repurposed yarns have a number of weaknesses and limitations as well. If these limitations are overcome then utilisation of repurposed yarns can be maximised. Unsorted repurposed yarns are made in low count (thick) and are therefore suitable only for the making of carpets and rugs in the floor covering industry. Future study

on this can follow the same line of research using innovative techniques to overcome the drawbacks of thickness of this yarn making it suitable for generic usage. There can be more experimental merchandises from repurposed yarns utilising techniques that will further decrease the gap between waste textiles and textile raw materials. This research defines the aspects of an existing repurposed yarn. Although repurposing techniques have been used through the ages, it is imperative that more traditional waste minimising techniques are documented and understood in order to improvise upon them which can result in reduced waste and effectuate sustainable development.

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