Development of Textiles for Automotive Applications Using Recycled Fibres

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Abstract

The increased demand fabric cost to address the issue of sustainability creates the need for the incorporation of used fiber based materials in textiles. In this work, we have planned to implement a technique for enhancing the garment through used fabric. This research work starts with opening and segregating the used fibers. Later the fibers transformed to a woven and knitted fabric, by passing it through a sequence of operations. These disposed off after their intended use in an eco-friendly way. Implementing this innovative method reduces the production cost of garment.

Introduction

Recycled fibres

'Recycled fibres' from a secondary cycle of processing. To obtain them, fabric-type or thread-type textile waste is mechanically broken down as far as the fibres. Conventionally, the waste is pre-treated by means of cutting or picking and then transported through a take-in unit, acting as a clamp, of a drum rotating at high speed. The textile structure is broken down by steel pins which are on the drum surface, together with the clamping effect mentioned above. Structures will take several passages through the drum to become single fibres.

Currently, raw materials available from reclaimed fibres have short fibre lengths but it is hard to clearly define their other characteristics. We should aim to break down the waste in question so as to achieve a type of reclaimed fibre which, with regard to its further application, is easy to characterize. In particular, we should aim to preserve fibre length as much as possible for most final applications.

Methodology

Material Preparation

Before woven and knitted could be manufactured, the raw clothing materials had to be converted into yarn by open spinning method. The most widely accepted preparatory method. This involves passing cut fabric pieces through two nipped feed rollers that grip the textile while a rapidly rotating cylinder covered in sharp metallic pins mechanically opens the fabric into smaller fractions. The product of

mechanical pulling typically consists of a mixture of individual fibres, yarn segments and smaller fabric pieces. Further separation stages are employed to increase the reduction of the segments and pieces into fibre form. The fibre is then collected on a vacuum assisted drum and fed out of the machine. The structure of the textile being refiberised influences the dimensions, degree of separation and homogeneity of the fibrous product. Dense woven textiles tend to produce very short fibre lengths, which are unsuitable for use in traditional yarn processing. More loosely formed structures, such as weft knitted textiles, tend to have lower density structures which yield longer fibre lengths when reprocessed.

Experimental

Materials

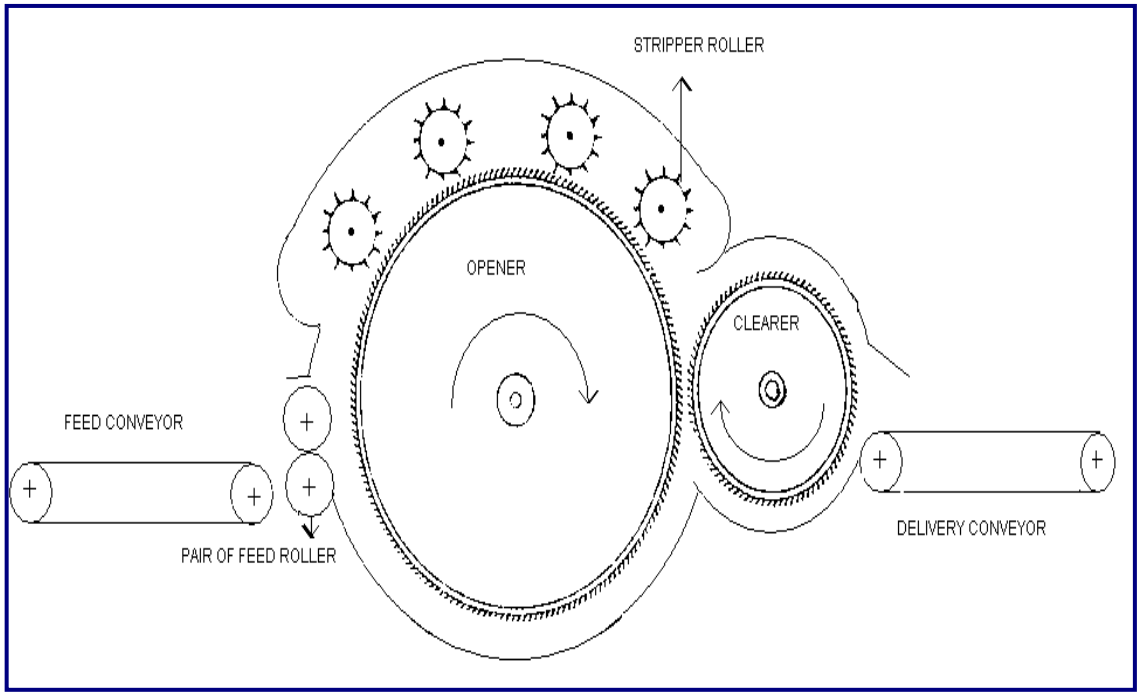
Textile Waste - The textile waste is used in this research are two types:

1. Pre-consumer textile waste

Pre-consumer textile waste is manufacturing waste that is generated by processing fibres, (be they natural or synthetic fibres) and the production of finished yarns and textiles, technical textiles, non-woven, garments and footwear, including off-cuts, selvages, shearings, rejected materials and/or B-grade garments. Whilst “cabbage” (over estimated fabric meters and off-cuts of saleable size) has for many years, been resold into markets or made-up into smaller items, most pre consumer textile waste is simply sent to landfill. Pre-consumer textile waste is usually “clean waste”. Firms either arrange their own waste disposal services or use council managed services and pay landfill fees according to how much is dumped.

2. Post-consumer textile waste

Post-consumer textile waste consists of any type of garments or household textile (such as sheets or towels) that the consumer no longer needs and decides to discard, either because they are worn out, damaged, outgrown, or have gone out of fashion. This category has typically been of reasonable to good quality garment that can be recovered and subsequently recycled by another user as second-hand clothing, much of which is sold to third-world nations. Clothing that is unlikely to be worn again is potentially functional as it may be shredded into fibre to be used in products similar in nature to those manufactured from pre-consumer textile waste.



Recycle Survey

- The volume of textile waste generated during various processes in textile, apparel and soft furniture manufacturing industry in proportion to the quantity of raw materials used.
- The composition of textile waste.
- The main properties of textile waste.
- The nature of the wastes (cuttings, thread waste and the like).

	Characteristic	Amount, t	Amount, %
Textile fabric cuttings	Knitted fabric cutouts of different size, stained, with dying defects up to 2 kg, fine knitted fabric waste, woven fabric borders, weighted cuts of woven fabrics (0.1-2 m length), templet cutouts from garment industry enterprises	1747.9	62.5
Thread waste	Dyed, bleached or natural. Flax, cotton, synthetic, mixed. The waste from knitted and woven fabrics. The thread remnants from garment industry enterprises. Some part of the threads is on conuses.	359.6	12.8
Non –woven materials	Cuttings of sewing fabric lays, wastes from non-woven fabric production	298.0	10.7
Flax tow	Yarn production waste	66.8	2.4
Rope, sliver, fibre strand	Forming ends of ropes, slivers and fibre strands	221.0	7.8
Combing noils from carding machines	Short-staple fibre	29.5	1.1
Rove waste	Synthetic and blended fibre waste	14.0	0.5
Floor sweepings	Waste from production of extremely fine wool and blended fibre	29.9	1.1
Textile fabrics with coating	Woven fabrics of synthetic and fibre blends with polyvinyl chloride, polyurethane coating	10.5	0.4
Fluff - feathers	Clean fine wastes of fluff and feathers	20.0	0.7

Textile Waste Composition

Seq No.	Waste composition	Amount, %
1	Mixed fibers	40.74
2	Cotton	36.02
3	Flax/linen	7.71
4	Wool	2.01
5	Artificial fibres	1.87
6	Polyester	1.78
7	Polyamide	0.18
8	Polyacrilnitrile	8.97
9	Feather-fluff	0.72

These are cuttings of a different size with dyeing defects, stained, knitted fabric cuts up to 2 kg of weight, fine knitted fabric waste, woven fabric borders, weighted cuttings of woven fabrics (0.1-2 m length), cutouts from garment sewing industry, templets and fine waste from soft furniture production enterprises.

Waste Amount and Recycling Degree in Respect Of Entreprise Type

Enterprise type	Overall amount of waste, t	Average amount of waste in company, t	Amount of the waste recycle/used in companies, t	Amount of the waste sold, given away, t	Amount of the waste transported for landfilling, t
Textile production	1671.2	93	342.7	815.4	513.1
Apparel industry	1001.0	83	0	299.6	701.4

The company uses waste of wool, half-wool, cotton/synthetic and polyester as raw materials that originate from post-industrial waste. These are knitted and woven fabric cuttings, various thread wastes, nonwoven fabric cuttings. Over 1200 t of waste (a part of it

is imported) is reprocessed over a year. A requirement is raised that woven fabric waste for non-woven materials production should not be woven densely, as those that are woven dense fibre themselves are poorly processed on the equipment existing at the enterprise.Still the textile wastes at a number of apparel industry enterprises show themselves as rather densely woven fabric cuttings, thus more effective fibring equipment should be obtained for nonwoven materials production. A wide range of textile waste may be employednot only for new textile fabric production but for different technological purposes as well: for composite materials of different purposes, wooden boards for furniture manufacturing , nonwoven materials for soil erosion monitoring, plastic fillings , concrete reinforcement , power generation by mixing with coal and others. Implementation of new equipment for waste recycling, investigation of waste usage for new product development, increase in product added value providing them with multifunctional properties would allow an increase in the post-industrial textile waste recycling level.

Method

Fabric opening

The machines existing at the present are known under the name of “shredding machine” or “waste opening machine” or “tearing machine”. Each known machine has one or more drums with points. Each of these drums with points rotates in front of a wad of textile wastes which is fed to it and which it shreds in pieces. The materials thus de-fibered by a drum are presented to the following drum, which shreds them in pieces again, and does this again until a complete and perfect fiber removal is obtained.

Reclaimed Fibre in Automotive Application

Reclaimed fibres are automotive textiles and building textiles with the main functions insulation and covering, agro-textiles and geo-textiles (erosion protection). Further examples are versions of Non-wovens for the upholstery and mattress-producing industries as well as textile secondary backs for floor covering.

Reclaimed Material Acoustical Liner:

- Excellent Noise Absorption
- Resists Microbial Growth
- Class A Fire Rated
- Low Air Resistance
- Reduces Heat Loss/Gain
- No Itch or Skin Irritation
- No Formaldehyde

Conclusion

In this Research, we treated textiles waste used in the apparel industry in to fabric. This is how they can best achieve the characteristics or the functionality required. Cost is also of interest in this context. The textiles based stamped parts used in the vehicle interior are typical representatives. The decorative and base materials may also be used for the home textiles products. A high-grade knitted fabric is made from recycled fibres. This knitted by flat knitting machine. The whole system serves to reduce fabric cost to the apparel industry and Eco-friendly.

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