DEVELOPMENT OF COMFORTABLE MOTORCYCLIST GLOVES FROM RECYCLED PPTA

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ABSTRACT (10 pt)

A motorcyclist is all the time prone to mechanical risks while riding. The aim of this research is to develop cost effective seamless functional/ protective knitted gloves for motorcyclists for winter season. Recycled PPTA, acrylic and cotton were used in different ratios for producing three different samples of gloves. Abrasion resistance test and thermophyscological comfort tests i.e thermal insulation, air permeability, and moisture management test were performed. All the developed protective gloves have good abrasion resistance and were thermally insulated. The best results were obtained for samples with 60% recycled PPTA and 40% acrylic. Usage of recycle material will be helpful for environmental protection.

Key Words: Gloves, , Recycled material, Thermal resistance, moisture management

1. INTRODUCTION

Gloves are the knitted garments which cover the whole hand. Different types of gloves are available in market for different purposes. There are also two different techniques for manufacturing gloves either seamless or cut and sewn gloves. Seamless gloves are wholly knitted on ultra-fine seamless machines while cut and sewn gloves are cut from woven or knitted fabric and then they are seamed later on in a separate process. Such type of gloves need stitching to make them usable. The gloves can be categorized as aesthetic gloves and functional gloves. The aesthetic gloves are used for ornamentation purposes. These gloves are normally made up of natural fibres like cotton and wool. Initially they were worn to differentiate between different classes of people and social status i.e. the British royal society wear special type of gloves. The functional gloves are used for protection against anything that could damage the hand. They fall into the category of personal protective equipment (PPE)[1-2].

Clothing comfort properties have significant effect on human body. Clothing comfort is an extremely complex phenomenon resulting from the interaction of various physical and nonphysical stimuli on a person wearing given clothing under given environmental conditions. There are three types of comfort i.e Thermo- physiological comfort, Sensorial comfort and Tactile comfort. Thermo-Comfort is the key parameter for gloves. Optimum comfort level is required for gloves to be wearable. Another key factor for gloves is protection of hands from outside weather as well as accidents [3-5].

A motorcyclist is all the time prone to such mechanical risks while riding. Normally Leather gloves are used .Certain gloves are available in the market to protect against abrasion and cold hazards but are made from leather on their outer side and fleece inside. Mostly gloves available in market are either cold protection gloves or cut-resistant gloves. PPTA (Poly Para-Phenylene Terephthalamide) is a high performance fiber with exceptional mechanical and heat resistant properties. Owing to their high mechanical properties it is preferred to use in many personal protective equipment (PPE) which include ballistic protection, abrasion, cut,

heat resistant etc. Because of their high cost recycled PPTA /para-aramid can be used which cut down the cost of final product [6].

Different researches focused on inclusion of PPTA for the manufacturing of gloves for protection purposes. Their price is quite high. Recycled PPTA can be one option to reduce its cost[6-9].To improve the moisture management property of PPTA, different fibers were used by different researchers[10] .

Gloves available for protection against abrasion and thermal together are made by using materials in different layers of gloves. Then these layers are either stitched or attached by any binder. Moreover this is a time consuming process and heavy gloves are formed.

The purpose of this research is to develop winter functional gloves for motor-cyclists by using plating technique. Both the properties i.e abrasion resistance and thermal insulation are tried to achieve. The process is less time-consuming and lightweight gloves can be achieved. The objective of this research is to develop cost effective seamless functional/ protective knitted gloves for motorcyclists for winter season.

2. MTERIALS & METHODS

Materials used are Recycled para aramid, acrylic and cotton .Shima Seiki SFG-1 glove knitting machine of gauge E 7 is used for the development of gloves. For the development of gloves, plating technique is used. Plating is a technique in which two or more yarns are used having different physical and mechanical properties. The plating technique will not increase the weight of the gloves. It is also time saving. Description about samples are given in Table 1.

Table 1.Composition of gloves

Sr.No.	Sample Code	Composition	Percentage (%)
1	A	1 end of 10/2 Recycled Para aramid	45
		2 ends of 16/2 Acrylic	55
2	B	1 end of 10/2 Recycled Para aramid	60
		1 ends of 16/2 Acrylic	40
3	C	1 end of 10/2 Recycled Para aramid	47
		1ends of 16/2 Acrylic	30
		1 ends of 10/1 cotton	23

All the testing were done after washing .The hot washing was done to remove the impurities from the samples. For abrasion test Martindale abrasion resistance tester is used on MAT1000. Samples are cut from the palm of a glove and rubbed against a 100 grit abrasive paper using a abrasion machine .For testing thermo-physiological comfort properties i.e air permeability, SDL air permeability tester M021A is used to determine the air permeability of samples according to ISO-9237, Sweating Guarded Hot plate tester,M2598 is used to measure the thermal resistance of samples according to standard ISO-11092. It is used for the measurement of thermal according to Skin model, and for moisture management test SDL, moisture management tester M-290 is used .Testing are done according to AATCC-195 standard. For each sample, 3 measurements are done and the mean (m) and standard deviation (r) are calculated. All the measurements are made under standard atmospheric conditions.

3. RESULTS & DISCUSSIONS

Results of all testing are given in Table 2.

Table 2. Results of testes samples

Sample code	Abrasion Resistance(1000 cycles)	Thermal Resistance (m^2K/W)	Air Permeability(mm/sec)	Moisture management(OMMC)
A	No abrasion	0.0583	718	0.339
B	No abrasion	0.0656	634	0.585
C	No abrasion	0.0648	544	0.576

The abrasion resistance of recycled PPTA is good for all samples due to high strength and high modulus of PPTA. Yarns from recycled fibres exhibited higher coefficient of friction owing to fibrillation during mechanical recycling process [7] . According to standard EN 388, all the samples crosses the performance level 2. Four performance levels are defined in EN 388 ranging from level 1 = holing > 100 cycles to Level 4 = holing > 8000 cycles.

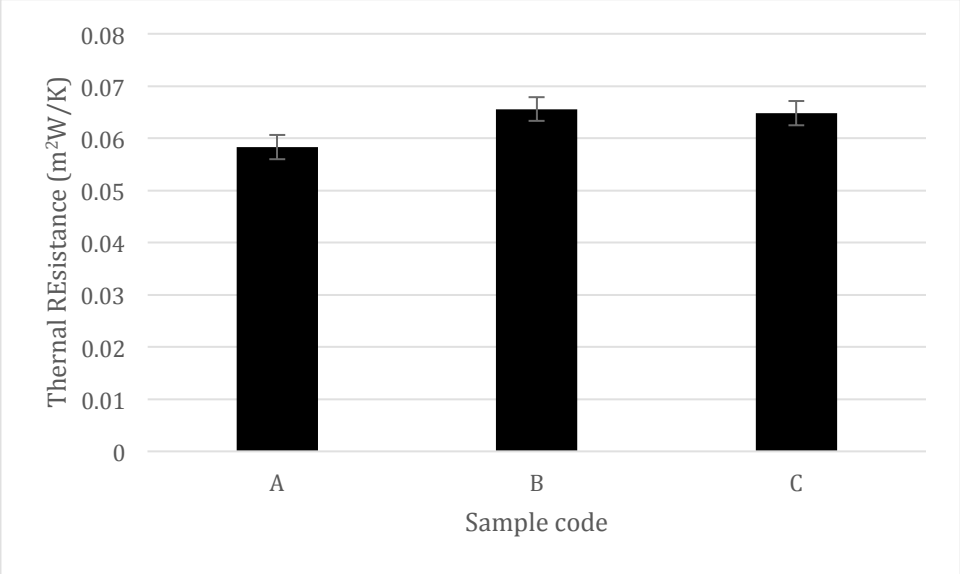

Figure 1.Thermal Resistance of samples

As Acrylic fiber has good thermal insulation property, so overall all samples have good thermal resistance. Thermal insulation of sample B is higher than both sample A and sample C. Although in sample B and C the difference is not very significant. As sample B has higher recycled PPTA composition, so due to recycling, short fiber contents increases, which leads to increases in microspores. Theses microspores, lead to increase air pockets, so thermal insulation increases. In sample C, due to cotton hairiness clogging of air, also leads to increase thermal resistance of sample.

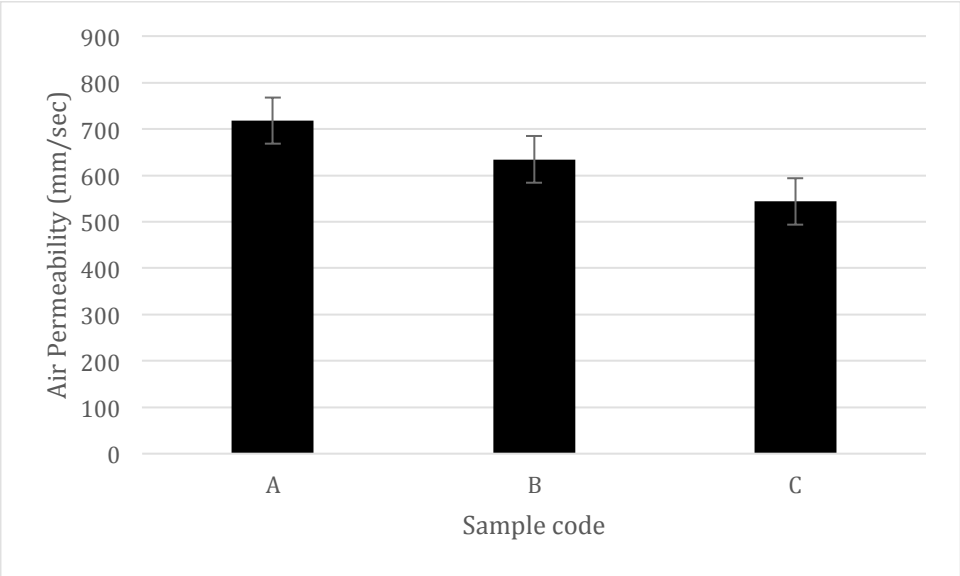

Figure 1.Air Permeability of samples

Air permeability value of sample A is higher than other samples. In sample B and sample C, clogging of air leads to reduce air permeability.

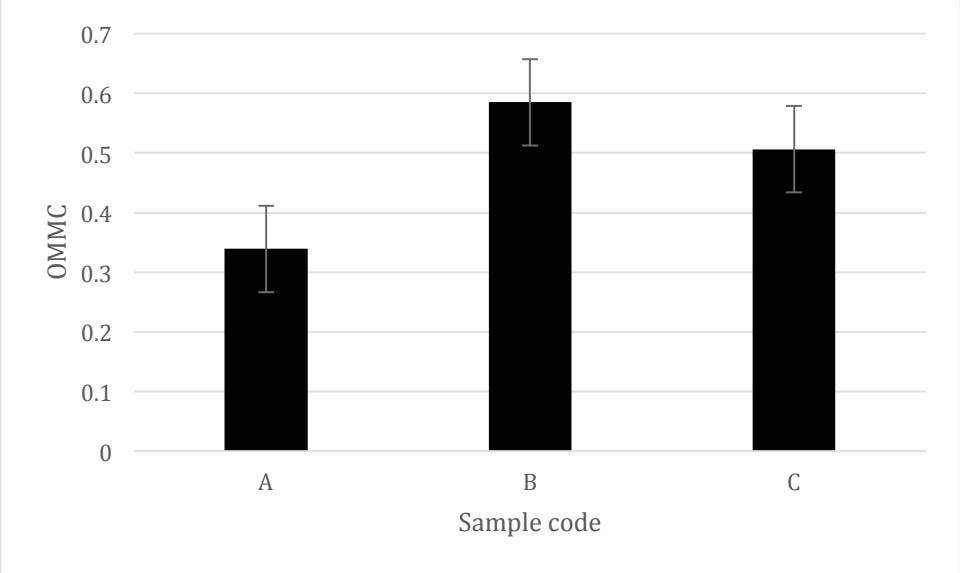

Figure 3.Overall moisture mananagement cummulative of samples

OMMC is higher for sample B. Acrylic is used in gloves for good wick ability property and it helps in drying by moving moisture from the skin. Cotton has good moisture absorption property, but its drying capacity is not good, so sample containing cotton has less OMMC value.

4. CONCLUSIONS

In this study, seamless gloves for motorcyclists, made from different fiber ratios were tested. All the 3 types of samples have good abrasion resistance .All the sample have no abrasion till 1000 cycles. .The higher abrasion resistance of recycled Para aramid is due to high strength

and high modulus. Comfort properties i.e thermal insulation, air permeability and moisture management vary by changing fiber ratios. Gloves made from 60% recycled Para aramid and 40% acrylic ratio ,i.e sample B have higher thermo-physiological properties Regarding comfort properties, thermal insulation is high, because acrylic has good thermal insulation property. Air Permeability is also in good range for this composition of gloves. Moisture management is also good because acrylic has the property to wick away moisture from the skin. So it is concluded from this study that with higher percentage of Para aramid and combination with acrylic motorcyclist gloved with improved comfort properties can be produced. The gloves produced in this manner is lightweight, cost effective and process of producing is also less time consuming. . Use of recycled materials is a need of time as environment is prone to be affected with materials that are not degraded and present in environment causing many hazards including increasing heat, degradation of environment and many more. Usage of recycle material will be helpful for environmental protection. The recycling process is sustainable, cost-effective and exhibits required performance for the development of protective gloves.

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