# Production of Weft Knitted Fabrics from Different Types of Acrylic Yarns and Study of Their Properties

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## Introduction

Polymerization of acrylonitrile gives polyacrylonitrile. The polymer obtained is either dry or wet spun into fibres [1]. Fibre produced for the manufacture of man-made staple fibre is first produced as tow [2]. 'Tow' means a thick bundle of continuous filament [2]. Tow has to be cut, broken or abraided to convert it into staple fibre. The machines are mainly used as tow-to-top machines that produce sliver [2,3].

Knitted fabrics produced from textured acrylic yarns (same denier count) are not comfortable for apparel under certain condition due to the nature of the texture. In this process, different range of denier counts is employed; tow-to-top application produces the most wool-like-fibres

## Results

Due to the differences in the elasticity and count of four different samples of acrylic yarns obtained from the Nigerian Spinner and Dyer Limited, Kano, Nigeria, the samples were knitted under different tensions using weft knitting machine (Riccar No. 4206066047).

| Sample | Spinning Condition | Tension Type |
|---|---|---|
| A | 3-ply Twisted Ring Spun | No.6 |
| B | 3-ply Relaxed Ring Spun | No.8 |
| C | 2-ply Repco Spun | No.5 |
| D | 2-ply Repco Relaxed | No.7 |

## Fabric Abrasion Resistance

The results obtained in Fig. 1 show that Sample B has a very good abrasion resistance since the weight loss after applying 1000 rubs is very low, followed by Sample D. Sample C has the lowest abrasion resistance followed by Sample A. This is due to the fact that relaxed or textured acrylic yarn is always stronger than twisted or untextured acrylic yarn. The order of abrasion resistance is Sample B> D> A> C.

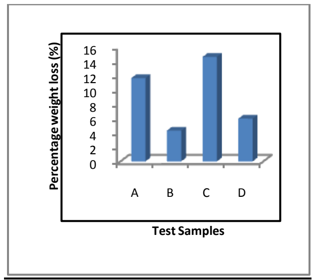


Fig. 1: A plot of percentage weight loss against test samples

## Fabric Wettability

Wettability is a factor which determines the movement of moisture into fibres or along the surface of fibres, yarns and fabrics [4]. The results in Fig. 2 shows the order of increase in wettabiity is sample C> A> D> B This couple with the fact that Samples C and A have large interstices and these permit rapid transfer of water, but Samples B and D were constructed with tiny interstices and these made them to repel water.

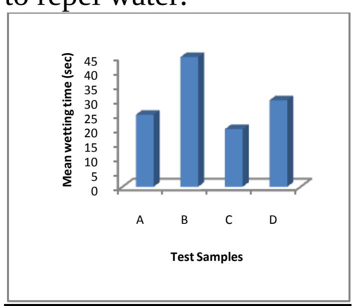


Fig. 2: A plot of mean wetting time (sec) against test samples

## Fabric Thickness

The thickness of a fabric depends on its mass per unit area, the type of yarn used, the weave structure, bulkiness of fabric and density [5,9]. From Fig. 3, it can be observed that Sample B has the highest value of thickness while Sample C has thermal insulation, dimensional stability, stiffness and abrasion resistance. Fig. 3 shows that the fabric thickness increases in the following order, Sample D> C> B> A.

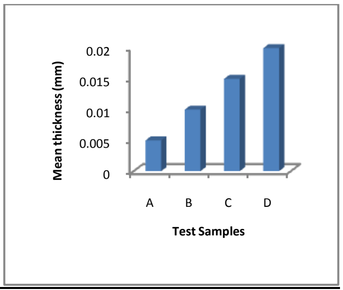


Fig. 3: A plot of mean thickness against test samples.

## Fabric Flammability

The results in Fig. 4 implies that the order of increase in flammability is sample B>D>A>C. The variation in flammability rating may be attributable to the type of fibre used, as well as the type and extent of the flame retardant and the finishing incorporated into the fabrics.

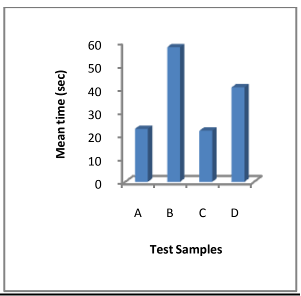


Fig. 4: A plot of flammability rating against test samples

## Fabric Air Permeability.

Fabric air permeability is a factor which depends on the fabric sett, yarn count and the diameter of yarn used to produce the fabric [6]. Figure 5 shows the trend in the fabric air permeability is C> A> D> B This implied that Samples B and D were constructed with less porosity and could be used or suitable in cold weather compared to Samples C and A..

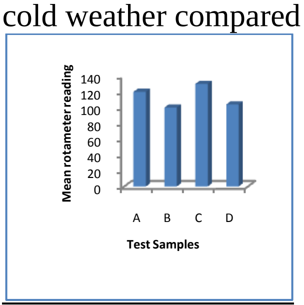


Fig. 5: A plot of mean rotameter reading against test samples

## Fabric Shrinkage

Fabric shrinkage is one of the factors that affect the dimensional stability of the fabric, though the effect is less in knitted fabric than on wovens and non-wovens [7,8]. Figure 6 show that sample C has the highest percentage shrinkage in both wale, and course direction. While sample B has zero, that is, no shrinkage in both length and width direction, and this indicate that sample B has excellent dimensional stability and D has a very good dimensional stability

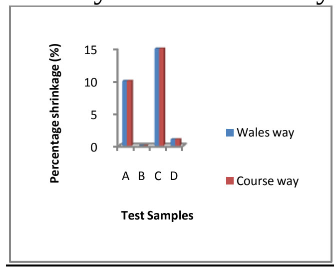


Fig. 6: A plot of percentage shrinkage against test samples

## Conclusion

Samples B and D have better abrasion resistance, air permeability, wetability, fabric shrinkage and fabric flammability. Samples A and C have low abrasion resistance; high air permeability as well as wetability. They are softer in term of fabric handle and fabric thickness but they have poor shrinkage.

Samples B and D will be better used in cold weather because of their tiny hole (interstices), air cannot flow rapidly and therefore keep the body warm.

Samples A and C can be used in hot weather because of their porosity, they will allow for good ventilation in hot seasons.

## References

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