# COMPARATIVE ANALYSIS OF SOME PROPERTIES OF NON-TEXTURED AND TEXTURED ACRYLIC YARNS

LAWAL, A. S[1]. & ISA, A. D[2].
[1]Department of Textile Science and Technology
Ahmadu Bello University, Zaria, Nigeria
[2]Department of Textile Technology and Fashion Design
Kaduna Polytechnic, Kaduna, Nigeria
E-mail: abuslawal@yahoo.com
Phone No: +234-802-373-7968

## Abstract
*A study was carried out to compare the properties of non-textured and textured acrylic yarns. Five samples of non-textured acrylic yarns (plied) of the same count were obtained. Each of these samples was textured and this gave five samples of textured acrylic yarns. Some of the yarn properties such as count, twist, strength, elongation and tenacity were investigated. The results obtained shows significant changes in yarn strength and elongation for both the textured and non-textured acrylic yarns. Yarn properties such as count, strength and elongation were found to be higher for textured acrylic yarns compared to the non-textured acrylic yarns. This is due to more accessibility of the fibres in the yarn and the bulky nature of the textured acrylic yarns.*

Keywords: Acrylic yarns, plied, texturing, yarn properties.

## Introduction
Acrylic yarns are produced as either continuous filament yarns or staple yarns. Acrylic yarns can be treated physically or chemically so as to have a noticeably greater 'apparent volume' or bulk which are referred to as bulked (textured) yarns (Caroline, 1973; James, 1995). The increased bulk may be obtained by the introduction of crimps, coils, loops or other fine distortion along the length of the originally straight and parallel filaments (Sunmonu, 1995). The increased bulk may be obtained by blending together, during yarn spinning, fibre of high and low potential shrinkage (James, 1995; Clara, 2007). During subsequent hot or wet processing, the greater contraction of the high shrinkage fibre causes the yarn to contract longitudinally and the low shrinkage fibres to buckle, thus, increasing the bulkiness of the yarn (Caroline, 1973). Textured yarns are classified into three main categories namely: stretch yarns, modified stretch yarns and bulked yarns (Lord, 1973; John, 1976). Stretch yarns have high extensibility and good recovery, but only moderate in comparison with the other two categories. They are used mainly in stretch fabrics, which are produced mainly by the false – twist type of machine and are made up into many domestic goods and garments. Modified stretch yarns are stretch yarns which have been subjected to a further treatment usually heat treatment, e.g. in the partly strained condition (Lord, 1973; Gregor and Swarz, 2008; Pillar, 1973). This modifies and stabilizes the characteristics of the yarn. The additional process is commonly integrated into the yarn texturing machine. A typical treatment consist of overfeeding a stretch yarn into a heated zone, this acts like a stuffer box giving the yarn greater bulk and lower stretch yarns which gives good stitch clarity and smoothness to knitted fabrics and they are in consequence widely used for garment manufacturing. Non-textured filament yarn with a minimum of bulk is deficient in these characteristics. Acrylic is a general purpose fibre which has a lot of properties such as tenacity (g/denier), tensile strength, elongation, specific gravity, elastic recovery, etc, (Joseph, 1977; Majory, 1981; Bella, 2008). The appearance and touch of filaments yarns can be altered from smooth, lustrous and flat to crimped, dull and soft. This modification yields entirely new properties. The study has made significant contribution to the knowledge of texturing acrylic yarns, where its properties changes and produced a different configuration for a particular end-use.

## Materials and Methods

### Research Materials

The materials used in this study are non-textured and textured acrylic ring spun yarns obtained from the Nigerian Spinners and Dyers Limited Kano, Nigeria.

### Methods

The ring spun acrylic yarns used for this research were obtained from the Nigerian Spinners and Dyers Limited Kano, Nigeria. Five samples of 100% acrylic yarn of the same count in tex were collected. The samples of each were taken and textured using the stuffer box (Univap model) resulting into five textured acrylic yarns. Tensile strength tester (Model: Uster Tensorapid 3 V6.1) and twist tester (model: Zweigler 314 were used for the determination of some of the yarn properties. The five samples of textured and non-textured acrylic yarns were tested for properties such as count, tensile strength, elongation, tenacity and twist.

### Testing of the Yarn Samples

Testing of the yarn samples were carried out in a conditioned laboratory (65$\pm$ 2% R.H and 27$\pm$ $2^0$C) where the yarns have been allowed to condition for atleast 48 hours in the laboratory. The yarns were then tested for count, twist, strength tenacity and elongation.

The yarn twist measurement was carried out using the twist tester (Zweigler twist model 314). The results obtained were recorded. The counts of the textured and non-textured acrylic yarns were determined in direct system of yarn numbering (tex), and the values tabulated.

The Uster Tensorapid 3 V6.1 tensile testing machine was made to determine the strength and elongation of textured and non-textured acrylic yarns. The machine is computerized and operates on the principle of constant rate of extension. The rate of loading can be adjusted to give a precise result. The results of these tests are shown in Table 1. Also, the machine was used to determine the tenacity in all the yarn samples.

### Results

The results obtained from the study are presented in Table 1. The Table shows results of count, twist, breaking force, tenacity and elongation of both non-textured and textured acrylic yarns.

Table 1: Effects of yarn properties on non-textured and textured acrylic yarns

| Sample | Non-textured | | | | | Textured | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean Count (text) | Mean Twist (/m) | Mean Breaking Force (N) | Mean Tenacity (CN/Tex) | Mean Elongation (%) | Mean Count (text) | Mean Twist (/m) | Mean Breaking Force (N) | Mean Tenacity (CN/Tex) | Mean Elongation (%) |
| A | 136.33 | 0.09 | 74.80 | 10.01 | 13.22 | 167.92 | 0.09 | 118.31 | 8.34 | 27.65 |
| B | 135.77 | 0.09 | 74.12 | 10.00 | 13.39 | 166.46 | 0.09 | 118.41 | 8.44 | 28.18 |
| C | 135.65 | 0.09 | 74.43 | 10.01 | 13.31 | 166.53 | 0.09 | 118.71 | 8.56 | 28.37 |
| D | 136.57 | 0.90 | 75.31 | 10.02 | 13.41 | 167.08 | 0.90 | 118.22 | 8.30 | 27.19 |
| E | 135.95 | 0.89 | 75.20 | 10.01 | 13.50 | 166.61 | 0.89 | 118.55 | 8.44 | 28.79 |

### Discussion of Results

The results in Table I show the count in tex for both the non-textured and textured acrylic yarns. It can be seen that the count of the non-textured yarns are lower than the textured acrylic yarns. This is because after texturing of the acrylic yarns, the yarn becomes bulkier, heavier and fuller than that of the non-textured acrylic yarns and this changes the volume of the acrylic yarns. Hence, there is an increase in the count.

In case of twist in both the non-textured and textured acrylic yarn, the results indicate that there were no much differences in the twist level. This is because the twist level in the yarns remains the same even after texturing.

Based on the result obtained, the tenacity is higher for the non-textured acrylic yarns than the textured acrylic yarns. This is due to the variation in the breaking force and the linear density and also some fibres which have possibly been distorted in the textured yarns.

Furthermore, it can be observed that the breaking force required to break the textured acrylic yarns is greater than that of the non-textured acrylic yarns. This is because during texturing, the yarns become more elastic and bulkier. Hence, it requires more time and force to break the sample.

Although, it is expected that the elongation of textured yarns should be higher than that of the non-textured yarns. Thus, the results obtained agreed with the literature (Pillar, 1973) which shows that the elongation of textured yarn was seen to be higher than the non-textured yarns. This is as a result of the fact that the textured acrylic yarns are more elastic and this tends to increase the elongation compared to the non-textured yarns.

## Conclusion

The mechanical properties such as strength and elongation in the yarns increased after texturing. This shows that the tensile properties of the yarns that were textured are higher than that of the non-textured yarns. Hence, after texturing the acrylic yarn properties such as tenacity, strength and elongation were affected.

## References

Bella, M. (2008). *Free article and web content amazines*. http://www.amazines.com/articledetailcfm

Caroline, A.A. (1973). *Textile terms and definition (7th Edition).* The textile institute ltd. Prescott Mersey, p. 25.

Clara, P. (2007). *Knitter's book yarn.* Ettow. Inc.

Gregor, M. & Swarz, E. (2008). Mechanical properties of cash mere single Jersey Knitted Fabric. *Textile Research Journal, 78, 9-216.*

James, C. (1995). *Acrylic fibre technology and applications.* www.infeprogetti.com

John, W. (1976). *Encyclopedia of textile technology (2nd Edition).* New York: Willey and Sons Inc., p. 21 – 169.

Joseph, J. H. (1977). *Fibre science.* New York: Fair child publication Inc. p. 80-84.

Lord, P. R. (1973). *Spinning in the 70's.* England: Merror Publication Co. Ltd., p. 47-65.

Majory, L. (1981). *Manual of standard fabric defects in textile industry (5th Edition).* America: CBS College Publication, p. 35 – 52.

Pillar, B. (1973). *Bulked yarns.* Manchester: The textile trade press, p. 74 – 416.

Sunmonu, O.K. (1995). *An introduction to the chemistry of fibres.* Zaria: New Heritage Publication, p. 97 - 101