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CHARACTERIZATION OF NIGERIAN SHEEP AND GOAT HAIR

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ABSTRACT

The Characterization of Nigerian Sheep and Goat hair has been studied. The Nigerian sheep fibres contain more impurities and are creamy white in colour having a length of about 60mm and fineness of 30 micron with a coarse texture while the goat fibres contain fewer impurities and are reddish brown in colour having a length of about 40mm and fineness of 25 micron with a fine texture. The surface characteristics of the fibres using the Scanning Electron Microscope (SEM) also shows that the scales of the sheep fibre is rough and more (18 scales per 10cm) compared to the smoother and fewer goat fibre scales (12 scales per 10cm).

Key Words: Sheep hair, Goat hair, Characterization, Colour, Length, fineness, texture

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1.0 INTRODUCTION

Wool/hair fibres is the textile fibre or hair obtained from sheep and certain other animals, including cashmere from goats, mohair from goats, angora from rabbits, and other types of wool from camelids (*Braaten, 2005;* Cottle 1991; Popescu and Wortmann,2010; Sawbridge and Ford, 1987). It is a protein known as keratin and it is made up of amino-acids joined by peptide linkages. In addition to carbon, hydrogen, oxygen and nitrogen it also contains sulphur and its length usually ranges from 1.5 to 15 inches (3.8 to 38 centimeters) depending on the breed of sheep. Fibre diameter ranges from 16 microns in superfine merino wool (similar to cashmere) to more than 40 microns in coarse hairy wools. It is composed of eighteen different amino acid**s** in which the important amino acid**s** are cysteine (13.1%), glutamate (11.1%) and serine (10.8%) (Simpson and Crawshaw, 2005).

Wool is by far the most important animal fibre used in textiles and appears to have been the earliest fibre to be spun and woven into cloth. It readily absorb moisture, but are not hollow and can absorb almost one-third of its own weight in water and also absorbs sound more than any other fabrics. It is generally a creamy white colour, although some breeds of sheep produce natural colours, such as black, brown, silver, and random mixes. It ignites at a higher temperature than cotton and some synthetic fibres (Merinos, 2008).

Wool fibre is a luxury fibre with exceptional warmth, resilience, elasticity, fire-retardancy, quick-dryability, and antistatic properties (Hassan and Leighs, 2017). Recently wool fibre has drawn attention because of its various attributes including its natural origin. The presence of a medulla, topographical features such as scale shape, height and frequency, and the distribution of cuticle and cortical cells are considered unique to each mammal and are often used to identify hair fibres from different mammals (Chernova, 2002; Leeder, McGregor and Steadman, 1998; Tonin *et al.,* 2002). Scale intervals vary along the length of a fibre and finer fibres tend to have more widely spaced scales (Langley and Kennedy, 1981).

Grease wool fleece contains impurities like wool grease, perspiration products i.e. suint, adhered materials like dirt and vegetable matter. Before spinning, these impurities are removed by wet processing methods like scouring and/or carbonizing (Banerjee *et al*, 2009) and it is made from polypeptide chains (97%) and lipids (1%) with a heterogeneous morphological structure, it is considered as natural composite fibre (Heine and Hocker, 2001).

In Nigeria, little or nothing is known about the characteristics of our local sheep and goat hair. Therefore, in this research work, Characterization of the Nigerian Sheep and Goat hairs such as colour, fibre length, fineness, impurities present and surface structure characteristics (scales) were determined.

2.0 MATERIALS AND METHODS

2.1 MATERIALS

Sheep and goat fibres from a Local abattoir in Lagos, Nigeria.

Hand gloves

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Nose mask

Laboratory glass wares

Mixing bowls and buckets

Detergent (Klin)

Razor Blade

2.2 Equipment

Scanning Electron Microscope (PHENOM PRO X)

Anytical Weighing balance

TEXTEST (Model 107 A Compact Micronaire)

2.3 Fibre Extraction and Scouring

The raw materials for this research are the hairs of the sheep (West African dwarf) and goat (sokoto red) obtained from a local abattoir in Lagos, Nigeria. They were expertly scrapped off from their skin using a very sharp razor blade (shearing) (Dalton, 2011). The sheared fibres contains both inherent and acquired impurities such as dried sweat (suint), grease, blood, soil matters, dust, dirt, straw, manure and vegetable matters (Garner, 1997; Glaser, 1996). Therefore pre-treatment is necessary to remove these impurities and enhance further processing (Banerjee *et al.,* 2009).

The fibres were soaked in a bowl of water for 24 hours causing the impurities to float out and fibres to swell for easy washing. The fibres were thoroughly washed with 2% klin detergent in warm water (30-35˚C) for 15 minutes. It was thoroughly rinsed with running water and dried in open air (air dried) for 12 hours and finally in an oven at 60°C for 24 hours.

2.4 Percentage Impurities of the Fibres (ASTM D584 - 10(2018)

The fibres of the sheep and goat in its raw state were weighed before and after pre-treatment to determine the percentage impurities and constituents present in the fibres.

$$\frac{W_1 - W_2}{W_1} \times 100\%$$

Where W_1 is weight of the raw fibres

W_2 is weight of the cleaned fibres

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2.5 Determination of the Fibre Characteristics

2.5.1 Fibre Length

The fibre length of the sheep and goat was determined by carefully sorting out 20 strands of the hair and measuring each of them with a metre rule. The length of each fibres were noted and the average length of the already measured 20 samples were taken.

2.5.2 Fibre Texture

The fibre texture of sheep and goat was determined by 'hand feel' to determine the coarseness or smoothness of the samples.

2.5.3 Fibre Colour

The fibre colour of sheep and goat was determined by mere observation to know the actual colours of the samples.

2.5.4 Fibre Fineness

The fibre fineness of sheep and goat were determined using the air flow method with TEXTEST

(Model 107 A Compact Micronaire) machine. The fibres were weighed and inserted into the machine. The fibre fineness was automatically detected by the machine.

2.5.6 Surface Characteristics

The surface characteristics of the sheep and goat fibre samples were analysed using the SEM-MODEL PHENOM PRO-X). For all samples the image was captured at a voltage of 15KV at 80 micron and a magnification of 1000x.

3.0 RESULTS AND DISCUSSIONS

3.1 Percentage Impurities of the Nigerian Sheep and Goat Fibres

The result of the percentage impurities of the Nigerian sheep and goat fibres is displayed in table 3.1

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Table 3.1: Percentage Impurities of the Nigerian Sheep and Goat hair

	Cleaned Fibres (%)	Impurities (%)
Nigerian Sheep Fibres	55.4	44.6
Nigerian Goat Fibres	60.8	39.2

Table 3.1 shows the result of the percentage impurities present in the Nigerian sheep and goat fibres. The cleaned fibres of the sheep are 55.4% while the impurities are 44.6%. Also the cleaned fibres of the goat are 60.8% while the impurities and constituents are 39.2%. It can be observed that the sheep fibres has more impurities than the goat fibres, this may be because the sheep naturally has more inherent constituents and higher tendencies to acquire more impurities than the goat (Dominguez *et al.*, 2004). These constituents and impurities were however removed after pre-treatment was carried out to enhance further processing.

3.2 Fibre Characteristics

The characterization of the Nigerian sheep and goat fibres used for this study is shown in table 3.2 below;

Table 3.2: Characterization of the Nigerian Sheep and Goat Fibres

Characteristics	Sheep Fibres	Goat Fibres
Colour	Creamy white	Reddish Brown
Texture	Coarse	Smooth
Fibre Length	60mm	40mm
Fibre Fineness	30 micron	25 micron
Surface structure (Scales)	Rough/More scales	Smooth/fewer scales

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The results of the fibre characteristics from table 3.2 shows that the sheep fibres are creamy white in colour with coarse texture and rough scale structure having a length of about 60 mm and a fineness of 30 micron while the goat fibres are reddish brown in colour with a relatively fine texture and fewer scales having a length of about 40 mm and a fineness of 25 micron. Therefore the sheep fibres are longer and have more scales than the goat fibres while the goat fibres are finer than the sheep fibres.

3.3 Surface Characteristics of the Fibres

The Scanning Electron Microscope (SEM) micrographs of the sheep and goat fibres are displayed in Plates I and II below;

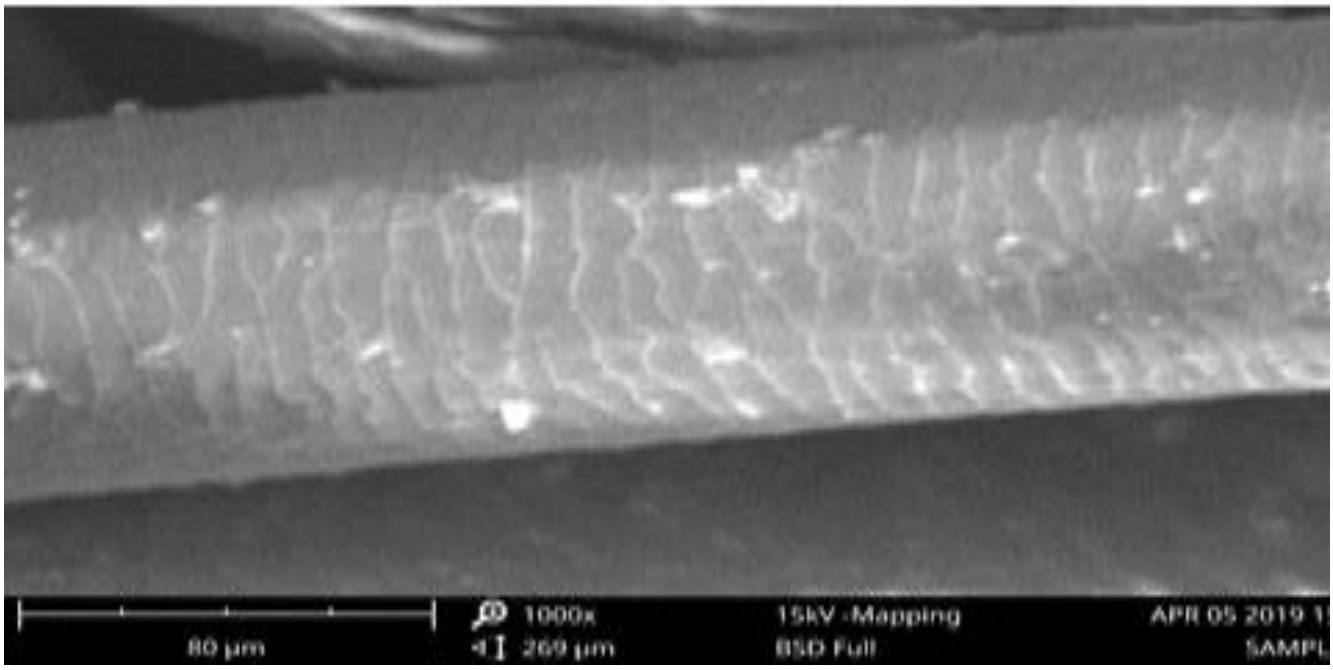

Plate I: Nigerian Sheep Fibres Scales

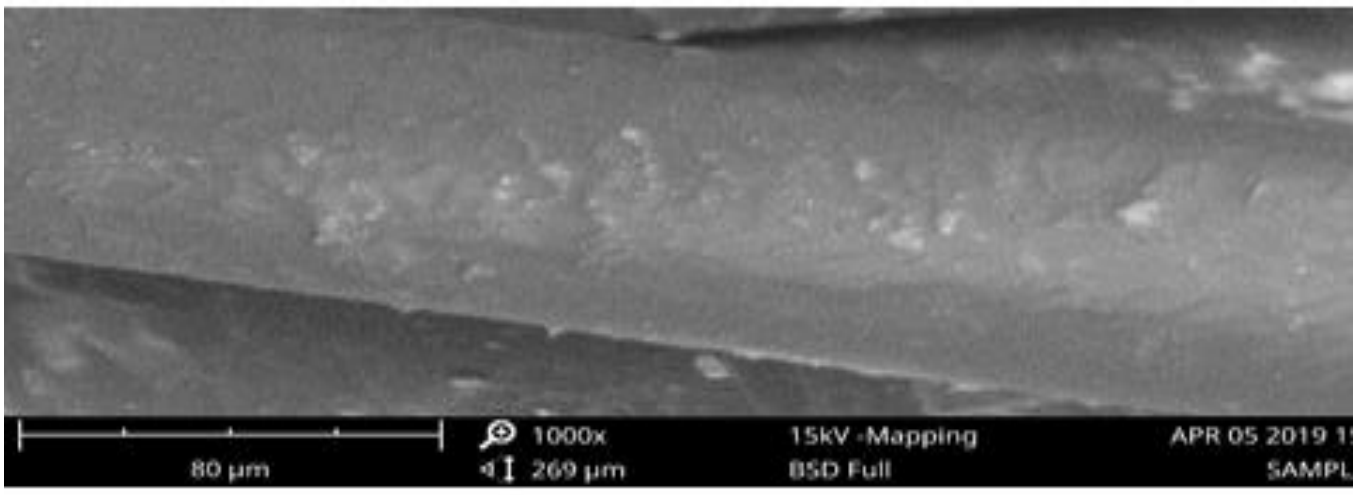

Plate II: Nigerian Goat Fibres Scales

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Plates I and II are the micrograph results of the sheep and goat fibre strands obtained from the Scanning Electron Microscope (SEM). It can be seen that the sheep fibre scales are rough and more than the fewer and relatively smooth goat fibre scales. The sheep fibres have approximately 18 scale counts per 10cm while the goat fibre has approximately 12 scale counts per 10cm.

4.0 CONCLUSION

The characterization of the Nigerian sheep and goat fibres shows that the sheep fibres have longer length than the goat fibres while the goat fibres have better fineness than the sheep fibres. The sheep fibre is also creamy white in colour with coarse texture and more impurities while the goat fibre is reddish brown in colour with smoother texture and fewer impurities.

The surface characteristics of the fibres using the Scanning Electron Microscope (SEM) also shows that the sheep fibre scales are rough and more than the fewer and relatively smooth goat fibre scales. These differences in characteristics are attributable to the difference in the breed and genetic makeup of these animals.

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