Annual Academic Sessions 2011
ISSN 2012-9912; ©2011 Open University of Sri Lanka

PROPERTIES AND CHARACTERISTICS OF FIBRES OF ROSELLE PLANT

G. B. Delkumburewatte*

Department of Textile and Apparel Technology, The Open University of Sri Lanka

INTRODUCTION

Climate change and global warming is a current topic in developed countries as well as in developing countries as the effect of climate change is felt by all without any discrimination. Environmental friendly products, processes and policies are given priorities to minimize a possible catastrophic situation in the future. Textile and Apparel is one of the most important needs of human beings. Eco friendly Textile products, production process and other activities related to textile are encouraged by scientists and financed by other organizations. Textile industry in one of the areas, where the need of a reduction of energy usage for production of raw material & clothing, recycling and man-made fibre production is necessary.

After the invention of man-made fibres such as Nylon, Polyester, Viscose and Poly-acrylic, scientists accelerated the development of synthetic high performance fibers with engineered characteristics according to the requirement. *Normex, Kevlar, Tencel, Carbon and Lycra* are some of the high performance man-made fibres. However by modification of characteristics of natural fibres it is possible to make them suitable to use for various products with required properties and characteristics.

The year 2009 was declared as the International Year of Natural Fibres by the UN and officially launched on 22 January 2009, at the headquarters of the Food and Agriculture Organization of the United Nations (FAO) in Rome (Flainox, 2010). This declaration promote the use of natural fibres and minimizing man-made fibre production, reducing the release of CO2 to the environment. Today, the use of natural fibres amounts to 30 million tones of which 20 million Cotton, wool and jute each around 2 to3 million followed by other natural fibres. It also helps to improve the living standard of people in natural fibre producing countries.

For some developing countries natural fibres are of major economic importance. For example, cotton in some west African countries, jute in Bangladesh and sisal in Tanzania. In other cases these fibres are of less significance at the national level but are of major local importance, as in the case of jute in West Bengal (India) and sisal in north-east Brazil. Natural fibres are an important component of clothing, upholstery and other textiles for consumers, and many of them also have industrial uses in packaging, papermaking and in composite materials with many uses, including automobiles.

Although we do not have any commercial scale fibre production industry in Sri Lanka, we find different varieties of vegetable fibres, which belong to all four sub categories, *bast fibre*, *leaf fibre*, *seed fibre* and *fruit fibre*. These fibres are used for domestic purposes and cottage industry.

Roselle plant or *Hibiscus Sabdariffa* is one of the bast fibre plants found in Sri Lanka. However, these plants were cultivated in rubber estates as cash crop. In 1939 the fibres were mainly used to make sack to pack Copra and sugar.

* All correspondence should be addressed to Dr. G. B. Delkumburewatte, Department of Textile and Apparel Technology, The Open University of Sri Lanka (email: gbdel@ou.ac.lk)

Figure 1: Roselle plant

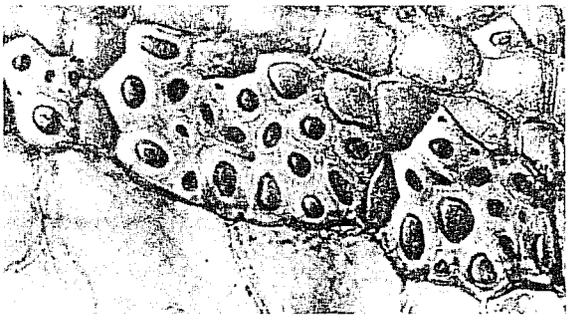

Figure 2. Cross-section of Roselle fibre

Today, the use of plant fibres has spread into different areas such as buildtext, autotext, geotext, agrotext, etc. For example coir is used to make (via injection molding) components for car manufacture because it is strong, lightweight and easy to work with. Other uses include fibrous matting for insulation (replacing glass fibre), linings for hanging baskets, pet bedding and materials for the construction industry. There is also an opportunity to make paper and pulp from farm wastes (such as straw) or specially produced crops.

It is important to know about the properties and characteristics of the fibres to determine what and how changes should be done depending on the required properties and characteristics of end products. This research paper will present the properties and characteristics of fibres of the Rosselle plant found in Sri Lanka. It is also expected to raise the awareness and stimulate demand for natural fibres.

METHODOLOGY

Roselle seeds were collected and planted in partly shadow lands in Aranayake area. Figure 1 shows a Roselle plant with edible fruits, flowers, leaves and the stem. Plants were cut, when they were 4 months, 6 months and 8 months old. The barks were removed and retted in water for several days, some for 7, 9, 11, 13 and 14 days. Fibres were cleaned with water and dried at 80^0C before conditioning under 27 ± 2^0C temperature and 65 ± 2 % relative humidity. The fibres were tested for physical properties and characteristics such as fibre length, fibre diameter, density, tensile strength and elastic recovery, moisture content, microscopic appearance, and reaction with chemicals.

RESULTS AND DISCUSSION

Fibre yield from plant aging from 4 to 6 months are long soft and white. Fibre length is about 150 cm and depends on the height of the plant. Fibre content is about 12% of the green bark. The *lumen* of the cell fibre is larger in young fibres and gets smaller with the age of the plant. The diameter of the cell fibre is about 12μm to 33μm and the length is about 1 to 4mm. The diameter of the technical fibre is 25μm to 160μm and depends on the number of cell fibres in a cross-section. Figure 2 shows a cross-section of Roselle technical fibre (Delkumburewatte, 1997). It consists of several cell fibres and the large lumen (4μm) of individual cell fibres and the lumen becomes smaller with plant maturity. The length to width ratio is about 10,000.

The density of fibre changes with the age of the plants and it is maximum, when they are 6 months old. The elongation at break varies from 1.1% to 2.6% depending on the fibre diameter, causer the fibre higher the breaking elongation. *Elastic recovery* of the Roselle fibre varies from 65% to 96% depending on the percentage of the elongation and the diameter of the fibre. The *Cyclic Load-Elongation* test was carried out to investigate the elastic recovery. Figure 3 shows that the elastic recovery is lower or the increase of plastic elongation, when the elongation is higher.

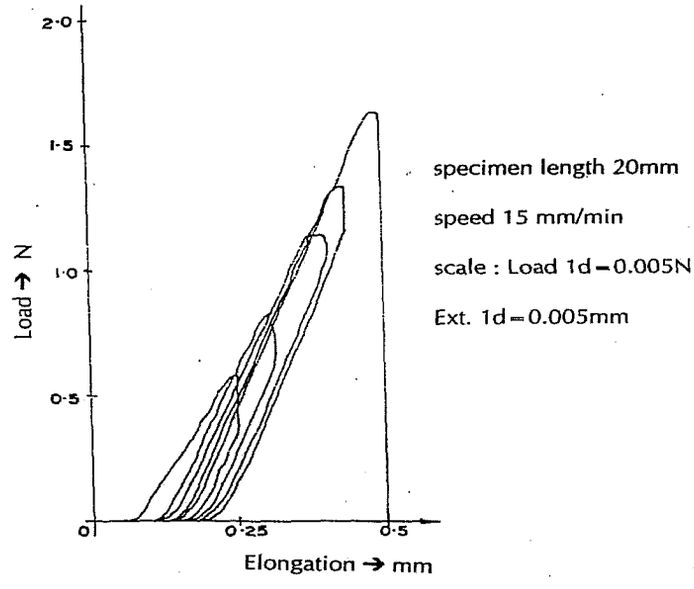

Figure 3: Cyclic variation of Load/Elongation of Roselle fibre

The moisture content of Roselle fibre is about 10.2% when the fibres are taken from 6 months old plants. Resistance to various chemicals such as acids, alkali and salts as well as sunlight and weathering were tested by measuring the bundle strength and elongation. Bundle strength and the elongation were also tested under wet conditions. Figure 4 shows the strength and the elongation after various treatments. It shows the bundle strength and the elongation reduces considerably after treatment with 5% sulphuric acids.

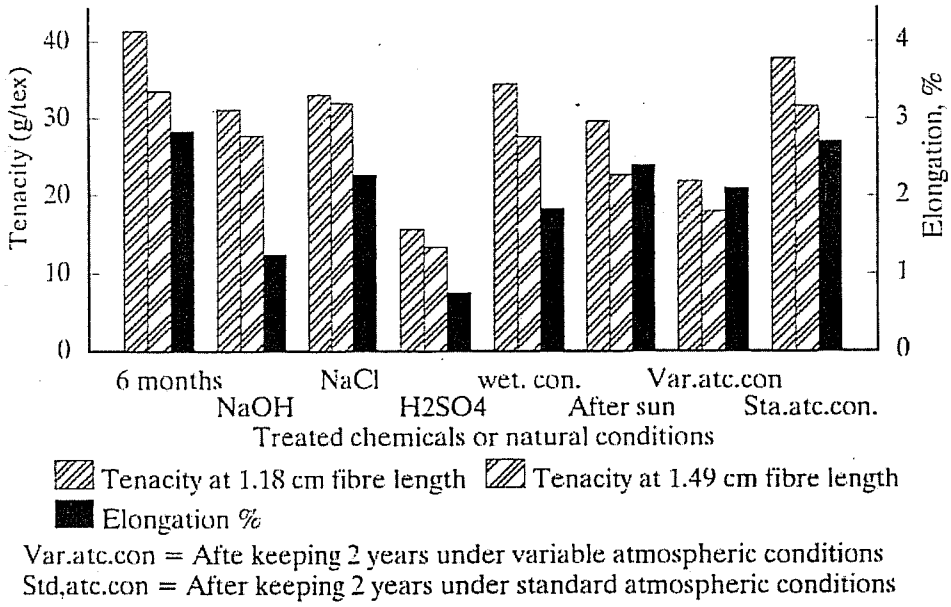

Figure 4: Effect of chemicals and different weathering conditions on strength and elongation

CONCLUSION

Looking at the physical properties and durability characteristics, it can be said that the Roselle fibre is most suitable for household textiles and technical textiles. Considering the elastic recovery property, wet strength and the moisture absorbency, it can be concluded that production of clothing material is possible if finer fibres are selected. The chemical properties of the fibre are similar to the other cellulosic fibre.

REFERENCES

Delkumburewatte, G.B.(1997) Investigation into the properties of Sri Lankan Vegetable fibres, MPhil. Degree thesis submitted to the OUSL.

Flainox (2010) Fibres back to natural fibres, Sustainability mission,

http://www.flainox.com/blog/2010/06/fibres-back-to-natural-fibres