INVESTIGATION OF TENSILE PROPERTIES AND DURABILITY OF COIR FIBRES/GEOTEXTILES

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"I certify that this thesis does not incorporate any material previously submitted for a degree or diploma in any university and to the best of my knowledge and belief it does not contain any material previously published or orally communicated by another person except where due reference is made in the text."

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ABSTRACT

Coir is a ligno-cellulosic fibre, cheap and abundantly available in Sri Lanka as a by-product of the coconut industry. Coir-geotextiles, which are manufactured from coir, have been identified as good geotextile material to be used for soil reinforcement in soil erosion problems until sustainable vegetation is established. Because of this reason coir based geotextiles have the potential to be an exportable product. It has become necessary to scientifically study the properties of coir fibres and coir-geotextiles in great detail to meet the suitability requirements of the export market as well as the local market.

Mechanical and physical properties including tensile properties, initial modulus, length, mass and diameter of brown and white coir fibre obtained from Kurunegala District have been used in the evaluation. Moisture absorption characteristics of coir fibres were also evaluated.

Results show that there is a direct relationship between the length and tenacity as well as extension at break of retted brown coir fibre. This relationship is not significant in unretted white coir fibre, which is a longer fibre with a higher in tenacity and extension at break.

Wet tensile strength and wet extension at break of coir fibres were found to be greater than the tensile strength in the conditioned state. In seawater immersion, coir fibres did not lose strength after 24 hours at room temperature. During a 24 hours period coir fibres did not lose strength significantly in the pH 5-9 range at ambient temperature.

At different NaOH concentrations and different time periods at 25°C, coir fibres were immersed in alkaline medium to find out whether the strength was affected. After 30min in 10 % NaOH brown coir showed highest strength but white coir fibre showed highest strength in 25% NaOH concentration after 30min immersion.

It was attempted to apply the idealized staple fibre yarn model to coir yarns. For this purpose coir-yarn initial modulus was calculated using results of strength tests for coir

fibres and coir yarns. Calculated initial modulus is greater than experimentally obtain results but deviate considerably from the actual situvation.

The durability of coir fibres was investigated by immersing in distilled water, acid medium, alkaline medium and saline solution at ambient temperature over a period of time and the results showed that brown coir fibre and white coir fibre had similar losses in strength in acidic medium after 3 months. White coir fibre lost strength significantly after 3 months in distilled water (pH=5.89) treatment. But both coir fibres do not lose strength significantly during 3 months time in alkaline medium or saline water. Scanning Electron Microscope (SEM) analysis of selected treated coir fibres was carried out to investigate the effect on surface structure of fibres. This analysis explained the results of tensile strength tests between brown and white coir fibres and untreated and treated conditions.

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LIST OF ABBREVIATIONS

SEM	-	Scanning Electron Microscopy
CV	-	Coefficient of Variation
ISO	-	International Standards Organisation
BS	-	British Standard
SLS	-	Sri Lanka Standard
AATCC	-	American Association of Textile Chemists & Colourists